

# مجلة

## كلية المصطفى الجامعة

مجلة علمية محكمة نصف سنوية

العدد الخاص بالمؤتمر العلمي الدولي السابع

(إسهامات الدراسات العليا في النهضة العلمية

و بناء مستقبل المجتمع)

٢٠-٢١/نيسان/٢٠٢٤

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# وزارة التعليم العالي والبحث العلمي كلية المصطفى الجامعة

وقائع المؤتمر العلمي الدولي السابع

قال تعالى :

وَقُلْ اَعْمَلُوا فَسَيَرَى اللّٰهُ عَمَلَكُمْ وَرَسُولُهُ وَالْمُؤْمِنُونَ

برعاية معالي وزير التعليم العالي والبحث العلمي

(الدكتور نعيم العبودي ) المحترم

وتحت شعار (إسهامات الدراسات العليا في النهضة العلمية

و بناء مستقبل المجتمع)

تقيم كلية المصطفى الجامعة مؤتمرها العلمي الدولي السابع

وذلك على قاعة فندق المنصور ميليا في تمام الساعة التاسعة من صباح يومي

السبت والاحد الموافق ٢٠-٢١/نيسان/٢٠٢٤

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- ٦- أ.م.د أحمد زيدان / جامعة بغداد عضواً

## هيئة التحرير:

- ١- أ.د هادي حسن جاسم رئيساً
- ٢- أ.د سالم علي عباس عضواً
- ٣- أ.م.د عبد الأمير عبد العزيز عضواً
- ٤- أ.م.د علي عبد الرسول حمودي عضواً
- ٥- أ.م.د سهير إبراهيم حاجم عضواً
- ٦- أ.م.د خالد علي عبيد عضواً
- ٧- السيدة ايمان ليث اكرم التصميم الداخلي والاعلام



## اللجنة العلمية للمؤتمر :

- أ.د. هادي حسن جاسم / عميد كلية المصطفى الجامعة
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  - أ.د. علي منذر مصطفى / الجامعة التكنولوجية
  - أ.م.د. سهير ابراهيم حاجم / كلية المصطفى الجامعة
  - أ.م.د. أحمد طارق نعمان / كلية المصطفى الجامعة
  - أ.م.د. علي عبد الرسول حمودي / كلية المصطفى الجامعة
  - أ.م.د. عبد الامير عبد العزيز سلمان / كلية المصطفى الجامعة
  - أ.م.د. محمد علي عبد الرحمن / الجامعة المستنصرية
-

## قواعد النشر في المجلة

- ١- تتخصص المجلة بنشر البحوث ذات التخصصات العلمية والإنسانية .
  - ٢- تعرض البحوث المقدمة للمجلة على هيئة التحرير؛ لبيان ملاءمتها ويحق لهيئة التحرير أن تعتذر عن قبول البحث .
  - ٣- يتم عرض البحث مسبقاً على لجنة السلامة اللغوية ولجنة السلامة الفكرية بالنسبة للتخصصات الإنسانية قبل إرسال البحث إلى التحكيم العلمي .
  - ٤- تلتزم هيئة التحرير بإرسال البحوث إلى خبراء علميين من الاختصاص نفسه عدد (٢) وفي حالة الرفض من أحدهم يرسل إلى خبير ثالث لغرض الترجيح .
  - ٥- تلتزم هيئة التحرير بعدم الكشف عن أسماء المحكّمين ، لضمان سرية التحكيم و لرفع، الرصانة العلمية وكذلك تكون المعلومات الخاصة بهوية الباحث في الصفحة الأولى من البحث فقط . وأن يلتزم الباحث بعدم الإشارة إلى هويته أو مكان عمله في ثنايا البحث .
  - ٦- تكون حقوق الطبع للبحث ملكاً للمجلة عند قبوله للنشر، ولا يحق النقل والاقْتباس عنه إلا بعد الإشارة إلى المجلة .
  - ٧- لا يجوز نشر أكثر من بحث للباحث في العدد الواحد .
  - ٨- تحتفظ هيئة التحرير بحق أولوية النشر للبحوث مع مراعاة التنويع في النشر بحسب المحاور المعتمدة .
  - ٩- ما ينشر في المجلة من بحوث ودراسات تعبّر عن رأي أصحابها ولا تعبّر بالضرورة عن وجهة نظر هيئة تحرير المجلة أو وجهة نظر الكلية .
-

## شروط النشر :

- ١- أن لا يكون البحث مشاركاً في مؤتمر أو ندوة علمية سابقاً أو مقمداً للنشر في مجلة علمية أخرى .
- ٢- يقدم البحث على قرص مدمج مع نسخة ورقية أو يرسل على البريد الإلكتروني: [info@almustafauniversity.edu.iq](mailto:info@almustafauniversity.edu.iq)
- ٣- أن لا يزيد عدد صفحات البحث عن ٣٠ صفحة .
- ٤- أن لا يزيد عدد المشتركين على ثلاثة باحثين في البحث الواحد .
- ٥- يطبع البحث على ورق (A4) ونوع الخط (Simplified Arabic) بالنسبة للبحوث باللغة العربية و(Times New Roman) بالنسبة للبحوث باللغة الانكليزية ويكون حجم الخط (١٤) للمتن والهامش (١٢) .

حقوق الطبع محفوظة لكلية المصطفى الجامعة

رقم الإيداع في دار الكتب والوثائق ببغداد : ٢٢٤٨ لسنة ٢٠١٧



## اهداف المؤتمر :

١. توجه الدراسات العليا نحو معالجة مشكلات المجتمع .
٢. تعزيز التواصل و التفاعل بين قطاع التعليم و القطاعات الأخرى لتحقيق تكامل فعال يعزز التطور العلمي و التكنولوجي في المجتمع.
٣. اقتراح استراتيجيات فعالة لمواجهة التحديات في الدراسات العليا بما ينعكس إيجابا على التطور العلمي.
٤. تعزيز التعاون الدولي و تبادل المعرفة بين مختلف البيئات العلمية لتحقيق التنمية المستدامة.
٥. وضع رؤى استراتيجية لتعزيز دور الذكاء الاصطناعي في الدراسات العليا والاستفادة منه في تطور الحركة العلمية في المجتمع.
- ٦- أهمية الدراسات العليا في تعزيز النمو الاقتصادي في البلد

## محاور المؤتمر:

- محور العلوم الطبية
  - محور العلوم الهندسية
  - محور العلوم الإدارية و الاقتصادية
  - محور العلوم التربوية
  - محور علوم التكنولوجيا و الابتكار
  - محور الذكاء الاصطناعي
-

## كلمة المؤتمر:

بسم الله الرحمن الرحيم

الحمد لله رب العالمين والصلاة والسلام على افضل خلق الله سيدنا محمد وعلى اله وصحبه اجمعين

السيد معالي وزير التعليم العالي والبحث العلمي الدكتور نعيم عبد ياسر العبودي المحترم

السيد ممثل رئيس المجمع العلمي العراقي المحترم

السادة رؤساء الجامعات وعمداء الكليات المحترمون

السيدات والسادة الباحثون المحترمون

السيدات والسادة الحضور مع حفظ الالقاب والمقامات

السلام عليكم ورحمة الله وبركاته

يسعدنا في مؤتمرنا هذا والذي يتزامن مع اليوم العالمي للابتكار والابداع

ان نرحب بكم اجمل ترحيب وبموضوعه المتضمن اسهامات الدراسات العليا في النهضة العلمية وبناء مستقبل المجتمع فأهلاً وسهلاً بكم

ان حضوركم اليوم يعكس حرصكم العالي والعميق بالتقدم العلمي وتعزيز البحث العلمي ورفع مستوى التعليم العالي وهو امر محوري لتحقيق التقدم والازدهار لمجتمعنا.

كما معلوم ان الدراسات العليا تمثل عمقاً وتطوراً في المعرفة وهي المحرك الرئيسي للابتكار والاكتشاف لمختلف المجالات العلمية والبحثية

نود الاشارة ان تعزيز النهضة العلمية وبناء مستقبل مشرق لمجتمعنا يتم من خلال دعم الدراسات العليا وتشجيع البحث العلمي والابتكار ان تامين بيئة مواتية للباحثين وتوفير الامكانيات اللازمة بتطوير مهاراتهم العلمية هو استثمار لا غنى عنه في مستقبل اكثر تطوراً وازدهاراً وفي مؤتمرنا هذا نجد امامنا فرصة ذهبية لتبادل الخبرات والمعارف وتعزيز التعاون بين المؤسسات الاكاديمية والحكومية والجامعات الاهلية

كما نشيد بجهود الحاضرين جميعاً والذي يسهم في دعم التعليم العالي والبحث العلمي وتعزيز التعاون بين المؤسسات البحثية الحكومية منها والاهلية لتحقيق التنمية المستدامة

وفي الختام اود الاشارة الى اهمية هذا المؤتمر ودور الدراسات العليا في تحقيق الاهداف العلمية والاجتماعية ونتطلع الى مناقشات مثمرة وتبادل افكار بناءه تسهم في تطوير مجتمعنا وبناء مستقبل واعد

شكرا لحضوركم والشكر موصول لمن تجشم واعطى من جهده ومن وقته للعلم والمعرفة لبناء عراقنا العزيز والسلام عليكم ورحمة الله وبركاته .

أ.د. هادي حسن جاسم

عميد

كلية المصطفى الجامعة

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# منهاج المؤتمر العلمي الدولي السابع

(إسهامات الدراسات العليا في النهضة العلمية وبناء مستقبل المجتمع)

اليوم الاول السبت الموافق 2024/4/20

## Curriculum of the Seventh International Scientific Conference (Contribution of Postgraduate Studies to Renaissance Science and Building the Future of the Society)

The first day, Saturday, 20/4/2024

ت	المنهاج	الوقت	الملاحظات
١	ترحيب بالحضور الكرام	9:30 AM	
٢	تلاوة أي من الذكر الحكيم	9:35 AM	
٣	النشيد الوطني	9:40 AM	
٤	كلمة اللجنة العلمية	9:45 AM	أ.د. هادي حسن جاسم عميد الكلية
٥	كلمة وزارة التعليم العالي والبحث العلمي	9:50 AM	
٦	كلمة المجمع العلمي العراقي	9:55 AM	أ.د. محمد عبد اللطيف عبد الكريم
٧	فيلم وثائقي عن كلية المصطفى	10:00 AM	
رئيس الجلسة: أ.د. فتيبة عباس حمد مقرر الجلسة: د. حسين تبيينه كاظم			
٧	الجلسة الافتتاحية	10: 10 AM	الأستاذ الدكتور محمد عبد عطية السراج وكيل الوزارة للتعليم العالي والبحث العلمي للشؤون الإدارية سابقا
	كلمة رئيس جامعة أراك	10: 20 AM	أ.د. مجتبي ذو الفقاري
	اهمية البحث العلمي في تنمية المجتمعات	10: 25 AM	أ.م.د. نسرین محي مصطفى
٨	توزيع الدروع والشهادات	10: 30 AM	
٨	معرض مشاريع التخرج المميزة ومعرض الفن التشكيلي	10: 45 AM	
٩	Coffee break and lunch	11: 00 AM	

## منهاج المؤتمر

### اليوم الاول

#### قاعة قرطبة - فندق المنصور ميليا

السبت ٢٠ / ٤ / ٢٠٢٤

الساعة ١٢:٠٠ م

الجلسة الأولى		
مقرر الجلسة ا.م.د. عمر جعفر عبد الحسن	رئيس الجلسة ا.د. عدنان حكمت عبد سعيد	
عنوان البحث	اسم الباحث	ت
Women's Knowledge of Health Practices during the Postpartum Period	نسرین محي مصطفى	١
Exploratory Data Analysis and Machine Learning Classification for Autism Spectrum Disorder Detection	محمد زهير ناجي عبد الحميد	٢
ISIS Restricted Al-Anbar Healthcare Services	حازم عبد الرحمن جمعه نياي الهيبي	٣
Removal of Copper, Cadmium, and Zinc using Activated carbon derived from Tea Residue	علاء كريم محمد	٤
Advancements in Hematology Laboratory Techniques: A Mini Review	المعتصم بالله عبد الرحمن جعيز	٥
Environmental pollution and its impact on sustainable health التلوث البيئي وأثره على الصحة المستدامة	خالد عبد الكريم محمد عبد الله	٦
Photodetector fabrication using blue laser assisted ZnO chemical bath growth technique.	ناصر محمود احمد إبراهيم	٧
The effect of Psychosocial competencies-based educational program on Undergraduates Health	ايسين كمال محمد نوري	٨
Statistical Method for Image Noise Detection Based Gamma Distribution	جمال كامل الرديني	٩
THE STRUCTURAL DESIGN FOR STORING AND PROCESSING SMALL FILES ACROSS DISTRIBUTED SYSTEMS	احمد نافع عايش حمد	١٠
تأثير اضافة المستخلص المائي لبذور الرمان على الصفات الفيزيوكيميائية والحسية لبيرغر الدجاج	بيداء حافظ محمد حنضل	١١

## منهاج المؤتمر

### اليوم الاول

#### قاعة الحمراء - فندق المنصور ميليا

السبت ٢٠ / ٤ / ٢٠٢٤

الساعة ١٢:٠٠ م

الجلسة الثانية		
مقرر الجلسة	رئيس الجلسة	
د. عبد الانمة بركة علي	ا.د. سحاب محمد الاسدي	
عنوان البحث	اسم الباحث	ت
اثر النموذجي (Appleton) و نارودو المطور في اكتساب المفاهيم البلاغية لدى طلاب الصف الخامس الاديبي وتنمية تفكيرهم الارتدادي	فلاح صالح حسين	١
الفكر الاجتماعي التربوي الاصلاحى عند السيد الشهيد محمد صادق الصدر (قدس سره)	اركان مهدي عبد الله سواك	٢
دور الرشاقة التنظيمية في تعزيز الابداع الاستراتيجي	ضرغام علي مسلم هاشم العميدي	٣
الرؤية النفسية في تطور الذات الحقيقية لدى الطلاب ومعالجة المشكلات التي تواجهها في البيئة الدراسية	هديل علي قاسم محمد	٤
استخدام الاساليب الاحصائية في تحليل تأثير القيادة الريادية في تحقيق الاداء التنظيمي بحث تطبيقي لعينة من قادة وموظفي (شركة تسويق النفط سومو)	عباس فاضل كريمة كزار	٥
البصمة الوراثية والادلة الجنائية	نور جمال طالب مزهر	٦
الوضع الذهني للقيادات الجامعية وأثره على متطلبات التغيير الإستراتيجي دراسة استطلاعية لآراء الادارتين العليا والوسطى في الجامعة المستنصرية	احمد عبد السلام احمد سالم	٧
استحداث الطرق الحلقية في مدينة بغداد ودورها في تنمية المواقع الترفيحية المستدامة	عماد حسين سعود مزعل	٨
التجديد الإستراتيجي ودوره في تحقيق التميز التنظيمي / دراسة استطلاعية في مصرف الرافدين / الإدارة العامة	خالد زيدان عبد الهادي إسماعيل	٩
Review of University social media Real-Time Sentiment Analysis System	ياسمين مكي محي الدين عبد الحميد	١٠
المعجم اللغوي التاريخي للمستشرق أوغست فيشر August Fischer (1865-1948): دراسة نقدية	عبد الحسن عباس حسن جاسم	١١
المحاسبة الإدارية الخضراء وإثرها في ترشيد القرارات الخضراء لدعم لتنمية المستدامة في الوحدات الاقتصادية العراقية	محمد زهير مجيد كاظم	١٢
استراتيجية تنمية القطاع الصناعي ودوره في تحقيق التنمية الاقتصادية	علي جابر سعيد عذافة	١٣

## منهاج المؤتمر

### اليوم الثاني

قاعة الشهيد الطالب حسين علي حسين / كلية المصطفى الجامعة

الاحد ٢١ / ٤ / ٢٠٢٤

الساعة ٠٩:٠٠ ص

الجلسة الأولى		
مقرر الجلسة ا.م.د. سهير إبراهيم حاجم عنوان البحث	رئيس الجلسة ا.د. محجوب إبراهيم ياسين اسم الباحث	ت
مسؤولية المصرف المنظم في العقود المشتركة المصرفية	استبرق محمد حمزة	1
مدى توافر أبعاد الصيانة المستخدمة في معاونه السمنت الشمالية-معمل سمنت بادوش التوسيع / دراسة استطلاعية	رغيد ابراهيم اسماعيل	2
A Survey of Harnessing the Power of Artificial Intelligence for Diagnosis and Treatment	نادية محمود حسين	3
AI in Autism Diagnosis and Treatment: A Comprehensive Review	ياسمين مكي محي الدين عبد الحميد	4
Study of Some Type of Congenital Anomalies in Mousl City	اروى ادريس احمد النعيمي	5
Anemia and its relationship with dopamine and other parameters	سرى احسان عبد جابك	6
Multi-Focus Image Fusion Based on Variance Measurement of Edge Contrast	ايمان محمد جعفر علوان	7
A review of IoT Technology in Agriculture: Applications and Future Direction and Challenges	محمود عارف لفته عمران	8
امكانية توظيف الخلطة الخرسانية الحاوية على رماد الورق الطباعة في الساحات العامة	افراح خالد نصير عباس	9
The characterization of the thickness layer produced by the process of electrophoretic deposition on the 316 bio-stainless steel	ايمان عدنان عنون مهدي	10
Nutritional Knowledge and Practices among women at childbearing age attending Primary Health Care Centers in Baghdad City	منى عبد الكاظم زيدان عليوي	11
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وزارة التعليم العالي والبحث العلمي  
كلية المصطفى الجامعة

## البحوث المشاركة في المؤتمر (المحور العلمي و الهندسي و المحور الطبي)

الجزء الثاني

ملاحظة: جميع البحوث خاضعة للاستلال الالكتروني





## Design and Implementation of CNC Machine Using Stepper Motor and Small Capability Microcontroller

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**Abstract**—A computer-controlled machine, often known as a CNC machine, is a machine tool that is operated by a computer and uses pre-programmed instructions to handle tools and materials. The design and implementation of low-cost three-dimensional computerized numerical control (CNC) machines for industrial applications are the topics that are covered in this study. The fundamental purpose of this CNC machine which is based on a microcontroller is to cut the materials into the particular shape that is required. Communication between a personal computer (PC) and a numerical control machine is the topic that will be discussed in this article. The growing demand for flexibility and cutting-edge quality was the impetus behind the development of a computer-controlled cutting machine as a solution to accommodate this requirement. To achieve cost-effectiveness and retain the requisite precision and dependability for complex shapes, the system is equipped with an embedded system that is based on an Arduino UNO AVR microcontroller (Atmega328). Accuracy is achieved through the combination of a mechanical system that has been skillfully built and an embedded system, which together form the backbone of the system. C++ is the programming language that is utilized by the system, while the Universal G-code Sender platform is utilized for the user interface.

**Index Terms**—CNC laser, industrial CNC machine, and Teflon laser

## I. INTRODUCTION

Lubrication and cooling systems are essential for machine tools to keep them running smoothly and prolong their life. Reduced friction and wear can be achieved by applying lubrication to moving parts. When mechanical parts and the cutting process are cooled, the heat is removed. There are major moral and ecological concerns with the use of cutting fluids (CFs) in machine operations [1], [2]. There have been efforts to discover remedies for their main drawbacks in recent years. The end goal is to completely block CFs [3]. Demand for eco-friendly products is driving the development of new CF formulations [4]. Due to economic and ecological concerns, the industry is seeking solutions to reduce the usage of lubricants during metal-cutting procedures [5], [6]. The main objective of the ISO 14,000 family of standards is to protect the environment while also balancing social and economic demands [7]. For the industry to agree to these standards, there must be quantification and proof of a decrease in the five key areas: hazardous air emissions, water contamination, waste management, land pollution, and protection of natural resources and raw materials [8].

An increase in output cannot be achieved without CFs. The main functions of CFs in machining are cooling (tool-workpiece contact) and lubrication, which together decrease tool wear. Consequently, CFs offer improved energy efficiency and corrosion protection for the machined surface, tools, and components of the machine. On top of that, CFs reduce heat and redirect chips away from the cutting area, which means that contaminants and waste are removed as liquids instead of airborne particles [9]. Surface tension and viscosity have a major impact on how well the chips evacuate. The cooling effect is vital for reducing the impact of heat on the cutting tool and machined workpiece. The lubricant also facilitates chip removal from the rake surface due to its low coefficient of friction. A tool with a smoother surface and less built-up edges may be the result [10], [11].

The chip that is created by the workpiece's machined surface and the cutting tool can be eliminated through flood cooling. A significant amount of heat is also dissipated by the chips. Studies have shown that while cutting at faster speeds, flood cooling becomes less effective because the coolant can't reach the critical areas (tool-workpiece contact) where cooling is needed and more heat is generated. A small amount of lubricant is another possibility that should be carefully studied to get the target outcome [12], [13]. Improving performance and efficiency is the goal of any machining process to save costs [14], [15]. Based on the machining process, CFs are made by combining oil (the basis) with additives; these CFs might have different properties [16]. The efficiency and precision of machining processes have been greatly enhanced by them. With CFs, you may achieve higher cutting speeds, longer tool lives, reduced workpiece damage, better surface quality, and meet all of your dimensional needs. Consequently, CFs increase efficiency and production, make safety standards better, and make machining more precise [17].

As a result, CFs are classified as either straight or water-soluble oils based on their chemical composition. Although straight oils are better at lubricating and preventing corrosion, the absence of cooling capability in them could cause a harmful mist that workers are not equipped to handle [9]. The tool, chips, and workpiece can all benefit from the reduced friction that water-soluble lubricants provide. Mineral (petroleum-based) oil, vegetable oil, or animal oil are the possible components. Cutting with straight oils is most effective at modest speeds, as their efficacy decreases with increasing speed. One possible reason is that the rapid movement of the chips prevents the fluid from getting close to the tool interface. One more thing: oils can't lubricate at high speeds since they evaporate at high cutting temperatures. While cutting at extremely high speeds, water-soluble oils outperform straight oils due to reduced heat output and improved resistance to high temperatures. Since oils are usually supplied in concentrated form, it is common practice for the end user to dilute them with water before use [18], [19]. With a higher percentage of water, the coolant has a higher specific heat and thermal conductivity, enabling it to absorb heat from the machining process and bring the temperature down. Bacterial growth, corrosion, and evaporative deficiencies are all facilitated by a high concentration of water. These fluids usually have chemicals that offer good cleaning properties, although occasionally they have foaming tendencies that inhibit heat transmission. Less likely to produce aerosols than straight oils, water-soluble oils are also non-flammable [20], [21].

In this paper, we will primarily focus on designing three-axis CNC machines and defining their capabilities in terms of task performance and simultaneous movement along all three axes. Here we have X, Y, and Z. A tool's Z-axis runs perpendicular to its spindle. Sculpted or tapered surfaces are no problem for three-axis computer numerical control machines. The mechanical component stands in for the machine itself; the electrical component symbolizes the circuitry linking the computer to the machine; and the computer itself constitutes the third primary component of this machine. Motors allow these machines to move along three or more axes. You won't believe the accuracy of these machines. Useful for small and medium industrial projects because of its low cost and great output, it is utilized in the fields of woodworking, wood carving, and the creation of various Molds.

The rest of this paper is organized as follows. Section II reviews the literature review. Section III proposes the CNC machine of this paper. Section IV provides the results and discussion. Finally, the conclusion and future work are listed in Section V.

## II. LITERATURE REVIEW

” Construction and evaluation of low-cost table CNC milling machine,” a study on CNC machine systems given by [22], weighed a hefty amount. This machine requires a voltage range of 12VDC to 42VDC to operate, with 24VDC being the optimum value. It also requires a current range of 500mA to 3A. Created this tabletop CNC router to run programs like

[22].

The electrical components of a CNC (computer numerical control) machine were first conceptualized and built upon a basic prototype [23]. The authors also suggested using LabVIEW software for computer control and to set up communication between the machine and the computer. This machine made use of three stepper motors, each with a holding torque of 10 kg·cm, 8 W of power per phase, a step angle of 1.8°, and a position accuracy of more than 95%. Additionally, it made use of a universal DC machine that had an unspecified degree of accuracy, ran at 35,000 RPM, and had a few power ratings of 150 W.

The work by [24] focuses on the design of an affordable CAD-CAM converter for CNC applications, however, it does not include any hardware production. In control system theory, a mathematical model can be generated by calculating transfer functions (H<sub>y</sub>) as a relation between input (u) and output (y) signals. When compared to other CNC machines, the system’s positioning inaccuracy is significantly larger.

Another larger numerical control router that made use of three stepper motors and three motor drivers was the system of fabrication of low-cost three-axis CNC routers devised by [25]. The router grew in size thanks to three motor drivers and a stepper motor. Various steps were involved in its production. The router made use of an Atmega328p, which is an Arduino-based microcontroller, to manage this system. The CAD applications were used to design every component of the machine. The end result was a drawing in one of many acceptable forms, the most preferred of which is the.stl format. It was common practice to feed the drawings into computer-aided manufacturing (CAM) applications, which would then use this equipment to cut the surface.

[26] three-axis CNC prototype system for assembling Zen tools was developed. U.S. citizens utilized that. The three-axis stepper motors, frame components, lead screws, guide rods, anti-backlash springs, and other necessary hardware were included in this machine kit. The machine’s body is constructed from a dense PVC board. A stepper motor regulates the motion of this machine’s three axes. The addition of a stepper motor to the z-axis made the machine significantly larger. Swapping out the stepper motor for a servo motor on the z-axis is the way to go.

Ren Qiang created an open CNC system [27] that uses the Serial Real-time Communications System (SERCOS) to function. A specialized operating system is required to run such systems. This system was designed to run on RTLinux. Not applying to all situations is the biggest problem with this system.

## III. METHODOLOGY

### A. Design and CAD/CAM technology

Experts in computer-aided design (CAD) use their backgrounds in engineering, information technology (IT), and mathematics to create blueprints for structures, machines, and components. Building and machine blueprints are both made possible by computer-aided design (CAD) specialists. Numerous fields rely on computer-aided design (CAD) experts, such as engineering, manufacturing, and construction. Professional computer-aided designers (CAD) can manipulate both two and three-dimensional (or "surface" and "solid") models. Engineering firms often utilize solid modeling, which involves creating a three-dimensional representation of a structure or component, to give clients a "virtual tour" of planned construction or an inside look at production equipment. The goal of surface modeling is to create a flat depiction of a design. Lines, forms, and components are created on the computer screen by using the mouse and keyboard. Graphics can be copied, pasted, and edited with far more ease and speed than paper copies. Also, anybody with the right software can open the PDF files you send them by email.

## B. 3D's Max design

The machine's design was created using CAD techniques and 3D's max program in stages. The design began on the y-axis and worked its way to the x-axis and lastly to the z-axis, as seen in Figure 1.

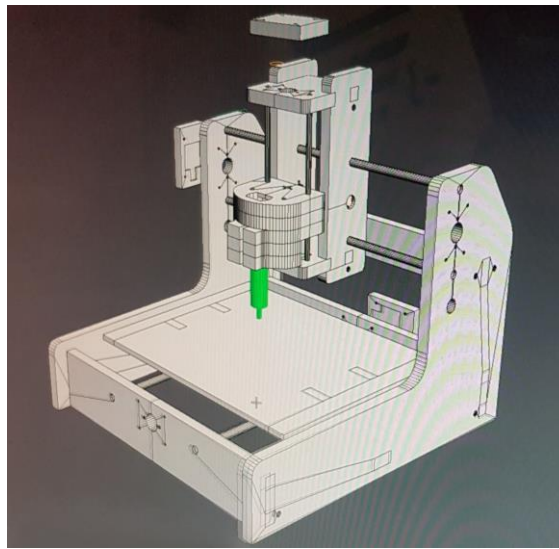


Fig. 1. 3D design of the machine

Next, we'll use computer-aided design (CAD) software to flatten the machine's three-dimensional model into a three-layer plan for cutting, perforating, and drilling, much like in Figure 2. Translating these blueprints into G-code that the CNC can use to build the machine components is the last step in the process.

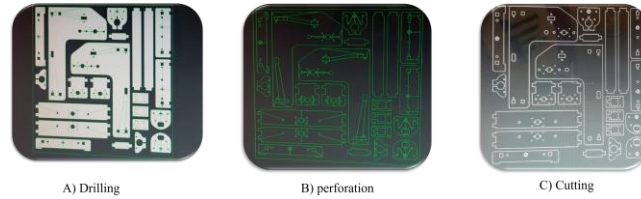


Fig. 2. 2D design of the machine (a: drilling, b: perforation, and c: cutting)

## C. Hardware

Figure 3 shows the hardware of the proposed CNC machine.

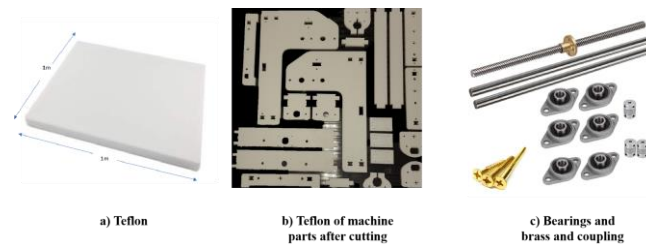


Fig. 3. Hardware of Designed CNC-Machine

- Teflon: Applications abound for synthetic fluoropolymer polytetrafluoroethylene (PTFE). The best-known PTFE-based formula is Chemours' Teflon. PTFE is one of the least frictional solids.
- Stainless steel shaft
  - Two 50 cm \* 12 mm stainless steel shafts for the y-axis.
  - Two x-axis stainless steel shafts measuring 50 cm \* 12 mm.
  - Two 30-centimeter by 8-millimeter stainless steel shafts for the x-axis.
- Stainless steel scrolls
  - Two 50 cm \* 8 mm stainless steel scrolls for the y-axis
  - Stainless steel scrolls measuring 50 cm \* 8 mm for the x-axis
  - Two 30-centimeter by 8-millimeter stainless steel scrolls for the x-axis
  - A 50cm\*8mm scroll is used to link the machine parts and provide support for the machine.
  - a few fasteners
- Bearings and brass and coupling
  - (6 bearings) two for each axis holding the scrolls to the machine's body so they can turn freely.
  - (3 couplings) one for each scroll to connect the scroll to the stepper motor.
  - (3 brass) on for each scroll to connect the scrolls to the axis so and convert the circular motion into linear motion.

## D. Electronic and devices

- Hybrid bipolar stepper motor: One type of hybrid motor is the two-phase hybrid bipolar stepping motor. A stator and rotor make up a two-phase hybrid stepping motor. Common stator features include eight or four poles, a uniform distribution of a specific number of tiny teeth on the surface of

the poles, and bidirectional electrification of the coil on the pole. The rotor, which is made up of two halves of teeth, also has a specific number of tiny teeth around its perimeter. Half a pitch separates the two teeth. Clamped between the two teeth is a ring-shaped permanent magnet that exhibits axial magnetization. Naturally, the polarity of any two teeth on a single rotor blade is orthogonal to that of any other tooth on that same blade.

- D.C motor spindle: Drilling and cutting are both made possible by the 12V DC motor spindle.
- Arduino Uno: As an open-source electronics platform primarily built around the AVR microcontroller Atmega328, Arduino. cc has created a microcontroller board called Arduino Uno. In 2003, David Cuartielles and Massimo Banzì began the first Arduino project at the Interaction Design Institute Ivrea to give students and professionals a flexible and inexpensive means to manage a variety of devices in the real world.
- Motor driver: An intuitive and powerful stepper motor driver that can manage a two-phase stepping motor is the TB6600 Arduino Stepper Motor Driver. If your microcontroller can produce a digital pulse signal of 5 volts, like Arduino, this will work with them. The TB6600 stepper motor driver for Arduino boards can accept a wide range of power inputs, from 9 to 42VDC. Plus, it has a peak current output of 4A, which is more than enough for the vast majority of stepper motors.
- Power supply: Alternating Current 12V 12.5A 150W Power Supply Overload and Overvoltage Protection Built Into This Regulated Transformer for Your Safety
- some wires and limit switches and shrinks: The machine's electronic components are linked by wires, which are encased in shrinks. The axis is limited, and its zero position is detected by limit switches.

## E. Software

- Arduino IDE: One such Java app is the Arduino IDE or integrated development environment. It works on multiple platforms. You can use it to program and upload to boards that are compatible with Arduino, and other vendor development boards that work with third-party cores.
- GRBL: Running on a basic Arduino, Grbl is free, open-source, and very performant software for controlling the motion of devices that move, make objects move, or both. Grbl would be the gold standard if the maker movement were an industry.
- Universal G code Sender: A feature-rich G-code platform that can communicate with sophisticated CNC controllers such as GRBL and TinyG. Suppose you already have the Java Runtime Environment installed. In that case, Universal G-code Sender (UGS) will take care of the rest as it is a standalone Java application that incorporates all external dependencies.

## F. building and connection

Once you have cut all of the CNC machine's pieces, you can begin assembling it by screwing and scrolling together its various parts. Detailed in the figure are the machine's control components, as depicted in the general Figure 4.

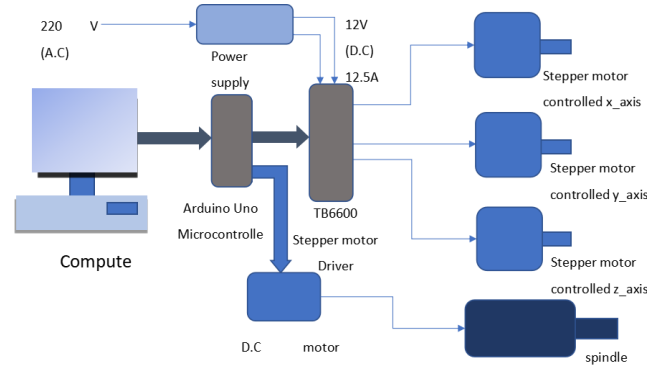


Fig. 4. Designed Machine schematic in general

#### IV. RESULTS AND DISCUSSIONS

### A. Proposed CNC Machine

Figure 5 shows the final shape of the machine after the building and connection procedures.

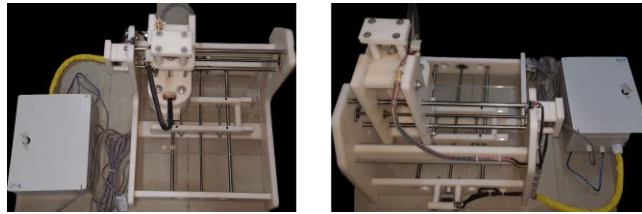


Fig. 5. Designed CNC-Machine

### B. Coloration

Calibration is the process of determining the amount value of instruments, equipment, and test devices by industry requirements, using their metrological features as a basis. The present study used a direct method to explore and quantify a significant parameter that impacts the precision and quality of a CNC milling machine's output. Linear displacement errors, angular errors of linear axes, straightness errors of linear axes, and squareness errors between the axes are all examples of position-dependent and position-independent characteristics that make up these other parameters. To give the consumer more accurate information, we additionally measured the CNC milling machine's repeatability, lead screw, and resolution error. Without this additional information, a misperception would remain, which would greatly impact the product's overall accuracy and quality. The parameters were measured and quantified on a manufacturing CNC milling machine under controlled environmental circumstances using a laser interferometer using artifacts as working standards.

To compensate for and improve the accuracy of a machine system, polynomial regression studies were used to identify the coefficients that would forecast the errors at every desired coordinate. To evaluate and



guarantee the precision, competence, or accuracy monitoring of the CNC milling machine, a comprehensive chart representing machine accuracy was also created.

## C. Testing G-code

The evaluations Generated with the Aspire program plate form One such program is Aspire, which can create both two and three-dimensional designs, export them as G-code, and then transmit them to a CNC machine for cutting. As depicted in the Figure 6.

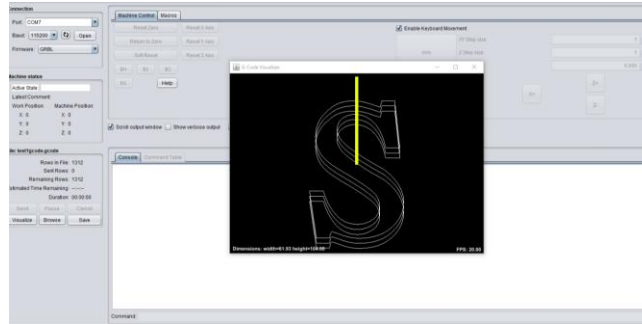


Fig. 6. Chopping the S character using g-code

## D. Discussion

It is evident from this result that the machine is capable of drilling and cutting, but it is necessary to pay attention to certain conditions and follow certain measures before starting the machine. Before anything else, make sure the design fits the machine's dimensions. Think about things like cutting depth, feed rate (6000 is recommended), and cutting speed; cutting efficiency decreases with higher speeds. so, the machine's speed shouldn't be too high, but rather appropriate for the material. The spindle speed for the test is set at 8000 RPM. Additionally, before doing anything else, the machine needs to travel to home (0.0.0). You can accomplish this by sending the homing instruction to the machine from the UGS. Before you begin cutting the material, you should do a testing cycle. Some important factors to think about are:

- **Strengths:** Economical: When contrasted with industrial CNC machines, this design provides a substantial cost benefit. The low-power microcontrollers and stepper motors needed are easily accessible and affordable. Reduced complexity: This design is great for classroom use or do-it-yourself projects because of how little parts it uses. Machine portability may be possible with less complicated parts, depending on the finished dimensions and material selections.
- **Limitations:** Stepper motors can experience step loss, which can affect the CNC machine's overall precision. The processing power of microcontrollers can be a limiting factor in real-time control, which in turn can impact accuracy. Material Handling: When working with harder materials that demand more force to cut or engrave, low-power stepper motors might not be the best choice. Functionality: The machine's ability to comprehend sophisticated G-code commands may be constrained by the processing capability of the microcontroller, which could limit its functionality.
- **Potential Improvements:** When choosing a driver for a stepper motor, you may want to look at micro-stepping drivers. This paves the way for more precise regulation of motor movements, which could

lead to enhanced precision. If you need to interpret complex G-codes or run control loops faster, you might want to look into upgrading your microcontroller. The homing accuracy and safety aspects of the machine can be enhanced by integrating limit switches or homing sensors. Create or make use of open-source CNC control software tailored to low-power microcontrollers in the software development process.

## V. CONCLUSION AND FUTURE WORK

Based on the findings of this project, we can conclude that the construction of the CNC machine must consider the data and the fundamental conditions of the building. The structure must be robust, coherent, and balanced, and it must be accurate with a percentage error measured in parts or millimetres. Additionally, we can conclude that there are important steps that must be taken before the process of building the machine, including planning, designing, and searching for materials that are suitable for a construction that is both inexpensive and robust. Moreover, we conclude that an appropriate plate form ought to be accessible before the beginning of the cutting process to manage the transmission of commands to the machine, such as the UGS. Take into account the dimensions of the machine, as well as the speed of the cutting and the speed of the spindle. These are also vital things to take into mind.

When choosing a CNC machine, knowing the goal or function is crucial. For cutting and drilling, construction parts should be efficient and durable. Z-axis strength and cohesiveness are crucial to the machine. The machine should use servo motors in a closed-loop system to better locate and respond to commands.

One of the most significant ideas for potential future improvements and additions to this project is to incorporate the Mach 3 microcontroller. This board is capable of recognizing the machine's numerous important capabilities, such as its ability to self-calibrate and control its four-axis mechanism. The actual four-axis system allows for the addition of a fourth axis to the machine. Another option is to equip the machine with an ATC system, which allows it to automatically change the drilling piece.

In the future, CNC machines that use stepper motors and microcontrollers with limited capabilities may go the following intriguing paths:

- Enhanced Functionality with Limited Resources:
  - Microcontroller efficiency: Enhancing code efficiency for low-power microcontrollers to facilitate battery-powered operation or portable designs.
  - Hybrid control systems: The use of specialised motor driver chips or basic logic circuits in conjunction with a mini microcontroller to relieve the main microcontroller of some of its job.
  - G-code subsets: Making microcontroller-based Gcode interpreters that focus on the most important commands for less complex designs.
- Increased Precision and Control:
  - Microstepping implementation: Achieving better resolution and smoother motion with limited computing power is possible using micro stepping techniques in stepper motor drivers.
  - Sensor integration: Sensors are integrated to offer real-time feedback on tool positioning, spindle speed, and cutting pressures, enhancing accuracy and safety.
  - Adaptive control algorithms: Create control algorithms that optimize motor parameters according to cutting conditions and material qualities.
- Improved User Experience and Connectivity:
  - Wireless control: establishing wireless or Bluetooth links to provide control and monitoring from mobile devices.

- Cloud-based G-code generation: Making use of online resources to generate complicated G-code and transmit it straight to the CNC machine.
- User-friendly interfaces: Designing user-friendly interfaces for direct microcontroller control of the CNC machine, especially in the absence of a full-featured display.

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## اثر تدريبات مقترحة لتطوير القوة الانفجارية ودقة التهديف من خارج منطقة الجزء للاعبين كرة القدم لفئة الشباب

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## مستخلص البحث

يعتمد التدريب الرياضي في الأساس على تدريب الرياضي لمختلف التمرينات سواء كانت بدنية او مهارية والتي تؤدي وفق تدريب منظم ومخطط بشكل علمي من قبل المدربين والخبراء والمختصين لوصول اللاعبين في نهاية مراحل التدريب إلى التكيف بصورة تجعله قادرا على تحقيق افضل الانجازات أثناء الاشتراك في البطولات والمنافسات الرياضية سواء كانت محلية او دولية وتعد لعبة كرة القدم من اهم الرياضات الجماعية الاكثر ممارسة وشعبية ، حيث هدف البحث الى التعرف على تأثير التمرينات المقترحة في تطوير القوة الانفجارية ودقة التهديد من خارج منطقة الجزاء بكرة القدم ، واستخدم الباحث المنهج التجريبي بتصميم المجموعتين المتكافئتين حيث كانت عينة البحث لاعبي شباب نفط الوسط بأعمار (١٦ ، ١٨) عام وقسمت العينة الى مجموعتين كل مجموعة (١٠) لاعبين وتعد صفة القوة من الصفات البدنية المهمة لاعبي كرة القدم وذلك لارتباطها الوثيق بباقي الصفات البدنية الاخرى كما وان للقوة اهمية كبيرة في التهديد إذ ان تنمية وتطوير المجاميع العضلية من خلال التدريب تعطي اللاعب تأثيرا افضل ومجهودا اقل عند التهديد من خرج منطقة الجزاء ومن هنا جاءت أهمية البحث المتضمنة الوقوف على امكانات اللاعبين الشباب الحقيقية في متغيرات الدراسة وتطوير الصفات والمهارات الاساسية من خلال اعداد تمرينات مركبة تزود اللاعبين والمدربين والمختصين بشؤون اللعبة ببيانات عن الجانب التدريبي لاستثمار الوقت والجهد للتوصل الى تدريب الشباب في افضل صورة ممكنة لتحقيق الفوز. من خلال الملاحظة الميدانية والمتابعة المستمرة في اللعبة ، ولاحظ الباحث بعدم إعطاء تمرينات خاصة داخل المنهاج التدريبي والوحدة التدريبية اليومية بهدف اكتساب وتطوير قوة ودقة التهديد من مسافات مختلفة في المنهج التدريبي بل يكون معظم تركيزهم على تحسين الاداء المهاري الخاص .

## الكلمات المفتاحية

التمرينات المركبة وتشمل التمرينات المهارية والبدنية

١-التعريف بالبحث :

## ١-١- مقدمة البحث وأهميته :

أن التطور الحاصل في علم التدريب الرياضي على المستوى العالمي الحديث فرض علينا آفاقاً جديدة في عملية تطوير وتنمية طرق حديثة في العملية التدريبية مما جعل المختصين في المجال الرياضي يتطلعون إلى مستقبل أفضل من خلال إيجاد الحلول المناسبة عن طريق مختلف الوسائل والأجهزة والطرق العلمية الحديثة التي تؤثر في نتائج المباريات بمختلف تخصصاتها ويتطلب الوصول إلى المستوى الجيد إلى إتباع التخطيط العلمي المنظم وإتباع الأساليب العلمية الحديثة الموضوعية والتدريب المبني على أسس علمية ويتعلق هذا الأمر بما يقدمه التدريب وطرائقه من مبادئ وأسس تخدم العملية التدريبية وما يتطلب من أداء مركب بدني مهاري حيث أصبح لزاماً إتباع كل ما هو متطور ومدروس من قبل علماء التدريب الرياضي بصورة عامة وتدريب لاعبي كرة القدم بصورة خاصة ومحاولة معرفة جميع المؤثرات التي تؤدي إلى عدم تحقيق نتائج إيجابية خلال الاشتراك بالبطولات المختلفة في كرة القدم .

وتعد لعبة كرة القدم من أهم الرياضات الجماعية الأكثر ممارسة وشعبية في أغلب بلدان العالم ، وتعد صفة القوة من الصفات البدنية المهمة والأساسية للاعب كرة القدم وذلك لارتباطها الوثيق بباقي الصفات البدنية الأخرى كالسرعة كما وأن للقوة أهمية كبيرة في التهديف إذ أن تنمية وتطوير المجاميع العضلية من خلال التدريب تعطي اللاعب تأثيراً أفضل ومجهوداً أقل عند التهديف من مسافات مختلفة ويحتاج اللاعبون إلى صفة القوة العضلية في جميع تحركاته أثناء ممارسته التهديف وأن احتياج اللاعب للقوة العضلية يختلف بتنوع النشاط الرياضي الممارس ونظراً لتعدد أنواع صفة القوة العضلية فإننا نطلق على أنواع القوة التي يحتاج إليها لاعب كرة القدم في التهديف إلى القوة الانفجارية والوصول إلى النتائج الإيجابية المتوقعة إضافة إلى أهمية دقة التهديف الذي بدوره ينعكس إيجاباً على نتائج المباريات وبالتالي تحقيق الفوز ، أن الدراسة سوف تساهم وبدرجة كبيرة في رفد المعلومات اللازمة وإضافة الخبرات الضرورية لكل من المدربين واللاعبين والأندية والاتحادات والمؤسسات الرياضية والمهتمين والمختصين والقائمين على لعبة كرة القدم من خلال الاستفادة من التمرينات المتنوعة التي تتسم بصفة القوة عند الأداء في التمرين والتي تساعد في تطوير وتحسين قوة ودقة التهديف التي تساهم وبشكل فعال في اكتساب الأداء المهاري المتميز بالقوة

والمهارة والتي تؤدي الى حسم نتيجة المباراة لصالح الفريق الذي يتميز أداءه بقوة ودقة التهديف وبفاعلية عالية مستمرة في الاداء الهجومي.

ومن هنا جاءت أهمية البحث المتضمنة الوقوف على امكانيات اللاعبين الشباب الحقيقية في متغيرات الدراسة وتطوير قدراتهم الضرورية من خلال اعداد تمارين بدنية مهارية تزود اللاعبين والمدربين والمختصين بشؤون اللعبة ببيانات عن الجانب التدريبي لاستثمار الوقت والجهد للتوصل الى تدريب الشباب في افضل صورة ممكنة لتحقيق الفوز.

#### ٢-١ مشكلة البحث :

من خلال الملاحظة الميدانية والمتابعة المستمرة في اللعبة ، ولكون الباحث لاعب كرة قدم مثل العديد من الاندية لاحظ أن الكثير من المدربين لا يقومون بإعطاء تمارين خاصة داخل المنهج التدريبي والوحدة التدريبية اليومية بهدف اكتساب وتطوير قوة ودقة التهديف من مسافات مختلفة في المنهج التدريبي بل يكون معظم تركيزهم على تحسين الاداء المهاري الخاص مما سبب هنالك ضعف واضح في صفة القوة الانفجارية مما انعكس سلبا على قوة ودقة التهديف على المرمى وتدني في مستوى اداء اللاعبين الهجومي اثناء المباريات لذا ارتأى الباحث الخوض بدراسة هذه المشكلة دراسة وافية ومحاولة ايجاد الحلول الناجحة لحل هذه المشكلة وذلك من خلال اعداد تمارين مركبة حديثة ومتنوعة في اللعبة تساعد لاعبين كرة القدم الشباب على اكتساب قوة ودقة التهديف وتطويرها مع الاداء المهاري الهجومي الفعال طوال فترة المباريات اثناء التدريب المنتظم المستمر عليها والالتزام بتطبيقها .

#### ٢-١ أهداف البحث :

يهدف البحث إلى ما يلي :-

- ١- اعداد تمارين مهارية بدنية على تطوير قوة ودقة التهديف من خرج منطقة الجزاء للشباب .
- ٢- التعرف على اثر التمارين المهارية البدنية على تطوير قوة ودقة التهديف من خرج منطقة الجزاء للشباب.



١- ٤ فروض البحث :

- ١- توجد فروق معنوية ذات دلالة احصائية للتمرينات بين الاختبارات القبلية والبعدية .  
٢- توجد فروق معنوية ذات دلالة احصائية للتمرينات المقترحة على تطوير قوة ودقة التهديف من خارج منطقة الجراء للشباب

١- ٥ مجالات البحث :

- ١-٥-١ المجال البشري:- لاعبي نادي نفط الوسط الرياضي لكرة القدم .  
١-٥-٢ المجال الزمني:- المدة من ٥/١١/٢٠٢٣ لغاية ١/٤/٢٠٢٤ .  
١-٥-٣ المجال المكاني:- ملعب نادي نفط الوسط بكرة القدم للشباب .

٢ منهجية البحث وإجراءاته الميدانية :

٢\_١ منهج البحث :

استخدم الباحث المنهج التجريبي ذو المجموعتين المتكافئتين الضابطة والتجريبية "المنهج التجريبي هو عملية منظمة تجري تحت ظروف او شروط معينة ومسيطر عليها او اختبار وجيه نظر جديدة لاكتشاف شيء جديد " (محمد الياسري ، ٢٠١٧ ، ص٢٥٨) .

٢\_٢ مجتمع وعينة البحث :

تم تحديد مجتمع البحث وهم لاعبي (نادي النجف الاشرف ، نادي نفط الوسط ، نادي الخورنق ، نادي الكوفة ، نادي المشخاب ، نادي التضامن ) للشباب واختار الباحث نادي نفط الوسط الرياضي بكرة القدم بأعمار ( ١٦ - ١٨ ) والبالغ عددهم ( ٢٠ ) لاعبا بالطريقة العشوائية .

٢-٣ الوسائل والاجهزة المستخدمة في البحث :

٢- شبكة المعلومات الدولية .

٣- كرات عدد (١٠) .

٤- شواخص عدد (١٢) .

٥- ملعب كرة قدم .

٦- صافرة عدد (٢) .

٧- شريط قياس نسيجي .

٢- حاسبة عدد (١) نوع ( hp ) .

٣- ساعة توقيت عدد ( ٢ ) .

٤- كاميرا فيديو لتوثيق البيانات نوع ( sony ) .

٥- استمارة الاستبيان للآراء الخبراء والمختصين حول اختيار الاختبارات الخاصة بالبحث..

١١- جهاز من الخشب لقياس التوازن العضلية .

٢-٤ إجراءات البحث الميدانية

٢-٤-١ اختبار القوة الانفجارية :

اختبار القوى القصوى للرجلين

١- اسم الاختبار : دفع الساقين

٢- الغرض من الاختبار : قياس القوة القصوى لعضلات الرجلين الرباعية والخلفية والكولف .

❖ العمل الميكانيكي : مركب .

٣- الأدوات المستخدمة

❖ ماكينة دفع الساقين .

٤- وصف الاداء

الجلوس على ماكينة دفع الساقين ، ضع اقدمك سوية ضد العارضة والفتحة بين القدمين بعرض الكتف مع تأشير

اصابع قدمك الى الخارج قليلا ، امسك المقبض او جوانب المقعد ، ثم اثني ركبتيك واخفض الوزن قدر الامكان من

دون تغيير موقع وركك ، عدم خفض الوزن الى ابعد من بداية الورك لكي لا يثنى المقعد ، ثم ادفع الوزن ببطء الى الاعلى باستعمال كعوب حذائك وليس اصابع قدميك ، لا تغلق ركبتك في الاعلى ، اجعل الوزن منخفضا مرتا اخرى ببطء .

٥- طريقة التسجيل :

( ody Building ٢٠٠٤ )

❖ تسجل افضل نتيجة من بين محاولتين وبأعلى وزن ممكن .



شكل (١) اختبار القوة الانفجارية

٢-٤-٢ اختبار التهيف

١- اسم الاختبار التهيف من خارج منطقة الجراء والكرة ثابتة ( المعدل ) .

٢- الهدف من الاختبار : التهيف من خارج منطقة الجراء .

٣- الادوات المستخدمة: ملعب كرة قدم - صافرة - بورك لتثبيت مسافة الاختبار- كرات قدم.

٤- طريقة الاداء : توضع للمختبر (٣) كرات على بعد ( ١٩ ) م من خط المرمى ثم يبدأ بالتسديد على المربعات المرسومة على الهدف وبمسافة (٨٠) سم للمربع الواحد على ان يتم اداء الاختبار من وضع الركض ويبدأ الاختبار من (١) وينتهي بـ(٣) والشكل ( ٨ ) يوضح ذلك ولا تعد المحاولة صحيحة في الحالات الآتية

١- الفشل في ركل الكرة .

٢- اذا تدرجت الكرة على الارض منذ البداية بتأثير الهواء او تأثير اخر .



(٢) دقة التهديف من خارج منطقة

الجزء

يحتسب ع

٥- طريقة التسجيل:

يحتسب عدد الاصابات التي تدخل المربعات ، اذ تسجل ثلاث درجات للمربع (٣) ودرجتان للمربع (٢) ودرجة واحدة للمربع (١) وصفرا اذا كانت الكرة خارج المرمى. (مفتي ابراهيم حماد ، محمد صالح عبدة الوحش : ١٩٩٤ ، ص ١٩٠).

ملاحظة/كان في الاختبار السابق تنفذ(٦) محاولات، اما بعد التعديل أصبحت ثلاث محاولات ، وتم استخدام جهاز الـ(emg) لقياس القوى العضلية القصى للرجلين .

٢\_٥ التجربة الاستطلاعية

لغرض التعرف على الصعوبات التي قد تظهر خلال الاختبارات او التجربة الرئيسية قام الباحث بأجراء تجربة استطلاعية حيث قام الباحث بإجراء تجربة استطلاعية على عينة مكونة من (٨) لاعب من شباب نادي التضامن

الرياضي وهم من مجتمع العينة على قاعة ملعب نادي نفط الوسط لكرة القدم في يومي الجمعة المصادف ١٨ / ١١ / ٢٠٢٣ / في تمام الساعة الثالثة عصرا قبل القيام بالتجربة الرئيسية .

## ٦-٢ الأسس العلمية للاختبارات

### ١- صدق الاختبارات

الاختبار الصادق منطقيا" هو الاختبار الذي يمثل تمثيلا سليما للميادين المراد دراستها " وعليه فقد استخدم الباحث صدق المحتوى اذ يعتمد على اراء الخبراء والمختصون في التأكيد على ان الاختبار يقيس الظاهرة التي وضع من اجلها فعلا وهذ ما اكده الخبراء عندما اجمعوا على ان الاختبارات المستخدمة في البحث تقيس الظاهرة التي وضعت من اجلها فعلا . ( مصطفى باهي ، ١٩٩٩ ، ص٢٩ )

### ٢- ثبات الاختبارات :

استخدم الباحث طريقة الاختبار واعادة الاختبار ( ان الاختبار يحقق نفس النتائج او مقارنة اذا اعيد تطبيقه على نفس الافراد تحت نفس الظروف اكثر من مرة ) واستخدم الباحث ( الاختبار واعادة الاختبار ) للتحقق من ثبات مجموعة الاختبارات المرشحة وتم تطبيق الاختبارات على عينة مكونة من ( ٢ ) لاعبين . ( محمد الياسري : ، ٢٠١٠ ، ص٥٢ )

### ٣- موضوعية الاختبارات

" وتعني ان تصف قدرات الفرد كما هي موجودة فعلا لا كما نريدها ان تكون ، أي انها درجة

الاتفاق بين الخبراء والمختصين والابتعاد عن الآراء الذاتية وان الاختبار الذي يتصف بالموضوعية ، ، حيث اجريت الاختبارات بإشراف محكمين اثنين\* وقد استخرجت موضوعية الاختبارات بأستخدام الارتباط البسيط بيرسون بين اراء السيدين المحكمين وكما مبين بالجدول (١) الذي يبين ان الاختبارات تتمتع بموضوعية عالية .

(مصطفى حسين باهي: ١٩٩٩، ص ٦٤ . \*المحكمون)

جدول (١) يبين معامل الصدق والثبات والموضوعية للاختبارات

ت	الصفة / المهارة	الاختبارات	الصدق	الثبات	الموضوعية
٢	القوة الانفجارية لعضلة الرجلين	أسم الاختبار :- اختبار الوثب الطويل من الثبات	٠,٧٥	0.85	٠,٨٩
١١	التهديف من خارج منطقة الجراء	دقة التهديف	٠,٧١	0.84	٠,٨٢

## ٢- ٧ الاختبارات القبليّة

تم اجراء الاختبارات القبليّة على عينة البحث بعد استكمال الاسس العلمية للاختبارات وإجراء التجربة الاستطلاعية حيث اجريت الاختبارات في ( قاعة جو وايدر لبناء الاجسام - ملعب نفط الوسط ) وقد اجريت يوم الجمعة المصادف ٢٩ / ١١ / ٢٠٢٣ في الساعة ٤ عصرا.

## ٢\_ ٨ المنهج التدريبي

قام الباحث بأعداد منهج تدريبي كما موضح في الملحق (١) لا افراد عينة البحث مبني على الاسس العلمية مراعيًا" كافة المتطلبات و الشروط اللازمة لا عداد المنهج التدريبي كما موضح ادناه

١- استغرق تطبيق المنهج التدريبي (٨) اسبوع وبمعدل (٣) وحدات تدريبية اسبوعية وبذلك بلغت عدد الوحدات (٢٤) وحدة تدريبية.

٢- تم استخدام طريقة التدريب الفكري مرتفع الشدة خلال تطبيق المنهج لتمرين الإطالة، واستخدم التدريب التكراري لتمرين القوة القصوى .

٣- تم تطبيق لمنهج في يوم السبت المصادف ٦ / ١٢ / ٢٠٢٣ ولغاية ٧ / ٢ / ٢٠٢٤ .

٤- تم تنفيذ المنهج في يوم الاحد والثلاثاء والخميس من كل أسبوع .

٥- تم تطبيق المنهج التدريبي في فترة الاعداد العام .

## ٢\_٩ الاختبارات البعدية :

تم اجراء الاختبارات البعدية على عينة البحث بعد الانتهاء من مدة تطبيق المنهج التدريبي يوم الاحد المصادف ١١ / ٢ / ٢٠٢٤ الساعة الرابعة عصرا .

## ٢- ١٠ الوسائل الاحصائية

استخدم الباحث الحقيقية الاحصائية (SPSS) للحصول على نتائج البحث .

➤ اختبار ( t ) للعينات المستقلة .

➤ اختبار ( t ) للعينات المترابطة .

➤ معامل الارتباط البسيط ( بيرسن ) .

➤ معامل الاختلاف .

➤ قانون الأهمية النسبية .

➤ الوسط الحسابي .

➤ الانحراف المعياري .

٤- عرض النتائج وتحليلها ومناقشتها :-

٤-١ عرض نتائج الاختبارين القبلي والبعدي للقوة الانفجارية والتهديف من خرج منطقة الجراء للمجموعة الضابطة والتجريبية وتحليلها ومناقشتها:

الجدول (٢)

يبين الفروق بين الاختبارين القبلي والبعدي للمجموعتين الضابطة والتجريبية في المتغيرات

ت	المتغيرات	وحدة القياس	الاختبار القبلي		الاختبار البعدي		س ف	ع ف	قيمة t المحسوبة	مستوى الدلالة
			ع	س	ع	س				
٢	القوة الانفجارية	المتري	٢,٠٠٤	٠,٠٩٤	٢,٠٧٢	٠,٠٨٥	٠,٠٦٨	٠,٠٢٩	٧,٥٢٠	٠,٠٠٠
٦	التهديف من خارج منطقة الجراء	درجة	٤,٤٣٢	٠,٦٦٧	٥,٦٣٨	٠,٥٦٠	١,٢٠٦	٠,٦٥٣	٥,٨٣٦	٠,٠٠٠

المناقشة

في صفة (القوة الانفجارية) ظهرت فروق معنوية بين الاختبارين القبلي والبعدي ولصالح الاختبار البعدي في المجموعة التجريبية ، ويعزو الباحث هذا التطور إلى التمارين البدنية المهارية (المركبة) التي اثرت في الأداء وبشكل خاص وتعتمد على الحس الحركي بالعضلة العاملة والمقابلة ، حيث تم تنمية صفة القوة من مبدأ العلمي في التدريب وهو التدرج بالحمل حيث من السهل الى الصعب ومراعاة اعمار اللاعبين عن طريق



التكرارات بالنسبة للشدة والحجم بزيادة ارتفاع القفز من فوق الصناديق بارتفاع (٢٠سم ، ٢٥ سم ، ٣٠سم ) أو المسافات على سلم ارضي ، وتعد هذه التمرينات هي الأكثر فعالية في تنمية وتطوير القوة الانفجارية ولأنها تمارين مقننة اعدت بأسلوب علمي رصين تفرض على اللاعب جهداً عالياً وبشكل خاص على العضلات والأوتار والمفاصل العاملة لهذا السبب يتأقلم الجسم بالتدريج مع هذا النوع من اداء التمرينات عن طريق البدء بالتمرينات الأقل صعوبة ،الى اعلى صعوبة ، وعمد الباحث إلى استخدام التمارين (المركبة) التي يؤدي خلالها اللاعبون القفز بالكرة وبدون الكرة ، أو التحرك السريع لاستقبال الكرة أو السيطرة على الكرة بأقصر وقت ممكن اضافة الى المراوغة السريعة بين اللاعبين لاجب ضد لاعب والانطلاقات السريعة بالكرة ومن دونها والمناولات الطويلة (الجمل الحركية المركبة) تلك الحركات كلها تعتمد على العضلات العاملة والمقابلة وان الربط بين السرعة الحركية والقوة العضلية في العضلات تعد من متطلبات الأداء الحركي. فالشدة المستعملة التي تتناسب مع الصفات المبحوثة والمدة الزمنية لاستغراق التدريب كانت كافية بإحداث التغيير الحاصل في النتائج بالقدر الكافي والمناسب وهذا ما أكده كل من (ويلمور وكومستل) 1994 نقلاً عن (أبو العلا) " بأن معظم التغيرات البدنية الناتجة عن التدريب تحدث غالباً خلال المدة الأولى من البرنامج في غضون 6 . 8 أسابيع".

( أبو العلا احمد 1996 ، ص 32 )

### اما مهارة دقة التهديف

اعتمد البرنامج التدريبي الأساليب العلمية الصحيحة في وضع التمارين المركبة المتعلقة بمهارة التهديف من خارج منطقة الجزاء مما لذلك من تأثير كبير في تطوير مستوى أداء اللاعبين عن طريق التمرينات الخاصة التي تتناسب بطبيعة العينة إذ أن " اختيار التمرينات المناسبة تمكن المدرب من تطوير الصفات البدنية وفي الوقت نفسه تعمل على إتقان اللاعب للمهارات".

(حنفي محمود مختار : : ١٩٨٠، ص

. (٤٦

اضافة الى استعمال الامثل للأجهزة، ولأدوات المتاحة لتحقيق هدف التمرينات المركبة اذا توكد (الين وديع فرج ٢٠٠٢) " الاستعمال الامثل للإمكانات، والتجهيزات والادوات المتاحة، والزمين المخصص للتدريب يعد عاملا مهما لأجراء تدريب ولتحقيق الأهداف الموضوعية. (الين وديع فرج : ٢٠٠٢ ، ص ١٢٧)

ان التمرينات المركبة التي اعددها الباحث كان لها القدرة على توافر التنوع في التدريب لتنمية المهارات والصفات ، اذ يشير (كمال جميل ٢٠٠١) " التنوع في الاداء الرياضي من العوامل الاساسية لعملية التوازن في التكامل المهاري، والخططي، ويعمل على زيادة الرغبة في التدريب الرياضي للاعبين. . (كمال جميل الرياضي، ٢٠٠١ ، ص ١٢٩-١٢٧)

تم تنفيذ التمرينات المركبة التي اعددها الباحث في ظل ظروف مشابهة لظروف اللعب، حيث يوكد (Luiselli2011) " التنفيذ للمهارات المركبة في ظل ظروف مشابهة لظروف اللعب تؤدي الى تطور مهارات اللاعب في كل المواقف التي توجه خلال اللعب.

Luiselli K. james and d. Derek :, 2011 , p 162)

( حيث يذكرون ان (التدريب يعمل على تحسين الصفات البدنية ومستوى الأداء المهاري على حدٍ سواء). ويرى الباحث هذا التطور في المجموعة التجريبية إلى التمارين (البدنية المهارية) التي طبقت على العينة خلال الاعداد الخاص حيث من الضرورة ان تكون التمارين في هذه الفترة مشابهة للأداء ومؤثرة بالإضافة إلى تكيف اللاعبين مع التمارين من حيث الشدة والتكرار والاداء وفتترات الراحة. أن لعبة كرة القدم لعبة جماعية تتطلب التعاون بين اللاعبين داخل الملعب، كما يجعل الفريق الحائز على الكرة من خلال الترابط بين اعضاء الفريق عن طريق الدرجة بالكرة او التحرك بدون كرة كذلك المناولات بأنواعها القصيرة والمتوسطة والطويلة والتهديف بأنواعه وهذه المهارات تحتاج الى صفات بدنية مما اقتضى على الباحث التركيز عليها ورفع القابليات البدنية وتوظيفها في

##### 5- الاستنتاجات والتوصيات

## ٥- ١ الاستنتاجات :

١- للتمرينات المركبة المهارية والبدنية اثر ايجابي في صفة القوة الانفجارية والتهديف من خارج منطقة الجراء .

## ٥- ٢ التوصيات :

- ١- ضرورة ان يتولى تدريب الفئات العمرية مدربين اكفاء مؤهلين علميا لان الشباب هم القاعدة الأساسية في الوصول الى المستوى العالي.
- ٢- التأكيد على أهمية تدريبات القوة بأساليب حديثة بما يخدم المستوى المهاري للاعبين .
- ٣- اجراء دراسات مشابهة لوضع وتخطيط مناهج تدريبية مبنية على اسس علمية حديثة تساعد المدربين والقائمين على لعبة كرة القدم في تأهيل لاعبيهم والارتقاء بمستوياتهم البدنية والمهارية.

## الملاحق

## التمرين الاول

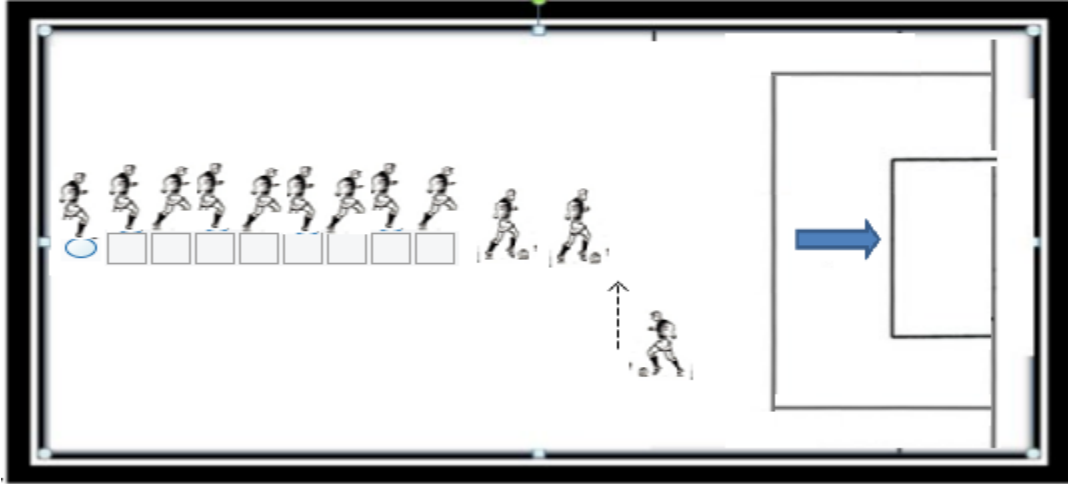
اسم التمرين : القوة الانفجارية و دق التهديف من خارج منطقة الجراء.

هدف التمرين : تنمية القوة الانفجارية و دق التهديف من خارج منطقة الجراء..

الادوات المستخدمة : كرات عدد (١٠) ، كرة طبية عدد (٤) ، سلم ارضي طولة (٨) متر، صافرة عدد ( ١ )

طريقة الاداء : الوقوف على كرة مطاطية بقدم الارتكاز لمدة ( ١٥ ) ثانية ثم مناولة ثم مناولة قصيرة و القفز

بالقدمين على سلم ارضي طولة (٥) متر استلام الكرة من زميل والتهديف من خارج منطقة الجراء.



رسم (١)

## قائمة الرموز والأشكال

الشكل	التفسير	الشكل	التفسير
	مسار الكرة مع اللاعب		مسار اللاعب
	التهديف		شاخص
	لاعب		كرة قدم
	مسار الكرة		كرة مطاطية

## التمرين الثاني

اسم التمرين : التوازن و الرشاقة و القوة الانفجارية والتهديف .

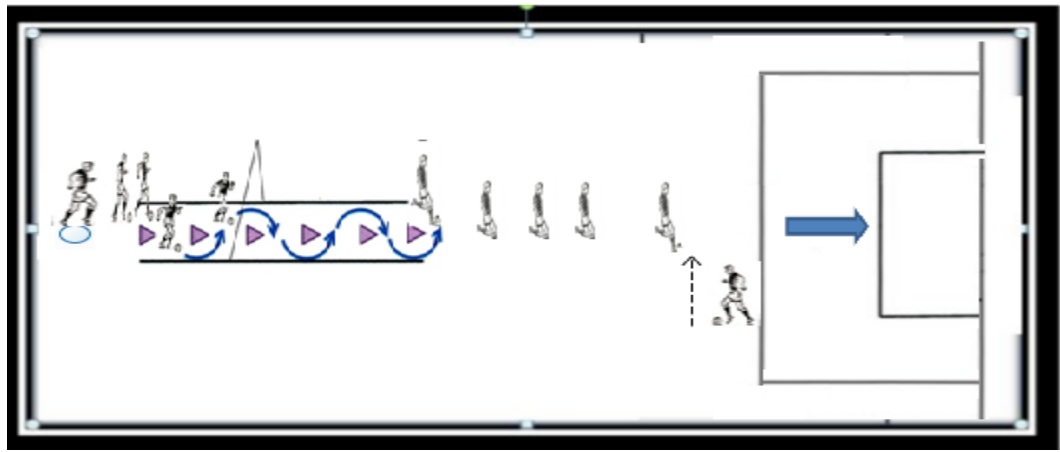
هدف التمرين : التوازن و الرشاقة والتهديف و القوة الانفجارية والتهديف.

الادوات المستخدمة : كرات عدد ( ١٠ ) ، كرة طبية عدد ( ٤ ) ، شواخص عددها (٦) ، صافرة عدد ( ١ ) .

طريقة الاداء : الوقوف على كرة مطاطية ( للتوازن ) بقدم الارتكاز لمدة (١٠) ثانية ثم الدرجة بالكرة بين

الشواخص عددها ( ٦ ) بين كل شاخص ( ١,٥ ) متر ومناولة الكرة لزميل يبعد (٩) متر بعدها القفز بكلتا

القدمين لأبعد مسافة ممكنة لثلاث مرات ثم استلام الكرة من زميل والتهديف من خارج منطقة الجزاء.



الرسم (٢)

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➤ أبو العلا احمد : حمل التدريب وصحة الرياضي ، القاهرة ، دار الفكر العربي ، 1996 ، ص 32

➤ حنفي محمود مختار : الأسس العلمية، تدريب كرة القدم، القاهرة، دار الفكر العربي ١٩٨٠، ص ٤٦ .

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## تشخيص الهيدروكربونات العطرية متعددة الحلقات PAHs في عينات عصير الفواكه

### Diagnosis of polycyclic aromatic hydrocarbons (PAHs) in fruit juice samples

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## الخلاصة

هدف البحث الحالي الى التحقق من مستوى PAHs المركبات الحلقية الهيدروكاربونية الاروماتية في عينات عصير الفاكهة من خلال اختبار ثلاث عينات من عبوات مختلفه مصنعه من المواد ( الزجاجية، العلب الرباعية ، العلب المعدنية) ولنوعين من العصير البرتقال والخوخ . اذ تم الحصول على هذه العينات من مصادر الاسواق في مدينة بغداد ، تم عزل هذا العينات وتشخيصها بأستخدام جهاز كروماتوكرافي الغاز عالي الاداء GC اذ اظهرت النتائج في العبوات الثلاث للنموذجين بنسب مختلفه ،اذ لم تظهر في عصير البرتقال نوع العلبه الزجاج ، وفي العلبه المعدنية المعلبه بلغت ٠,٢٩ ppm وبلغت النسبة في العلبه الرباعية ٠,١٧٧ ppm . اما بالنسبة لعصير الخوخ نوع العلبه الزجاجية أيضا لم تظهر هذه المركبات وفي العلبه المعدنية المعلبه بلغت النسبة ٠,١٣ ppm وفي العلبه الرباعية حيث بلغت ٠,١٤٤ ppm ، وكان اعلى مستوى للهيدروكاربونات العطرية متعددة الحلقات في عصير البرتقال 0.049 ppm في العبوة الرباعية ، وادنى مستوى في عصير الخوخ بلغ ٠,٠١٢ ppm اشارت هذه الدراسة الى وجود مخاطر صحية على المستهلكين اذ تسبب هذه المركبات الامراض التراكمية والتي تظهر على صحة الانسان على المدى البعيد.

**Abstract**

The current research aimed to verify the level of PAHs and aromatic cyclic hydrocarbon compounds in fruit juice samples by testing three samples from different containers made of materials (glass, square cans, metal cans) and two types of juice, orange and peach. As these samples were obtained from market sources in the city of Baghdad, these samples were isolated and diagnosed using a high-performance gas chromatograph (GC). The results showed different percentages in the three containers of the two models, as they did not appear in the orange juice type of glass container, and in the canned metal container it amounted to 0.29 ppm, and the percentage in the quadrilateral box reached 0.177 ppm. As for the peach juice type in the glass container, these compounds also did not appear. In the canned metal container, the percentage reached 0.13 ppm, and in the four-pack container, it reached 0.144 ppm. The highest level of polycyclic aromatic hydrocarbons in orange juice was 0.049 ppm in the four-pack container, and the lowest level in peach juice was 0.049 ppm. 0.012 ppm This study indicated the presence of health risks to consumers, as these compounds cause cumulative diseases that appear on human health in the long term.



**Keywords: cyclic hydrocarbon compounds - dangers of glass, metal and aluminum containers - consumer health**

## المقدمة

الهيدروكربونات العطرية متعددة الحلقات (PAHs) هي مركبات عضوية تحتوي على حلقتين عطريتين أو أكثر. تشتمل الهيدروكربونات العطرية متعددة الحلقات على أكثر من ١٠٠ مادة كيميائية خطيرة من الغذاء والبيئة (Nagpal, 1993). تؤدي التفاعلات التي لا يمكن تجنبها مع الغلاف الجوي والماء والتربة إلى هجرة الهيدروكربونات العطرية متعددة الحلقات إلى الغذاء، وبالتالي فإن المصدر الرئيسي للتعرض لهذه الهيدروكربونات العطرية متعددة الحلقات هو الغذاء (Hodson, 2017)، تتراكم الهيدروكربونات العطرية متعددة الحلقات في البيئة بسبب طبقة الشمع الموجودة في قشر المادة الخام أو يمكن أن تتلوث بمواد التشحيم في آلة الحصاد (Machado et al., 2014). يمكن أن تكون خزانات الخشب أو رقائق الخشب المصنوعة من عمليات التجفيف والتحميص المتكررة بالنار مصادر للهيدروكربونات العطرية متعددة الحلقات (Chinnici et al., 2007). يمكن أن تتلوث الأطعمة النيئة مثل الفواكه من خلال الظروف البيئية المعاكسة (تلوث الماء والهواء والتربة) والأطعمة المطبوخة أثناء عملية الطهي (التحميص أو التجفيف والتدخين والقلي والشوي). لذلك، يمكن أن يكون تراكم مركبات PAH في عصائر الفاكهة بسبب تلوث الفواكه أو المواد المضافة أثناء المعالجة أو التعبئة والتغليف (Camargo & Toledo 2003; Jafarabadi et al. 2020; Moazzen et al. 2013; Shariatifar et al. 2020a; Shariatifar et al. 2021).

يعد تحليل مركبات PAH في عينات عصير الفاكهة أمراً صعباً بشكل خاص لأن هذه الأطعمة تحتوي على العديد من المكونات مثل الأحماض العضوية وقطع الفاكهة المقطعة ولب الفاكهة والأصبغ والبوليفينول والسكر والكلوروفيل. ويجب استخدام طريقة لاستخراج وتنظيف عينات عصير الفاكهة من أجل تحقيق هذا الهدف

حتى الآن، لم يتم إجراء أي دراسة شاملة حول كمية الهيدروكربونات العطرية متعددة الحلقات في عينات عصير الفاكهة في الاسواق العراقية ، أيضاً، في هذه الدراسة، تم تقييم تأثير التغليف على كمية PAHs في

عصير الفاكهة. لذلك، كان الغرض من الدراسة الحالية هو قياس مستويات PAH في عينات عصير الفاكهة (البرتقال، الخوخ،) في ثلاث عبوات مختلفة (زجاجية، عبوة معدنية ورباعية ورقية) باستخدام طريقة GC-MS/

### المواد وطرق العمل

#### • تحضير العينة

جمعت العينات من الاسواق المحلية لمدينة بغداد / العراق لنوعين من العصائر وهما البرتقال والخبوخ لثلاث علب مختلفة ( زجاجية - معدنية - ورقية رباعية ) . اذ ان العلب الزجاجية من شركة الميلاذ /العراق لأنتاج العصائر ، العلب المعدنية من شركة ريان العراق للصناعات الغذائية ، اما العلب الرباعية من شركة سن كويك/ العراق .

#### الاستخلاص

وضع ٥٠ مل من العينة المتجانسة للعصائر في أنابيب زجاجية نظيفة و ١٥ مل من الأسيتون/١:١ ( n-hexane). تم خلط أنابيب العينات ( لمدة دقيقة واحدة) واستخراجها عن طريق المعالجة بالموجات فوق الصوتية (١٥ دقيقة). ثم فصلت العينة المختلطة والمرحلة العضوية عن طريق الطرد المركزي عند ٣٠٠٠ دورة في الدقيقة لمدة ١٠ دقائق. وجمعت الطبقة العضوية التي تحتوي على المركب المستخرج في أنبوب زجاجي نظيف آخر ، واعد استخراج العينة المتبقية مرتين باستخدام ١:١ (v / V) الأسيتون / ٥ ( n-hexane مل). وجمعت المستخلصات، وأضيف النحاس المنشط إلى المستخلص لإزالة الكبريت. ثم جفف كبريتات الصوديوم اللامائية بتركيز ٠,٥ مل، و باستخدام تيار من النيتروجين. و خزنت في الثلاجة للتخزين لحين إجراء التحليل.

#### تشخيص المركبات الهيدروكاربونية الأروماتية متعددة الحلقات في GC

اجريت التحاليل في مختبرات وزارة العلوم والتكنولوجيا - مركز أبحاث الأغذية للكشف عن الهيدروكربونات العطرية متعددة PAHs باستخدام تقنية كروماتوغرافيا الغاز GC ٢٠١٠ - نموذج، شيمادزو من الأصل الياباني، كان عمود الفصل HP-5MS الشعري العمود (٣٠ م، ٠,٢٥ مم، بدرجة الحرارة ٤٠

درجة مئوية / دقيقة واحدة و ١٢٠ درجة مئوية ٣٥ درجة مئوية / دقيقة ١٦٠ درجة مئوية و الانتظار لمدة ١٠ دقائق (كانت درجات حرارة الحاقن والكاشف (FID) على التوالي ٢٨٠، ٣٣٠ درجة مئوية) Chil واخرون، (٢٠١٩).

### النتائج والمناقشة

يبين الجدول (١-١) نسبة الهيدروكربونات العطرية متعددة الحلقات (PAHs) في عينات عصير فاكهة البرتقال والخوخ لثلاث انواع من العلب ( زجاج ، معدني ، ورق رباعي ) ، اذ يبين الجدول (١-١) والاشكال (١-١) و(٢-١) نسبة هذه المركبات بالعلب المعدنية لعصير البرتقال اذ بلغت نسبة المواد Acenaphthene، Benzo(b)Fluranthen، Benzo(a)Anthracene، Anthracene و Naphthalene (0.031) ، (0.025) ، (0.018) ، (0.022) و(0.032) ppm على التوالي . ونسب المواد Anthracene، Benzo(a)Anthracene، Benzo(b)Fluranthen، Acenaphthene و Naphthalene للعلب الورقية الرباعية (0.041) ، (0.030) ، (0.025) ، (0.032) و(0.049) ppm على التوالي . ويبين الجدول ايضا والاشكال(١-٣) و (١-٤) بالنسبة لعصير الخوخ للعلب المعدنية نسب المواد للعلب المعدنية اذ بلغت النسب An(0.024)ppm ، B(a)A(0.021)ppm، B(b)F(0.012)ppm، Ac(0.013)ppm و Na(0.025)ppm . اما العلب الورقية الرباعية فبلغت B(b)F(0.020)ppm، B(a)A(0.026)ppm، An(0.035)ppm ، Ac(0.024)ppm و Na(0.039)ppm على التوالي .

و كانت اعلى نسبة في عينة عصير البرتقال نوع العلب الورق الرباعي والتي بلغت ٠,٠٤٩ ppm وهذه النسبة تشير الى مركب Naphthalene في العينة . ويشير الجدول ( ١-١) الى ان عينات العصائر ( البرتقال ، الخوخ ) في العلب الزجاجية خالية من الهيدروكربونات العطرية متعددة الحلقات اذ لن يتمكن الجهاز من تحسس هذه المركبات مقارنة بالعلب الاخرى. و بلغ مجموع نسبة المركبات الهيدروكربونات العطرية متعددة الحلقات ( PAHs ) لعصير البرتقال في العلب الورقية الرباعية ٠,٢٩ ppm اما العلب المعدنية بلغت ٠,١٧٧ ppm) اما بالنسبة لعصير الخوخ في العلب الورقية الرباعية بلغت ٠,١٣ ppm، و العلب المعدنية فبلغ مجموع نسبة المركبات ٠,١٤٤ ppm، وهذه النسب اقل من النسب التي تؤدي الى ضرر

على صحة المستهلك ولكن قد يكون هناك ضرر تراكمي نتيجة الاستخدام المتكرر علماً أن النسب المسموح بها تكون اقل ضرراً ( اقل من ١٠٦ ) واختلفت

Name( ppm )	Sample 1	Sample 2	Sample 3	Sample 4
Anthracene	0.031	0.024	0.041	0.035
Benzo ( a ) Anthracene	0.025	0.021	0.030	0.026
Benzo ( b ) Fluranthene	0.018	0.012	0.025	0.020
Acenaphthene	0.022	0.013	0.032	0.024
Naphthalene	0.032	0.025	0.049	0.039

No .sample	Name
1	برتقال معدني
2	خوخ معدني
3	برتقال ورقي
4	خوخ ورقي

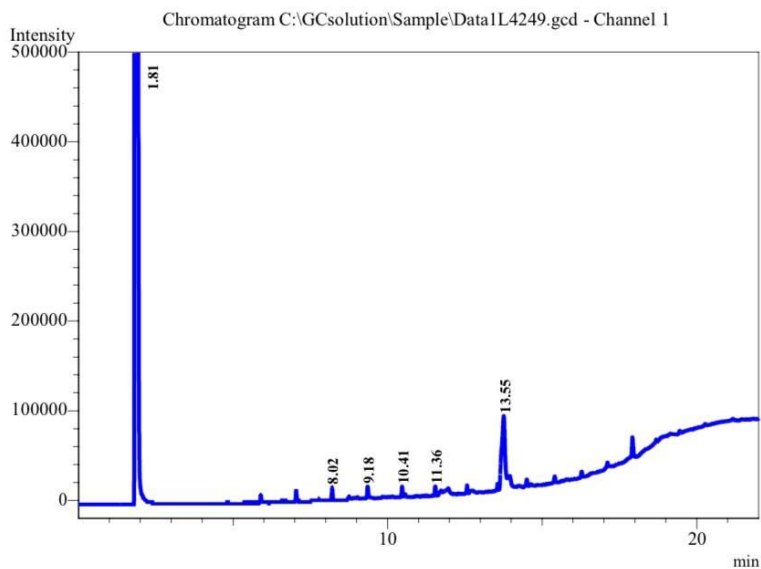
النتائج مع ما توصل اليه الباحث .at.al Mahsa Naghashan (٢٠٢١) اذ بلغ معدل ٠,٠٣٢ ppm

PAHs

جدول (١-١)

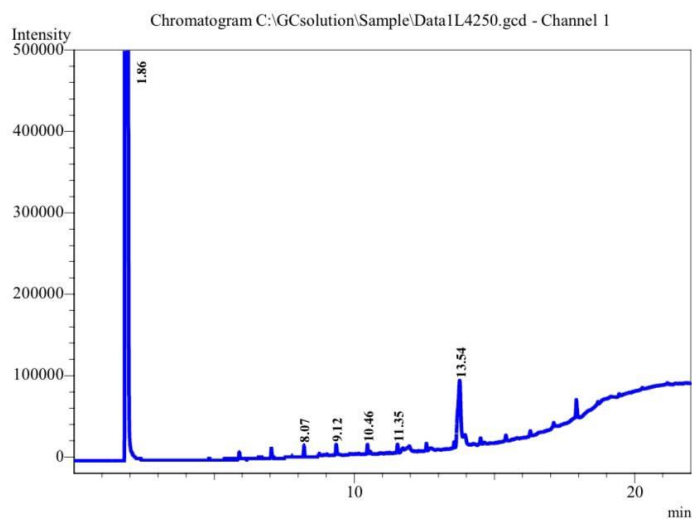
Sample Information

Sample Name = sample 1  
 Injection Volume = 1 µL  
 Tem Injector = 295 C  
 Tem Detector ( FID ) = 330 C  
 Column Oven ( ZB- 5 ) = 100 – 300 C ( 10 c / min )  
 pressure= 100kpa



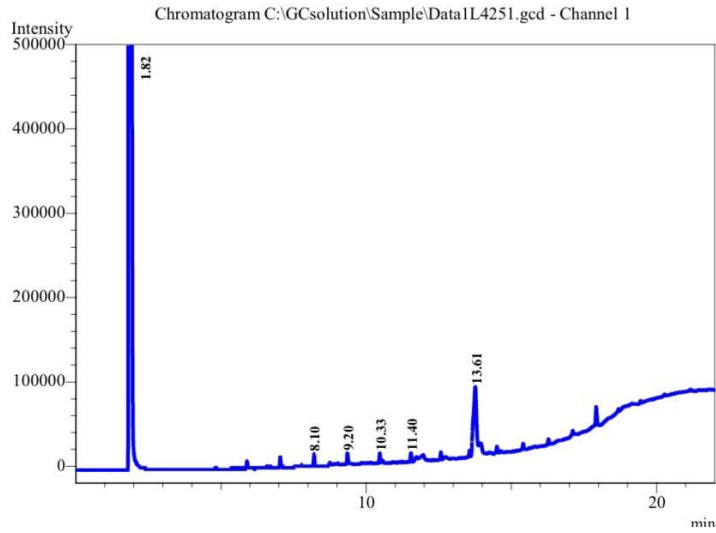
Sample Information

Sample Name = sample 2  
 Injection Volume = 1 µL  
 Tem Injector = 295 C  
 Tem Detector ( FID ) = 330 C  
 Column Oven ( ZB- 5 ) = 100 – 300 C ( 10 c / min )  
 pressure= 100kpa



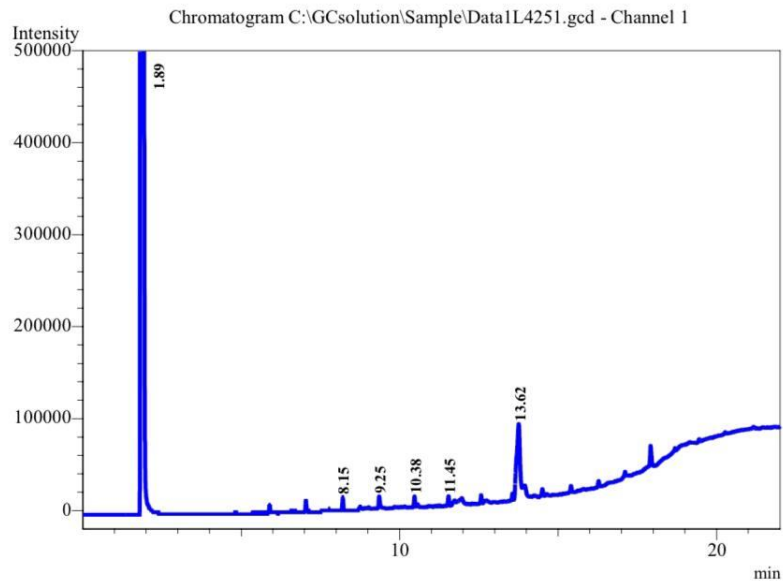
Sample Information

Sample Name = sample 3  
 Injection Volume = 1 µL  
 Tem Injector = 295 C  
 Tem Detector ( FID ) = 330 C  
 Column Oven ( ZB- 5 ) = 100 – 300 C ( 10 c / min )  
 pressure= 100kpa



Sample Information

Sample Name = sample 4  
 Injection Volume = 1 µL  
 Tem Injector = 295 C  
 Tem Detector ( FID ) = 330 C  
 Column Oven ( ZB- 5 ) = 100 – 300 C ( 10 c / min )  
 pressure= 100kpa



### الاستنتاجات والتوصيات

اشار هذا البحث الى ان هذه المواد الموجودة في العصائر لا تسبب تأثيراً كبيراً على المستهلك لكن نوصي بالتقليل من استهلاك العصائر المصنعة بالرغم من محتواها القليل في هذه المركبات وقد يكون الضرر تراكمي ويؤدي الى امراض على المدى البعيد او الاصابة بالسرطان تمت التوصية بالتعرض لل B(a)P بما يزيد عن ٢٠٠ نانو غرام/لتر من وزن الجسم/اليوم عن طريق النظام الغذائي بأعتبره تهديداً محتملاً لصحة المستهلكين (Mahsa Naghashan.at.al)

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## التلوث البيئي وأثره على الصحة المستدامة

### **Environmental pollution and its impact on sustainable health**

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يعتبر التلوث البيئي من أخطر العوامل التي تؤثر على صحة الإنسان وتسبب اعراض صحية طويلة الامد، حيث تؤثر على الاعضاء المهمة مثل القلب والرئتين. البحث يبين مخاطر التلوث البيئي على الصحة المستدامة وتقليل الاثار السيئة على صحة الانسان من خلال النتائج والبيانات الإحصائية المستخرجة.

*الكلمات المفتاحية: الصحة المستدامة، التلوث البيئي، صحة الإنسان، الكائنات الحية*

## Introduction

The issue of environmental and health sustainability has become one of the most important issues of concern to the global community current time. Everyone is aware of the danger to life that environmental problems and environmental pollution pose to human and economic development in the short and long term. Making it environmentally friendly for human health is a strategic dimension because it is a basic condition for achieving sustainable development. Environmental rehabilitation It entails reducing environmental problems that result from the individual's interaction and anti-environmental culture Paying attention to environmental health to evaluate and control these factors that affect health. Human With the aim of health sustainability, disease prevention, and creating an environment that supports health.[1]

The relationship between humans and the environment has undergone major historical transformations throughout human history, but this research will shed light on this relationship from a philosophical perspective. Researchers have used the term nature in its broadest sense to express the environment, which did not appear as a term until the end of the nineteenth century with the beginning of the crisis. [2,3,4]

## pollution Types

**1-Air pollutants:** is manner of the discharge of various gases, satisfactory solids, and dispersed drinks into the environment at high fees that exceed the environment's potential to burn up, dilute, or absorb them. Concentrating those substances in the air may cause many fitness, monetary, and undesirable aesthetic problems. [5] The phenomenon of air pollution is not new, as it dates back to the Middle a long time, and air pollutants have brought about many tragic accidents these days. [6,7]

**2-Water pollution:** can be defined as the terrible impact on water satisfaction as a result of foreign materials getting into its additives. Water pollution includes the pollution of all water resources on the floor of the Earth, whether or not freshwater or seawater, which includes seas, rivers, oceans, and groundwater.[8]

**3-Noise pollution:** Acoustic clustering or noise pollutants is a cacophony of unwanted sounds over time, normally as a result of business development. [9]

**4-Soil pollution** means the creation of foreign substances into the soil or an increase in the awareness of certainly one of its natural components, which may also propose an alternative within the chemical and bodily composition of the soil.[10]

**5-Thermal pollution:** Main sources of thermal pollution

These are tanks and power plants that use water. In cooling and heating metals to produce Steam. Many countries have enacted laws to control water waste discharged by these facilities. [11]

**6-light pollutants:** it's far the soreness resulting from unnatural artificial lighting, which impacts human health on the one hand and the arena of

animals and flowers on the other hand. artificial lights have emerged as clean and occasional-value, and people want them daily.

handling, and disposal of radioactive materials, waste, and contaminants in nuclear power plants. [12,13,14]

## MATERIALS AND METHOD

By collecting extensive data from the Ministry of Environment, the study reached important results:-

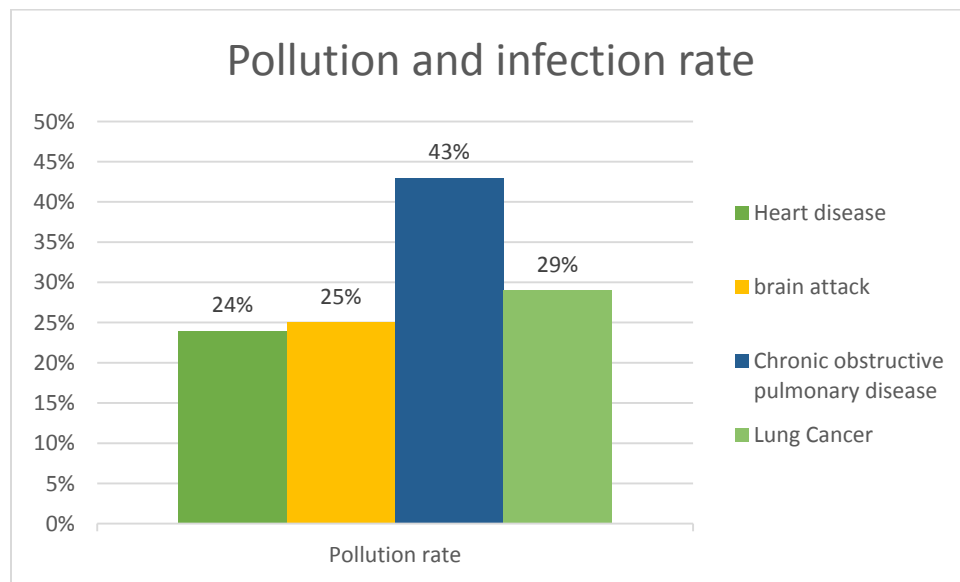


Figure (1) shows the percentage of diseases resulting from pollution

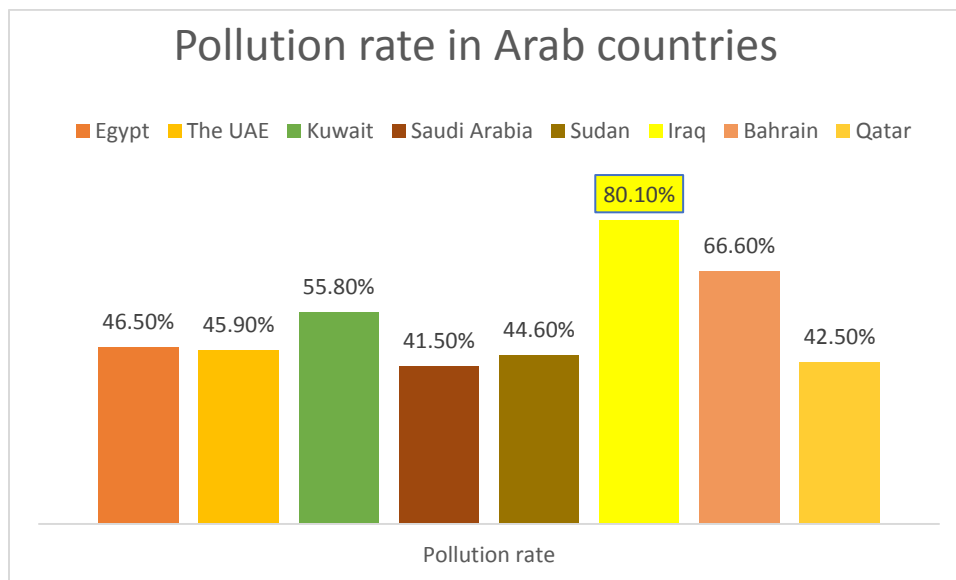


Figure (2) The rate of environmental pollution in Arab countries

### **Results and discussion of environmental pollution on human life:**

Figure (1) illustrates the impact of pollution on human health

Figure (2) shows that Iraq has the highest percentage of environmental pollution among the Arab countries

The consequences of the many risks of environmental pollution are: -

- 1- The increase in environmental and thermal pollution has brought about a hollow within the ozone layer. Which in flip led to a boom in harmful ultraviolet rays that directly affect the skin and eyes.
- 2- The mom's exposure to the consequences of radiation resulting from factories, nuclear reactors, and energy flowers distorts the fetus.
- 3- Soil pollution leads to the death of animals and vegetation.
- 4- Contaminated agricultural soil affects the human digestive system.

- 5- Acid rain falling on the soil causes an imbalance in the pH of the water and soil, thus greatly affecting human health.
- 6- Smog causes the amount of sunlight to be blocked from the ground, resulting in the death of plants and significant damage to plants as a result.
- 7- Global warming causes natural and environmental disasters that cause severe harm to humans, such as melting ice and rising Earth's temperature.
- ٨- Environmental pollution affects a person's health, psychological, and nervous life. causing harm to the natural habitats of terrestrial and marine organisms, and growing their toxicity. [15]

## Conclusion

The environment surrounding a person is considered one of the influences on his health, and the increase in the amount of environmental pollution these days greatly affects all of life, with the abundance of these pollutants, the lack of agricultural space, and the large number of buildings and buildings. Thermal pollution with the increase in factories, and other factors such as an increase in amount of gases emitted from various engines, as well as the bad human habits of smoking and uprooting trees and forests, all led to an imbalance in the environmental thermal balance.

## Recommendations to reduce environmental pollution. [16,17]

- 1- Reducing water consumption: by repairing leaks, using water-saving devices, and reusing water.

- 2- Use environmentally friendly products: by purchasing products that do not contain harmful substances.
- 3- Safely dispose of waste: through recycling and safely disposing of solid waste.
- 4-Avoid polluted air
- 5-Refrain from burning garbage because burning it produces pollutants that cause human diseases, including dioxin, which is a carcinogen.
- 6-Reducing the operation of air conditioners and limiting the use of electricity because power plants produce air pollutants. Preventing and combating smoking everywhere.
- 7-Stop using public transportation, start cycling, or even stop; Major specialty for instant fuel to air.
- 8- Regular car maintenance: To avoid fuel leakage.
- 9-Using natural paints and quick preservation of vegetables, such as sawdust, is the preferred choice.
- ١٠-Close the car windows while driving, and adjust the car's ventilation system to recirculate the air; To avoid inhaling car exhaust.
- ١١-Avoid exposure to air pollutants, such as wood smoke, car exhaust, tobacco smoke, and other pollutants.
- ١٢-Avoid working or walking outdoors near busy roads full of air pollutants.

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## دراسة تصميم عربة صناعية لنقل المواد

### A study of designing Industrial Trolley of carrying materials

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## ABSTRACT

An industrial trolley is a device designed for the transportation of materials and goods within a factory, warehouse, or other industrial setting. It typically consists of a flat platform or basket mounted on wheels or casters, which allows it to be easily moved from one location to another. Industrial trolleys may be designed to carry a variety of different loads, from lightweight packages to heavy machinery or equipment. The design of an industrial trolley can vary depending on the specific requirements of the workplace, but most will be constructed from durable materials such as steel or aluminum or plastic to ensure long-lasting durability and reliability. Some trolleys may be designed to be pulled or pushed by hand, while others may be motorized for more efficient transportation. Overall, an industrial trolley is an essential piece of equipment for any workplace that requires the movement of materials or goods. It can help to streamline workflow, reduce the risk of injury or strain on workers, and increase productivity and efficiency in the workplace. Industrial trolleys are commonly used in manufacturing, warehousing, and distribution facilities to move raw materials, parts, finished products, tools, and equipment around the workplace. They come in different sizes, shapes, and configurations depending on the application, load capacity, and maneuverability needed. 8 Some trolleys are designed to carry specific types of materials, such as flatbed trolleys for large sheets of metal or wood, or cage trolleys for transporting small parts and components. Other trolleys may have specialized features like shelves, drawers, or bins to organize and store items during transport. Industrial trolleys can be manually operated or motorized, depending on the size and weight of the load and the distance it needs to travel. Manual trolleys are typically operated by pushing or pulling, while motorized trolleys use electric or hydraulic power to move loads more quickly and efficiently.

**Keywords:** industrial, distance, efficiency, reliability.

## الخلاصة

العربة الصناعية جهاز مصمم لنقل المواد والبضائع داخل المصنع أو المستودع أو أي مكان صناعي آخر. تتكون عادةً من منصة مسطحة أو سلة مثبتة على عجلات ، مما يسمح بنقلها بسهولة من مكان إلى آخر . يمكن تصميم العربات الصناعية لتحمل مجموعة متنوعة من الاحمال المختلفة ، كمثال العبوات خفيفة الوزن إلى الالات أو المعدات الثقيلة. يختلف تصميم العربة الصناعية اعتماداً على المتطلبات المحددة لمكان العمل ، ولكن تصنع معظمها من مواد متينة مثل الفولاذ أو الالمنيوم أو البلاستيك لضمان المتانة والموثوقية طويلة الامد. قد تم تصميم بعض العربات بحيث تم سحبها أو دفعها ، قد تكون عربات أخرى مزودة بمحركات من أجل نقل أكثر كفاءة. بشكل عام ، تعتبر العربة الصناعية قطعة أساسية من المعدات في مكان عمل يتطلب فيه نقل المواد أو البضائع . يمكن أن تساعد في تسهيل العمل ، وتقلل مخاطر الإصابة أو الضغط على العمال ، وزيادة الانتاجية والكفاءة في مكان العمل. تُستخدم العربات الصناعية بشكل شائع في اماكن التصنيع والتخزين ومرافق التوزيع لنقل المواد الخام والمنتجات والادوات والمعدات في مكان العمل. تأتي بأحجام وأشكال ومكونات مختلفة حسب التطبيق وسعة التحمل والقدرة على المناورة المطلوبة. تم تصميم بعض العربات لحمل أنواع معينة من المواد ، مثل العربات المسطحة للصفائح الكبيرة من المعدن أو الخشب ، أو عربات الاقفاص لنقل الاجزاء والمكونات الصغيرة. قد تحتوي العربات الاخرى على مميزات خاصة مثل الرفوف أو الادراج أو الصناديق لتنظيم العناصر وتخزينها أثناء النقل. يمكن تشغيل العربات الصناعية يدويا أو تشغيلها بمحركات ، اعتماداً على حجم ووزن الحمولة والمسافة التي تحتاجها للتنقل. عادةً ما تم تشغيل العربات اليدوية عن طريق الدفع أو السحب ، بينما تستخدم العربات المزودة بمحركات الطاقة الكهربائية أو الهيدروليكية لتحريك الاحمال بسرعة وكفاءة أكبر .

الكلمات المفتاحية: صناعي، مسافة، كفاءة، مرونة.

## INTRODUCTION

As the world advances with new technologies, we engineering students have decided to fabricate an automated trolley for our institution. The prime objective of the work is to carry from one block to another in our institution.

Today, as material handling is important in every sector, the industries find it difficult to meet the financial burden in implementing the handling systems. Also, in every institute or office, it is necessary to appoint an employee to move goods and services from one point to another [1, 2]. When our institution was experiencing the same situation, we thought of solving it by developing an automated trolley that can move files or goods from one place to another without any human intervention. Automatic trolley, the name itself says that it will reduce the human interference to carry a load from one place to another. So, it will increase the comfort of both employees and employers in a firm. An automatic trolley enhances the working speed by reducing the time of load carrying [3]. The design is focused to reduce weight and to carry the predefined payload. The structure and body of the trolley is made simple in manner with all standard dimensions The Arduino assisted automated trolley is a robotic load carrying machine that functions with the help of a programming system. One of the important design criteria was reducing the weight of the trolley[4].

## **MATERIALS AND METHOD**

The concept of using automated systems for material transportation in industrial facilities is not a new one. However, recent advancements in technology have made it possible to design more efficient and cost-effective systems [5]. One such system is the Industrial Trolley of Carrying Materials using Arduino. 12 the Industrial Trolley of Carrying Materials using Arduino is an effective and efficient solution for material transportation in industrial facilities. The system is scalable, cost-effective, and can reduce the need for manual labor[6]. The use of Arduino technology in the system provides a high level of control and customization, making it ideal for a wide range of applications. Future research can explore ways to further optimize the system for specific industrial needs [7].

When industrial trolleys are integrated with an Arduino system as shown in figure 1, there are several advantages, such as:

1. Automation: With an Arduino system, industrial trolleys can be automated [8,9, 10, 11],

reducing the need for manual labor. This can help to improve efficiency and

reduce labor costs.

2. Increased Accuracy: Arduino systems can provide precise control over the movement of the trolley, ensuring that materials are transported accurately and safely.
3. Improved Safety: The integration of sensors and other safety features into the Arduino system can help to improve the safety of the industrial trolley, reducing the risk of accidents.
4. Real-Time Data: The use of an Arduino system can provide real-time data on the performance of the trolley, allowing for quick adjustments and improvements.
5. Customization: Arduino systems can be customized to fit the specific needs of a particular industry or application, providing greater flexibility and versatility

There are several applications of using an Arduino system in industrial trolleys for carrying materials, including:

1. Automation: Industrial trolleys with an Arduino system can be used to automate the movement of goods within a warehouse, reducing the need for manual labor and improving efficiency.
2. Manufacturing: In manufacturing facilities, industrial trolleys can be used to transport raw materials or finished products from one area to another, and an Arduino system can help to improve accuracy and reduce the risk of errors.
3. Construction: Industrial trolleys equipped with an Arduino system can be used to transport materials and equipment on construction sites, providing greater control and safety.

4. Agriculture: In agriculture, industrial trolleys can be used to transport crops or equipment, and an Arduino system can help to automate the process and reduce the need for manual labor.

5. Retail: Industrial trolleys equipped with an Arduino system can be used in retail stores to transport goods from the backroom to the sales floor, providing greater efficiency and reducing the need for manual labor.

As hardware system components used in this study:

**Arduino Uno:** is an open-source microcontroller board created by Arduino.cc that uses the Microchip ATmega 328P microprocessor. A variety of expansion boards (shields) and other circuits can be interfaced with the board's sets of digital and Analog input/output (I/O) pins. The board contains 6 Analog I/O pins and 14 digital I/O pins, six of which can be used for PWM output. It can be programmed using the Arduino IDE (Integrated Development Environment) via a type B USB connector.

**L298N Motor Driver Module:** is a high power motor driver module for driving DC and Stepper Motors. This module consists of an L298 motor driver IC and a 78M05 5V regulator. L298N Module can control up to 4 DC motors, or 2 DC motors with directional and speed control.

**Buzzer:** An audio signaling device like a beeper or buzzer may be electromechanical or piezoelectric or mechanical type. The main function of this is to convert the signal from audio to sound. Generally, it is powered through DC voltage and used in timers, alarm devices, printers, alarms, computers, etc. Based on the various designs, it can generate different sounds like alarm, music, bell & siren.

**HC-06 Bluetooth module** designed for establishing short range wireless data communication between two microcontrollers or systems. The module works on Bluetooth 2.0 communication protocol and it can only act as a slave device. This is cheapest method for wireless data transmission and more flexible compared to other methods and it even can transmit files at speed up to 2.1Mb/s. HC-06 uses frequency hopping spread spectrum technique (FHSS) to avoid interference with



other devices and to have full duplex transmission. The device works on the frequency range from 2.402 GHz to 2.480GHz.

HC-SR04 ultrasonic distance sensor: actually consists of two ultrasonic transducers. One acts as a transmitter that converts the electrical signal into 40 KHz ultrasonic sound pulses. The other acts as a receiver and listens for the transmitted pulses. When the receiver receives these pulses, it produces an output pulse whose width is proportional to the distance of the object in front. This sensor provides excellent non-contact range detection between 2 cm to 400 cm (~13 feet) with an accuracy of 3 mm. Since it operates on 5 volts, it can be connected directly to an Arduino or any other 5V logic microcontroller.

Electronic switch: is an electronic component or device that can switch an electrical circuit, interrupting the current or diverting it from one conductor to another. Electronic switches are considered binary devices because they can be on or off. When an electronic switch is on, the circuit is closed and when it is off, the switch is open in the circuit.

geared DC motor: a DC motor is a class of rotary electrical motors that converts direct current electrical energy into mechanical energy. In our project we used four motors equipped with gearboxes, the motors work within 3 ~ 6 volts and give an output rpm about 100-208 rpm depending on the input power.

Battery Rack: Four cells are connected in Series on the battery rack that is being used here

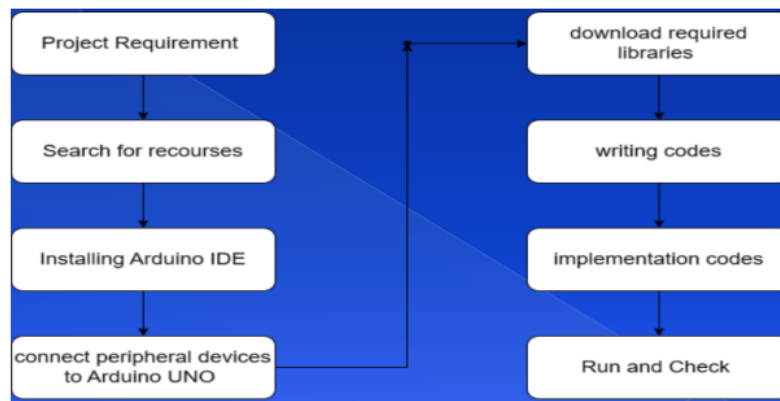
Charger: a Battery Charger, sometimes known as a Recharger, is a tool used to inject power into a secondary cell or rechargeable battery.

Charging Jack: The batteries are recharged by connecting an external power source to the charging jack.

As software of this stud: The Arduino Programming Environment (IDE) Arduino is an electronic platform with a diverse number of development boards available to communicate between real and programming worlds. It allows students, beginners, teachers, and engineers to design academic and real time projects to solve modern problems. Apart from Arduino's vast scope it has some limitations also. Nothing is 100% perfect in this world! Like every electronic gadget Arduino has also some

restrictions to work with Arduino is designed to make the microcontroller world more accessible. It is based upon ATmega AVR microcontrollers. Arduino platforms consist of circuit boards like UNO, normally referring to microcontrollers and the development part known as IDE. Using IDE, Arduino boards can be programmed using C++ language. The Arduino platform has multiple learning opportunities due to its vast usage and advantage over microcontrollers but along with good there is always a chance of bad things.

Also fritizing program used as shown in figure 2.



## RESULTS

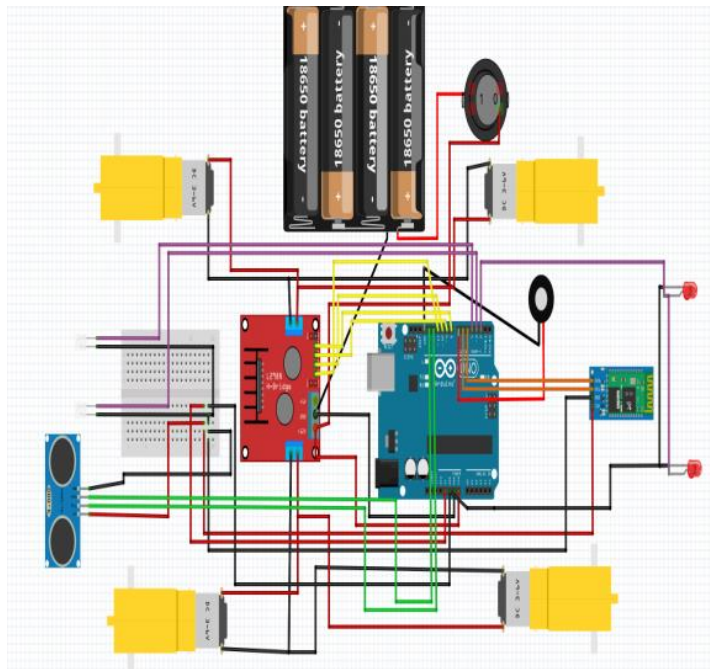
The specific results of a car using Arduino to carry things using Bluetooth will depend on the specific design and implementation of the system as shown in figure 3. However,

some potential results that can be achieved include:

1. Improved mobility: By using a car instead of a fixed industrial trolley, the system can be more flexible and adaptable to changing requirements.
2. Remote control: By using Bluetooth or other wireless communication systems, the car can be controlled remotely, making it more convenient and safer for the operator.

3. Increased efficiency: The use of an automated car can help reduce the time and effort required to move materials, which can lead to increased productivity.
4. Improved accuracy: The use of sensors and control systems can help ensure that materials are transported accurately and precisely, reducing the risk of errors
5. Enhanced safety: By reducing the need for manual intervention, the risk of injuries and accidents can be minimized.

Overall, the results of a car using Arduino to carry things using Bluetooth will depend on the specific design and implementation of the system. Proper testing and optimization can help ensure that the car performs as expected and meets the needs of the application.



**Figure 1: Study concept.**

**Figure 2: Designing the project with fritzing program.**



**Figure 3: Industrial Trolley of carrying materials.**

## DISCUSSION

industries serve as the primary drivers of the national economy, significantly impacting the prosperity of a nation. Enhanced performance and increased efficiency within these industries contribute to economic growth. Recent advancements in manufacturing have led to the integration of intelligent technologies, resulting in a notable productivity boost of 17-20% [12]. This improvement is attributed to enhanced machine utilization and the optimization of energy usage through smart manufacturing systems. Manufacturers are now engaged in a competitive environment where innovation, rapid response to market changes, cost-effectiveness, and the delivery of reliable products are crucial to meeting consumer demands. This competitive landscape has prompted the

adoption of smart manufacturing practices, which include digitization of processes and the implementation of cyber-physical controls in manufacturing facilities and business operations. The integration of smart devices and sensors in the manufacturing process has reduced the need for human intervention, allowing for the customization of manufacturing instructions based on direct feedback from end consumers via the internet[13].

Most nations have implemented policies regarding cyber-physical systems and digital manufacturing to enhance future manufacturing processes. Germany has introduced the concept of 'Industry 4.0', which involves interconnected machining systems collaborating for tasks such as production planning, plant scheduling, product customization, and fault identification and recovery. This notion of Industry 4.0 can be viewed as a comprehensive integration of Internet of Things (IoT), Cyber-Physical Systems (CPS), digital manufacturing, smart manufacturing technologies, additive manufacturing, 5G mobile communications, robotics technologies, big data processing, data analytics, system integration, simulation, and Flexible Manufacturing Systems (FMS). Similarly, China has unveiled their strategy for 2025 called "Made in China 2025" along with the internet plus program, aiming to enhance the manufacturing sector significantly[14,15].

## CONCLUSION

As conclusion from this study the application of a car using Arduino to carry things using Bluetooth can be useful in a wide range of industrial and commercial settings. Some potential applications include:

1. Manufacturing: The car can be used to transport raw materials, finished products, or tools and equipment between different stages of the production process.
2. Warehousing and logistics: The car can be used to transport items between different areas of a warehouse or distribution center, improving efficiency and reducing the need for manual labor.
3. Agriculture: The car can be used to transport crops, fertilizers, and other agricultural products around a farm, reducing the need for manual labor and improving productivity.

4. Hospitals: The car can be used to transport medical supplies, equipment, and patient files between different areas of a hospital, improving efficiency and reducing the risk of errors.

5. Retail: The car can be used to transport goods between different areas of a store or warehouse, making it easier to restock shelves and manage inventory. Overall, the application of a car using Arduino to carry things using Bluetooth can be useful in any setting where materials or equipment need to be transported efficiently and safely. The specific application will depend on the requirements of the particular industry or setting.

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### **CONFLICT OF INTEREST**

“The authors declare no conflict of interest”.

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## مراجعة في تطورات التقنيات المختبرية لامراض الدم

# Advancements in Hematology Laboratory Techniques: A Mini Review

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**ABSTRACT**

Hematology, the study of blood and its disorders, has witnessed remarkable advancements in laboratory techniques over the years. This review provides a comprehensive overview of recent developments in hematology laboratory techniques, encompassing advancements in cell counting, blood smear analysis, molecular diagnostics, flow cytometry, and automation. By integrating these innovative techniques into routine laboratory practice, hematologists can enhance diagnostic accuracy, streamline workflows, and improve patient care.

**Keywords:** Hematology, Laboratory techniques, Diagnosis

**الخلاصة**

شهد علم امراض الدم، وهو دراسة الدم واضطراباته، تطورات ملحوظة في تقنيات المختبرات على مر السنين. تقدم هذه المراجعة لمحة شاملة عن التطورات الأخيرة في تقنيات مختبر أمراض الدم، بما في ذلك التقدم في عد الخلايا، وتحليل صورة الدم، والتشخيص الجزيئي، وقياس التدفق الخلوي، والأتمة. ومن خلال دمج هذه التقنيات المبتكرة في الممارسة المخبرية الروتينية، يمكن لأخصائيي أمراض الدم تعزيز دقة التشخيص، وتبسيط سير العمل، وتحسين رعاية المرضى.

الكلمات المفتاحية: علم امراض الدم، التقنيات المخبرية ، التشخيص.

**INTRODUCTION**

Hematology laboratory techniques play a pivotal role in the diagnosis, monitoring, and management of various hematological disorders, ranging from anemia to leukemia. Recent advancements in technology have revolutionized the field, enabling more precise and efficient analysis of blood samples. This review aims to explore these advancements comprehensively, highlighting their implications for clinical practice.

## **CELL COUNTING TECHNIQUES**

Include a clear description of materials, equipment, and methods in sufficient detail to allow repetition of the work elsewhere. Also, describe all safety considerations including any procedures requiring special precautions in sufficient detail so that those repeating the experiments can take appropriate safety measures. Published procedures should be cited, but not described, except for substantial modifications. Ethical clearance must be obtained for any study involving animal or human subjects.

## **BLOOD SMEAR ANALYSIS**

While automated analyzers provide valuable quantitative data, blood smear analysis remains indispensable for evaluating cell morphology and identifying abnormal cells. Digital microscopy has emerged as a promising tool, allowing for the capture and analysis of high-resolution images of blood smears (Lichtman & Kaushansky, 2020). Image analysis algorithms aid in the identification of subtle morphological changes, improving the sensitivity of diagnostic interpretation

## **MOLECULAR DIAGNOSTICS**

Advancements in molecular techniques have transformed the diagnosis and prognostication of hematological malignancies. Polymerase chain reaction (PCR), fluorescence in situ hybridization (FISH), and next-generation sequencing (NGS) enable the detection of genetic mutations, chromosomal abnormalities, and clonal rearrangements with high sensitivity and specificity (Nikiforova et al., 2021). These molecular assays guide treatment decisions, predict disease progression, and monitor minimal residual disease.

## **FLOW CYTOMETRY**

Flow cytometry continues to evolve as a cornerstone technique in hematology, facilitating the immunophenotypic characterization of blood cells and

hematopoietic neoplasms. Multiparameter flow cytometry allows for the simultaneous analysis of multiple surface antigens, enabling the classification of leukemias, lymphomas, and myelodysplastic syndromes based on distinct immunophenotypic profiles (Loken et al., 2020). Furthermore, advancements in instrumentation and software enhance the resolution and interpretability of flow cytometric data.

## **AUTOMATION AND INTEGRATION**

Automation plays a pivotal role in modern hematology laboratories, streamlining workflows, reducing turnaround times, and minimizing errors. Integrated laboratory information systems (LIS) enable seamless communication between analyzers, middleware, and electronic medical records (EMR), facilitating data management and result reporting (George, 2020). Moreover, the integration of artificial intelligence (AI) algorithms holds promise for predictive analytics, quality control, and decision support in hematology.

## **CONCLUSION**

In conclusion, recent advancements in hematology laboratory techniques have revolutionized the diagnosis, monitoring, and management of hematological disorders. From automated cell counting to molecular diagnostics and flow cytometry, these innovations offer unprecedented precision and efficiency in blood analysis. By embracing these technologies and incorporating them into routine laboratory practice, hematologists can enhance diagnostic accuracy, improve patient outcomes, and advance the field of hematology.

## **CONFLICT OF INTEREST**

The authors declare no conflict of interest.

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## AI in Autism Diagnosis and Treatment: A Comprehensive Review

الذكاء الاصطناعي في تشخيص وعلاج مرض التوحد: مراجعة شاملة

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**ABSTRACT**

AI has grown progressively positive in overcoming autism diagnostic and behavioral challenges. This study examines the significance of autism on social, language, and expressive abilities in autistic people using artificial intelligence (AI). The automation of autism analysis has improved by machine learning algorithms and AI. These methods have efficiently provided important approvals and recognised situations for further investigation. This article studies the use of intelligent skills in autism diagnosis and highlights many AI applications being established or implemented. These applications help identify autism spectrum illness in children, adjust involvements, and optimize treatment strategies based on individual needs and reactions. These methods may improve autism analysis and treatment using AI. This study also highlights the relevance of machine learning algorithms, a subset of artificial intelligence, outperforming humans in autism pattern recognition. AI systems now help diagnosticians by confirming diagnoses and recommending additional testing. In addition to its analytic uses, this study also discovers the development of artificial intelligence (AI)-based applications that are particularly designed to address the different needs of people with autism and their caregivers. These smart applications provide readily available and user-friendly tools that aid in developing social and communication skills, emotional regulation, and adaptive learning. As a result, they provide a more individualized and successful intervention.

**Keywords:** AI systems, Autism spectrum disorder, Autism diagnosis, Deep learning, Treatment optimization.

**الخلاصة**

حقق الذكاء الاصطناعي تقدماً كبيراً في المعالجة الفعالة للعقبات التشخيصية والسلوكية المرتبطة بالتوحد. تبحث هذه الدراسة في تأثير مرض التوحد على المهارات الاجتماعية واللفظية والتعبيرية لدى الأفراد المصابين بالتوحد من خلال توظيف الذكاء الاصطناعي (AI). لقد عززت تقنيات التعلم الآلي



والذكاء الاصطناعي أتمتة تحليل مرض التوحد. لقد منحت هذه الإجراءات موافقات مهمة بشكل فعال وحددت الظروف التي تتطلب فحصًا إضافيًا. تتناول هذه المقالة استخدام القدرات الذكية في تشخيص مرض التوحد وتؤكد على العديد من تطبيقات الذكاء الاصطناعي التي يتم تطويرها أو وضعها موضع التنفيذ. تساعد هذه البرامج في تحديد اضطرابات طيف التوحد لدى الأطفال، وتكييف التدخلات، وتحسين خيارات العلاج وفقًا للمتطلبات والاستجابات الفردية. الذكاء الاصطناعي لديه القدرة على تعزيز تحليل وعلاج مرض التوحد.

تؤكد هذه الدراسة على أهمية خوارزميات التعلم الآلي، التي تعد مجموعة فرعية من الذكاء الاصطناعي، متفوقة على البشر في الكشف عن الأنماط المتعلقة بالتوحد. تساعد تقنيات الذكاء الاصطناعي الآن أخصائي التشخيص من خلال التحقق من التشخيص واقتراح المزيد من الاختبارات. لا تستكشف هذه الدراسة التطبيقات التحليلية للذكاء الاصطناعي (AI) فحسب، بل تكشف أيضًا عن التطورات في التطبيقات القائمة على الذكاء الاصطناعي والمصممة خصيصًا لتلبية المتطلبات المتنوعة للأفراد المصابين بالتوحد والقائمين على رعايتهم. توفر هذه البرامج الذكية أدوات يسهل الوصول إليها وسهلة الاستخدام تساعد في تطوير المهارات الاجتماعية ومهارات الاتصال والتحكم العاطفي والتعلم التكيفي. وبالتالي، فإنها توفر استجابة أكثر تخصيصًا وفعالية.

الكلمات المفتاحية: أنظمة الذكاء الاصطناعي، اضطراب طيف التوحد، تشخيص التوحد، التعلم العميق، تحسين المعالجة.

## INTRODUCTION

Autism Spectrum Disorder (ASD) [1] is a widely realized neurodevelopmental condition defined by cognitive skills that fall below the average variety for persons of their age [1]. Communication difficulties, intense interests, and repetitive behavioral patterns are recognized as significant markers of autism [2]. For example, individuals diagnosed with Autism Spectrum Disorder (ASD) may have challenges accurately seeing and understanding the intentions of

others, as well as exhibit diminished levels of eye contact [3]. Autism Spectrum Disorder (ASD) has been shown to significantly impact physical and mental well-being, hindering persons' capacity to acquire knowledge and engage in routine tasks such as employment and education [4]. The timely detection and suitable intervention are of utmost importance in enhancing the overall well-being of children diagnosed with Autism Spectrum Disorder (ASD) [5]. Although Autism Spectrum Disorder (ASD) may not manifest observable symptoms, scholarly investigations have shown that its development may be influenced by several aspects, such as genetics, biology, and mental processes [1-3].

Presently, the predominant methods used in clinical assessments, interviews, and screening procedures for identifying autism spectrum disorder heavily depend on behaviour analysis facilitated by questionnaires answered by parents or guardians [4]. The World Health Organization acknowledges the increasing need for precise and effective diagnostic approaches on a global scale as the incidence of Autism spectrum disorder (ASD) continues to escalate, with an estimated occurrence rate of one kid with ASD for every 160 children [5].

AI can now identify autism [6]. AI uses biological networks in the brain to create intelligent systems that can impersonate human cognition and perform cognitive tasks [7]. Artificial intelligence (AI) may learn from mistakes and improve its performance over time, dipping human unreliability and increasing exactness. Examining autistic people helps AI find nuanced data designs for careful analysis [6, 7].

Machine learning systems, a subtype of AI, assess new data using previous data and report the most accurate answers [8]. In testing situations, AI-enabled devices can recover autism detection. Using detection data, these AI-enabled devices can alter their behaviour clinically [9]. AI's flexibility allows for autism analysis and action apps. [8-10].

This object examines the possibility of artificial intelligence (AI) to recover autism diagnosis, initial ID, and modified involvement. Artificial intelligence (AI) can recover autism diagnosis by analyzing behavioural patterns and finding key data drifts [6]. However, ensuring its precise combination into healthcare systems needs to address ethical challenges, data privacy alarms, and the need for human

direction [8, 9].

## RELATED WORK

Rendering to various papers, AI and machine learning technologies for initial autism discovery have great potential. This section quickly defines this research's impact and performance, demonstrating AI's potential in autism diagnosis and treatment.

Academics diagnosed autistic children by using facial landmark documentation and deep CNN show learning systems in academic education by Alkahtani, H. et al. (2023) [11].

The optimization of the CNN model optimizer and hyperparameter locations was conducted to enhance forecast accuracy. Numerous classifiers, such as logistic regression, linear provision vector machine (SVC), arbitrary forest, decision tree, gradient boosting, MLPClassifier, and K-nearest neighbours, were used in the utilization of transfer learning approaches, including MobileNetV2 and hybrid VGG19. The evaluation of Kaggle's dataset, containing 2,940 photographs of both autistic and non-autistic youngsters, revealed that MobileNetV2 achieved a worthy accuracy rate of 92%. The study posits that using MobileNetV2's transfer learning methodologies exhibits superior performance compared to other systems, presenting a future instrument for doctors to validate the diagnosis of Autism Spectrum Disorder (ASD).

In a separate investigation, Voinsky, I et al. in (2023) [12] several machine learning-generated models were advanced using RNA expression datasets from RNA-seq trials to explore their potential as diagnostic methods for Autism Spectrum Disorder (ASD). The random forest classifier achieved an accuracy of 82% in distinguishing between neurotypical (NT) and children with Autism Spectrum Disorder (ASD) utilizing two of the used models. Nevertheless, the authors of the study highlight the need for more improvement and independent verification using greater groups of children with Autism Spectrum Disorder (ASD) and neurotypical (NT) children before the development of more accurate machine learning-based tools. However, these methodologies provide a potentially fruitful approach to the early detection of Autism Spectrum Disorder (ASD).

In a separate investigation, Ahmed, Z. et al. in (2022) [13], a web-based application was created to notice autism using a convolutional neural network with transfer learning. Specifically, the MobileNet, Xception, and InceptionV3 models were used with the Flask framework to analyze face signals. The MobileNet, Xception, and InceptionV3 models achieved validation precisions of 95%, 94%, and 89%, separately. These accuracies were evaluated using a dataset consisting of 3,014 face photos of children from varied backgrounds, including autistic and non-autistic children, in equal sizes of 1,507 each.

In an earlier investigation. Ganesh, K. et al. (2021) [14], academics examined the use of thermal imaging by using a modified convolutional neural network to classify the thermal pictures of 50 persons diagnosed with autism and 50 individuals without autism. Clear variations in temperature were noted in some areas of the face, including the eyes, cheeks, forehead, and nose, throughout the process of evoking emotions (such as pleasure, anger, and grief) in youths. The study's authors used a customized neural network and ResNet 50 network to obtain diagnostic accuracy rates of 96% and 90%, respectively, in correctly identifying children with autism based on thermal imaging.

Furthermore, a research of Lin, R., et al. (2022) [15] introduced a facial landmark detection network capable of multitasking to improve the precision of combined attention broadcasts and the stability of gaze estimation. The study comprised a cohort of 39 toddlers aged 16 to 32 months. The suggested approach was assessed using a dataset consisting of 19 facial landmarks from infants. The new findings recognized a 92.5% accuracy rate in the assessment of shared attention.

The education underlines the potential of artificial intelligence (AI) in analyzing autism. However, it is vital to acknowledge and challenge the limits and problems that these methods encounter. To augment the influence of AI in autism analysis and treatment, it is advisable to expand the scope of comparative analysis across diverse AI models, research into the complications of the obtained results and suggest potential avenues for future study. Table 1 lists a comparative analysis depending on factors for related work studies.

## ARTIFICIAL INTELLIGENCE APPLICATIONS FOR AUTISM

In recent years, there has been significant progress in artificial intelligence (AI) requests and technology designed to assist persons with autism spectrum disorder (ASD) and their families. This section elucidates some noteworthy uses of artificial intelligence (AI) that endeavour to enhance the diagnosis and treatment of autism [16].

Behavior Imaging is a company based in Boise, Idaho that uses the Naturalistic Observation Diagnostic Assessment. This application enables parents to submit videos of their children, which are then viewed by distant medical professionals for diagnostic purposes.

**Table 1: Comparative Analysis of AI-Based Autism Diagnosis Studies**

Study Title and Authors	Methodology	AI Model Used	Dataset	Accuracy Rate
Alkahtani, H. et al. (2023) [11]	Facial landmark documentation and deep CNN learning systems	Deep CNN, Transfer learning (MobileNetV2, hybrid VGG19)	Kaggle dataset (2,940 photographs of autistic and non-autistic children)	92%
Voinsky, I. et al. (2023) [12]	Analysis of RNA expression datasets from RNA-seq trials	Random forest classifier	RNA expression datasets	82%
Ahmed, Z. et al. (2022) [13]	Web-based application using convolutional neural networks with transfer learning	MobileNet, Xception, InceptionV3	Dataset with 3,014 face photos of autistic and non-autistic children	MobileNet (95%), Xception (94%), InceptionV3 (89%)
Ganesh, K. et al. (2021) [14]	Thermal imaging and modified convolutional neural network	Customized neural network, ResNet 50	Thermal pictures of 50 autistic and 50 non-autistic individuals	Custom NN (96%), ResNet 50 (90%)

Lin, R. et al. (2022) [15]	Multitasking facial landmark detection network	Not specified	Dataset with 39 toddlers aged 16 to 32 months	92.5%
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The organization has deployed artificial intelligence (AI)-based systems capable of observing and classifying human behavior, offering significant insights to healthcare professionals and perhaps detecting unnoticed behaviours.

Cognoa, a company headquartered in Palo Alto, California, provides an autism screening tool that utilizes artificial intelligence technology. Parents can use this smartphone application without the need for a certified evaluator. This study examines the analysis of answers to multiple-choice questions with kid videos. Although the autonomous diagnostic capabilities of AI about autism are still subject to examination, the application serves as a valuable tool for diagnosis, effectively streamlining the screening procedure [17].

The use of SoftBank's NAO humanoid robots in the field of robotics, particularly in the context of children with autism, has shown their efficacy as interactive and captivating companions. These robots, imminent androids, have successfully engaged and connected with children diagnosed with autism spectrum conditions. These robotic units can alter the kind of their ocular organs, manipulate their appendages, and adjust their vocalization to take various emotional states. Regular and constant interactions with NAO might provide distinguished advantages for children with autism, as they may derive ease and establish connections via these likely interactions [18].

The robot advanced by the Massachusetts Institute of Technology (MIT). A team of academics from the Massachusetts Institute of Technology (MIT) has successfully engineered a robot with the aptitude to effectively process and analyze many forms of physical input, including video, audio, heart rate data, and skin sweat. This advanced incorporation of multiple data sources allows the robot to grow children's behaviour better and then react in a more custom-made manner. This data documents the robot to modify interactions to house the kid's requirements [19].

The suggestion project known as E. BiBli involves the joint efforts of Manatee and Robauto. BiBli is a progressive robot developed to assist youngsters in navigating hard circumstances at their adapted speed while maintaining a non-critical approach. Although artificial intelligence (AI) cannot be extra for all types of therapy, it can deliver a scalable and easily accessible street for providing care to children who may have challenges accessing conservative treatment options. Furthermore, using robots or applications to adopt emotional effects enhances communication for those with autism or anxiety problems. Analyzing data collected by artificial intelligence technology may provide therapists with significant insights [20].

The F. Manatee App is a mobile application with numerous landscapes and functionalities. The Manatee app, accessible for free on the iPhone, is one of the primary uses of artificial intelligence. It combines specific goals that medical psychologists have sensibly designed. The request powerfully stresses parents' appointments, offering them full leadership and support via consecutive instructions [21].

## CONCLUSION

This research underscores the substantial ramifications of artificial intelligence (AI) technology in autism analysis and treatment, mainly for experts, the healthcare business, and medical practitioners. The regular review presents evidence from various studies that endorses the use of machine learning techniques in developing analytical models, enhancing the accuracy and efficiency of autism diagnosis. Artificial intelligence (AI) suggests a unique and positive strategy for beginning the complexities associated with the diagnosis of Autism Spectrum Disorder (ASD).

Though AI-based robotics and programs significantly assist children's educational development, it is important to acknowledge their inherent limits. The expense associated with the production and operation of robots might position a significant barrier, while the utilization of applications necessitates youngsters to possess passable reading and thoughtful skills. Moreover, using these technologies often necessitates a certain degree of mental functioning and self-driven behaviour

that may better the capacities of many people with autism, even when charming in partially autonomous application use.

Modern AI applications inform social interactions, facial expression detection, and eye interaction, some kids like robots, but how much they improve their play with humans is unclear.

Artificial intelligence in autism study and treatment has important benefits, despite these challenges. Study in this area expectations to improve limits and create beautiful AI-driven solutions.

To generally integrate AI technology in autism diagnosis and treatment, it must imitate autism's specific needs and talents. Modifying AI solutions to resolve specific challenges and provide modified support can boost their effectiveness.

The scene of AI technology serving autistic people and their relations is promising. By technology's advancement, AI-driven solutions may become additional convenient and extensive in healthcare and other organizations.

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## **CONFLICT OF INTEREST**

The authors declare no conflict of interest.

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## الطريقة الإحصائية لتوزيع جاما على أساس كشف ضوضاء الصورة

**Statistical Method for Image Noise Detection Based Gamma Distribution**

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## الخلاصة

في مجال معالجة الصور الرقمية، تعد إزالة الضوضاء مهمة بالغة الأهمية لتحسين جودة الصور. أحد أنواع الضوضاء السائدة هو الضوضاء النبضية، والتي يمكن أن تؤدي إلى تدهور المظهر المرئي للصور بشكل كبير. ولمعالجة هذه المشكلة، قام الباحثون باكتشاف طرق مختلفة من المرشحات المتوسطة الكلاسيكية غير الخطية. سوف تتعمق هذه الورقة في فعالية إزالة الضوضاء النبضية باستخدام توزيع جاما مقارنة بالمرشحات المتوسطة الكلاسيكية غير الخطية التقليدية في الصور الملونة الرقمية. المرشحات المتوسطة الكلاسيكية كانت طريقة طويلة الأمد في معالجة الصور ولكن الإمكانيات المتقدمة لتوزيع جاما تجعلها خيارًا مقنعًا للسيناريوهات التي يكون فيها الحفاظ على جودة الصورة أمرًا بالغ الأهمية. ومن خلال الاستفادة من قوة توزيع جاما، يمكن للباحثين والممارسين تحقيق نتائج فائقة في اكتشاف ضوضاء الصورة وإزالتها، مما يؤدي في النهاية إلى تعزيز الجاذبية البصرية وفائدة الصور الرقمية الملونة.

## INTRODUCTION

In the past few years, significant progress has been made in 2D nonlinear image restoration. In this work, we present a new filter architecture based on gamma distribution that estimates noise using a nonlinear component that accounts for the visual phenomenon of human noise perception. We provide frequent and infrequent communications to ensure candidate stability, which is very important. Recovering sudden noises while preserving fine textures and details is our filter promise. We also recommend using median-based filters <sup>(1)</sup> for noise recovery.

The gamma distribution, a probability distribution characterizing radioactive decay <sup>(2)</sup>, forms the basis of the proposed filter architecture. Image processing is one of many fields in which this distribution is widely used to represent statistical properties of noise. To account for the visual phenomenon of human noise detection, our filter uses a nonlinear prediction structure. This nonlinear element improves the filter performance by estimating image noise and reducing its impact on the final result <sup>(3,4)</sup>.

To ensure the robustness of our filter, we provide redundant and non-redundant connections, which are essential components of any filter architecture. In recursive communication, the filter output is fed back to the input, creating a feedback loop. In contrast, non-recursive communications rely on a feed-forward loop that uses filter inputs to determine the output. Filter stability can be ensured with both types of connection <sup>(5,6)</sup>.

One of the typical problems in image processing is sudden noise, but our filter eliminates this problem. One type of noise that can significantly reduce image quality is impulse noise, which appears as seemingly random pixels. To improve image quality and recover pulse noise, our filter combines mean-based filters and gamma distribution-based estimation <sup>(7)</sup>.

Preserving small textures and details is one of the advantages of our filter. Preserving textures during image processing is very important to maintain the original appearance of the image. To achieve this, our filter combines mean-based filters and gamma distribution-based estimation to remove noise while preserving fine textures and features of the image <sup>(8)</sup>.

In summary a filter design is introduced that uses the gamma distribution to enhance nonlinear two-dimensional images. Our approach involves both non redundant connections incorporating optical effects that affect how humans perceive noise to ensure the stability of the filter. Our filters are designed to remove noise while preserving texture and fine details. Additionally, we recommend using dielectric based filters for noise reduction. The proposed filter structure is a tool, for improving image quality in various image processing applications.

In the field of image processing, enhancing nonlinear 2D images is a critical area of focus. The use of filters plays a pivotal role in this field, and the introduction of filter design using gamma distribution offers an innovative approach to address this challenge. This article seeks to explore the contribution of gamma distribution filter design to 2D nonlinear image enhancement, with an emphasis on its potential impact on image processing applications. The proposed filter design presents a new approach that incorporates non-redundant connections, thus taking advantage of the visual effects that affect human perception of noise.

By integrating these connections, filter stability is ensured, paving the way for more effective noise reduction while preserving fine texture and detail of images. This approach represents a major advance in image processing, because it addresses the dual challenge of removing noise and preserving important image features. In addition, the recommendation to use statistical isolation-based filters to reduce noise enhances the practicality of the proposed filter design. This recommendation is consistent with the goal of achieving improved image quality across different image processing applications, thus expanding the potential impact of filter design in real-world scenarios. In conclusion, the introduction of a filter design that enhances the gamma distribution represents a significant advance in the field of nonlinear 2D image enhancement. By addressing the complexities of noise reduction while preserving essential image details, this approach promises to revolutionize image processing applications. The incorporation of non-redundant connections and the recommendation of dielectric-based filters further emphasizes the comprehensive nature of the proposed filter design. As such, this filter structure serves as a valuable tool for improving image quality and advancing the field of image processing.

## **FILTER PROCESSING**

Isolating a signal in a noisy environment has always been a challenging task in signal processing. Among the methods used for this purpose filters that estimate noise based on gamma distribution have shown to be quite effective <sup>(9-11)</sup>. By applying a statistical approach these filters can estimate and reduce signal noise through the mathematical properties of the gamma distribution <sup>(12-14)</sup>. The gamma distribution, which is commonly used to characterize variables plays a crucial role in this technique. By modelling noise as a variable with a gamma distributions probability density function it becomes easier to predict noise behaviour and eliminate it from the original signal. One of the benefits of using gamma distribution-based noise estimation filters is their ability to handle nonlinear noise. Unlike methods that only deal with noise <sup>(15,16)</sup> these filters can adjust dynamically to changing noise conditions like variations in signal amplitude and frequency. Their adaptability makes them suitable, for applications requiring signal processing techniques. The flexibility of these filters enhances their utility.

By adjusting the gamma distribution model to accommodate fluctuations in process noise this method can fine tune noise reduction settings to match the distinct characteristics of the encountered noise. This feature enables the filter to effectively address types of noise leading to favourable noise reduction results. However, using gamma distributions as filters for noise measurement poses some challenges. The efficacy of the algorithm relies heavily on the accuracy of the noise process model. If the model lacks adequacy or is overly complex the filter may yield signal quality and false positives due to inadequate noise elimination. To optimize filter performance, it is essential to engage with sophisticated models. This research showcases that filter based on gamma distribution for estimating noise prove valuable in signal processing tasks. By leveraging gamma distribution to characterize and predict noise behaviour within these filters they can eliminate noise in time even in scenarios with nonlinear variations in noise. Despite challenges in replicating noise processes these filters have shown effectiveness across diverse applications such, as audio signal processing and voice recognition.

## GAMMA DISTRIBUTION CONCEPT

The gamma distribution is widely used in the fields of mathematics and statistics when other distributions fail to represent positively skewed data. This continuous distribution is commonly applied to model data behaviour. This article will explore the gamma distribution covering its characteristics, mathematical formulas and practical applications.

The gamma distribution stands out from continuous probability distributions due to its two parameters;  $\alpha$  for shape and  $\beta$  for scale. These parameters play a role in adjusting the shape and spread of the distribution respectively. With its ability to capture skewness seen in real world scenarios the gamma distribution finds extensive use in various fields like finance, engineering and physics.

An important aspect of the gamma distribution is its connection with the distribution. When  $\alpha$  equals one it transforms into a distribution making it a subset of the gamma family. This relationship holds significance as it allows for flexible time simulation between events using either or both distributions, for applications.

Moreover, the gamma distribution is applied in modelling sums of independent exponentially distributed variables. The analysis of how various

separate events add up over time plays a role, in shaping reliability engineering and queueing theory.

The Continuous random Variable  $X$  is said to have gamma distribution with respect to  $\alpha > 0$ ,  $\lambda > 0$  shown an  $X \leftrightarrow$  gamma  $(\alpha, \lambda)$ , if the (P.D.F) is given by:

$$F(x) = \begin{cases} \frac{\lambda^\alpha x^{\alpha-1} e^{-\lambda x}}{\Gamma(\alpha)}, & x > 0 \\ 0 & otherwise \end{cases} \quad \dots (1)$$

Where:  $\alpha$  is the shape parameter.

$\lambda$  is the scale parameter, or rate parameter.

The gamma function is expressed as:

$$\Gamma(x) = \int_0^\infty t^{(x-1)} e^{-t} dt \quad t > 0 \quad \dots (2)$$

In some application, they use  $\beta = 1/\lambda$  on inverse scale parameter.

The gamma distribution model right skewed date, like carrier rates, insurance claims, rainfall – it is similar to the exponential distribution.

The most frequent use is to model the time between two independent event the occurs a constant average rate.

$$\Gamma(n) = (n - 1)! \quad \dots (3)$$

The shape parameter ( $\alpha$ ), specifien the number of events you are anodeling.  
Eg: To evaluate probabiliten for elapsed time of three accidents their shape parameter equals (3).

The scale parameter ( $\beta$ ) is the mean time between events.



The higher the value of  $\beta$ , the more spread it will be. i.e. a peak characterization using shape ( $\alpha$ ) and scale ( $\beta$ ) is  $X \sim \Gamma(\alpha, \beta) = \text{Gamma}(\alpha, \beta)$  and the P.D.F. is:

$$f(x; \alpha, \beta) = \frac{x^{\alpha-1} e^{-\beta x} \beta^\alpha}{\Gamma(\alpha)} \quad x > 0, \alpha, \beta > 0 \quad \dots (4)$$

When  $\Gamma(\alpha)$  is gamma function  $f(x) = (a-1)!$

The commutative distribution function is regularized gamma function

$$F(x; \alpha, \beta) = \int_0^x f(u; \alpha, \beta) du = \frac{\delta\mathcal{S}(\alpha, \beta x)}{\Gamma(\alpha)} \quad \dots (5)$$

Where  $\delta\mathcal{S}(\alpha, \beta x)$  is the lower incomplete gamma function.

Mean and variance are calculated as:

$$\mu = \alpha / \beta \quad (\text{the mean}) \quad \dots (6)$$

$$\sigma^2 = \alpha / \beta^2 \quad (\text{the variance}) \quad \dots (7)$$

Skewness, depend on shape parameter  $\alpha$ , and this equal to  $2\sqrt{x}$ .

Highest moment of the  $n^{\text{th}}$  raw moments is:

$$E(X^n) = \lambda^n \frac{\Gamma(k+n)}{\Gamma(k)} = \lambda^n \Gamma_{c=1}^n(k+i-1) \quad \dots$$

$$n = 1, 2, \dots \dots \dots \quad \dots (8)$$

Modelling time between successive samples, where  $\alpha$  (shape parameter) represents frequency of earth quackers and  $\beta$  (scale parameter) represent the duration between samples. so, by estimating  $\alpha$  &  $\beta$  from the historical data, we can calculate the expected time between samples.

In terms of mathematical formulas, the gamma distribution has several important characteristics. Its probability density function (PDF) is given by the following equation:

$$f(x; \alpha, \beta) = (1/\beta\alpha) * (x/\beta)^{(\alpha-1)} * e^{(-x/\beta)} \quad \dots (9)$$

where  $x$  is the random variable,  $\alpha$  is the shape parameter, and  $\beta$  is the scale parameter. The cumulative distribution function (CDF) of the gamma distribution is given by the following equation:

$$F(x; \alpha, \beta) = \Gamma(\alpha, x/\beta)/\Gamma(\alpha) \quad \dots (10)$$

where  $\Gamma(\alpha)$  is the gamma function, which is defined as the integral of  $t^{(\alpha-1)} * e^{(-t)}$  from zero to infinity (Figure 1).

To sum up, the gamma distribution is an effective probability distribution with many practical uses. It is a flexible tool for simulating positive skewness real-world phenomena due to its features and mathematical formulations. If you work in mathematics, statistics, or a related subject, you absolutely must know about the gamma distribution.

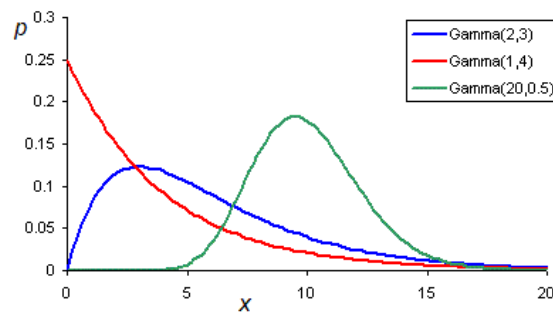


Figure 1: Probability function (p) calculated for the Gamma distribution ( $\Gamma$ ) with variation of ( $\alpha, \beta$ ) for the input samples (x).

## DESIGN CONCEPT

Numerous filters and approaches have been developed to significantly improve digital image quality as the area of image processing has progressed. Cameras and computers utilize methods like the Gamma distribution-based filter to

fix gamma corrections and reduce noise in photos. We will go over the gamma distribution and correction, the switching technique for filter building, the linear transformation of the median filter, and the merits of this filter compared to others in this paper.

One common method for improving picture quality is to linearly alter the median filter. Separate linear transformations are applied to the image's RGB color components. This streamlines the filter structure and enhances memory allocation. There is a trade-off between the median filter's ability to reduce noise and its potential impact on the quality of fine lines and textures in photographs. This issue is resolved by applying a linear transformation to the median filter.

Important parts of the filter design include gamma correction and distribution. The gamma distribution is utilized by the filter to assess the likelihood of a pixel being contaminated by noise in gamma-adjusted images acquired by cameras and computers.

Noisy pixels are considered to be outside the gamma distribution of nearby local samples. The Gamma distribution-based filter uses a switching technique for filter construction, where only anticipated pixels that are deemed to be noise-corrupted receive the reference filter's application. Figure 2 depicts the filter construction, and a 3x3 sampling frame traverses the entire picture, with the middle containing the processed pixel.

When an image is distorted by noise, the Gamma distribution changes. The highest value of the probability function is used to determine whether a pixel is corrupted by noise. The probability function of the Gamma distribution is shifted based on the distance between the corrupted pixel value and the usual Gamma distribution. The Gamma distribution-based filter handles textures and minute details much better than other median filters. It is simple to extend this application to a vector filter by making a few adjustments to this straightforward filter.

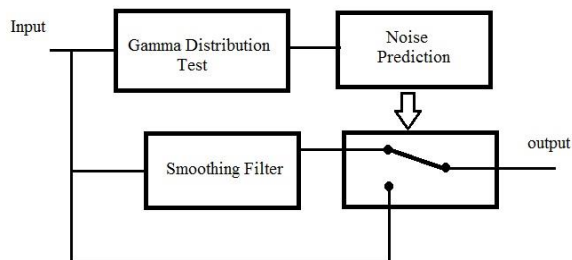


Figure 2: Filter Structure.

The specified filters are capable of handling textures and fine details with ease, among their many other advantages. But they detract from the sharpness of the narrow lines that contrast with the background. To solve this problem, the Gamma distribution-based filter processes the incorrect prediction using a nonlinear filter instead of a memory-less nonlinear element.

The Gamma distribution-based filter, to sum up, is an effective method for raising picture quality. Its linear transformation of the median filter, gamma distribution and correction, and switching technique for filter creation make it quite adept at handling textures and minute details. Although tiny lines may have their quality diminished, this issue is easily addressed by using a nonlinear filter to process prediction inaccuracies. An essential tool for enhancing digital image quality, the Gamma distribution-based filter will be around even as technology advances further.

## EXPERIMENTAL RESULTS

Noise in digital images can result in a loss of quality and difficulty in interpreting the image. Therefore, the development of effective noise reduction techniques is crucial for the improvement of image processing. This essay discusses the experimental results of a noise detection procedure based on the Gamma distribution.

Lena, Boats, Baboon, and Pepper are the test pictures used in this study. Impulsive noise, of amplitude up to 255, has been applied separately to cause random disturbance to the RGB components. Both the spread of impulse values and the pixel selection are uniform, with a given pixel in a given component

having a  $p$  present chance of being altered. Filters with and without the prediction framework have been used to process the images, and the efficacy of these filters has been demonstrated using an objective quality estimate of PSNR. The perceived quality of filter performance with prediction (PF) is also higher than that of median filters (MF). A feedback cycle has been employed to improve the preservation of fine texture in the filter output.

Figure (3a) displays the observed increase in PSNR [dB] when the forecast is used. According to Figure (3b), the median filter (MF) is not as effective as the proposed filter (PF), which results in a larger rise. Figure 4 shows the proposed structure in action, which necessitates keeping the thin lines. The efficacy of impulsive noise rejection is slightly diminished in order to accomplish this advantageous feature.

This study's findings show that a Gamma distribution-based noise detection process, with its prediction framework, is an excellent way to lessen digital photos' impulsive noise. Another great thing about this technology is how it uses a feedback loop to make the filter output better at preserving fine texture.

Finally, the issue of impulsive noise in digital photos is well addressed by this noise detection approach that is based on the Gamma distribution. Presented in this post are experimental data that prove this strategy works and show how important noise reduction techniques are for image processing.

## CONCLUSIONS AND DISCUSSION

Noise estimation filters that utilize the gamma distribution, a signal processing technique are designed to eliminate background noise. This approach involves using the gamma distribution to estimate noise in the original signal. In contrast techniques like Wiener filters rely on assumptions to mitigate noise. The gamma distribution is commonly employed for representing variables and modeling the probability density function of signal noise. By leveraging gamma distributions nonlinear noise estimation filters can treat noise as a variable and predict its future behavior. One notable advantage is their capability to handle noise reduction effectively by temporarily eliminating potential persistent noise. This methods ability to address varying signal amplitude or frequency dependent noise can be particularly advantageous for signal processing tasks. Additionally, the flexibility of adjusting the gamma distribution model in real time enables accommodating changes in process noise. However, a key drawback of filters based on gamma

distributions is their reliance on meticulous modeling of the noise process to identify different types of noise and optimize settings, for noise reduction. If the model is inadequate or if the nature of the noise is highly complex this method may not completely eliminate all signal interference.

In the realm of signal processing the gamma distribution serves as a method for eliminating nonlinear disturbances. These disruptions could potentially lead to compromised signal accuracy or erroneous identifications. By representing disturbances through a gamma distribution model this solution can promptly pinpoint and eliminate such interferences in live scenarios. While certain challenges exist with this approach it has proven effective in practical scenarios, such, as object identification and audio signal manipulation.

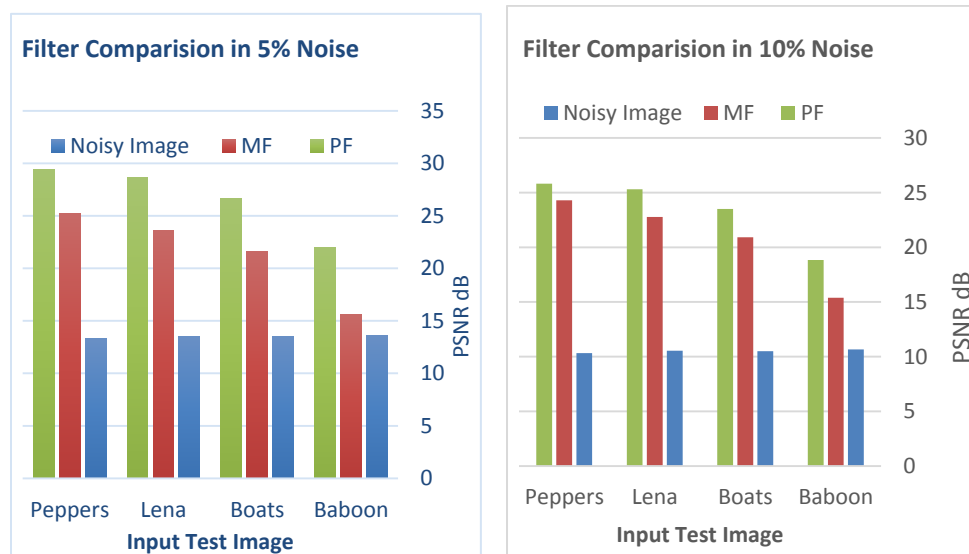


Figure 3: Filter performance analysis with presence of a)  $p=5%$  noise and b)  $p=10%$  noise.

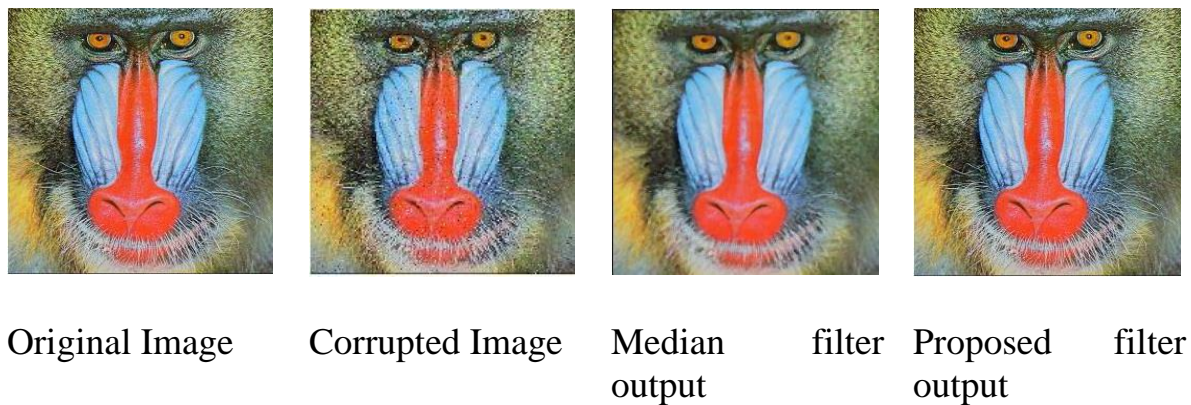


Figure 4: Noise rejection of impulse noise with a probability of  $p=10%$ .

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## Studying in Situ Synthesis and Characterization of $\text{CaTiO}_3$ Perovskite

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## ABSTRACT

A perovskite calcium titanate ( $\text{CaTiO}_3$ ) material has been synthesized in situ by hydrothermal method under a  $160\text{ }^\circ\text{C}$ , for 4 hrs. the synthesized powder was analyzed by X-ray diffraction (XRD). It showed an orthorhombic phase having lattice constants;  $a = 5.467\text{ \AA}$ ,  $b = 7.658\text{ \AA}$ , and  $c = 5.389\text{ \AA}$ . The morphology of the surface of the powder was analyzed by using scanning electron microscope (SEM). It was found a homogenized, and cubic shaped grains with an average grain size  $3.9\text{ }\mu\text{m}$ . The elemental composition of the sample was detected by energy dispersive X-ray spectrometer (EDX). The obtained results from spectrum agreed with the stoichiometric ratios of starting materials. Also, the density of the sample was geometrically estimated, and its value was  $2.96\text{ g/cm}^3$  with compactness of 73.01%. The measurement of dielectric constant ( $\epsilon_r$ ) and dielectric loss (D) were done by using LCR meter, and temperature range ( $30 - 200$ ) $^\circ\text{C}$ , for various frequencies 1 kHz., 100 kHz., and 1 MHz. It was obvious that  $\epsilon_r$  and D have a stabilized values with temperature, but generally, the values of decreases with increasing frequency.

**Keywords:** *calcium titanate, perovskite structure, hydrothermal synthesis, dielectric constant, X-ray diffraction.*

## INTRODUCTION

Calcium titanate is considered one of alkaline earth titanates; such as barium titanate, strontium titanate, and magnesium titanate. These materials have recently an appreciated attention due to their semiconductive, photorefractive, and ferroelectric properties. Dielectric materials based on calcium titanate took a wide range in various electronics applications and catalytic fields<sup>(1)(2)(3)(4)</sup>. Because of its high dielectric constant and low dielectric losses,  $\text{CaTiO}_3$  recommended as a promising material for applications in high frequency electronics<sup>(5)</sup>. Perovskite-structure oxide materials has a chemical formula  $\text{ABO}_3$ , where both A and B are metals<sup>(6)</sup>.  $\text{CaTiO}_3$  can be prepared conventionally through solid state reaction between  $\text{CaO}$  or  $\text{CaCO}_3$  and  $\text{TiO}_2$  powders at temperatures between  $1000\text{-}1300\text{ }^\circ\text{C}$  approximately<sup>(7)</sup>. The produced powders from the solid state reaction are often have low purity, wide size distribution, and large particle sizes. Although, there is a reduction to these problems, via wet chemical methods; like hydrothermal and

solvothermal, sol-gel, microemulsion, and polymeric precursor, etc., and almost of them are not cost effective<sup>(8)</sup>. Recently, calcium titanate due to its photocatalytic properties, have been developed in the advanced oxidation technologies in degradation of emerging pollutants<sup>(9)(10)</sup>. In the present work,  $\text{CaTiO}_3$  powder was in situ synthesized by hydrothermal method. The effect of crystalline phase on the dielectric properties, effect of starting materials on the morphology of particles, and effect of temperature on dielectric behavior were investigated.

## MATERIALS AND METHOD

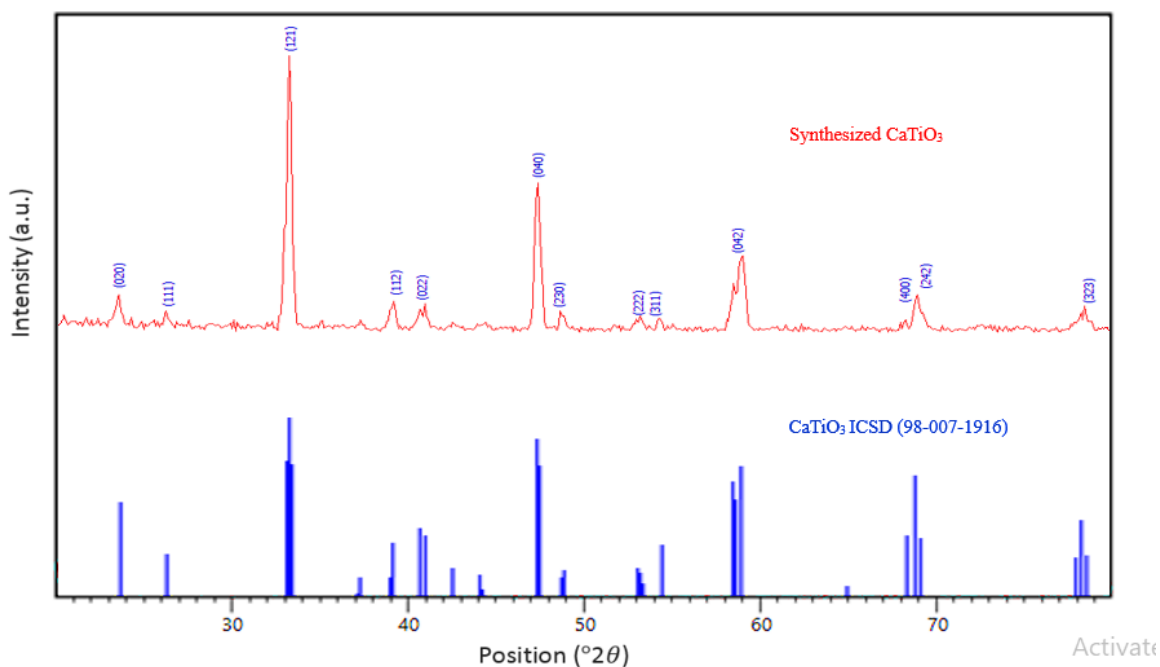
An equimolar amounts of titanium and calcium precursors were used. Weights calculation of reactants from the molar mass law ( $n = w/m.w$ ). Titanium tetrachloride ( $\text{TiCl}_4$ ) which was purchased from Merck company, and calcium acetates [ $(\text{CH}_3\text{COO})_2\text{Ca}\cdot\text{H}_2\text{O}$ ], purchased from HW chemicals company, were used as starting materials with a stoichiometric (1:1) ratio.  $\text{TiCl}_4$  was dissolved in isopropanol which was cooled to 0 °C, with a volume ratio (1:10) respectively. Meanwhile, calcium acetates were dissolved in distilled water. Then, the two solutions were mixed together, and NaOH, purchased from EMC Lab. company was added as mineralizer, till the pH value of the mixture reached to 13. The basic suspension resulted then was transferred into a Teflon lined vessel and occupied 80% of its volume, and then placed in autoclave. The hydrothermal process was achieved by adjusting the temperature on 160 °C, and 18 bar pressure for a period 4 hrs. After that, the component was cooled to room temperature, and the gained white suspension washed five times with distilled water for removing the solved materials and filtered using Buchner funnel.

The washed, and filtered material was dried in oven for 18 hrs., then a  $\text{CaTiO}_3$  then was achieved. Then the sample was analyzed by XRD technique to approve its phase. SEM and EDX techniques were followed to detect the morphology, and composition of the sample as well. The powder then was compacted with a pressure 127 MPa into pellets with a 10 mm in diameter using an electrical press and a stainless steel die. The following step was the sintering process at 900 °C for 4 hrs. to solidify the pellets for compactness and density estimation. Finally, the pellets were polished and prepared for dielectric measurement polished and prepared for dielectric measurements, by coating the electrodes with gold by

plasma sputtering technique, using LCR meter, specialized cell joined to vacuum, and programmable furnace.

## RESULTS

The material was characterized by X-Ray Diffraction (XRD), using PANalytical X'Pert PRO diffractometer with Cu  $k\alpha$  source ( $\lambda = 1.54 \text{ \AA}$ ), and applied voltage and current were respectively 40 kV and 30 mA. The pattern characterized and compared with the standard one as in figure 1. Unit-cell parameters of  $\text{CaTiO}_3$  sample and its relationship with standard ones are showed in



Parameter	Sample	Standard	Difference
$a$ (Å)	5.467	5.447	0.02

table I. it was calculated using Refine program by peak comparison method.

**Figure 1.**  
XRD

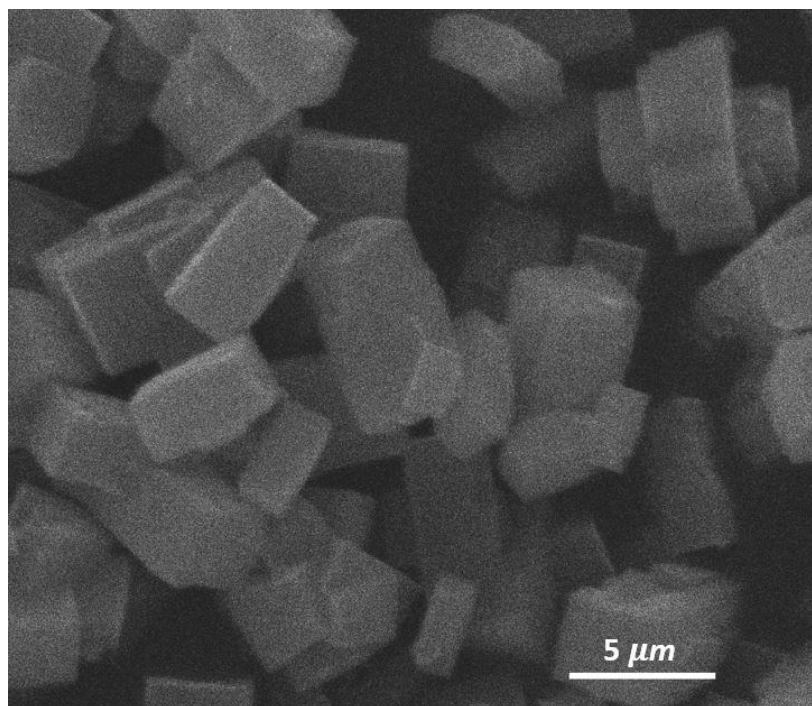
pattern of  $\text{CaTiO}_3$  sample.

$b$ (Å)	7.658	7.654	0.004
$c$ (Å)	5.389	5.388	0.001
$V$ (Å <sup>3</sup> )	225.62	224.63	0.99

**Table I.**  
*Unit-cell*

*parameters of CaTiO<sub>3</sub> sample and its comparison with standard values.*

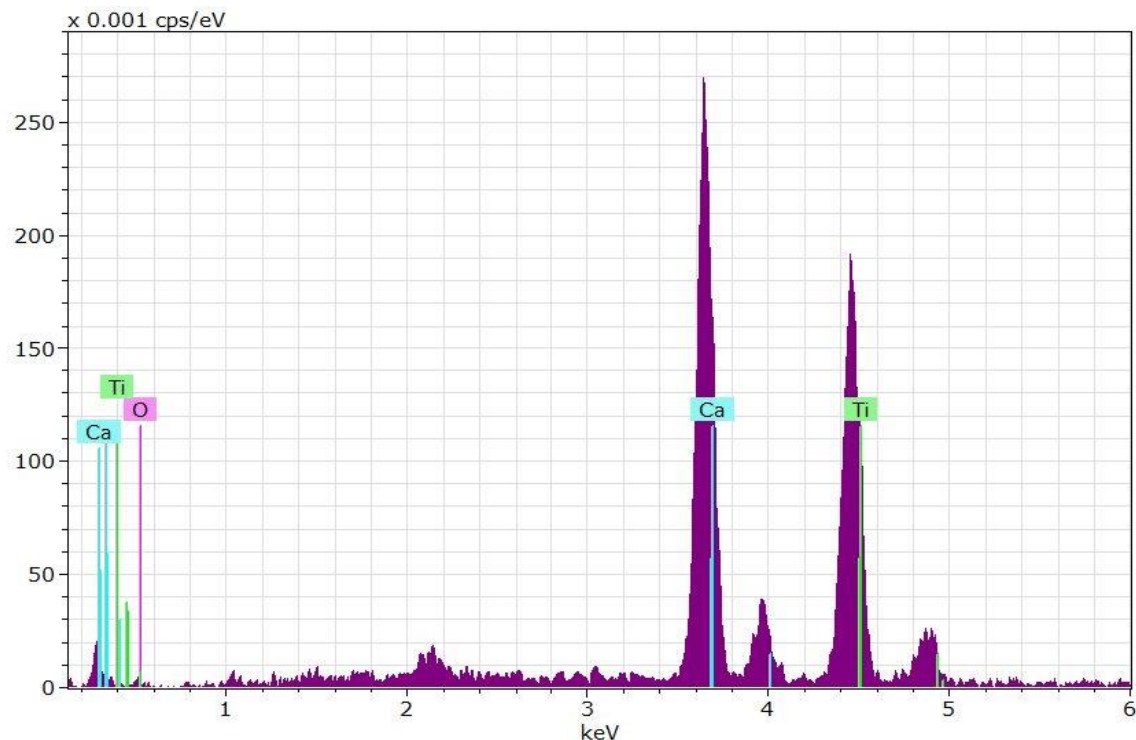
The surface morphology of synthesized powder was obtained from scanning electron microscopy (SEM), as shown in figure 2. The image was acquired from Inspect S50 microscope with an accelerating voltage and magnification were respectively; 30 kV, and 10405x. The micrograph shows the particles having a mono-disperse form, no agglomerations existed, and have cubic shape with an



average grain size (3.9 μm).

**Figure 2.** SEM image of synthesized CaTiO<sub>3</sub>.

Figure 3 shows the Energy Dispersive X-ray spectroscopic (EDX) data of as-synthesized  $\text{CaTiO}_3$  sample, which were evaluated from EDX spectrometer joined to the same SEM component. The evaluated ratios of Ca, Ti and O elements and its



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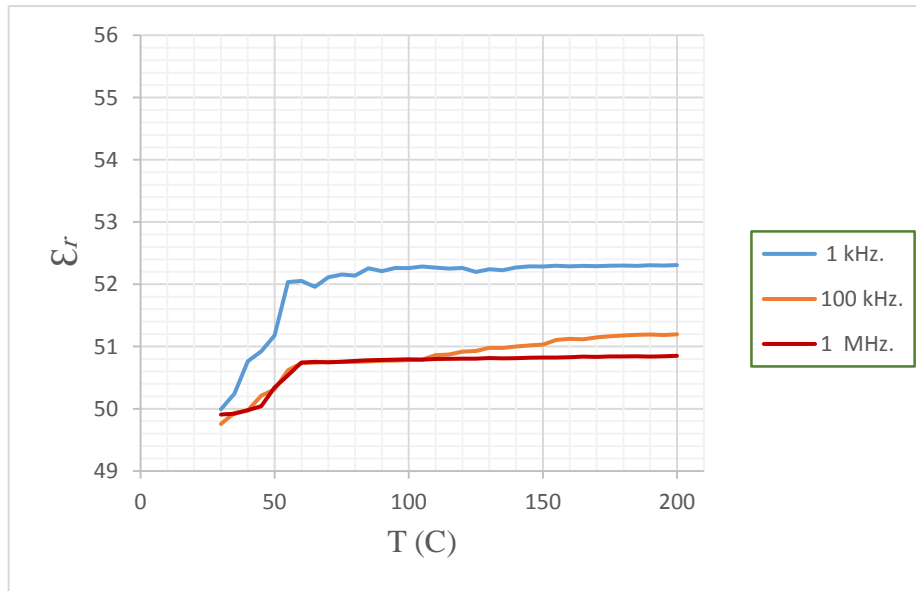
**Figure 3.** EDX spectrum of  $\text{CaTiO}_3$  sample.

The density of sintered  $\text{CaTiO}_3$  pellet was estimated using the geometrical method. The result of this estimation was ( $2.96 \text{ g/cm}^3$ ). Also the compactness was evaluated, to be 73.01%.

**Table II.** Quantitative EDX data of  $\text{CaTiO}_3$  sample.

<i>Element</i>	<i>% Theoretical</i>	<i>% Experimental</i>	<i>Difference</i>
<i>Ca</i>	29.49	31.25	1.76
<i>Ti</i>	35.21	32.07	3.14
<i>O</i>	35.30	36.68	1.38

The thermal variation with dielectric constant and dielectric loss, at different frequencies was measured in figures 4, and 5 respectively. In figure 4, the measurement of dielectric constant ( $\epsilon_r$ ) with temperature was carried out at 1 kHz., 100 kHz., and 1 MHz., and also for measurement of dielectric loss (D) in figure 5. It was considered the three frequencies to detect the variation in dielectric behavior values between low and high frequency. It is clear that dielectric values are

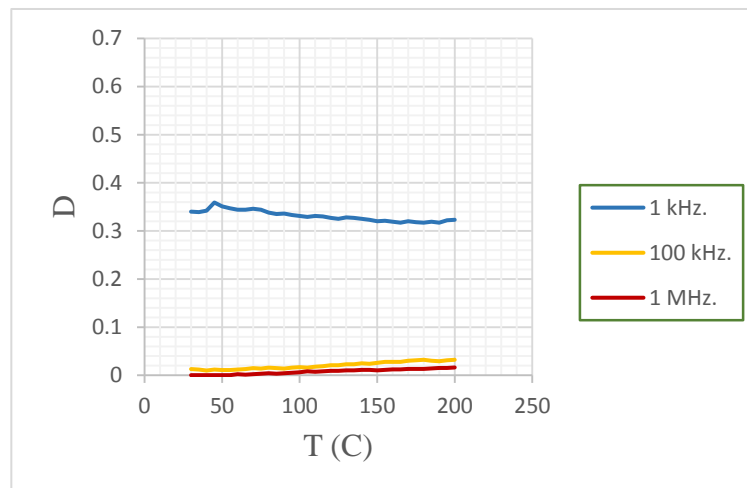


relatively stable at temperatures above 70°C.

**Figure 4.** Measurement of dielectric constant ( $\epsilon_r$ ) with temperature for  $\text{CaTiO}_3$  sample at various frequencies.

**Figure 5.** Measurement of loss tangent (D) with temperature for  $\text{CaTiO}_3$  sample at various frequencies.

## DISCUSSION



The present pattern was qualitatively analyzed by comparison with standard XRD pattern numbered (98-007-1916) from Inorganic Crystal Structure Databases (ICSD)<sup>(11)</sup>. The analysis showed a pure orthorhombic phase of (P n m a) space group, with lattice constants ( $a = 5.467 \text{ \AA}$ ,  $b = 7.658 \text{ \AA}$ , and  $c = 5.389 \text{ \AA}$ ), and unit cell volume  $225.62 \text{ \AA}^3$ . It is clear that the peak with miller indices (121) has a high intensity, which indicates that the concentration of these indices is high in the crystalline lattice. The crystallite size were obtained from Xpolder program which is based on Williamson-Hall equation; it was found to be 14.3 nm. The low crystallite size approve the presence of single crystalline formation.

From table I, the change in values of unit-cell parameters leads to a variation in energies of the ionic bonds between  $\text{Ca}^{+2}$ ,  $\text{Ti}^{+4}$ , and  $\text{O}^{-2}$  ions, due to the change in values of translational symmetry vectors represented by lattice constants. It is noted that the peaks were shifted toward the right side of pattern, which means there is an increase in the values of unit cell parameters of this structure. The pattern also showed a pure  $\text{CaTiO}_3$  with no extra phases for other materials like  $\text{CaCO}_3$ ,  $\text{CaO}$ , or  $\text{TiO}_2$  appeared in this pattern during the analysis.

The morphology of the particle is strongly affected by the precursors used, and synthesis time and temperature. Thus, the starting material used in this study under synthesis conditions mentioned, led to such a morphology of  $\text{CaTiO}_3$  like in the SEM image. In figure 2, It is clear that the particles have a filled cubic shape, since there are no hollow-cubes in its morphology as it was obtained by Yang et al.<sup>(12)</sup>.

Table II predicts that the results of EDX agrees with the stoichiometric ratios of equimolar amounts of starting materials used. Also, figure 3. indicates to a high purity of the synthesized powder by proving that there are no other elements utilized in the EDX spectrum.

The density value of  $\text{CaTiO}_3$  under study ( $2.96 \text{ g/cm}^3$ ) shows a difference from the calculated density of calcium titanate ( $3.98 \text{ g/cm}^3$ )<sup>(13)</sup>. So, the compactness was evaluated, and it was 73.01%, which is greater than that submitted by Evans et al., which was 50%<sup>(14)</sup>. The variation between the theoretical and experimental density depends mainly on parameters like, pressing pressure, sintering temperature, and particle size.



It is notable in thermal variation with dielectric constant that, the temperature range taken in this measurement (30 - 200) °C, does not include phase transition for calcium titanate<sup>(15)</sup>. From figure 4, it is clear that there is decrease in values of  $\epsilon_r$  with increasing of frequency, since, at 1 kHz., the value of  $\epsilon_r$  was 52.25, whereas at 100 kHz., the value decreased to 50.97, and at 1 MHz. it dropped to 50.82. Figure reveals a reverse behavior of loss tangent with frequency than that appeared with dielectric constant. In this case, at 1 kHz., the value of D was 0.34, but it decreased into 0.019 at 100 kHz., and had the value 0.0082 at 1 MHz.

It is noticed that, the values of  $\epsilon_r$  and D were nearly had a slight variation at 100 kHz., and 1MHz., this indicates to the stability of these values as the frequency increased and reach an approximately equal values. The behavior of dielectric constant and dielectric loss with temperature range included, reveals there is little effect of temperature on  $\epsilon_r$  and D. the low values of dielectric constant are resulted from the nature of calcium titanate as anti-ferroelectric material, and also related to synthesis route and precursors used<sup>(16)</sup>. It is regarded that the values of D for all measured frequencies did not exceed 0.34, indicating that, the losses in electrical permittivity for the synthesized sample are extremely low.

## CONCLUSION

A stoichiometric, ultra-pure, and homogenized  $\text{CaTiO}_3$  material was successfully synthesized by means of hydrothermally from the starting materials (calcium acetates, and titanium tetra chloride) under 160 °C, for 4 hrs., and exhibited a unique crystalline phase with no additional phases included without any heat treatment. it is worth mentioning here that the sintering process was performed just only to densify the compacted sample. The dielectric behavior of synthesized  $\text{CaTiO}_3$  sample at high frequencies is frequency independent approximately, as it is noted from the results of dielectric measurements. The stabilized values of  $\epsilon_r$ , indicates a stable crystalline phase of the material which reveals the success of hydrothermal method in preparing a completely grown phase of  $\text{CaTiO}_3$ . The stability behavior with a high temperature range, and low values of dielectric constant achieved, gives a possibility about investment of this material in microelectronics, and IC fabrication.

## ACKNOWLEDGMENTS

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## Smoking-associated DNA methylation biomarkers in prediction of lung cancer incidence in a sample of Iraqi patients

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## Abstract

**Background:** DNA methylation is a biological process by which methyl groups are added to the DNA molecule. Methylation can change the activity of a DNA segment without changing the sequence. In the mammalian genome, DNA methylation is an epigenetic mechanism involving the transfer of a methyl group onto the C5 position of the cytosine to form 5-methylcytosine. DNA methylation is associated with a wide range of biological processes, including deactivation of chromosome X, genomic imprinting, stem cell differentiation, gene expression control, chromosomal stability aging, and carcinogenesis. Changes in DNA methylation patterns are an important characteristic of human cancer including lung cancer

**Methods:** DNA methylation was investigated in the plasma from patients with lung cancer using High-Resolution Melting Analysis by Real time PCR and their diagnostic value for lung cancer etiology was evaluated Plasma samples were collected from 80 patients 20 patients with lung cancer, 20 cigarette smokers 20 Hookah smokers and 20 healthy controls. Real-time PCR of LINE-1 gene were investigated using two primer sets (methylated region primer and unmethylated region primer).

**Results:** LINE-1 methylation pattern appeared in 80 samples in total ,from which 34 samples were positive methylation , 3 (8.8%) samples for Lung cancer patients and for Hookah smokers 8 (23.5%) samples Cigarette smokers 5 (14.7) on the other hand the unmethylated LINE-1 elements in DNA samples were 62 ,negative samples for Lung cancer patients were 20 (32%) samples , In Hookah smokers the methylation was 20 (32%), for Cigarette smokers the methylated samples were 19 (30%) while, the umethylated LINE-1 repeats samples were only 3(4.3%) for non-smokers. According to this result, there was a significant difference in positive and negative methylation level for LINE-1 gene ( $P=0.001$ ).

**Conclusions:** LINE-1 gene was hypo-methylated in lung cancer patents, cigarette smokers and hookah smokers.

**Keywords;** LINE -1 gene, lung cancer, DNA methylation.

## Introduction

especially in developed countries. Furthermore, more than one third of men in the world smoke. fewer than 10% of women do (1). By 2025, tobacco use is anticipated to be the cause of 10 million deaths, with cigarette smoking being the main factor in adult mortality, LINE-1 hypomethylation was found to be associated with tumor malignant features in patients with lung adenocarcinoma (2). Another study demonstrated that The mean level of LINE-1 methylation in most cancer

types is lower than in normal cells and The degree of LINE-1 hypomethylation increases in more advanced cancers (3). It has been proposed that smoking has an impact on DNA methylation (٤) resulting in the growth of multiple cancers (٥). for instance, lung cancer. In case of LINE-1 element Interestingly Epigenetic changes in long interspersed nuclear element-1s occur early during the process of carcinogenesis. A lower methylation level (hypomethylation) of LINE-1 is common in most cancers, and the methylation level is further decreased in more advanced cancers (٣). This process is repressed in most normal cells, but LINE-1 expression is a hallmark of many types of malignancy (٦).

### **Materials and methods**

The study was conducted on 80 adult males including 20 lung cancer patients at different stages of the disease, 20 cigarette smokers 20 Hookah smokers 20 never smokers The age ranging between 30 to 50 years were included in this study. All clinical data have been obtained including complete medical history, type of treatment used and pathological variables. Blood samples were collected from Oncology Center in Medical City Hospital in the period from January 2022 to April 2022 . Plasma DNA Preparation Samples were separated by centrifugation at room temperature for 10 min at 2000 rpm. until use, plasma samples store at -20 ° C.

### **DNA Extraction from Circulating Tumors**

DNA was extracted using the Viral Nucleic Acid Extraction Kit II (Geneaid , Canada). With the Viral Nucleic Acid Kit with High Purity, all nucleic acids (Geneaid). Following the manufacturer's instructions, 1 cc of plasma was used to separate tumor DNA from the bloodstream.

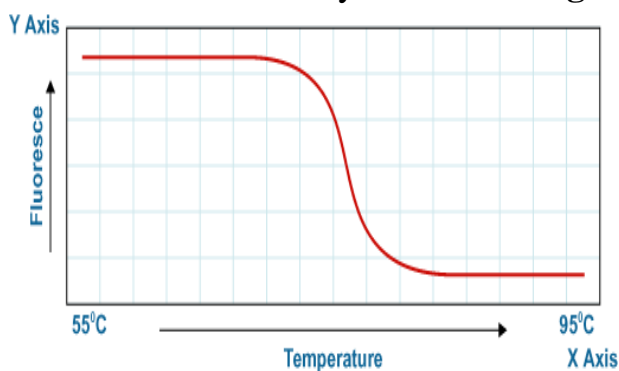
### **Estimation of DNA Concentration**

DNA concentration of samples was measured using Nano drop spectrometer, by putting 1 µl of the extracted DNA in the instrument to detect concentration and purity by reading the ratio of absorbance at wavelength 260\280 nm.

### **High-Resolution Melting Analysis by Quantitative Real time PCR**

High-Resolution Melting analysis (HRM) is the sensitive method detect to sequence vibration up to resolute single base pare without needing sequencing. HRM a novel post-PCR method to analyze genetic variations (methylations) in

PCR . It goes beyond the power of classical melting curve analysis by allowing us to study the thermal denaturation of a double-stranded DNA, characterize nucleic acid samples based on their disassociation (melting) behavior. Samples can be discriminated according to their sequence, length, GC content or strand complementarity and analysis software allow them to detect these changes and information about the underlying sequence. This is achieved by using a fluorescent dye (EVA Green). The dyes that are used for HRM are known as intercalating dyes they bind specifically to double-stranded DNA and when they are bound. **Figure 1,**



they fluoresce brightly.

**Figure (1) DNA Melt Curve for High Resolution Melting Analysis**

### Statistical Analysis

The Statistical Analysis System- SAS (2018) program was used to detect the effect of difference factors in study parameters(11). Least significant difference -LSD test (Analysis of Variation-ANOVA) was used to significant compare between means in this study.

### Results

DNA concentration of DNA ranged between  $17.06 \pm 0.96 \mu\text{g/ml}$  and  $38.93 \pm 2.84 \mu\text{g/ml}$ .

The percentage of methylation was defined as the ratio between methylated molecules and the sum of methylated and unmethylated molecules.

The real time PCR results demonstrated in **table (1)**, showed that LINE-1 methylation pattern

appeared in 80 samples in total ,from which 34 samples were positive methylation were 3 (8.8%) samples for Lung cancer patients and for Hookah smokers 8



(23.5%) samples Cigarette smokers 5 (14.7) on the other hand the unmethylated LINE-1 elements in DNA samples were 62 ,negative samples for Lung cancer patients were 20 (32%) samples , for Hookah smokers the methylation was 20 (32%), for Cigarette smokers the methylated samples were 19 (30%) while, the unmethylated LINE-1 repeats samples were only 3(4.3%) for non-smokers. According to this result, there was a significant difference in positive and negative methylation level for LINE-1 gene (P=0.001).

**Table (1) Distribution of LINE-1 gene methylation pattern**

Methylati on LINE- 1	Total No. n=80	Lung cancer patients n=20		Hookah smokers n=20		Cigarette smokers n=20		Control n=20	
		No.	%	No.	%	No.	%	No.	%
<b>Positive</b>	34	3	8.8	8	23.5	5	14.7	18	52.9
<b>Negative</b>	62	20	35	20	35	19	32	3	4.3

**Table (2) Methylation levels (mean±SD) for LINE-1 gene**

Patient	LINE-1 Methylation level (mean±SD) %	P-value
<b>Lung cancer patient</b>	67.4 ± 9.8	0.001*
<b>Non smokers</b>	87.6 ± 7.5	
<b>Hookah smokers</b>	69.7 ± 8.5	0.001*
<b>Non smokers</b>	87.6 ± 7.5	
<b>Cigarette smokers</b>	70.5 ± 6.8	0.001*
<b>Non smokers</b>	87.6 ± 7.5	

The result of the current investigation shown in **table (2)** for the mean±SD of LINE-1 methylation levels were (67.4 ± 9.8) for Lung cancer patients and (87.6 ± 7.5) for Non-smokers (P=0.001). Thus, it indicates there was a highly significant difference between Lung cancer patients and Non-smokers.

## Discussion

High-Resolution Melting Analysis is the sensitive method detect to sequence vibration up to resolute single base pare without needing sequencing. HRM a novel post-PCR method to analyze genetic variations (methylations) in PCR . It goes beyond the power of classical melting curve analysis by allowing us to study the thermal denaturation of a double-stranded DNA, characterize nucleic acid samples based on their disassociation (melting) behavior. According to this study, there was a significant difference in positive and negative methylation level for LINE-1 gene ( $P=0.001$ ),thus, it indicates there was a highly significant difference between Lung cancer patients and Non-smokers.

Similar results reported that Usually LINE-1 elements are heavily methylated in normal human tissues. LINE-1 hypomethylation is a common characteristic of human cancers and accounts for a substantial proportion of the genomic hypomethylation observed in this disease. Hypomethylation in the promoter region of potent full-length LINE-1 elements causes transcriptional activation of LINE-1, resulting in transposition of the retroelement and chromosomal alteration such as deletion (7.)

In another study, LINE-1 hypomethylation was found to be associated with tumor malignant features in patients with lung adenocarcinoma (8).Another study demonstrated that The mean level of LINE-1 methylation in most cancer types is lower than in normal cells and The degree of LINE-1 hypomethylation increases in more advanced cancers (9). These finding also agreed with a study was performed on 215 normal and 246 tumor tissues that were analyzed for methylation it was found out that LINE-1 methylation was significantly lower in cancer tissue (10).

## Conclusion

The main conclusion of this work is there was a significant relationship between LINE-1 methylation level and smoking . highly methylated areas was found in hookah and cigarette smokers, but there is no methylated area in the nonsmokers group.

LINE-1 gene was hypo-methylated in lung cancer patients, cigarette smokers and hookah smokers.

### Acknowledgements

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### Conflicts of Interest

The authors declare no conflicts of interest.

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## تقييم الحالة الصحية لعمال المولدات الكهربائية

# Evaluation of Health Status of Electric Generators Workers

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**ABSTRACT**

Employees who work with electric generators are constantly exposed to extremely loud noise, which can lead to various health problems. The aim of this study was to measure the blood pressure of individuals who work as electric generators in Najaf city. The study investigated the blood pressure of 68 nonsmoking male electric generator workers, 86 smokers working for 3 to 12 years, and 45 individuals as a control group, the study also used questionnaire surveys to obtain an idea of the frequency that accidents were involving electric generators among 100 diesel generator workers. The study elucidated a significant increase ( $p \geq 0.05$ ) in both systolic and diastolic blood pressure among smokers and nonsmokers working in electric generators, as compared to the control. Furthermore, the findings indicated that a significant percentage of incidents occurred in electric generators, such as workers experiencing excessive tiredness or collapse (60%), unintentionally drinking fuel (30%), and suffering accidental injury (20%). The present study demonstrates that exposure to stress and noise in the workplace leads to a significant rise in blood pressure.

**Keywords:** Blood pressure, Electric generators, Noise.

**الخلاصة**

يتعرض العاملون الذين يعملون في مولدات الطاقة الكهربائية باستمرار لضوضاء عالية للغاية، مما قد يؤدي إلى مشاكل صحية مختلفة. هدفت هذه الدراسة إلى قياس ضغط الدم لدى عمال مولدات الطاقة الكهربائية في مدينة النجف الأشرف. تضمنت الدراسة قياس ضغط الدم لدى ٦٨ من عمال المولدات الكهربائية غير المدخنين، و٨٦ مدخنًا يعملون لمدة ٣ إلى ١٢ سنة، و٤٥ فردًا كمجموعة سيطرة، واستخدمت الدراسة أيضًا استبيانات للحصول على نسبة وقوع الحوادث التي تتعلق بالمولدات ( في كل  $p \geq 0.05$  الكهربائية الى ١٠٠ عامل مولدات الديزل. أوضحت الدراسة وجود زيادة معنوية ) من ضغط الدم الانقباضي والانبساطي بين المدخنين وغير المدخنين العاملين في المولدات الكهربائية مقارنة مع مجموعة السيطرة. كما أشارت النتائج إلى أن نسبة كبيرة من الحوادث وقعت في المولدات الكهربائية مثل إصابة العمال بالتعب المفرط أو الانهيار (٦٠%)، وشرب الوقود عن غير قصد (٣٠%)، والإصابة العرضية (٢٠%). وتوضح الدراسة الحالية أن التعرض للضوضاء في مكان العمل يؤدي إلى ارتفاع كبير في ضغط الدم.

الكلمات المفتاحية: ضغط الدم، المولدات الكهربائية، الضوضاء.

## INTRODUCTION

The most prevalent sources of noise that contribute to the excessive sound levels generated by the machine are electric power generators [1]. Noise can have negative impacts on human health for both short and long durations, such as disrupted sleep, exhaustion, hypertension, and hearing loss [2]. Noise exposure, either for long or short periods, has negative impacts on human health, such as disruptions to sleep, exhaustion, hypertension, and hearing loss [3]. According to another study, diesel exhaust fumes can cause respiratory infections and eye irritation, particularly when starting generators without protective gear such as a mask [4].

Chemical compounds and gases from electric generators, lead to air pollution and adversely affect workers' health run generators[5,6]. Levels of noise limited to 70 to 75 dB have been related to elevated blood pressure, abnormal fetal growth, behaviour and intense emotions [7].

Previous research has focused on determining the level of noise pollution caused by electric generators. There have been a limited number of studies that have investigated the impact that noise from generators has on the blood pressure of employees. The objective of the research was to investigate the impact that levels of noise in the job environment have on workers who operate electric generators.

## MATERIALS AND METHOD

### 2.1. Workplace of study :

The study was carried out on employees who worked in the Iraqi city of Najaf and were exposed to noise pollution while operating diesel-electric generators.

The study consisted of 68 non-cigarette smokers and 86 cigarette smokers electric generators workers with mean age ( $33.1 \pm 9.05$  years), duration of employment ( $6.72 \pm 5.02$  years), height ( $166.26 \pm 9.19$  Cm), weight ( $76.87 \pm 15.02$  Kg) and body mass index BMI ( $27.6 \pm 3.47$  Kg/m<sup>2</sup>) Table (1).

## 2.2. Questionnaire surveys:

A survey was given to a population of 100 employees from various large private power plants in Al-Najaf city, Iraq. Interviews were conducted in the workplace and data was collected using a questionnaire. The contents included personal information, employment history, smoking habits, medical background, and important accidents involving electric generators.

## 2.3. Estimation of Blood Pressure :

A Mercury sphygmomanometer was used to measure the systolic & diastolic blood pressure of employees who worked in electric generators. The mean of the two distinct values was taken every time after work [8].

## RESULTS

The findings shown in Table (2) indicated a significant ( $p \geq 0.05$ ) increase in the systolic and diastolic blood pressure of nonsmoking electric generator workers as compared to the control group.

The results also showed that the average systolic and diastolic blood pressure of smokers who were employed in electric generators was higher than that of the control group (Table 3).

The findings of the study showed that the most frequent type of accident among electric generator employees (50%) was fatigue or collapse (Table 4). However, the statistical study showed that accidents including ignition of a fire (12%) and burns as a result to the exhaust (18%) were recorded among workers of electrical generators (Table 4).

The results shown in figures (1,2) showed a positive correlation between systolic and diastolic blood pressure and duration of work in smokers electric generators workers.



Also, the study showed that positive correlation between systolic and diastolic blood pressure and duration of employment in non-smoker electric generator workers (Figures 3, 4).

Table: (1) Personal information of workers in electric generators and control.

Characteristics	Electrical generators workers smokers and non-smokers	Control
	Mean± SD	Mean± SD
Age ( years)	33.1±9.05	32.93±9.34
Height (Cm)	166.26±9.19	165.27±9. 57
Weight (kg)	76.87±15.02	75.99±13.36
BMI (Kg/m <sup>2</sup> )	27.6±3.47	27.52±2.4

Mean ±SD: mean ± standard deviation.

Table (2) Blood pressure of electricity generator workers (non-smokers) and control.

Parameters	Control (n=68)	Electric generator operators (n= 68)	t-test value
	Mean ± SD	Mean ± SD	
Systolic blood pressure (SBP) (mmHg)	121.54±1.29	*128.75±1.73*	7.21
Diastolic blood pressure (DBP) (mmHg)	80.45±0.98	**82.89±1.06	2.44

\*\* Significant difference at  $p \leq 0.05$ .

Table (3) Blood pressure of electricity generator workers (smokers) and control.

Parameters	Control (n=86)	Electric generator operators (n= 86)	t-test value
	Mean±SD	Mean±SD	
Systolic blood pressure (SBP) (mmHg)	121.86±0.19	**133.26±4.59	20.28
Diastolic blood pressure (DBP) (mmHg)	80.28±1.38	**85.52±2.08	15.55

\*\* Significant difference at  $p \leq 0.05$ .

Table (4) Frequently occurring types of major accidents among workers who use electric generators.

No	Major types of accident	Frequency	
		Yes N(ratio)	No N(ratio)
١	Tiredness or collapse	(60%)	(40%)
٢	Intake of fuel	(30%)	(70%)
٣	Accidental Injury	(20%)	(80%)
4	Burns as a result to the exhaust	(18%)	(82%)
5	Ignition of a fire	(12%)	(88%)

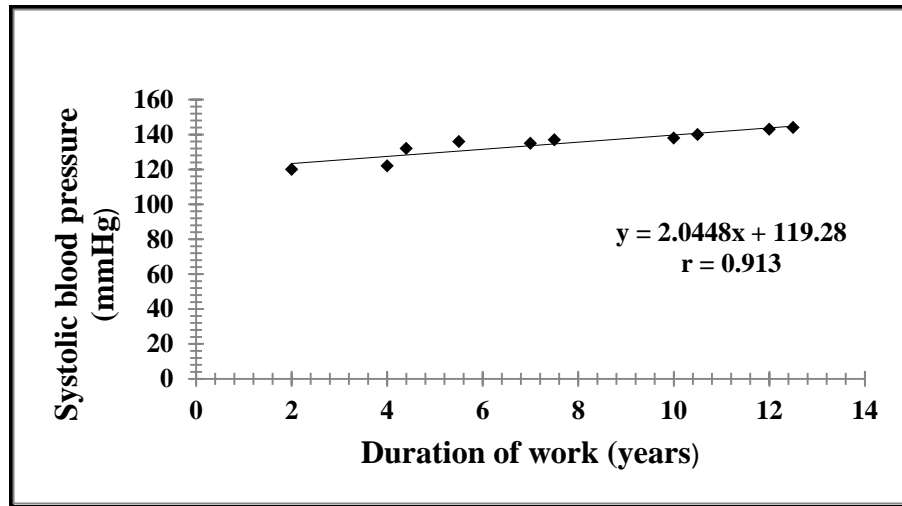


Figure (1) Correlation between systolic blood pressure (mmHg) and duration of work of smokers electric generators workers.

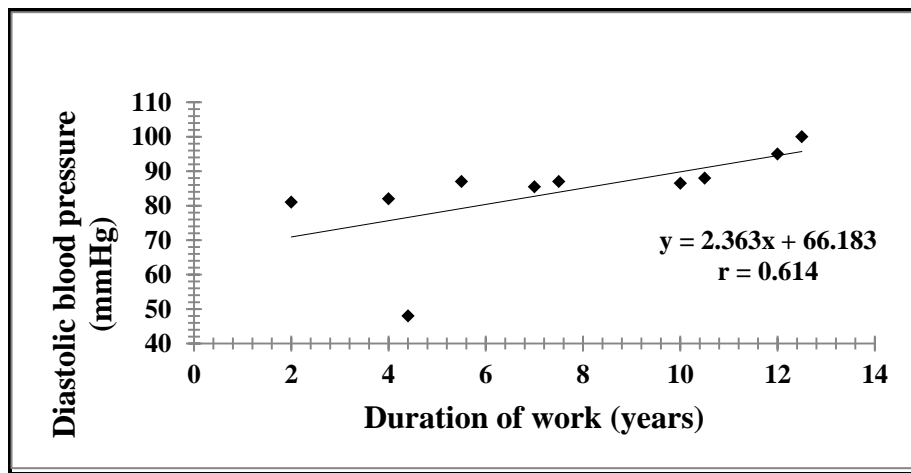


Figure (2) Correlation between diastolic blood pressure (mmHg) and duration of work of smokers electric generators workers.

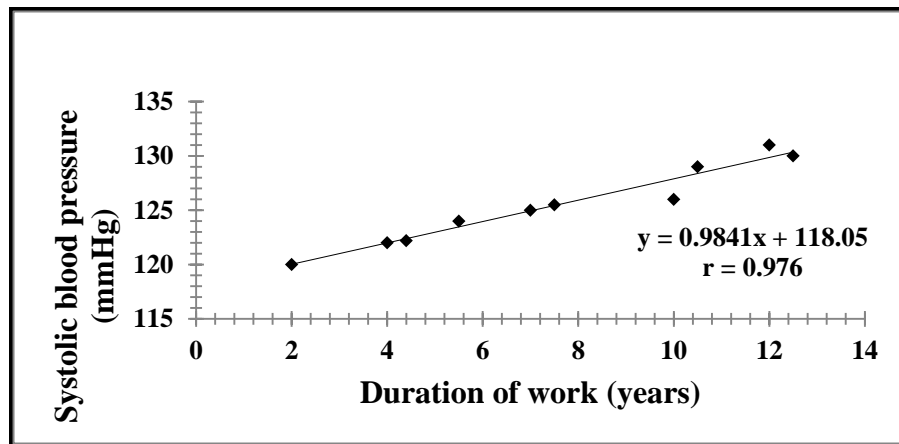


Figure (3) Correlation between systolic blood pressure (mmHg) and duration of work of non-smoker electric generator workers.

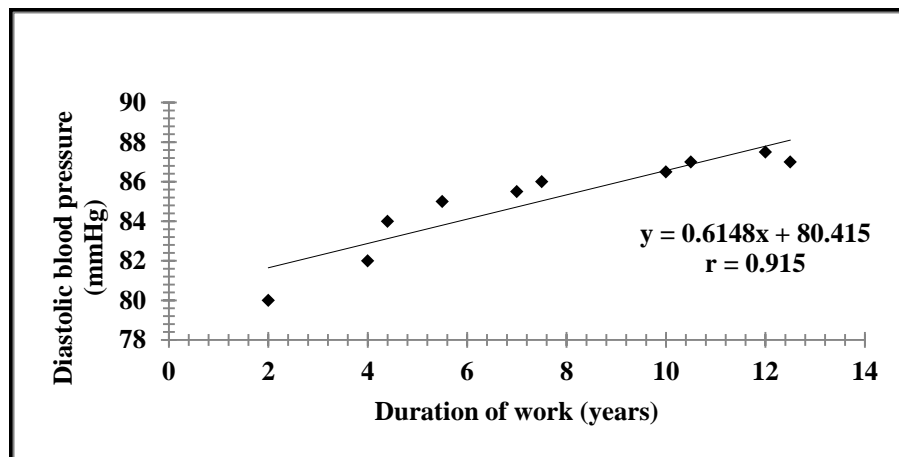


Figure (4) Correlation between diastolic blood pressure (mmHg) and duration of work of non-smoker electric generator workers.

## DISCUSSION

According to the results, both the systolic and diastolic blood pressure of smokers and non-smokers who work as electric generators were significantly higher than the control group (Table 2, 3). Similarly [9] research has shown that continuous loud noise at work increases the risk of hypertension, metabolic syndrome, and cardiovascular disease.

In addition, it was noted in [10] that noise-exposed individuals had significantly higher values of systolic blood pressure compared to the control group. Also, they found a strong correlation between exposure to noise and both SBP and DBP. Additionally, 17.8% of noise-exposed individuals had hypertension. The prevalence of hypertension was 33.2% in the noise-exposed groups, according to the same study [11,12]. According to the data in Table 4, electric generator workers reported a high prevalence of fatigue or collapse at 60%, fuel ingestion at 30%, and injury at 20%. Similar to previous research, this study observed that electric power workers had a greater prevalence of health concerns, including decreased hearing (67.2%), sleepiness (60.5%), and dizziness (31.9%). Extreme amounts of noise are associated with sleep difficulties, hypertension, and cognitive problems [14]. There have been studies that have shown a correlation between being in a noisy environment and an increase in blood pressure, possibly as a result of vasoconstriction [15.16.17]. [18] showed different psychosocial hazards like occupational stress (threat,) and emotional stress, were the causes of Hypertension.

In addition, the results showed that the duration of employment was positively correlated with both systolic and diastolic blood pressure in electric generator workers who smoked and non-smoked (1,2,3,4). This result agreed with [19] found a positive connection between noise exposure and blood pressure alterations among individuals. The risk of hypertension increased with each additional hour of exposure to air pollution that lasted 30 days or more. This study adds to the growing body of evidence linking air pollution to an increased risk of heart disease [20]. High blood pressure was a common health problem among metalworkers whose jobs required them to be exposed to noise levels above 85 dB, they found that people whose jobs made them constantly hear loud noise were more likely to have hypertension [21]. The frequency of hypertension, tinnitus, and hearing loss among employees exposed to 85 dB(A) or more of noise [22].

There is evidence that exposure to urban noise increases the likelihood of treatment-resistant hypertension and blood pressure levels [23]. Heart disease

risk factors include NO<sub>2</sub> and PM<sub>2.5</sub> concentrations, as well as persistently high levels of outdoor noise [24].

High blood pressure was a common health problem among metalworkers whose jobs required them to listen to noise levels above 85 dB. They found that people whose jobs made them constantly hear loud noises were more likely to have hypertension [21]. The frequency of hypertension, tinnitus, and hearing loss among employees exposed to 85 dB(A) or more of noise [22]. There is evidence that exposure to urban noise increases the likelihood of treatment-resistant hypertension and blood pressure levels [23]. Heart disease risk factors include NO<sub>2</sub> and PM<sub>2.5</sub> concentrations, as well as persistently high levels of outdoor noise [24]. An additional study indicated that those living in noisy cities are more likely to have high blood pressure and to develop treatment-resistant hypertension [23]. Heart disease is linked to constant exposure to outdoor noise levels, NO<sub>2</sub> concentrations, and PM<sub>2.5</sub> concentrations [24].

## CONCLUSION

This study shows that electrical generator employees' systolic and diastolic blood pressure significantly increases when they are exposed to high levels of noise and occupational pressures on the job. The risk of high blood pressure increases with prolonged exposure to loud noises.

## ACKNOWLEDGMENTS

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## CONFLICT OF INTEREST

No conflict .

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## **Effect of upstream fin length on longitudinally finned flat tubes bank performance based on constructal design**

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## ABSTRACT

Based on the constructal design method, the current study examines two-dimensional laminar incompressible flow across fin flat tubes. The study examined the impact of multiple independent parameters on the pressure drop and heat transfer rate, including Reynolds number and dimensionless upstream fin length. The governing equations are solved by the finite volume technique with a commercial computational fluid dynamic package (*ANSYS 2022/R2*) as the tool. Periodically, the flow is seen to reach a fully matured state. The nondimensionalized pressure drop diminishes monotonically with increasing Reynolds number. The module average Nusselt number rises in tandem with the Reynolds number. The staggered arrangement performs better overall for lower length ratio since it provides a higher heat transfer rate for all Reynolds numbers. A larger length ratio leads to a slower rate of heat transfer for all Reynolds numbers. demonstrating that, in terms of pressure drop, a longer ratio works better than a shorter length ratio for all Reynolds values.

**KEY WORDS**; constructal design, laminar forced convection, *LFFTBHE*, upstream fin length

## 1. INTRODUCTION

Estimating the maximum energy transported and the minimum power consumed allows one to assess a heat exchanger's performance. Since the resistance to heat transfer from the air side is dominating, Improve the performance of the air side by altering the design of the fin or tube, and in some circumstances, both. This is due to the air's low specific heat and the extremely high heat transfer coefficient of the interior fluid or the side of the water [1-4]. Controlling the tube shape, vertical and horizontal distances, fin height, and fin-to-fin distance is important to get the best possible design. Considering the type of metal, every one of the aforementioned factors directly affects the largest value of the heat transfer coefficient, or thermal conductance, as well as the area density and the ensuing cost, size, and weight. The aforementioned factors were taken into account when analyzing the performance of tube bank heat exchangers (TBHEs) through the research of forced and natural convection heat transfer [5-9]. Heat exchangers design criteria include the exterior tube heat transfer

coefficient and the external flow pressure drop. Previous research in the literature suggests that the tube's form and design can improve heat transfer [10–16]. The width of the flow channel is not equal to the convective body that forms on the channel walls as a result of boundary layers. This is due to the fact that the dimensions of the flow body and the channel are not the same. A different strategy is to equalize the size of the flow body and flow channel. This methodology is built upon the constructal design method, which is grounded in the constructal law. How quickly heat may be transmitted from the walls to the air streams determines the ideal flow channel's size to investigate the constructal design approach in crossflow for rhombic tubes [17, 18]. Three dimensionless pressure differences ( $Pd = 103, 104, \text{ and } 105$ ) were considered to prove that narrower rhombic tubes had a greater maximum heat transfer density for any dimensionless pressure differences [19]. In order to increase heat transfer density, a vertical array of flat tubes in cross-flow with a fixed pressure drop was examined, the maximum heat transfer densities from naturally cooled tubes with different cross-sectional areas were reported [20–22]. Maximum heat transfer densities from multiscale tubes and fins in forced and natural convection were also studied [23–27]. Numerical investigations of incompressible steady-state airflow over flat tubes. The first study gave a 2D examination of the thermal fluid characteristics over two staggered flat tubes; the second study showed the thermo fluid characteristics over a tube series between two parallel plates. The aforementioned studies illustrate the correlation between the  $Re$  and  $Nu$  numbers, indicating that a rise in the  $Re$  number consistently results in a rise in the  $Nu$  number [28–33]. Heat transfer and crossflow of air in a staggered configuration of flat tube heat exchangers were studied experimentally.

Furthermore, the effects of air attack angles and tube aspect ratios on the main research site were investigated. Nineteen examples of heat exchangers with six attack angles ranging from  $0^\circ$  to  $150^\circ$  with a  $30^\circ$  step and four aspect ratios (0.18, 0.39, 0.66, and 1) are examined in an air velocity range of 2 to 6 m/s. Their results show that the pressure drop and thermal performance were controlled by the tube aspect ratios and attack angles [34]. The Neuro-fuzzy inference system model was used to forecast the values of the pressure drop and

heat transfer coefficient. Three longitudinal pitches (3, 4, and 6) and transverse pitches (1.5 to 4.5, step of 1.0) are analyzed for Reynolds numbers between  $10 \leq Re \leq 320$ . The streamline, temperature contours, average Nusselt number, and dimensionless pressure drop are displayed together with the data. The study's primary conclusions are that the average variation between the numerical and *ANFIS* model values for the average Nusselt number is 1.9% and that the dimensionless pressure drop is 2.97% [35]. These investigations revealed that the numerical and experimental research on identically shaped tubes—that is, cylindrical, elliptic, etc.—for both inline and staggered flattened tube configurations. In the aforementioned research, constructal design was absent for *LFFBHE*. The current study presents a constructal architecture of crossflow with *LFFBHE*. Given a constant surface temperature and air characteristics,  $Pr=0.7108$  for  $200 \leq Re \leq 1200$ . The study focused on four dimensionless upstream fin lengths ( $Lu/Dt$ ): 0.4, 0.6, 0.8, to Maximizing heat transfer density and reducing pressure drop is the goal function.

## 2. THEORY

In order to improve heat transfer on the air side, the physical model of Fig. 1's *LFFBHE* has been taken into consideration. The common configuration of this kind of heat exchanger is many *LFFT*. Laminar flow, steady-state, constant surface temperature, incompressible fluid, negligible viscous dissipation; Table 1 displays the thermophysical characteristics of the material and working fluid [36]. The physical representation of the current problem is shown in Figure 1. Convection heat transfer between the heated flat tube surface and the input airflow is facilitated by the horizontal  $x$ - $y$  plane. The two-dimensional governing equations [37–40] are summarized as follows:

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = 0, \quad (1)$$

$$\rho \left( u \frac{\partial u}{\partial x} + v \frac{\partial u}{\partial y} \right) = - \frac{\partial p}{\partial x} + \mu \left( \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} \right), \quad (2)$$

$$\rho \left( u \frac{\partial v}{\partial x} + v \frac{\partial v}{\partial y} \right) = - \frac{\partial p}{\partial y} + \mu \left( \frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} \right), \quad (3)$$

$$\left(u \frac{\partial t}{\partial x} + v \frac{\partial t}{\partial y}\right) = \alpha \left(\frac{\partial^2 t}{\partial x^2} + \frac{\partial^2 t}{\partial y^2}\right), \quad (4)$$

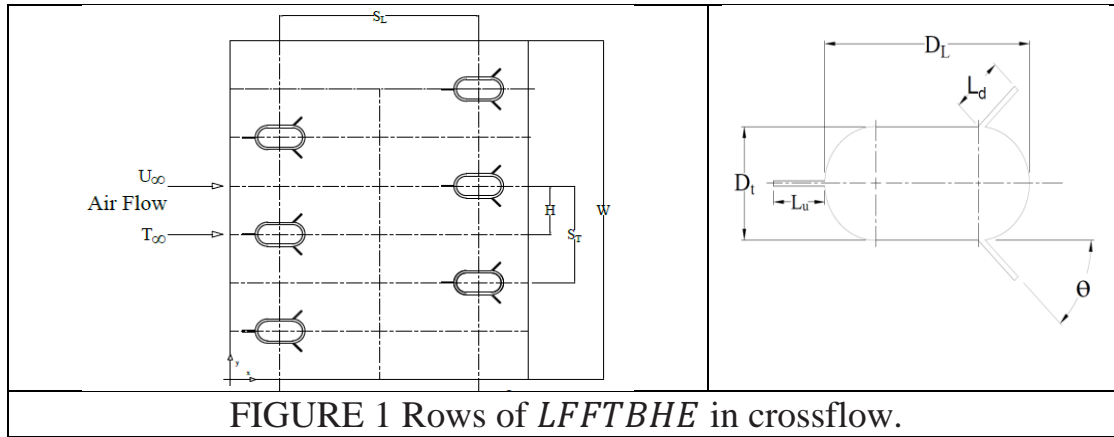


FIGURE 1 Rows of *LFFTBHE* in crossflow.

The finned tube diameter ( $DT=0.5DL=10mm$ ) scales the coordinates ( $x, y$ ), velocities ( $u, v$ ), pressure ( $p$ ) is mounted by  $\Delta P/\rho$ , and temperature ( $t$ ) is scaled by  $(T_w - T_o)$ . These scaling are applied to normalized Equations (1) through (4). Equations (1) to (4) can be non-dimensionalized by using the following dimensionless coordinates, velocities, pressure, and temperature [40]:

$$\begin{aligned} X, Y &= \frac{x, y}{Dt}, \quad U, V = \frac{u, v}{(\Delta p/\rho)^{\frac{1}{2}}}, \quad P = \frac{p}{p_{in} - p_{out}}, \quad \theta = \frac{T - T_o}{T_w - T_o}, \quad Be \\ &= \frac{\Delta p DT^2}{\mu \alpha}, \quad Pr = \frac{\mu C_p}{K} \end{aligned} \quad (5)$$

Now, with the above dimensionless variables in eq. (5), Eqs. (1 –4) becomes:

$$\frac{\partial U}{\partial X} + \frac{\partial V}{\partial Y} = 0 \quad (6)$$

$$U \frac{\partial U}{\partial X} + V \frac{\partial U}{\partial Y} = -\frac{\partial P}{\partial X} + \sqrt{\frac{Pr}{Be}} \left(\frac{\partial^2 U}{\partial X^2} + \frac{\partial^2 U}{\partial Y^2}\right) \quad (7)$$

$$U \frac{\partial V}{\partial X} + V \frac{\partial V}{\partial Y} = -\frac{\partial P}{\partial X} + \sqrt{\frac{Pr}{Be}} \left( \frac{\partial^2 V}{\partial X^2} + \frac{\partial^2 V}{\partial Y^2} \right) \quad (8)$$

$$U \frac{\partial \theta}{\partial X} + V \frac{\partial \theta}{\partial Y} = \frac{1}{\sqrt{(BePr)}} \left( \frac{\partial^2 \theta}{\partial X^2} + \frac{\partial^2 \theta}{\partial Y^2} \right) \quad (9)$$

The mean dimensionless are dominated by heat transfer and fluid flow [40];

$$Re = \frac{\rho V D}{K \mu}, Nu = (h_D)/K qds = \frac{Qt}{K(T_s - T_b)}, \quad (10)$$

Other dimensionless are normalized by the transverse tube diameter ( $DT$ ), as the transverse pitch ratio = ( $ST/DT$ ), the longitudinal pitch = ( $SL/DT$ ), upstream fin length = ( $Lu/DT$ ), downstream fin length ( $Ld/DT$ ), dimensionless fin angle  $\theta ds = \frac{\theta \pi}{180}$ ,

'Figure 1' displays the computing domain and the staggered tube banks concept. The following are the boundary conditions:

$$A: \quad \frac{\partial U}{\partial Y} = 0, V = 0, \frac{\partial \theta}{\partial Y} = 0 \quad (11)$$

$$B: \quad U = 1, \frac{\partial V}{\partial X} = 0, \theta = 0 \quad (12)$$

$$C: \quad \frac{\partial U}{\partial X} = \frac{\partial V}{\partial X} = 0, \frac{\partial \theta}{\partial X} = 0 \quad (13)$$

$$D: \quad U = V = 0, \theta = 1 \quad (14)$$

The governing equations are solved by the finite volume technique (FVM) with a commercial *CFD* package (*ANSYS 2022/R2*) as the tool. The grid is made up of triangular elements, using a SIMPLE procedure.



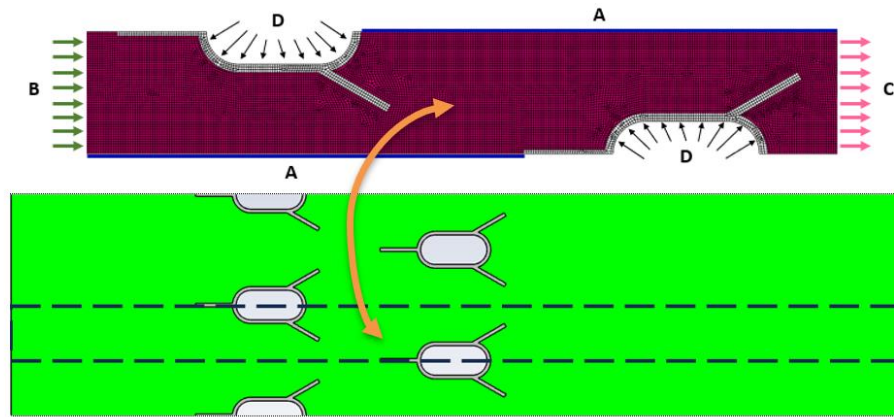


FIGURE 2 Boundary Conditions around and on LFFTBHE in crossflow.

Table 1: physical properties of the working fluid and material [36].

Physical properties	Symbol	Values	Unit
air			
Density	$\rho$	1,2240	$kg/m^3$
Thermal Diffusivity	$\alpha$	$2.2184 \times 10^{-5}$	$m^2/s$
Thermal conductivity	$K$	0,0242	$w/m^{\circ}C$
Prandtl number	$pr$	0,7108	—
Specific heat of the air	$Cp$	1006.43	$kJ/kg^{\circ}C$
Dynamic Viscosity	$\mu$	1.789E-05	$kg/ms$
Aluminium			
Density	$\rho$	2719	$kg/m^3$
Specific Heat	$Cp$	871	$j/kg^{\circ}C$
Thermal Conductivity	$K$	202.4	$w/m^{\circ}C$

### 3. VALIDATION

Figure 4 compares the current work with previous literature for average Nusselt number with Reynolds number at  $Pi = 0.7$ ,  $ST/DT = 3.0$ , and  $SL/DL = 4.0$ , transverse Element size=0.0005, cells=24907,  $10 \leq Re \leq 100$ . The numerical simulations were steady-state conditions for the LFFTB Figure 3 to validate with the same reference, a staggered configuration. Once more, it

is evident that there is a high degree of consistency between the numerical results and the current outcomes [41].

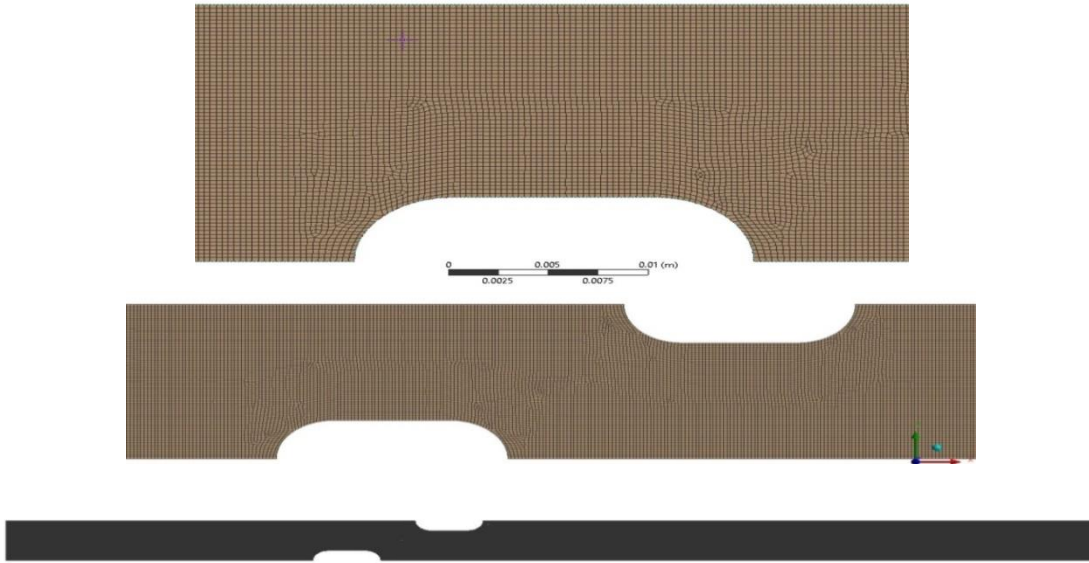


FIGURE 3 Schematic of grid systems generated by finite volume.

The numerical solutions for laminar forced convection heat transfer across *LFFBHE*, derived from the constructal design method, are presented in this section. With respect to the upstream fin length variable—the other parameters remain constant—the staggered finned flat tubes at a fixed volume were optimized. Figure 5 shows the dimensions of the fixed volume optimal technique.

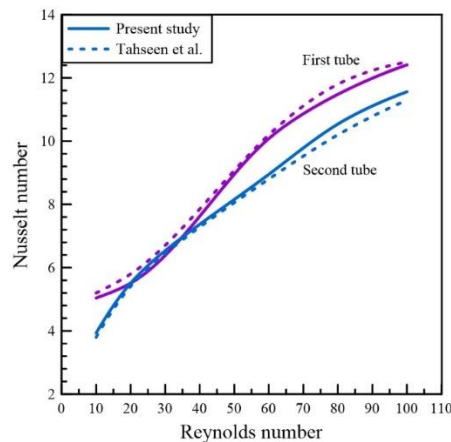


FIGURE 4 Comparison of Nusselt Number with Reynolds Number Literature [41].

#### 4. Results and discussion

This section presents the numerical solutions of laminar forced convection heat transfer across *LFFTBHE* based on the constructal design method. The optimum of the staggered finned flat tubes at a fixed volume was considered concerning the upstream fin length variable and the other parameters are constant. The dimensions of the fixed volume optimum procedure are presented in Figure 5.

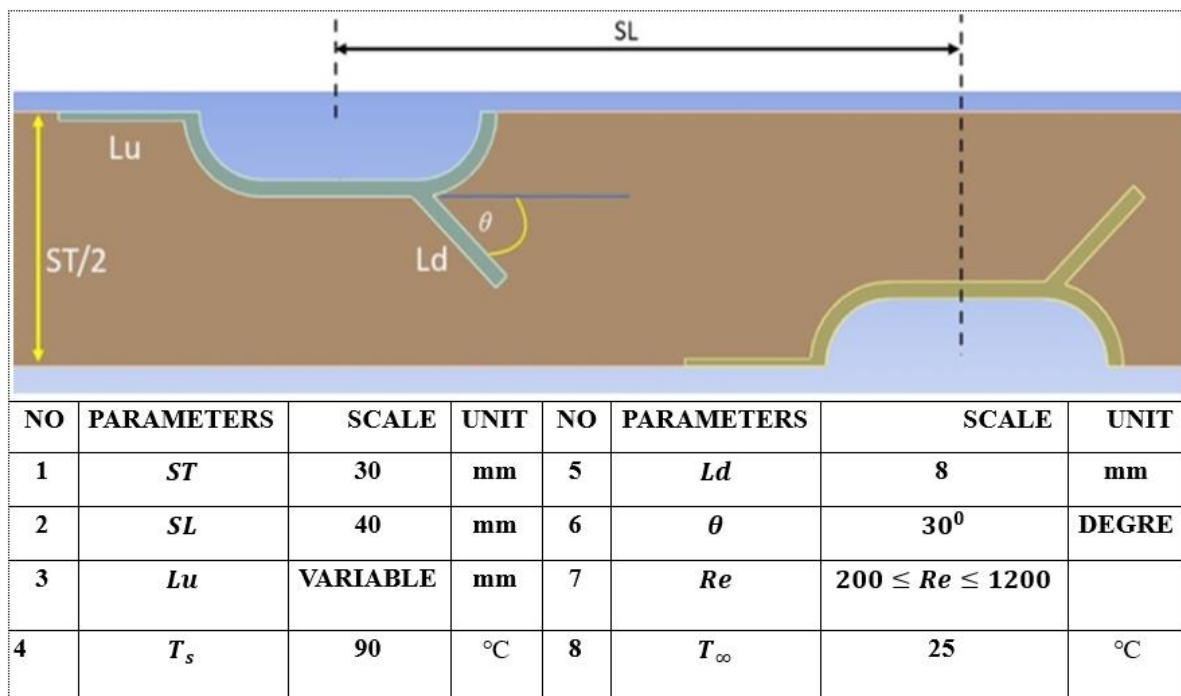


Figure 5: Geometric parameters of *LFFTBHE* arrangements with up-stream fin length variable.

This section presents numerical solutions based on the constructal design approach with staggered arrays for the laminar forced convection heat transfer across *LFFTBHE*. When Figure 5 tabulates  $Re-dh$ , and other characteristics. The effect of Reynolds numbers on isotherms and velocity contours for the upstream fin length variable of the four modules is shown in Figure 6. The temperature contour and velocity vector are directly impacted by the upstream

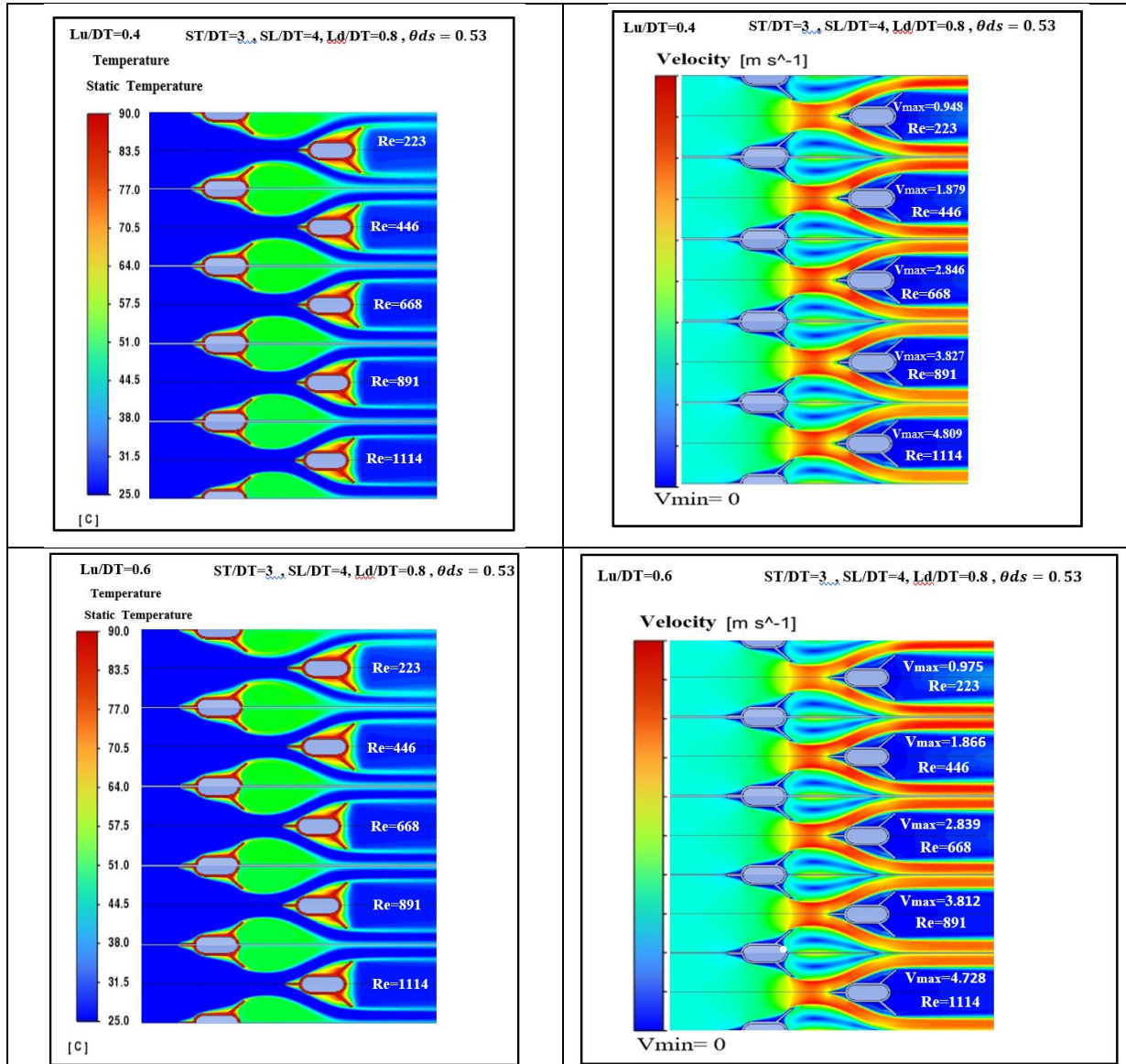
fin length for each of the four designs. The fluid and the upstream fin length collide, triggering the separation process. As the fin length increases upstream, the fluid angle starts to comparatively widen. Ahead of the *LFFBHE*, the fluid travels away. This indicates that even at high Reynolds numbers, the next layer expands continuously at the front interface. The relationship between the Nusselt number with transfer pitch and the dimensionless heat transfer rate for varying Reynolds numbers is shown in Figures 7 and 8. The upstream fin length is the geometric parameter in the configuration. Unlike the Reynolds number, it is evident from the above figure that the dimensionless heat transfer rate is inversely related to the upstream fin length. The fluid's separation in the early phases, which keeps it from clashing with the upstream fin, is the primary cause of this occurrence. Because the fluid momentum effect is absent, the surrounding layer grows and is unable to be swept away. Given that the Nusselt number is a function of the heat transfer coefficient by forced convection with the hydraulic diameter constant, this process results in an increase in thermal insulation between the fluid and the pipe's surface. Consequently, the heat transfer between the fluid and the surface decreases. This is a good enough justification. It is clear from the figures above that the dimensionless heat transfer rate and Nu are inversely proportional to the upstream fin length to reach a maximum value of 275 and 15.7 respectively at a high Reynolds number and minimum value of the upstream fin length

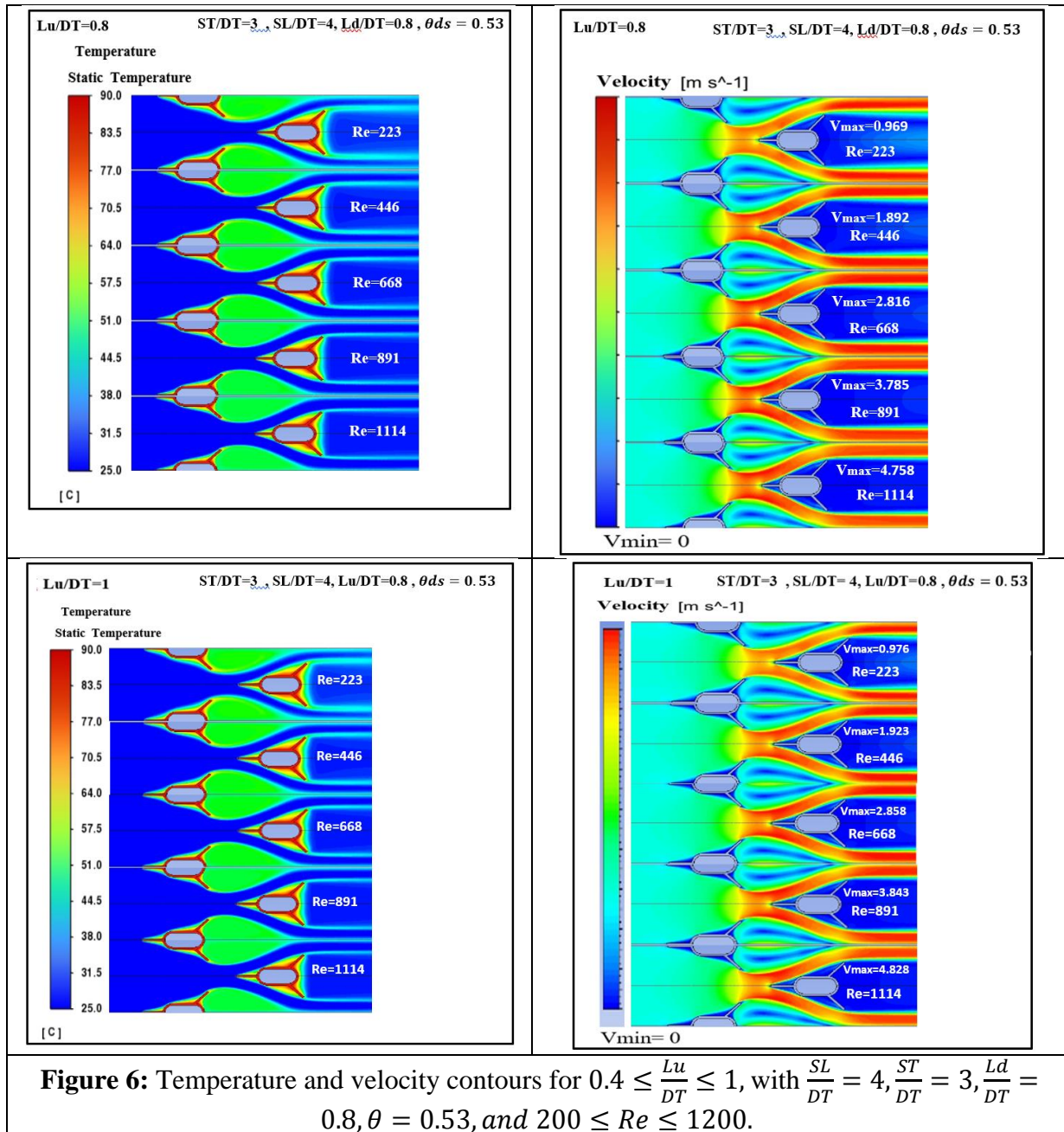
The link between the dimensionless pressure drop, Bejan number, and upstream fin length is shown in Figures 9 and 10. One of the laws of fluid mechanics, direct proportionality, seems to apply to both the relationship and the Reynolds number. Depending on the up-stream fin length, referring to the velocity contour and studying the fluid flow lines along the fin length provides a full explanation of the turbulence process. Furthermore, the momentum created by the fluid colliding with the fin's front is nearly entirely cancelled by this process, or rather, it vanishes in relation to the upstream fin length. As the fluid tries to fill the space between the tubes, the relative amount of friction starts to diminish. This is followed by a noticeable decrease in the pressure drop, which lowers the pumping power. The fluid that is pushed between the heat exchanger's rows accelerates throughout this procedure in order to crash into the

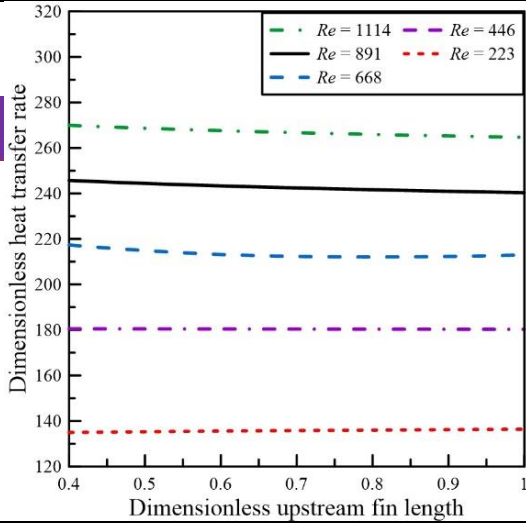
back fins. As a result, this process can be thought of as producing the pressure drop those results and the heat transfer that is gained. Inverse proportionality exists between the non-dimensional pressure drop and pumping power. The link between the friction factor, the Claiborne factor, and the thermal hydraulic performance with the upstream fin length can be adequately explained by the aforementioned rationale. Figures 11 through 14.

To examining the aforementioned variables with the Reynolds number for various values of the upstream fin length after going over the relationship between the rate of heat transfer and the pressure drop with the upstream fin length for various Reynolds number values. Figures 15 and 16 illustrate the relationship between the nondimensional heat transfer rate and the Nusselt number with the Reynolds number in order to infer the direct effect of speed on the system's performance. The Nusselt number and the dimensionless heat transfer rate had lowest and maximum values of 7,130 and 15.5,270, respectively, which makes the behavior evident in the preceding figures. The link between the Reynolds number and the dimensionless pressure drop, horsepower, Beggan number, Colbourn factor, friction factor, and thermal hydraulic performance factor is shown in Figures 17–22. With the exception of the Beggan number, which is directly proportional to the pressure drop, it is evident from the statistics that the proportionality is inverse. The friction resulting

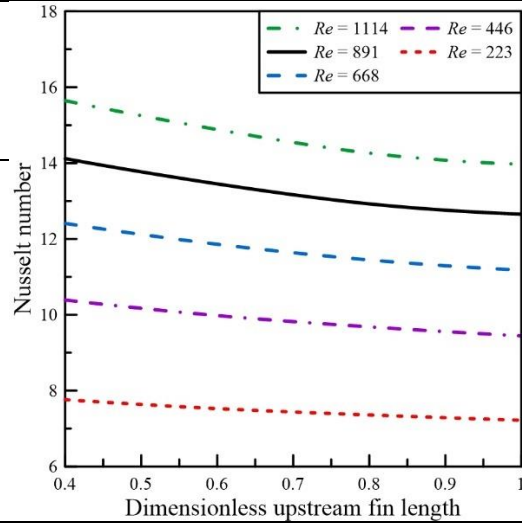
from fluid movement is depicted in the above figure. Therefore, it follows that an increase in the Reynolds number should also result in an increase in friction, with the exception of the Colburn factor, or hydraulic thermal performance factor, where the difference in friction is explained by the effect of heat transfer and momentum (thermofluid).



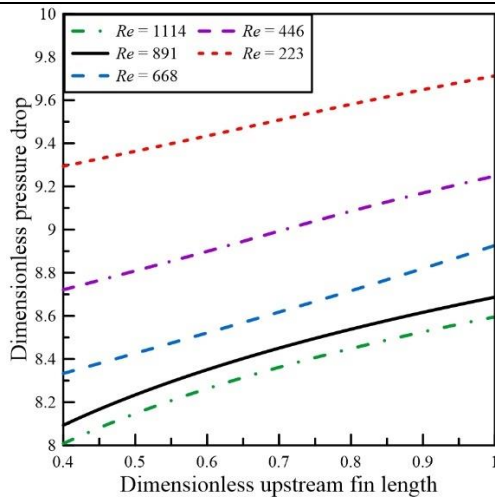




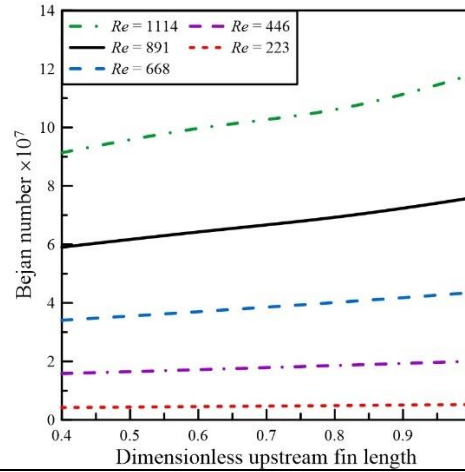
**Figure 7:** Dimensionless overall heat transfer rate against dimensionless upstream fin length for various Reynolds numbers.



**Figure 8:** Dimensionless pressure drops against dimensionless upstream fin length for various Reynolds numbers.

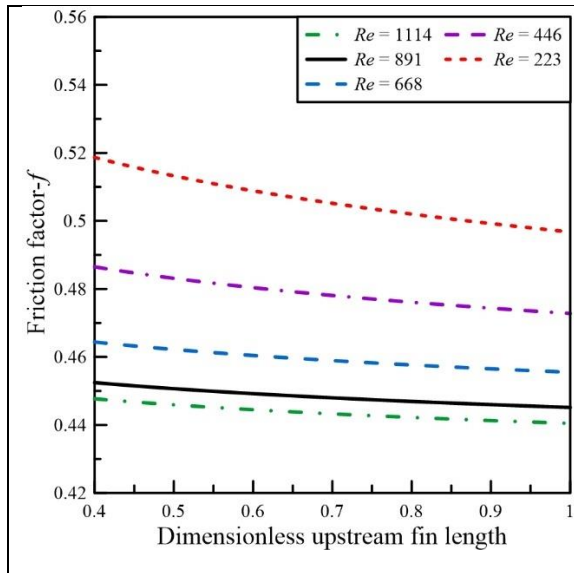


**Figure 9:** Influence of Nusselt number on dimensionless upstream fin length for various Reynolds numbers.

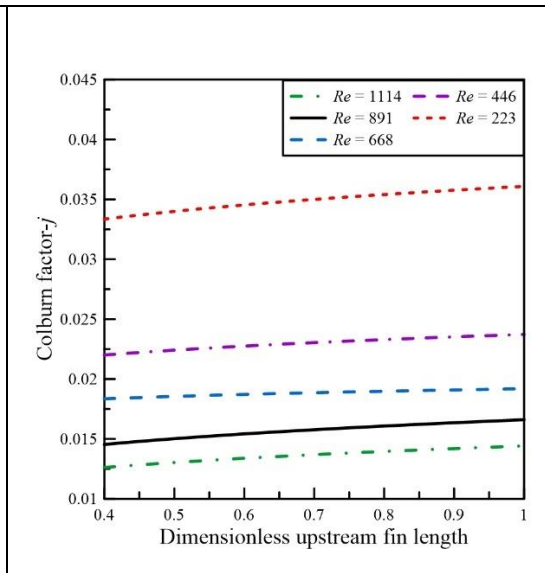


**Figure 10:** Influence of Bejan number on dimensionless upstream fin length for various Reynolds numbers.

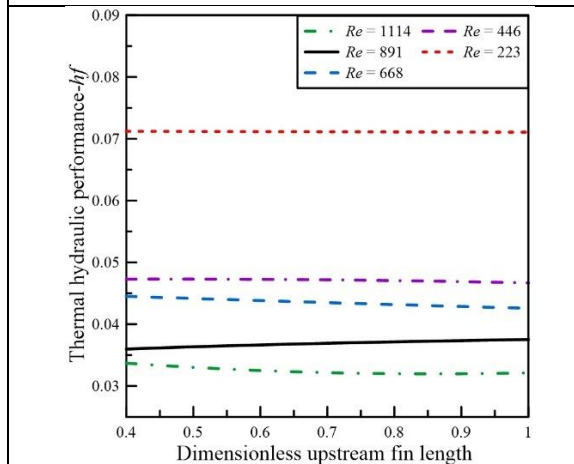




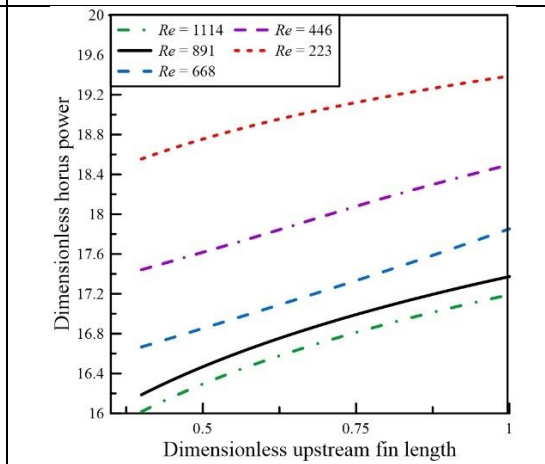
**Figure 11:** Dimensionless friction factor against dimensionless upstream fin length for various Reynolds numbers.



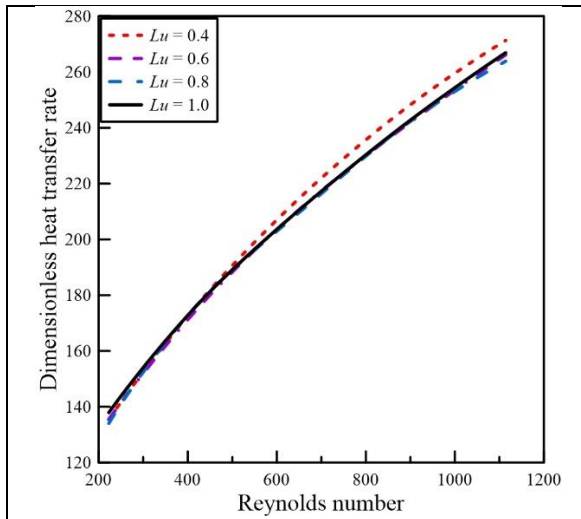
**Figure 12:** Dimensionless Colburn factor against dimensionless upstream fin length for various Reynolds numbers.



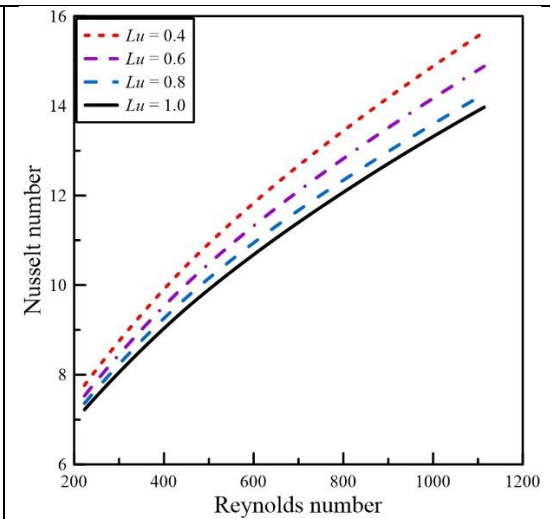
**Figure 13:** Dimensionless thermal hydraulic performance factor against dimensionless upstream fin length for various Reynolds numbers.



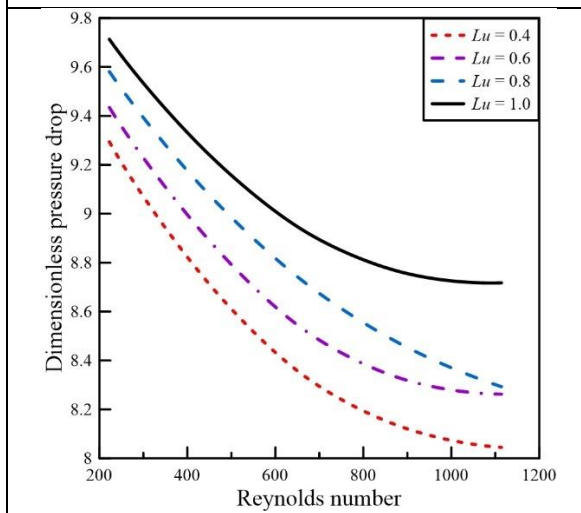
**Figure 14:** Dimensionless hours power against dimensionless upstream fin length for various Reynolds numbers.



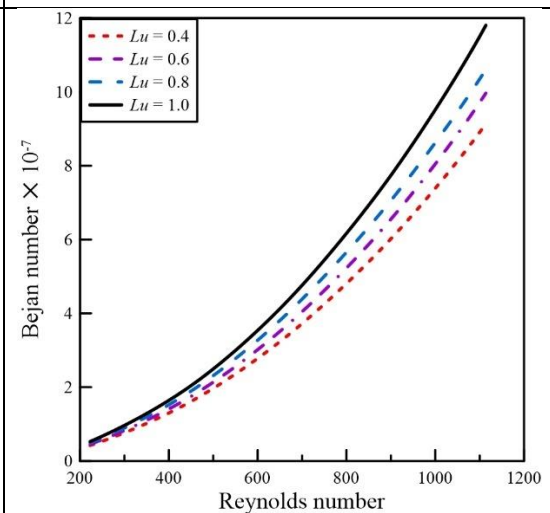
**Figure 15:** Dimensionless overall heat transfer rate against Reynolds numbers for various dimensionless upstream fin length.



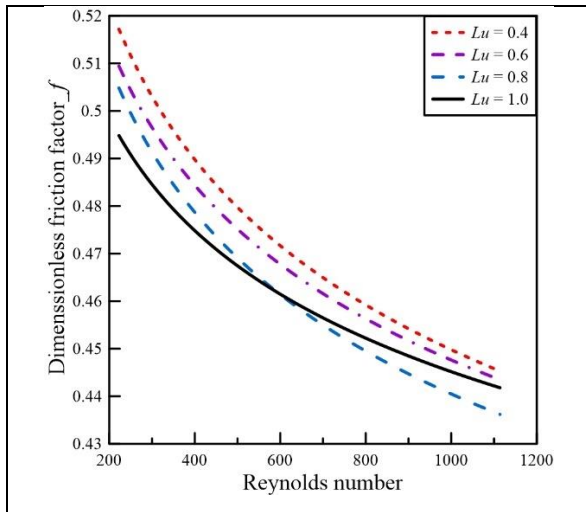
**Figure 17:** Influence of Nusselt number on Reynolds numbers for various dimensionless upstream fin length.



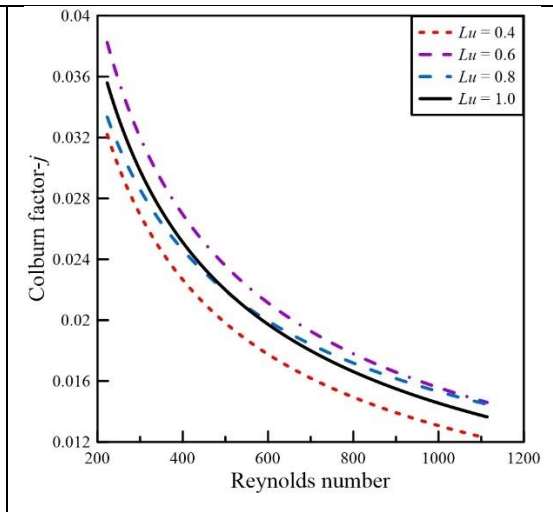
**Figure 16:** Dimensionless pressure drops against Reynolds numbers for various dimensionless upstream fin length.



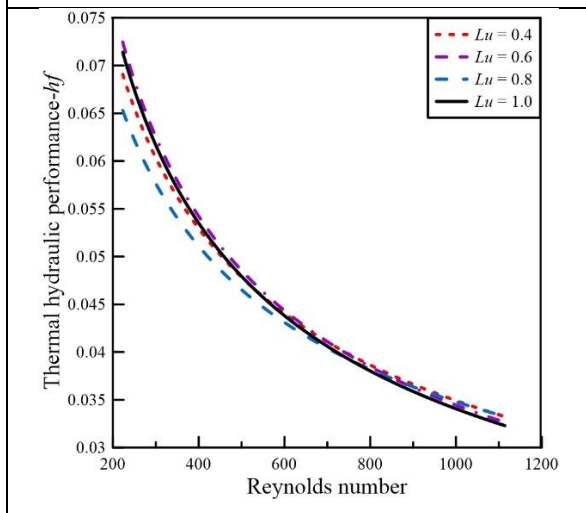
**Figure 18:** Influence of Bejan number on Reynolds numbers for various dimensionless upstream fin length.



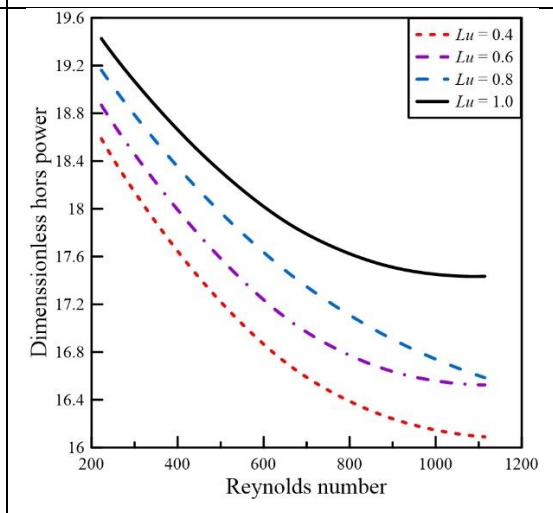
**Figure 19:** Dimensionless friction factor against Reynolds numbers for various dimensionless upstream fin length.



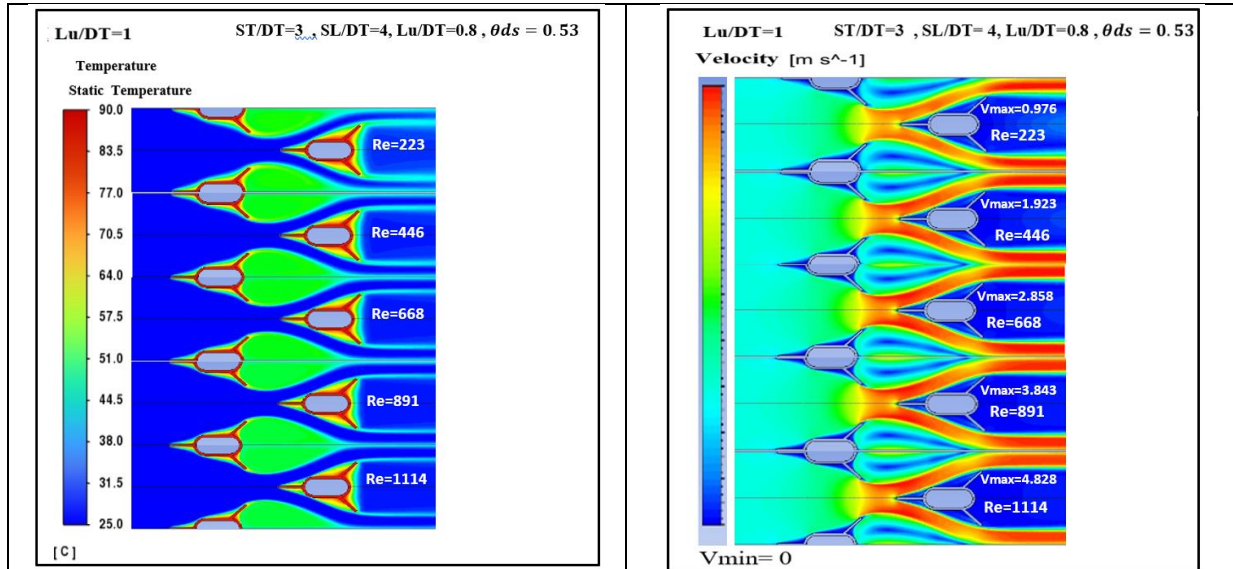
**Figure 20:** Dimensionless Colburn factor against Reynolds numbers for various dimensionless longitudinal pitch.



**Figure 21:** Dimensionless thermal hydraulic performance factor against Reynolds numbers for various dimensionless upstream fin length.



**Figure 22:** Dimensionless hours power against Reynolds numbers for various dimensionless upstream fin length.



**Figure 6:** Temperature and velocity contours for  $0.4 \leq \frac{Lu}{DT} \leq 1$ , with  $\frac{SL}{DT} = 4$ ,  $\frac{ST}{DT} = 3$ ,  $\frac{Ld}{DT} = 0.8$ ,  $\theta = 0.53$ , and  $200 \leq Re \leq 1200$ .

## 5. Conclusion

Using the constructal design technique, a two-dimensional numerical model of the *LFFBHE* has been successfully constructed and validated. Considering that the heat transfer density behavior for  $0.4 \leq Lu/DT \leq 1$  and  $200 \leq Re \leq 1200$  flow fields was demonstrated by the obtained results as a function of the change of the dimensionless upstream fin length. For the investigated operating conditions and heat exchanger geometry, the least amount of pressure drop results in optimal heat transfer. The conclusions can be summarized as follows:

- More heat is transported when the dimensionless  $Lu/DT=4$ .
- For dimensionless  $Lu/DT < 4$ , the pressure drop is reduced.
- For any Reynolds, the Began number rises as the upstream fin length increases.
- The flow recirculation zone grows as Reynolds numbers rise, but isothermal floods diminish as Reynolds numbers rise.

- As the Reynolds number rises, so does the average Nusselt number of airflows. Lastly, as the upstream fin length grows, the average Nusselt number drops.

#### ACKNOWLEDGEMENTS

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## Nomenclature

SYMBOL	
$DT$	Transverse Diameter, mm
$DL$	Longitudinal Diameter, mm
$h$	Domain Height, mm
$K$	Thermal Conductivity, W/m K
$Re$	Reynolds number
$Nu$	Nusselt Number
$p$	Pressure, Pa
$Pr$	Prandtl Number
$Q$	Dimensionless Volumetric Heat Transfer Density, W
$ST$	Transfer Pitch, mm
$ST/DT$	Transverse Pitch Ratio
$SL/DT$	Dimensionless Longitudinal Pitch Ratio
$Lu/DT$	Dimensionless Upstream Fin Length Ratio
$\theta_{ds}$	Dimensionless Fin Angle
$Lu$	Upstream Fin Length
$Ld$	Downstream Fin Length
$Ld/DT$	Dimensionless Downstream Fin Length Ratio
$SL$	Longitudinal Pitch, mm
$T_w$	Wall Temperature of The Tubes and Fins, °C
$T_\infty$	Ambient Temperature, °C
$t$	Fin Thickness, mm
$U, V$	Velocities In X And Y Directions, M/S
$U, V$	Dimensionless Velocities in X And Y Direction
$X, Y$	Cartesian Coordinates, M
$X, Y$	Dimensionless Cartesian Coordinates
Greek Symbols	
$\alpha$	Thermal Diffusivity, $m^2 / S$
$\theta$	Angle Between the Fins
$\nu$	Kinematic Viscosity, $m^2 / S$
$\rho$	Density, $Kg/m^3$
$\mu$	Dynamic Viscosity, $Kg/ms$

Subscripts	
<i>Max</i>	Maximum
<i>opt</i>	Optimal
Appreviation	
<i>FVM</i>	Finite Volume Method
<i>CFD</i>	Computational Fluid Dynamic
<i>CFHE</i>	Cross-Flow Heat Exchangers
<i>HE</i>	Heat Exchangers
<i>ANFIS</i>	Neuro-fuzzy inference system
<i>FTHE</i>	Flat Tube Heat Exchangers
<i>PD</i>	Pressure Drop
<i>TBHE</i>	Tube Banck Heat Exchangers
<i>LFFTB</i>	Longitudinally Finned Flat Tube Bank
<i>LFFTBHE</i>	Longitudinally Finned Flat Tube Bank Heat Exchanger

# Application of Machine Learning in Malware Detection

## تطبيق التعلم الآلي في الكشف عن البرامج الضارة

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## الخلاصة

تعد البرامج الضارة أحد أكبر المخاطر في العصر الرقمي الحالي. يمكن أن يلعب التعلم الآلي دورًا مهمًا في اكتشاف البرامج الضارة. طبقت هذه الدراسة تقنيات التعلم الآلي للكشف عن البرامج الضارة. تم تنفيذ تقنيات التعلم الآلي وشجرة القرار والغابة العشوائية وتعزيز التدرج باستخدام لغة بايثون. تم تقسيم مجموعة بيانات هجمات البرامج الضارة في نظام مايكروسوفت إلى قسمين، مجموعة الاختبار والتدريب. تحتوي مجموعة الاختبار على ٢٠% من مجموعة البيانات، بينما تحتوي مجموعة التدريب على ٨٠% من مجموعة البيانات. حققت شجرة القرار دقة بلغت ٦٥,٦٣%. حققت الغابة العشوائية دقة قدرها ٦٦,٥٥%. في حين أن تعزيز التدرج حقق دقة قدرها ٦٩,٥٤%. نلاحظ من ذلك تفوقت تقنية تعزيز التدرج.

الكلمات المفتاحية: كشف البرامج الضارة، الهجمات، امن المعلومات، الأمن السيبراني، التعلم الآلي.

## ABSTRACT

Malware is one of the greatest risks of the current digital era. Machine learning can play a significant in malware detection. This study applied machine learning techniques for malware detection. Machine learning techniques, decision tree, random forest, and gradient boosting, were implemented using python language. The dataset of malware attacks in the Microsoft endpoint system was divided into two parts, test set and training. The test set contained 20% of the dataset and the training set contained 80% of dataset. Decision tree yielded accuracy of 65.63%. The random forest yielded an accuracy of 66.55%. Whereas the Gradient Boosting yielded an accuracy of 69.54%. The gradient boosting technique outperformed.

**Keywords: Malware detection, attack, Security, Cybersecurity, Machine Learning.**

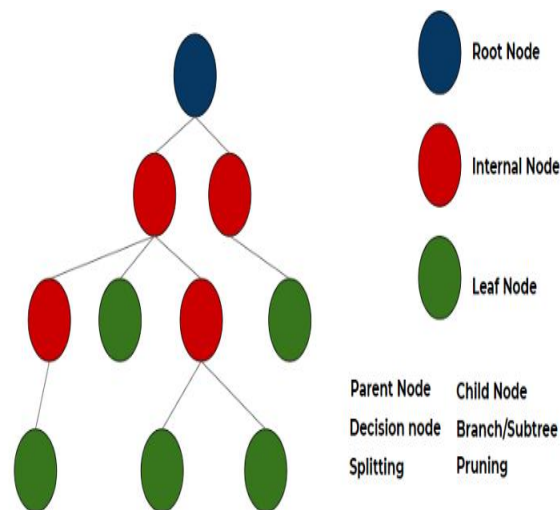
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## INTRODUCTION

The malware is malicious piece code deliberately designed to bring damage to user, computer, networks or organization. Malware detection is very an important research topic in the area of computer security. Machine learning is one of the hottest research areas in current. Application of machines learning in malware detection has been widely researched topic. A large number studies have been done in this domain. The study aims to predict the likelihood of a windows machine being infected by various types of malware, based on differents properties of machine. I will apply machine learning techniques, decision tree, random forest, and gradient boosting for prediction of malware and will compare the performance of these machine learning algorithms.

### A. Decision Tree

Decision tree is a supervised machine learning technique. It is one of the most powerful widely used classification techniques. It looks like similar to a flow chart, where every internal node represents a test on an attribute, every branch denotes a test outcome, and every leaf node holds a class label. Figure 1 illustrates the structure of a decision tree.

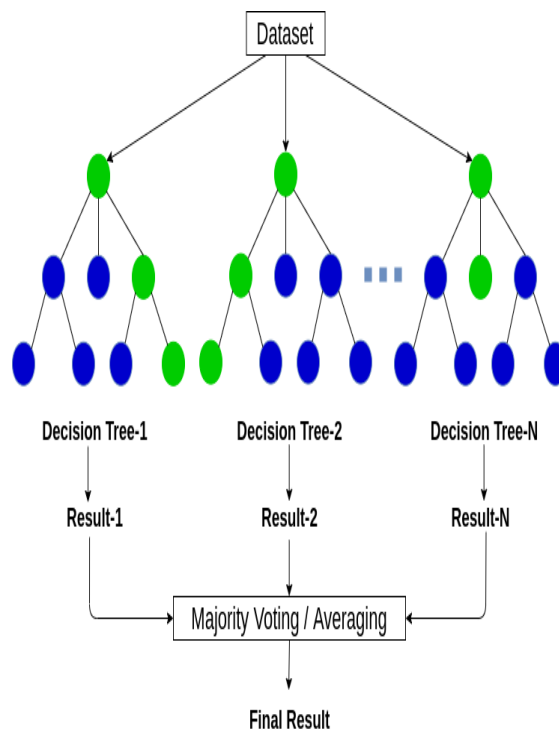


**Figure 1:** Decision Tree

A tree can be learned by dividing source set into subsets on basis of an attribute value test. This process is repeated on each derived subset recursively. The recursion is done when subset at a node has the same value of target variable or until division adds value to the predictions. The decision tree construction does not require any domain knowledge or parameter setting. Therefore, it is appropriate for exploratory knowledge discovery. The decision tree has capability to handle high-dimensional data. Generally, a decision tree offers good accuracy [2].

## B. Random Forest

A Random Forest is a supervised machine learning technique. It is an ensemble technique and has the ability to perform regression as well as classification using multiple decision trees and bagging. The works on the notion of combining multiple decision trees in determining the final outputs rather than relying individual decision trees [3]. Figure 2 illustrates the structure of the Random Forest.



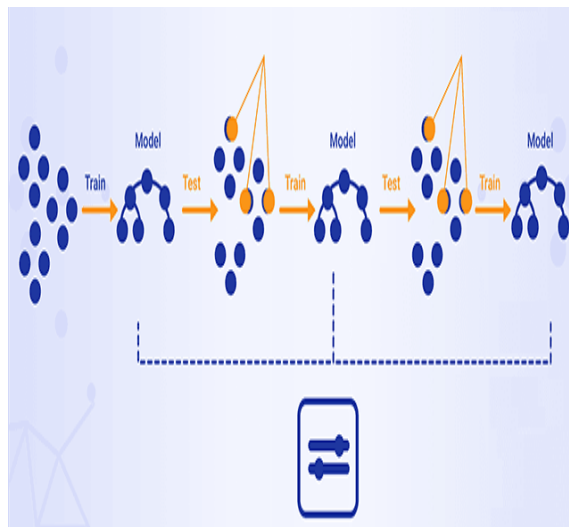
## Figure 2: Random Forest

The random Forest contains multiple decision trees which act as base learning models. This method performs row and feature sampling at random from dataset forming sample datasets for each model. This process is known as Bootstrap.

Each of decision trees involves high variance, but when they are merged in a parallel position this results in low variance, as each decision tree gets perfectly trained on that specific sample data, hence the result doesn't depend on one decision tree rather it depends on multiple decision trees. In classification, the final decision is made on the basis of majority voting. Whereas in regression, the final output is average of all outputs. This is known as Aggregation.

## C. Gradient Boosting

Gradient Boosting is a supervised machine learning technique. It is a popular boosting algorithm. In gradient boosting, every predictor corrects the error of predecessor. The weights of training instances are not tweaked, on the contrary, every predictor is trained using predecessor's residual errors as labels [4]. Figure 3 illustrates structure of Gradient Boosting.



## Figure 3: Gradient Boosting

Ensemble contains  $N$  number of trees. Tree1 is trained using feature matrix  $X$  and labels  $y$ . The prediction  $\hat{y}_1$  is used to determine training set

residual error  $r_1$ . Then Tree2 is trained using feature matrix  $X$  and residual error  $r_1$  of Tree1 as label. Predicted result  $r_1$  is then used to determine the residual  $r_2$ . This process is repeated until all of the  $N$  trees forming ensemble are the trained.

#### **D. Dataset**

I downloaded the dataset of malware attacks in Microsoft endpoint system from kaggle.com [1]. The dataset consists of 500,000 records and 1,795 attributes. Some of the significant attributes include machine identifier, Product Name, Engine Version, App Version, AvSig Version, Is Beta, Rtp State Bitfield, Default Browsers Identifier, AV Product States Identifier, Has Tpm, Country Identifier, the City Identifier, the Organization Identifier, Geo Name Identifier, Locale English Name Identifier, Platform, Processor, OS Version, OS Build, Sku Edition, Is Protected, Pua Mode, Has Detections, and S Mode, etc. We are interested in Has Detections as it indicates that whether Malware was detected on the machine or not.

### **2. Methodology**

I used Python language to implement the machine learning algorithms, decision tree, random forest, and gradient boosting. I used Google Colab notebook for implementation purposes. I divided the dataset into two parts i.e., test set and training set. The test set contained 20% of the data whereas the training set contains 80% of the data.

#### **A. Steps for Implementing Algorithms**

First of all, I loaded dependencies (python libraries) such as pandas, numpy, sklearn, matplotlib, seaborn scipy, etc. Then I loaded dataset and imported 28 columns containing significant attributes. I performed Exploratory Data Analysis (EDA) to the dataset for cleaning it. I found that the dataset contains 500,000 records and 1,795 attributes. The majority of the attributes were of int, float, and category type. Following 4 is the screenshot of some of the attributes.



MachinelIdentifier	00000b11598a75ea8ba1beea8459149f
ProductName	win8defender
EngineVersion	1.1.15100.1
AppVersion	4.18.1807.18075
AvSigVersion	1.273.1527.0
RtpStateBitfield	7
DefaultBrowsersIdentifier	NaN
AVProductStatesIdentifier	53447
AVProductsInstalled	1
AVProductsEnabled	1
HasTpm	1
CountryIdentifier	88
OsPlatformSubRelease	rs4
OsBuildLab	17134.1.amd64fre.rs4_release.180410-1804
IsProtected	1
leVerIdentifier	137
SmartScreen	ExistsNotSet
Firewall	1
Census_ProcessorCoreCount	4
Census_ProcessorManufacturerIdentifier	5
Census_ProcessorModelIdentifier	2273
Census_PrimaryDiskTotalCapacity	238475
Census_PrimaryDiskTypeName	UNKNOWN
Census_TotalPhysicalRAM	4096
Census_OSVersion	10.0.17134.228
Census_OSArchitecture	amd64
Census_OSBranch	rs4_release
Census_OSBuildNumber	17134
Census_OSBuildRevision	228
Census_OSEdition	Professional
HasDetections	1

**Figure 4:** Some of the selected attributes of the dataset

Since, I was interested in Malware so I filtered Has Detections and visualized it. Figure 5 shows the bar graph of malware, where 0 indicates no malware and 1 indicates a malware.

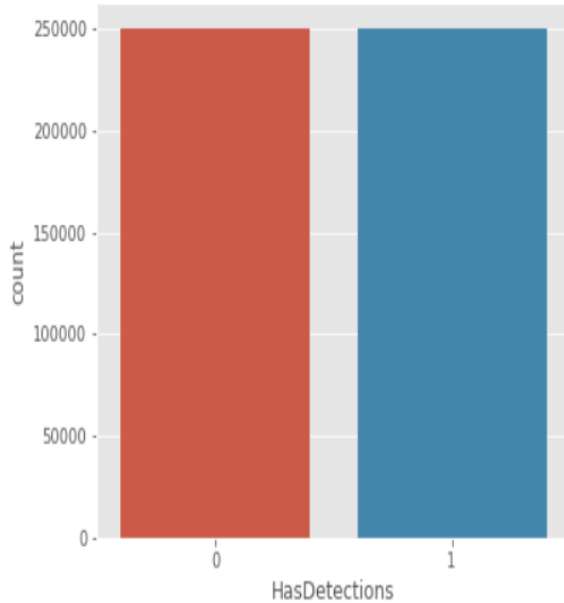


Figure 5: Count of Malware

Then I found descriptive statistics of some of the selected attributes of the dataset. I found total count, mean, standard deviation, min, 1<sup>st</sup> quartile, and median of the attributes. Following figure shows the descriptive statistics for different attributes.

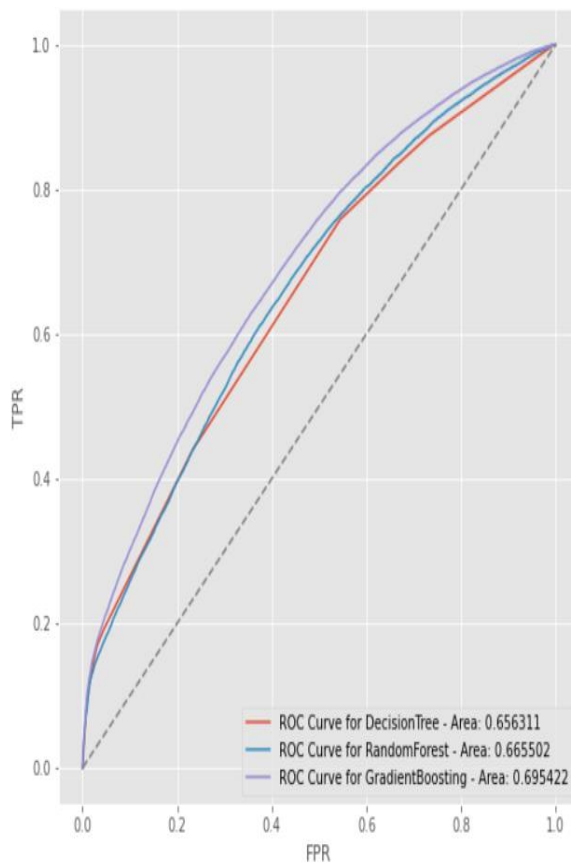
	count	mean	std	min	25%	50%
RtpStateBitfield	498239.0	NaN	0.000000	0.0	7.0	7.0
DefaultBrowserIdentifier	24282.0	1664.390625	1001.620056	1.0	788.0	1632.0
AVProductStatesIdentifier	497969.0	47771.421675	14035.223633	39.0	49480.0	53447.0
AVProductsInstalled	497969.0	NaN	0.000000	1.0	1.0	1.0
AVProductsEnabled	497969.0	NaN	0.000000	0.0	1.0	1.0
HasTpm	500000.0	0.987956	0.109082	0.0	1.0	1.0
IsProtected	500000.0	NaN	0.000000	0.0	1.0	1.0
Identifier	496708.0	NaN	NaN	9.0	111.0	117.0
Firewall	500000.0	NaN	0.000000	0.0	1.0	1.0
Census_ProcessorCoreCount	497712.0	NaN	0.000000	1.0	2.0	4.0
Census_ProcessorManufacturerIdentifier	497712.0	NaN	0.000000	1.0	5.0	5.0
Census_ProcessorModelIdentifier	497711.0	2371.137207	840.109863	17.0	1998.0	2500.0
Census_PrimaryDiskTotalCapacity	497054.0	512712.450635	360678.139763	10240.0	238475.0	476940.0
Census_TotalPhysicalRAM	495535.0	6114.083008	5073.799805	400.0	4096.0	4096.0
Census_OSBuildNumber	500000.0	15830.955258	1964.964127	7601.0	15063.0	16299.0
Census_OSBuildRevision	500000.0	973.621656	2932.799331	0.0	167.0	265.0
HasDetections	500000.0	0.499920	0.500000	0.0	0.0	0.0
CountryIdentifier_new	500000.0	8615.824200	6072.405845	8.0	3340.0	7721.0

**Figure 6:** Descriptive Statistics of selected variables of the dataset

Since variables showing NaN as mean value were not of numerical values so we could not get their mean value. NaN is an acronym for Not a Number.

### 3. Results and discussion

After cleaning the dataset, I divided dataset into test and training set. The test set contained 100,000 records and 1,795 attributes, whereas the training set contained 400,000 records and 1,795 records. After that, I applied decision tree on the dataset, which yielded an accuracy of 65.63%. The random forest yielded an accuracy of 66.55%. Whereas the Gradient Boosting yielded an accuracy of 69.54%. the Figure 7 shows the ROC Curve for decision tree, random forest, and gradient boosting.



**Figure 7:** Receiver Operating Characteristic (ROC) Curve

The X-axis of figure 5 represents False Positive Rate (FPR) and the Y-axis represents True Positive Rate (TPR). It is evident from figure 5 that the gradient boosting outperformed the decision tree and random forest.

## CONCLUSION

Machine learning has great potential to detect malware. Three of the techniques successfully detected malware. However, their accuracy rate varies. The gradient boosting outperformed the decision tree and random forest with an accuracy rate of 69.54%. In the future, more machine learning techniques can be applied to the dataset for more increased accurate results.

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## **A Survey: The Role of Artificial Intelligence for Diagnosis and Treatment**

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**ABSTRACT**

AI in diagnosis and treatment simplifies healthcare choices, optimizes precision, and improve results for patients through parsing massive volumes of information to uncover associations and trends that help in timely identification, tailored therapies, and optimum procedures. The purpose of this paper is to give a wide-ranging analysis of the application of artificial intelligence (AI) in the field of medicine. Starting with a review of previous research in the field, the paper explores the crucial function that AI plays in modern medical care. It explores the important effect that artificial intelligence has had on a variety of diseases, highlighting the significance of AI in precision medicine. In addition, the study explores the uses of artificial intelligence in the fields of dermatology, neurological diseases, and anatomy. This paper highlights the transformational potential of artificial intelligence in important the future of healthcare by shedding light on the wide range of applications that may originate from AI. The conclusion provides a summary of the greatest important ideas and emphasizes the relevance of future advances in artificial intelligence for medical events. Finally, AI enhances healthcare by harnessing information-based knowledge to increase clarity, reduce errors, and enhance outcomes for patients

**Keywords:** Artificial intelligence, Deep learning, Advanced healthcare, machine learning, Robotic surgery.

**الخلاصة**

يعمل الذكاء الاصطناعي في التشخيص والعلاج على تبسيط خيارات الرعاية الصحية وتحسين الدقة وتحسين النتائج للمرضى من خلال تحليل كميات هائلة من المعلومات للكشف عن الارتباطات والاتجاهات التي تساعد في تحديد الهوية في الوقت المناسب والعلاجات المخصصة والإجراءات المثلى. الغرض من هذه الورقة هو تقديم تحليل واسع النطاق لتطبيق الذكاء الاصطناعي (AI) في مجال الطب. بدءاً من مراجعة الأبحاث السابقة في هذا المجال، تستكشف الورقة الوظيفة الحاسمة التي يلعبها الذكاء الاصطناعي في الرعاية الطبية الحديثة. ويستكشف التأثير المهم الذي أحدثه الذكاء الاصطناعي على مجموعة متنوعة من الأمراض، ويسلط الضوء على أهمية الذكاء الاصطناعي في الطب الدقيق.

بالإضافة إلى ذلك، تستكشف الدراسة استخدامات الذكاء الاصطناعي في مجالات الأمراض الجلدية والأمراض العصبية والتشريح. تسلط هذه الورقة الضوء على الإمكانيات التحويلية للذكاء الاصطناعي في مستقبل الرعاية الصحية المهم من خلال تسليط الضوء على مجموعة واسعة من التطبيقات التي قد تنشأ من الذكاء الاصطناعي. يقدم الاستنتاج ملخصاً لأعظم الأفكار المهمة ويؤكد على أهمية التقدم المستقبلي في الذكاء الاصطناعي للأحداث الطبية. وأخيراً، يعمل الذكاء الاصطناعي على تعزيز الرعاية الصحية من خلال تسخير المعرفة القائمة على المعلومات لزيادة الوضوح، والحد من الأخطاء، وتعزيز النتائج للمرضى والكلمات المفتاحية: كتابة على الأقل ٥ كلمات مفتاحية و تظهر حسب التسلسل المذكور للكلمات المفتاحية في اللغة الانكليزية. الكلمات المفتاحية: الذكاء الاصطناعي، التعلم العميق، الرعاية الصحية المتقدمة، التعلم الآلي، الجراحة الروبوتية

## INTRODUCTION

The introduction Artificial intelligence Its applications in medicine include illness detection and diagnosis, tailored therapy, medical imaging, clinical trial efficacy, and drug development speed [1]. By providing clinicians with real-time data, AI improves patient care and medical decision-making. It helps medical pictures, radiography, computed tomography, and magnetic resonance imaging identify abnormalities, fractures, and tumors [2]. AI excels in laparoscopic and robotic surgery, where it displays information and instructions on video screens. AI-based surgical solutions let surgical teams tailor procedures to individual requirements. Artificial intelligence can help surgeons stratify surgical risks by analyzing previous surgical data and patient factors [3]. Deep learning technology, which is based on artificial neural networks, is emerging as an effective machine learning tool in the field of health informatics. It leverages the analysis of widely varying, unstructured information stored in hospitals and cloud service providers, providing unprecedented efficiency and powerful functionality [4] [8]. Artificial intelligence can support healthcare staff in many tasks, from administrative activities to automating medical devices and monitoring patients. AI also facilitates precision medicine, where healthcare interventions can be personalized based on genomic differences and diagnostic information of individuals [5]. AI technologies of great importance in healthcare include machine learning, neural networks, and deep learning. These technologies are actively used by payers, providers, and life sciences companies, and their applications include diagnostic and treatment recommendations, patient engagement and administrative activities [6]. The major surgical approach, robotic and laparoscopic, benefits from artificial intelligence. AI helps surgeons learn from prior experiences, access vast patient populations, standardize surgical methods, and minimize stress [11]. Data privacy, prejudice, and human expertise are all issues when using AI in medicine [2]. Artificial intelligence and robots in surgery create ethical concerns [7]. A Research issue: Artificial intelligence improves healthcare, yet it faces challenges in medical applications. Health data privacy and security, intelligent analytics bias, and medical professional-AI interaction are among these concerns. This literature overview illuminates medical AI applications.

The project will examine how AI can identify illnesses, make accurate diagnoses, speed up clinical trials, and accelerate medication development. The project will also consider how artificial intelligence might advise doctors and evaluate surgical data to enhance laparoscopic and robotic surgery results. Deep learning techniques will also be examined to improve health information administration and analysis. In addition, the study will discuss how AI can support healthcare staff in performing various tasks, which include administrative workflow for daily operations, advanced automation of medical devices, as well as patient monitoring. The study will shed light on how precision medicine and individualization of therapeutic interventions can be facilitated using personal and genomic information. The study will address the ethical and technical challenges related to the use of artificial intelligence in the medical field, providing a comprehensive vision of how to improve and develop this technology to achieve maximum benefit in improving health care. Significant hurdles in employing AI for evaluation and therapy involve quality of data problems, computer understanding worries, and legislative complexity, each of which necessitate broad solutions to enable effective and ethically adoption into medicine. In the framework of the study, Section 2 is titled "Related Work." In the third section, we will discuss the significant role that artificial intelligence plays in the field of medicine. Section 4 is conclusions are presented in Section

### **Related work**

In 2023, the study paper reviewed the part of artificial intelligence in determining the Metaverse, a combined virtual world based on progressive technologies. The paper examined the transformative impact of artificial intelligence, including machine learning algorithms and deep learning architectures, in creating and evolving the Metaverse. The paper provided a comprehensive analysis of various technical aspects, such as natural language processing, machine vision, blockchain, networking, digital twin, and neural interfaces, focusing on their role in building the virtual world. The paper also discussed AI-powered applications in areas such as healthcare, manufacturing, smart cities, and gaming, with an emphasis on potential challenges in virtual environments[6].

The study, conducted in 2022, delved into perceptions of artificial intelligence in the Chinese press. The study used an online survey to explore public knowledge, emotions, concerns, preferences, and expectations about artificial intelligence in the Chinese journalism industry. The results revealed general familiarity with AI applications, especially in new products, and showed positive sentiment toward AI simulation programs. She also noted that news reporting formats benefit from artificial intelligence more than regular content[7]. In 2021, a scientific study was conducted on the intersection between AI and the COVID-19 pandemic. Some 18,955 publications were analyzed from March 2020 to June 2021, and the study showed significant growth in research in this area. The analysis revealed the highlights of the research and its impact, with a focus on smart traffic solutions and technologies used to combat the pandemic[8]. In 2020, Saudi healthcare workers were surveyed regarding AI's use. AI job replacement worries and a lack of understanding highlighted the need for AI training and awareness in healthcare[9]. Also, in (2020) Authors are Using a CT database of 3,777 patients, researchers created an AI system capable of diagnosing NCP and distinguishing it from other common pneumonias and normal controls. AI can help radiology and surgeons diagnose quickly, especially during times of high demand in the healthcare system. Our AI algorithm found key clinical parameters that correspond with NCP lesion features. Our AI technology accurately



## Artificial Intelligence's Crucial Role in the Medical Field

Artificial Intelligence have a Crucial role in the healthcare field , in diagnosis .

<b>Table 1 Comparison Table of AI Applications in Healthcare</b>		
<b>Feature</b>	<b>Description</b>	<b>Benefits</b>
Diagnosis and Prognosis	Utilizes machine learning algorithms for analyzing medical imaging, enabling early detection and diagnosis.	Early disease identification, and improved prognosis.
Discovery of the Property	Accelerates drug discovery by analyzing and identifying potential drug candidates, saving time and effort.	Faster drug development, and increased efficiency.
Customized Treatment Plan	Analyzes patient data, including genetic information, to design personalized treatment plans for more effective healthcare.	Tailored treatments, and enhanced patient outcomes.
Remote Monitoring	Uses AI to remotely monitor patients through various technologies, transmitting vital measurements for real-time assessment.	Timely intervention, and continuous patient care.
Robotic Surgeries	Enables precision and flexibility in complex surgical procedures, controlled by surgeons through robotic systems.	Greater surgical accuracy, and minimally invasive techniques.
Monitoring Adverse Drug Events	Examine patient data to identify adverse drug interactions and monitor safety issues associated with medications.	Improved drug safety, and prevention of adverse effects.
Smart Healthcare Robots	Utilizes virtual assistants and AI-powered chatbots to streamline appointments, answer patient queries, and provide healthcare information.	Enhanced patient experience, and efficient healthcare services.
In-Depth Clinical Research	Analyzes clinical trial data sets to accelerate the development of new drugs and treatments.	Faster research, more informed decision-making.

the X-rays, MRIs, and CT scans are evaluated by machine-learning algorithms

to diagnose and monitor illnesses. This uses machine learning and patient data to detect cancer, diabetes, and

predicts clinical outcomes, allowing physicians to prioritize early management and resource allocation. We made our AI system available globally to help practitioners combat COVID-19[10]. In 2019 research analyzed how new communications and transportation technologies transformed smart traffic solutions. AI's function in advancing scientific research, notably in V2X systems, was examined. AI-based V2X system research is surveyed in the study to highlight unresolved issues and significant research challenges for intelligent transportation solutions[11]. Also in 2019. They provide the primary features of the mathematical techniques that are currently accessible for analyzing photos, in addition to the fundamental tenets of such investigation, as successfully as the primary terms and ideas concerned, as well as an examination of the impact of the advancement of AI on medical imaging and image analysis for diagnosis[12].

cardiovascular diseases early and predict disease risks[13]. Also in Discovery of the property, AI can examine and locate drug candidates, speeding drug discovery. AI can Customize your treatment plan, Healthcare is improved by artificial intelligence tailoring treatment plans from genetic, medical, and therapeutic data[14]. Using AI, remote patient monitoring covers blood pressure, heart rate, and weight. In last years, Surgeon-controlled robotic surgery conducts complex operations more accurately and flexibly. Ai ha a crucial role in Monitoring adverse drug events. Patient data may be analyzed by AI to find unfavorable medication interactions and safety problems. Farthermore , Smart healthcare robots, It simplifies appointment scheduling, patient inquiries, and healthcare information via virtual assistants and AI-powered chatbots[15][16]. These different branches of AI in healthcare demonstrate its broad and advanced applications in improving healthcare services and diagnosing diseases more effectively. Below are several tables that include the relationship of the role of artificial intelligence to life care magazines in terms of the services, diseases, and medicines they are interested in

Details	Branch	Factor
AI algorithms and X-ray and magnetic resonance imaging are used to diagnose and forecast illnesses.	Deep Learning, Medical Imaging	Diagnosis and Disease Prediction
Artificial intelligence speeds up drug discovery by screening and finding candidates.	Drug Discovery	Drug Discovery
Data from patients are evaluated to provide individualized treatment plans that are comprised of genetic and medical history information.	Precision Medicine	Treatment Plan Customization
Utilizes information technology to do remote monitoring of patients and transmits data to medical professionals, including readings of blood pressure and heart rate.	Telemedicine	Remote Monitoring
Surgical robots allow for more accurate and sophisticated procedures to be performed by medical professionals.	Medical Robotics	Robotic Surgeries
An artificial intelligence analysis of all patient data is needed to look for adverse medication interactions and safety concerns.	Drug Safety Monitoring	Monitoring Adverse Drug Events
Virtual assistants and robots can organize appointments and provide healthcare information.	Healthcare Robotics	Smart Healthcare Robots
Evaluate experimental data and improve clinical trial design.	Deep Clinical Research	Deep Clinical Research

AI Application	Medical Branch	Key Contributions
Colonoscopy Enhancement with Computer Assistance	Deep Learning, Medical Imaging	Artificial intelligence increases colonoscopy detection and separation of benign and malignant tumours. Helps identify chronic pancreatitis from pancreatic cancer, a frequent clinical problem. GI illness diagnostic and prediction models have also been constructed using artificial neural networks. A 150-patient retrospective research employed 45 clinical factors to diagnose oesophageal cancer with 100% accuracy:[13][14]

Key Aspects	Artificial Intelligence Techniques	Advantages Of Traditional Endoscopy
High-Precision Detection of Colon Diseases	Artificial Intelligence, CAD (Computer-Aided Detection)	AI/CAD offer accurate colon disease diagnosis and discrimination. Benign tumour detection rates are much higher than endoscopy. High-precision image and video analysis uses CAD and artificial neural networks. Build AI systems that measure colon, rectum, and other lesions and benign tumours.
Traditional Human Endoscopy	Human Inspection	Traditional human endoscopy without AI or technology. May discover less benign cancers than AI-assisted endoscopy. Does not use CAD models or neural networks to analyze images and videos. Diagnostic accuracy may be

	lower than AI-assisted endoscopy.
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<b>Table 5: Artificial Intelligence in Neuro-Ophthalmology</b>	
AI Application	Key Aspects
Differentiating Between Right and Left Eyes	AI analyzes medical images to differentiate between right and left eyes, aiding in identifying specific problem areas in each eye.
Glaucoma Diagnosis	AI continuously monitors changes in eye pressure and optic nerve structure, predicting the development of glaucoma. Provides regular reports to assist doctors in making quick decisions.
Identification of Special Cases	AI analyzes signs, symptoms, and differences in medical images to help differentiate conditions such as cystoid macular oedema, anterior ischemic optic neuropathy, and non-arthritis anterior ischemic optic neuropathy.
Decision Support	AI can provide detailed reports to doctors based on its analyses, aiding them in making faster and better decisions.
Overall, the use of AI in neuro-ophthalmology enhances doctors' ability to diagnose cases more accurately and intervene more effectively in the treatment of neurological issues in the eyes.	

<b>Table9: Applications and Tools for Artificial Intelligence in Anatomy</b>	
Name	Description
Visible Body	Offers interactive applications and programs that use 3D models and artificial intelligence techniques to illustrate human anatomy.
Complete Anatomy	An application that utilizes artificial intelligence techniques to create 3D models of human organs and tissues, providing detailed information.
Zygot Body	An interactive platform providing 3D models of human anatomy using artificial intelligence techniques.
Anatomy Learning Apps	A collection of applications like "Essential Anatomy," "Anatomyka," and "Anatomy Quiz" that use artificial intelligence to assist students in learning and understanding anatomy.
PathAI	An application using artificial intelligence to analyze pathology and histology images for accurate diagnosis of diseases and disorders.
Brain Atlas	Websites and applications that use artificial intelligence techniques for mapping and analyzing brain anatomy.

<b>AI Contribution</b>	<b>Scope in Dermatology</b>
Rapid and Accurate Diagnosis of Skin Diseases	AI analyzes skin images, enabling rapid and accurate diagnosis of dermatological conditions. Facilitates early treatment initiation.
Monitoring Patient Response to Treatment	AI tracks patient response to treatment, offering recommendations for treatment modifications if necessary.
Providing Additional Information to Patients	AI offers additional information to patients about their condition and how to care for their skin.
Examples of AI Programs and Systems in Dermatology	- VisualDx: A clinical decision support system for dermatology. - DermEngine: A platform for dermoscopy and artificial intelligence. - SkinVision: A mobile app for skin cancer risk assessment using AI.

<b>Program/System</b>	<b>Description</b>
VisualDx	A diagnostic medical tool employing artificial intelligence and image recognition to aid doctors in identifying and diagnosing skin diseases. The program compares clinical images with an extensive database for precise diagnoses.
Aysa	An AI-powered skin diagnosis app. Send photos for advice and diagnosis.
DermEngine	A program that helps doctors diagnose skin scans using machine learning and AI. Scars and skin patches can be monitored effectively.
First Derm	An app that lets people exchange skin photos with internet dermatologists. AI helps doctors make early diagnoses.
MetaOptima's DermEngine	Deep learning-based skin image analysis helps doctors detect tumours and skin abnormalities.

## CONCLUSION

AI has transformed medicine in many ways, as this survey has shown. AI has revolutionized medical technology, bringing innovations and efficiency. We've seen AI transform diagnoses, therapy, and healthcare administration through machine learning, natural language processing, and computer vision. AI in medical imaging has revolutionized diagnosis and early intervention, increasing patient outcomes. AI's speed and precision in analyzing large information have enabled more tailored and effective treatment strategies.

The poll showed that AI improves administrative procedures, relieves healthcare personnel, and improves diagnoses and treatment. Predictive analytics, virtual health assistants, and other AI-powered systems can improve patient involvement and empower them to manage their healthcare. AI in

medicine has many potential benefits, but ethical, data privacy, and legal issues must be addressed. Ethical AI usage in healthcare requires balancing innovation and responsible deployment. The interaction between AI and medicine practitioners, politicians, and technologists must work together to overcome obstacles, improve methods, and optimize AI's medicinal advantages. Artificial intelligence in medicine promises improved diagnosis, personalized therapies, and patient well-being, according to this survey.

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## Exploratory Data Analysis and Machine Learning Classification for Autism Spectrum Disorder Detection

تحليل البيانات الاستكشافية وتصنيف التعلم الآلي للكشف عن اضطراب طيف  
التوحد

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**ABSTRACT**

Autism Spectrum Disorder (ASD) is a condition that affects social interaction, communication, and repetitive behaviors. Detecting and intervening early is important for improving outcomes for people with ASD. Current screening methods are not very accurate or efficient. This paper suggests a new method that uses exploratory data analysis (EDA) and machine learning to better detect ASD. In our approach, we examine a large set of data that includes details about people's age, behavior, and health background gathered using specific assessment tools. By carefully analyzing the data, we gain valuable understanding about how different characteristics are connected to a diagnosis of Autism Spectrum Disorder (ASD). We then create a model that can predict outcomes by utilizing a type of AI called Artificial Neural Network (ANN). This model achieves an impressive accuracy rate of 97.25% when tested. The precision and recall metrics show how well the model can reduce mistakes in identifying cases, while also correctly identifying a large portion of positive cases. These results emphasize the potential of our method to enhance the accuracy and speed of ASD screening, ultimately resulting in improved outcomes for individuals with ASD and their families.

**Keywords:** Artificial Neural Network, Autism Spectrum Disorder, Early Detection, Exploratory Data Analysis, Machine Learning, Model Development, Predictive Modeling

**الخلاصة**

اضطراب طيف التوحد (ASD) هو حالة تؤثر على التفاعل الاجتماعي والتواصل والسلوكيات المتكررة. يعد الاكتشاف والتدخل المبكر أمرًا مهمًا لتحسين النتائج للأشخاص الذين يعانون من اضطراب طيف التوحد. طرق الفحص الحالية ليست دقيقة أو فعالة للغاية. تقترح هذه الورقة طريقة جديدة تستخدم تحليل البيانات الاستكشافية (EDA) والتعلم الآلي لاكتشاف اضطراب طيف التوحد بشكل أفضل. في نهجنا، نقوم بفحص مجموعة كبيرة من البيانات التي تتضمن تفاصيل حول عمر الأشخاص وسلوكهم وخلفيتهم الصحية التي تم جمعها باستخدام أدوات تقييم محددة. من خلال تحليل البيانات بعناية، نكتسب

فهمًا قيمًا حول كيفية ارتباط الخصائص المختلفة بتشخيص اضطراب طيف التوحد (ASD). نقوم بعد ذلك بإنشاء نموذج يمكنه التنبؤ بالنتائج باستخدام نوع من الذكاء الاصطناعي يسمى الشبكة العصبية الاصطناعية (ANN). يحقق هذا النموذج معدل دقة مثير للإعجاب يصل إلى ٩٧,٢٥% عند اختباره. تُظهر مقاييس الدقة والاستدعاء مدى قدرة النموذج على تقليل الأخطاء في تحديد الحالات، مع تحديد جزء كبير من الحالات الإيجابية بشكل صحيح. تؤكد هذه النتائج على إمكانية طريقتنا في تعزيز دقة وسرعة فحص اضطراب طيف التوحد، مما يؤدي في النهاية إلى تحسين النتائج للأفراد المصابين باضطراب طيف التوحد وأسرتهم .

**الكلمات المفتاحية:** الشبكة العصبية الاصطناعية، اضطراب طيف التوحد، الاكتشاف المبكر، تحليل البيانات الاستكشافية، التعلم الآلي، تطوير النماذج، النمذجة التنبؤية.

## 1. INTRODUCTION

Autism spectrum disorder is a multifaceted neurodevelopmental condition that manifests in early childhood and persists throughout an individual's lifetime. Characterized by a wide spectrum of symptoms, including challenges in social interaction, communication difficulties, and repetitive behaviors (1), ASD presents significant obstacles to individuals affected by it, as well as to their families and communities.

The prevalence of ASD has been steadily increasing, with current estimates suggesting that approximately 1 in 54 children in the United States are diagnosed with ASD, according to the Centers for Disease Control and Prevention (CDC) (2). This upward trend underscores the urgency of understanding and addressing the challenges associated with ASD diagnosis and intervention.

Autism spectrum disorder diagnosis traditionally relies on multifaceted approaches, integrating clinical and behavioral assessments such as the Autism Diagnostic Observation Schedule (ADOS) (3) and the Autism Diagnostic Interview-Revised (ADI-R) (4). Medical evaluations, including genetic testing (5) and neurological examinations (6), are also employed to rule out alternative conditions. While these methods offer valuable insights, their time-consuming

nature and subjectivity have spurred the exploration of technological innovations for more efficient and objective diagnoses (7).

Recent years have witnessed the integration of diverse technological advancements, including eye-tracking (8), neuroimaging (9), and machine learning algorithms (10), into autism diagnosis. The focus has been particularly on methods analyzing facial features and behavioral patterns, aiming to enhance the accuracy and efficiency of autism diagnosis. Despite the promise of these approaches, existing methods face limitations, underscoring the need for a more comprehensive understanding and exploration of alternative approaches.

Early detection of ASD is paramount for several reasons (11). Firstly, it allows for timely intervention and support, which can help mitigate the impact of ASD symptoms on development and functioning. Research has shown that early behavioral interventions can lead to significant improvements in social communication skills, adaptive behaviors, and cognitive abilities among children with ASD (12). Secondly, early diagnosis enables access to appropriate educational and therapeutic services tailored to the individual's needs, fostering optimal growth and development. Moreover, early intervention may positively influence the long-term prognosis for individuals with ASD, enhancing their quality of life and future prospects.

In light of the importance of early detection and intervention, there has been growing interest in the development of effective screening tools and diagnostic methods for ASD. While standardized screening instruments, such as the Modified Checklist for Autism in Toddlers (M-CHAT) (13) and the Social Communication Questionnaire (SCQ) (14), have been widely used to identify early signs of ASD in young children, there remains a need for more accurate and efficient approaches.

In this study, we aim to contribute to the ongoing efforts in ASD research by exploring the potential of machine learning techniques in improving the accuracy and efficiency of ASD screening. Specifically, our contributions include:

1. Conducting exploratory data analysis (EDA) to gain insights into the distribution and characteristics of the dataset related to ASD screening.

2. Developing a predictive model for ASD detection using machine learning algorithms.
3. Integrating data analysis and machine learning techniques to identify relevant features and patterns that may aid in the early identification of ASD and inform future diagnostic practices.

The methodology employed in this study encompasses data preprocessing, feature selection, and model development, with the aim of leveraging advanced computational methods to identify relevant features and patterns that may aid in the early identification of ASD and inform future diagnostic practices. Through integrating data analysis and machine learning techniques, we seek to contribute to the ongoing efforts in understanding and addressing the challenges associated with ASD diagnosis and intervention, ultimately enhancing outcomes for individuals with ASD and their families.

The remainder of this paper is organized as follows: Section 2 provides background information and related work on ASD, while Section 3 covers data collection and preprocessing methods. Section 4 explores further into exploratory data analysis, followed by Section 5 discussing data preprocessing techniques. Section 6 outlines the development of the machine-learning model, and Section 7 presents the results and discussions. Finally, Section 8 concludes the paper.

## **2. BACKGROUND AND RELATED WORK**

Thabtah (2017) conducted a study on using machine learning for screening individuals with Autism Spectrum Disorder, with the goal of improving accuracy and efficiency. The research examines current studies in the field, discussing both advantages and limitations. It also emphasizes the importance of updating screening methods to meet the criteria outlined in DSM-5 and ensuring consistency in diagnostic algorithms (15).

In their 2019 study, Erkan and Thanh delve into the application of machine learning methods for classifying ASD. They utilize three diverse datasets targeting various age ranges and implement kNN, SVM, and RF algorithms. The findings exhibit RF as the most successful, achieving a perfect accuracy rate of 100%. This research emphasizes the promising capabilities of machine learning in providing precise ASD diagnoses (16).

In 2019, Omar and his team introduced a machine learning model designed to detect ASD at an early stage. They created a mobile app that utilizes this model. By blending Random Forest-CART and Random Forest-Id3 techniques, the model showed better accuracy, specificity, sensitivity, precision, and false positive rate when compared to other approaches. Testing with the AQ-10 dataset and actual data sets validated the model's ability to predict ASD effectively (17).

In a study conducted by Akter and colleagues in 2019, they investigated the potential of using machine learning to detect autism spectrum disorder (ASD) at an early stage. The researchers collected datasets related to ASD from different age groups, implemented a range of feature transformations, and evaluated the effectiveness of classification methods. The results showed that Support Vector Machines (SVM) were most effective for detecting ASD in toddlers, Adaboost was the best for children and adolescents, and GImboost performed well for adults (18).

In a recent study, Nogay and Adeli (2020) examined the potential of machine learning (ML) in diagnosing ASD using brain imaging. Their findings suggest that ML shows great potential for early detection of ASD, especially in children, although more extensive research is necessary to enhance accuracy. The development of ML technology is anticipated to revolutionize the diagnosis of ASD in the coming years, offering valuable support to healthcare professionals (19).

In a study conducted by Raj and Masood (2020), the use of machine learning methods to identify Autism Spectrum Disorder (ASD) in individuals of various age groups was examined. The researchers tested several algorithms using publicly accessible datasets, finding that Convolutional Neural Network (CNN) models achieved the highest accuracy rates: 99.53% for adults, 98.30% for children, and 96.88% for adolescents (20).

In their 2021 study, Sujatha and colleagues delve into the application of machine learning (ML) methods in categorizing Autism Spectrum Disorder (ASD). They evaluate different ML algorithms with ASD data sets and underscore the efficacy of ML in precisely recognizing ASD traits across various age ranges. The findings reveal impressive classification accuracy, with Stochastic Gradient Descent

(SGD) reaching 99.7% accuracy for adults, Random Forest (RF) achieving 97.2% accuracy for adolescents, SGD attaining 99.6% accuracy for children, and AdaBoost securing 99.8% accuracy for toddlers (21).

Despite the advancements in ASD diagnosis and prediction, several research gaps persist. One key challenge is the heterogeneity of ASD, which complicates the development of generalized predictive models. Additionally, issues related to data quality, sample size, and model interpretability continue to be areas of concern in ASD research.

The current study aims to address some of these research gaps by conducting an in-depth analysis of a comprehensive dataset related to ASD screening. Through applying advanced data analysis and machine learning techniques, we seek to identify relevant features and develop a predictive model for early detection of ASD. Our research contributes to the existing literature by providing insights into the potential of predictive modeling in improving ASD screening methods and facilitating early intervention strategies for individuals with ASD.

### **3. EXPLORATORY DATA ANALYSIS**

In this section, we conduct an exploratory data analysis (EDA) of the dataset to gain insights into the demographic distributions, ASD prevalence, and potential correlations between features and ASD diagnosis.

#### **3.1 Summary Statistics of the Dataset**

The dataset consists of 704 entries and 21 columns. Among these columns, there are numerical features and categorical features. The numerical features include 'A1\_Score' through 'A10\_Score', 'age', and 'result'. These features have a count of 704 entries, except for 'age' and 'result', which are float64 data types, while the rest are integers. Importantly, there are no missing values in any of the numerical features. On the other hand, the categorical features encompass 'gender', 'ethnicity', 'jundice', 'austim', 'country\_of\_res', 'used\_app\_before', 'age\_desc', 'relation', and 'Class/ASD'. These features also comprise 704 entries and are of object data type (strings). Similar to the numerical features, there are no missing values in the categorical features. However, it is worth noting that the 'age' feature has two missing values that require handling in subsequent data preprocessing

steps. Overall, this summary provides a comprehensive understanding of the dataset's structure, including its data types, counts, and missing values, which will be instrumental for further analysis and modeling tasks.

### 3.2 Visualization of Demographic Distributions

#### A. Gender Distribution

We visualize the distribution of gender in the dataset using a histogram (Figure 1). From the visualizations, we observe that the number of males is slightly higher than females.

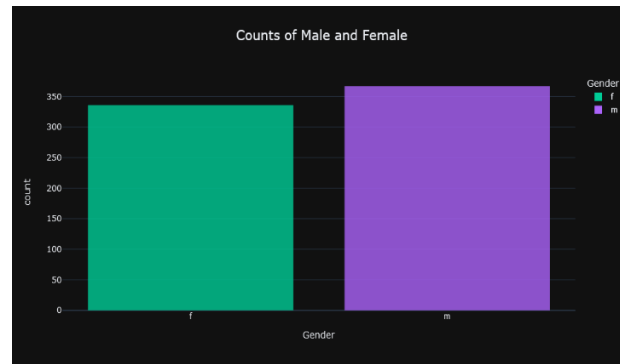


Figure 1: Gender Distribution

#### B. Average Age by Gender

The distribution of average age by gender in the dataset is explored using a histogram (Figure 2). For males, the average age is around 28 years while for women it is a little higher (29 years).

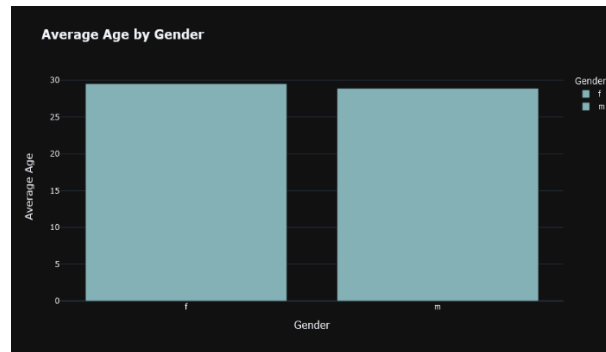


Figure 2: Average Age by Gender Distribution



### 3.3 Analysis of ASD Prevalence and Associated Factors

#### A. ASD Prevalence

We analyze the prevalence of ASD in the dataset (Figure 3). Approximately 27% of individuals in the dataset are classified as ASD-positive.

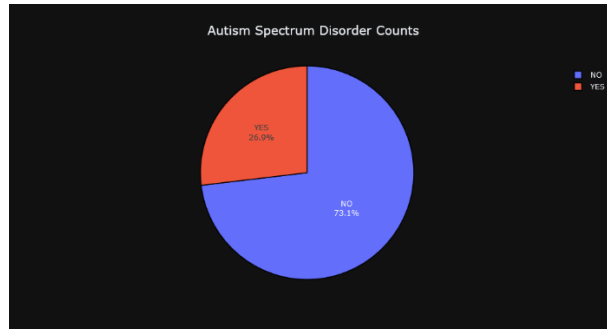


Figure 3: ASD Prevalence

#### B. Count of People with Jaundice

The count of individuals with jaundice is crucial for understanding potential links between jaundice and ASD development (Figure 4). Visualizing this count provides insights into possible risk factors and aids in targeted interventions and early screening strategies for ASD.

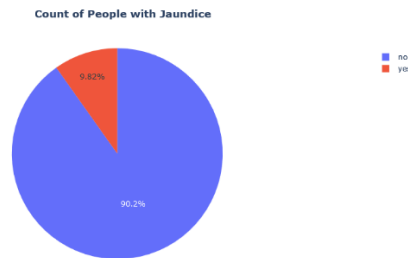


Figure 4: Count of People with Jaundice

#### C. The screening App before

Count of people who used the screening app before is vital for understanding the accessibility and utilization of ASD assessment tools. It provides insights into

early detection efforts, helps allocate resources effectively, and aids in research for improving screening tools and interventions. Visualizing this count through a pie chart offers a concise overview, highlighting its significance in ASD assessment (Figure 5).

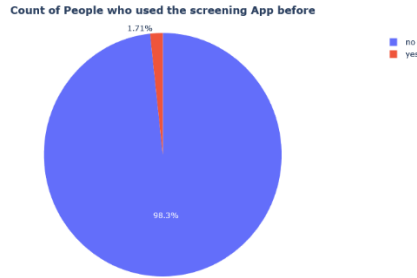


Figure 5: The screening App before

### 3.4 Counts of ASD Patients Country Wise

Analyzing the counts of ASD patients by country is vital for understanding the global epidemiology of Autism Spectrum Disorder (Figure 6). This data helps inform healthcare policies, resource allocation, and research priorities, enabling tailored interventions and support services for affected individuals and their families worldwide. Visualizing this information through tools like bar charts enhances communication and strategic decision-making in addressing the complexities of ASD diagnosis and management.

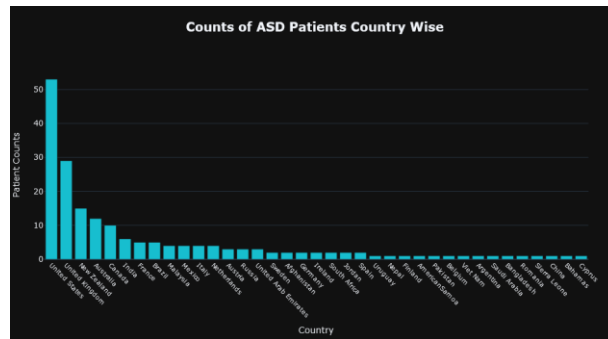


Figure 6: Counts of ASD Patients Country Wise

## 4. EXPERIMENTAL STUDY

### 4.1 Data Collection

The dataset (titled: Autism Screening on Adults) is available from Kaggle service. This dataset was chosen for its comprehensive collection of demographic, behavioral, and clinical attributes relevant to ASD screening and classification. With 704 rows and 21 columns, it offers a diverse sample size and encompasses a wide age range (17 to 65 years), reflecting various stages of life. The dataset's geographic representation, with participants predominantly from the USA and UK, enhances its applicability to diverse populations. Furthermore, the observed prevalence of ASD traits among approximately 26% of candidates, along with the intriguing gender disparity in ASD cases, underscores its relevance for investigating factors influencing ASD manifestation. The inclusion of both numerical and categorical attributes enables a multifaceted analysis, while the availability of features such as 'Jaundice' and 'Family member with ASD' provides additional insights into potential risk factors. Overall, the dataset's richness and relevance make it a valuable resource for advancing understanding and improving screening methods for ASD.

This dataset exhibits a mix of numerical and categorical attributes. Numerical variables encompass 'Age' and 'Result', while categorical ones such as 'Gender', 'Ethnicity', 'Jaundice', 'Autism', 'Country\_of\_res', 'Used\_app\_before', 'Age\_desc', 'Relation', and 'Class/ASD' necessitate encoding for analysis.

## 4.2 Data Preprocessing

Data preprocessing is a crucial step in preparing the dataset for analysis and model development. In this section, we discuss various techniques employed to handle missing values, detect outliers, address invalid entries, encode categorical variables, and drop unwanted columns.

### 1) Outlier Detection

Outliers, or extreme values, can skew analysis results and affect the performance of machine learning models. In our dataset, we focused on detecting outliers within the 'age' feature. We identified the record with the maximum age value using a conditional statement and removed it from the dataset to prevent distortion of results. Subsequently, missing values within the 'age' feature were imputed

using the mean age value, ensuring data integrity and completeness for subsequent analysis.

## 2) Handling Invalid Entries

Invalid entries, such as '?' symbols, can introduce inconsistencies and errors in the dataset. We addressed invalid entries within categorical features, particularly the 'ethnicity' and 'relation' columns. Initially, we examined the unique values within each categorical column and identified '?' symbols as invalid entries. To rectify this, we replaced '?' with appropriate values. For the 'ethnicity' column, '?' was replaced with 'Others' to signify unspecified ethnicities. Additionally, to ensure consistency in case sensitivity, all instances of 'others' were replaced with 'Others'. Similarly, '?' entries in the 'relation' column were replaced with the mode (most common) value to maintain data integrity. Finally, we verified the correction by reviewing the unique values in the affected columns.

## 3) Encoding Categorical Variables

Categorical variables such as 'gender', 'ethnicity', 'jaundice', 'autism', 'country\_of\_res', 'used\_app\_before', 'age\_desc', and 'relation' were encoded using one-hot encoding. This transformation converts categorical variables into numerical format suitable for machine learning algorithms while preserving the categorical nature of the variables. One-hot encoding ensures that each category is represented as a binary vector, facilitating model training and analysis.

## 4) Dropping Unwanted Columns

Removing irrelevant or redundant features is essential for enhancing model performance and efficiency. We identified and dropped unwanted columns from the dataset to simplify the data, reduce overfitting, computational complexity, and improve model generalization. This pruning process ensures that only relevant features are retained for analysis and modeling, leading to better machine learning outcomes.

Table (I) provides a summary of the data preprocessing steps applied in this study.

Table I: Data Preprocessing Steps

Step	Description
<b>Handling Missing Values</b>	Imputed missing 'age' values with the mean age of participants.
<b>Outlier Detection</b>	Removed outlier record (record number 52) from the dataset to prevent skewing of analysis results.
<b>Handling Invalid Entries</b>	Replaced '?' symbols in 'ethnicity' and 'relation' columns. Replaced '?' with 'Others' in 'ethnicity'. Mode imputation for 'relation'.
<b>Encoding Categorical Variables</b>	One-hot encoded categorical variables to convert them into numerical format suitable for machine learning algorithms.
<b>Dropping Unwanted Columns</b>	Removed irrelevant or redundant features to enhance model performance and efficiency.

### 4.3 Explanation of Each Feature and Its Relevance to ASD Diagnosis

Table (II) provides insights into the dataset features and their relevance to ASD diagnosis. Features such as ID, AQ score, demographics, family history, and screening tool results are crucial for understanding ASD prevalence and risk factors

Table II: Features and their Relevance to ASD Diagnosis

I	Feature	Description
	<b>index</b>	The participant's ID number
	<b>AX_Score</b>	Score based on the Autism Spectrum Quotient (AQ) 10 item screening tool AQ-10
	<b>age</b>	Age in years
	<b>gender</b>	Male or Female
	<b>ethnicity</b>	Ethnicities in text form
	<b>jaundice</b>	Whether or not the participant was born with jaundice?
	<b>autism</b>	Whether or not anyone in the immediate family has been diagnosed with autism?
	<b>country_of_res</b>	Countries in text format
	<b>used_app_before</b>	Whether the participant has used a screening app

<b>result</b>	Score from the AQ-10 screening tool
<b>age_desc</b>	Age as categorical
<b>relation</b>	Relation of person who completed the test
<b>Class/ASD</b>	Participant classification

#### 4.4 Splitting the dataset into training and testing sets

The dataset underwent a standard 75-25 split into training and testing sets to ensure an appropriate balance between model training and evaluation. By allocating 75% of the data for training and reserving 25% for testing, we aimed to train the model on a sufficiently large portion of the dataset while retaining unseen data for evaluating its performance. This division strategy helps mitigate issues such as overfitting and provides a reliable estimate of the model's generalization capability.

#### 4.5 Handling Missing Values

Missing values are a common occurrence in datasets and can adversely affect the analysis and modeling process. In our dataset, the 'age' column contained missing values. To address this, we imputed the missing age values with the mean age of the participants. Imputation ensures data completeness and allows us to retain valuable information for analysis.

#### 4.6 Feature Engineering and Selection Techniques

Prior to model development, rigorous preprocessing steps were undertaken to enhance the quality of the input data. This encompassed handling missing values, encoding categorical variables using one-hot encoding, and eliminating unnecessary columns. Specifically, missing values in the 'age' column were imputed with the mean age to maintain data integrity. Additionally, invalid entries in categorical features such as 'ethnicity' and 'relation' were appropriately replaced to ensure consistency and reliability in subsequent analyses.

### 5. MACHINE LEARNING MODEL DEVELOPMENT

For the construction of the classification model, we opted for an Artificial Neural Network (ANN) architecture implemented using the TensorFlow Keras library.

The choice of ANN was motivated by its ability to effectively capture complex nonlinear relationships within the data, which is particularly beneficial in tasks such as ASD detection where the underlying patterns may be intricate and multifaceted.

The decision to utilize an ANN for this study stems from its ability to handle the intricate and nonlinear relationships present in ASD data. ANNs are adept at processing diverse data types, including numerical, categorical, and textual inputs, enabling comprehensive analysis. They excel in automatic feature extraction, crucial for identifying subtle predictors of ASD, and have demonstrated scalability with large datasets commonly encountered in ASD research. Despite their perceived complexity, efforts to enhance interpretability make ANNs suitable for clinical adoption. Overall, ANNs align with the study's goal of accurately predicting ASD and improving outcomes for affected individuals and their families.

The architecture of the ANN comprised multiple dense layers, facilitating the extraction of hierarchical features from the input data. Rectified Linear Unit (ReLU) activation functions were utilized within each layer to introduce nonlinearity, enabling the model to learn intricate patterns and relationships present in the data. To prevent overfitting, dropout layers were strategically incorporated, randomly deactivating a fraction of neurons during training to promote model generalization.

Furthermore, batch normalization layers were integrated into the model architecture to enhance training stability and convergence speed. Through normalizing the activations of each layer, batch normalization mitigates issues such as internal covariate shift, thereby facilitating smoother optimization and improving the overall performance of the model.

Finally, the output layer of the ANN employed a sigmoid activation function, enabling the generation of binary predictions indicative of ASD diagnosis. The sigmoid activation function squashes the model's output into the range  $[0, 1]$ , representing the probability of an individual being diagnosed with ASD. This probabilistic output facilitates intuitive interpretation and decision-making, aiding

clinicians and stakeholders in informed decision-making processes. Table (III) provides a summary of the components of the ANN model described above.

Table III: Summary of the Components of the ANN Model

Component	Description
Input Layer	First layer of the neural network; receives input data with a number of neurons equal to the number of input features.
Hidden Layers	Intermediate layers between the input and output layers; perform transformations to learn complex patterns and representations.
Dropout Layers	Layers used to prevent overfitting by randomly deactivating neurons during training.
Batch Normalization	Layers used to normalize the activations of the previous layer, stabilizing and accelerating training.
Output Layer	Final layer of the neural network; produces predictions or classifications based on learned features.
Activation Function	Introduces non-linearity into the model; ReLU for hidden layers, sigmoid for output layer.
Optimizer	Algorithm responsible for updating weights during training; Adam optimizer used with a learning rate of 0.001.
Loss Function	Measures how well the model performs on training data; binary cross-entropy loss used for binary classification tasks.
Metrics	Used to evaluate model performance during training and testing; accuracy used as the evaluation metric.
Training Parameters	Includes the number of epochs, batch size, and other hyperparameters configured for training the model.

## 6. RESULTS AND DISCUSSION

### 6.1 Performance Evaluation of the ANN Model in Terms of Accuracy and Loss



Analysis of the accuracy metrics reveals a commendable range, with values fluctuating between approximately 0.86 and 0.91 across various epochs. These fluctuations signify nuanced shifts in the model's ability to correctly classify instances over time, reflecting the dynamic nature of the learning process.

Initially, there is a discernible uptrend in accuracy as the model adapts to the training data and learns to generalize patterns effectively. This phase of improvement is crucial as the model refines its internal representations to better capture the underlying relationships between input features and target labels. Following this initial surge, there is a period of relative stabilization, where the accuracy reaches a plateau, indicating that the model has achieved a certain level of proficiency in classification tasks.

Notably, the model attains its peak accuracy at around 0.91, showcasing its capacity to correctly classify a substantial portion of validation data samples. This high level of accuracy underscores the effectiveness of the ANN in discriminating between individuals with and without ASD, thereby demonstrating its utility as a predictive tool in clinical settings.

Concurrently, scrutiny of the loss metrics elucidates a downward trajectory, ranging from about 0.26 to 0.34 across epochs. This trend highlights the model's adeptness at minimizing the disparity between predicted and actual values throughout the training iterations. The decreasing loss values indicate that the model is progressively converging towards optimal performance, as it learns to minimize prediction errors and generalize well to unseen data.

As training progresses, the diminishing loss values reflect the model's enhanced predictive accuracy and convergence towards optimal performance. This iterative process of refinement enables the ANN to effectively capture complex patterns in the data and make accurate predictions. However, towards the latter epochs, a plateauing effect becomes apparent, suggesting that the model has reached a satisfactory level of proficiency, with further improvements likely yielding marginal gains.

Figure (7) gives the performance evaluation of the ANN model in terms of accuracy and loss.

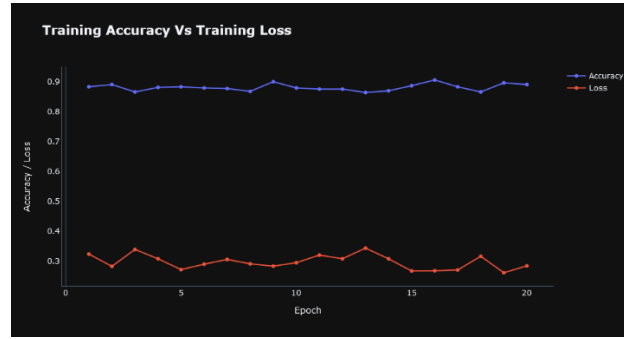


Figure (7): Training Accuracy Vs Training Loss

## 6.2 Performance Evaluation of the ANN Model in Terms of Accuracy, Precision, and Recall

The performance evaluation of the ANN model demonstrates impressive results across key metrics, highlighting its efficacy in accurately classifying instances within the test dataset.

- **Accuracy:** The ANN model achieves an outstanding accuracy of 97.25%, indicating its capability to correctly classify the majority of instances in the test dataset (equation 1)

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN} \quad ..(1)$$

- **Precision:** Precision measures the proportion of true positive predictions among all positive predictions made by the model. For the positive class (class 1), the model exhibits exceptional precision of 100%. This signifies that the vast majority of instances predicted as positive are indeed true positives, indicating minimal false positive predictions (equation 2)

$$Precision = \frac{TP}{TP + FP} \quad ..(3)$$

- **Recall:** Recall, also known as sensitivity, measures the proportion of actual positive instances that are correctly identified by the model. The ANN model achieves a recall of 88% for the positive class. This indicates that the model correctly identifies 88% of the actual positive instances present in the dataset (equation 3).

$$Recall = \frac{TP}{TP + FN} \quad ..(2)$$

- **F1-Score:** The F1-score, which is the harmonic mean of precision and recall, provides a balanced assessment of the model's performance. For the positive class, the ANN model achieves an F1-score of 0.93, indicating a harmonious balance between precision and recall. This suggests that while the model excels in precision, there is still room for improvement in recall to capture more positive instances effectively (equation 4).

$$F - 1 \text{ measure} = \frac{\text{Precision} * \text{Recall}}{\text{Precision} + \text{Recall}} \quad ..(4)$$

Overall, the ANN model demonstrates robust performance in classifying instances, with high accuracy, exceptional precision, and commendable recall. These results underscore the ANN model's potential as a promising tool for the task at hand, indicating its effectiveness in ASD detection and classification.

The following classification report (see Table IV) provides a detailed breakdown of precision, recall, and F1-score for each class, along with overall metrics such as accuracy, macro average, and weighted average. These metrics offer comprehensive insights into the model's performance across different evaluation criteria, facilitating a thorough assessment of its effectiveness in ASD classification.

Table IV: Classification Report of the Model's Performance

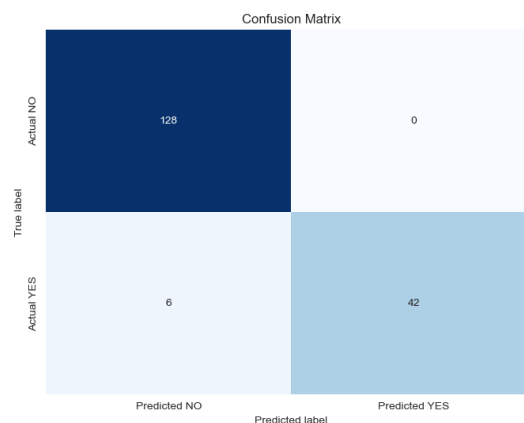
	<b>Precision</b>	<b>Recall</b>	<b>F1-Score</b>	<b>Support</b>
Class 0	0.96	1	0.98	128
Class 1	1	0.88	0.93	48
accuracy			0.97	176
macro avg	0.98	0.94	0.96	176
weighted avg	0.97	0.97	0.97	176

### 6.3 Confusion Matrix

In the field of autism detection, the confusion matrix serves as a cornerstone in evaluating the efficacy of classification models (20). It offers a nuanced

understanding of the model's discriminative power, delineating its capacity to discern between autistic and non-autistic individuals while highlighting potential misclassifications. Comprising four quadrants, the confusion matrix delineates the following:

- True Positives (TP): Instances where the model correctly identifies individuals with ASD. These are cases where the model's prediction aligns with the ground truth, affirming its sensitivity in capturing true ASD cases.
- True Negatives (TN): Representing instances where the model accurately identifies individuals without ASD, true negatives underscore the specificity of the model in correctly excluding non-ASD cases.
- False Positives (FP): Occurrences where the model erroneously classifies individuals without ASD as having the disorder. False positives signify the model's propensity to misclassify non-ASD cases, potentially leading to unnecessary interventions or distress for individuals incorrectly identified as ASD-positive.
- False Negatives (FN): Reflecting instances where the model fails to detect ASD in individuals who actually have the disorder, false negatives highlight the model's limitations in capturing all ASD cases. These misclassifications can impede timely interventions and hinder access to support services for individuals in need.
- Figure (8) depicts the confusion matrix illustrating the performance of the ANN model.



- Figure 8: Confusion Matrix Illustrating the Performance of the ANN Model
- 6.4 Comparison with Existing Approaches

- Evaluation of the performance of different neural network architectures on the autism detection dataset highlights nuanced differences in their predictive capabilities (Table V). The ANN model emerges as the top performer, achieving an impressive accuracy of approximately 97.25%. Following closely behind is the recurrent neural network (RNN) (22), with an accuracy of about 97.17%. These findings underscore the effectiveness of both ANN and RNN models in accurately discerning patterns indicative of autism within the dataset.
- In contrast, the convolutional neural network (CNN) (23) model exhibits a comparatively lower accuracy, hovering around 75.94%. While the CNN model demonstrates some level of predictive power, its performance suggests potential limitations in capturing the intricate patterns relevant to autism detection. This disparity in performance among neural network architectures may stem from differences in their inherent structures and capabilities in extracting features from the data.
- Table V: Comparison with Existing Approaches

Model	Accuracy
Artificial neural network ANN	97.25%
Recurrent neural network RNN	97.17%
Convolutional neural network CNN	75.94%

These results underscore the importance of selecting an appropriate neural network architecture tailored to the characteristics of the dataset and the task at hand. While ANN and RNN models demonstrate robust performance in autism detection, further investigation is warranted to optimize the CNN model's architecture and parameters for improved accuracy.

### 6.5 Implications for ASD Diagnosis and Future Research Directions

The findings of this study carry significant implications for both ASD diagnosis and ongoing research endeavors. Firstly, the development and validation of the ANN model present a promising advancement in the context of ASD screening and early intervention. Particularly noteworthy is its potential applicability in resource-constrained environments where access to specialized clinicians may be limited. Through offering an automated and scalable screening tool, the ANN

model has the capacity to expedite the identification of individuals at risk of ASD, facilitating timely intervention and support services.

Moreover, the elucidation of key features and risk factors associated with ASD, as elucidated through rigorous exploratory data analysis (EDA) and modeling techniques, offers invaluable insights for personalized intervention strategies. Through identifying demographic, clinical, and behavioral markers indicative of ASD susceptibility, healthcare professionals can tailor interventions to address the specific needs of individuals on the autism spectrum. This personalized approach not only enhances the efficacy of interventions but also fosters a more holistic and patient-centered approach to ASD care.

## 7. CONCLUSION

To summarize, our research focused on overcoming the difficulties in identifying individuals with ASD using exploratory data analysis (EDA) and machine learning classification. By examining a thorough dataset, we gained valuable information about the prevalence of ASD and the factors that contribute to its development. This revealed the intricate relationship between demographic and clinical characteristics. Our results emphasize the significance of early intervention and assistance, especially for those with a family history of ASD.

Our research uncovered demographic trends and risk factors linked to ASD, offering practical knowledge for healthcare providers and decision-makers. By grasping these factors, tailored intervention plans can be created to lessen the effects of ASD symptoms and improve developmental results.

The creation of a model that can predict autism spectrum disorder (ASD) with an accuracy of 97.25% is a significant advancement for healthcare professionals. By incorporating this model into current screening procedures, it can help quickly identify individuals who may be at risk of ASD, allowing them to receive necessary interventions and support services promptly.

In conclusion, our research supports the importance of early screening and intervention programs in healthcare systems. We also stress the significance of raising awareness and reducing stigma to create inclusive communities that

celebrate neurodiversity. By taking these steps, people with ASD can flourish and positively impact our shared human journey.

### **CONFLICTS OF INTEREST**

The authors declare that there is no conflict of interest regarding the publication of this article.

### **FUNDING STATEMENT**

The authors declare that they did not receive any specific funding for this research project.

### **DATA AVAILABILITY STATEMENT**

A link to access the dataset is provided at: <https://www.kaggle.com/datasets/andrewmvd/autism-screening-on-adults/data>.

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## Exploring Blockchain solutions for Enhanced Data Integrity and

### Privacy : A comprehensive Review

الديمقراطية في التصويت الإلكتروني باستخدام تقنية Blockchain المبنية على نظام إنترنت الأشياء: بحث مراجعة

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الديمقراطية في التصويت الإلكتروني باستخدام تقنية Blockchain المبنية على نظام إنترنت الأشياء: بحث مراجعة

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**ABSTRACT**

The Internet of Things or IoT plays a crucial role in making data exchange seamless but it also brings serious security concerns When devices get hacked it can lead to privacy breaches and data leaks Blockchain technology offers a solution by providing decentralized agreement, data immutability, and transparent transaction records. This helps ensure reliable and secure communication and maintains data integrity in IoT systems This paper gives a clear overview of blockchain technology, explaining its structure, key concepts, types, and how it can be integrated with IoT. It highlights the benefits like improved security while also acknowledging the challenges and limitations of blockchain. Whether you're a scholar or a practitioner this review serves as a valuable resource for understanding blockchain's potential impact on IoT

**Keywords:** blockchain's, Internet of Things, Functional requirement, E- voting, electronic devices

**الخلاصة**

قدم هذا البحث مراجعة شاملة لدمج تقنية البلوكشين مع إنترنت الأشياء المرتبطة بتبادل البيانات. يلعب إنترنت الأشياء دورًا حاسمًا في جعل تبادل البيانات سلسًا، ولكنه يثير أيضًا مخاوف أمان خطيرة. عند اختراق الأجهزة، يمكن أن يحدث انتهاك للخصوصية وتسريب للبيانات. تقدم تقنية البلوكشين حلاً واعدًا من خلال توفير اتفاق لامركزي وعدم قابلية التلاعب بالبيانات وسجلات العمليات الشفافة. يساعد هذا في ضمان التواصل الموثوق والأمن والحفاظ على سلامة البيانات في أنظمة إنترنت الأشياء. تقدم هذه المراجعة نظرة عامة واضحة على تقنية البلوكشين، مشرحة هيكلها ومفاهيمها الرئيسية وأنواعها المختلفة، مع التركيز على كيفية دمجها مع إنترنت الأشياء. تسلط المراجعة الضوء على فوائد تعزيز الأمان مع الاعتراف بالتحديات والقيود التي تواجه دمج التقنية. سواء كنت باحثًا أو ممارسًا، تعتبر هذه المراجعة مصدرًا قيمًا لفهم الأثر المحتمل للبلوكشين على إنترنت الأشياء وتأثيراتها على التواصل الموثوق والأمان

الكلمات المفتاحية: بلوكشين ، انترنت الاشياء، التصويت الالكتروني ، الجهاز الالكتروني .

## 1- introduction

By expressing one's opinion, one has the right to vote in democratic countries. Voting systems have been a part of communities from ancient times, adapting to social changes. They employed the simple technique of counting raised hands or pebbles in ancient Greece. With the advent of voting booths, punch cards, paper ballots, and optical scanning devices, voting systems evolved. One essential component of human democracy is voting. Voting has always been open, accessible, and verifiable, but throughout human history, efforts have been made to enhance the procedures, systems, and techniques employed. Even with advanced security, it has shortcomings in terms of eligibility, privacy, and trust. The reason traditional voting systems take so long is that votes have to be collected from multiple locations and then totaled by [1]

New voting techniques have been developed across the globe that offers some anticorruption protection while still maintaining accuracy during the voting process. The technology introduced new electronic voting techniques that are essential and have significantly challenged the democratic process. Despite this, the electronic voting system faces the risk of over authority and manipulation of details, compromising the essential fairness, transparency, anonymity, confidentiality, and privacy of the electoral process [2]. One controller typically oversees the entire voting process in most electronic voting commission) dishonesty, incorrect choices are made, which are difficult to change using the current techniques. To avoid the central authority, current electronic voting techniques might leverage decentralized networks [3,4]. methods.

## 2- Requirements and type of Voting System

Before identifying pertinent requirements for voting systems, we first classify the different types of voting systems

### 2.1 Methods of Voting

Information technology breakthroughs have been merged with voting methods to make them more accessible and efficient. From a technical point of view, there are several distinct kinds of voting systems.

A- Conventional voting: the traditional technique in which voters manually mark paper ballots or operate mechanical lever machines. Election officials gather and tally the votes, whether they are cast in a polling place or remotely. There are two basic categories in traditional voting: Voting on paper: Using this method, voters usually manually mark their choices next to the option or candidate they want to support on the ballot paper, and the ballots are then manually counted [5] .

B- E-Voting, an electronic voting method, utilizes electronic devices to record and cast votes. In contrast, on-site paper-based voting involves physically casting a vote at a designated polling place, whereas remote paper-based voting entails casting a vote through mail or another delivery method. [6]. Mechanical lever machines: These were introduced in the 1890s and work by having voters press a lever adjacent to their choice of candidate. When a voter finishes, they pull the big lever once more, which causes the system to be ready for the next voter and the counters related to their selection to go up by one [7].

E-voting is a voting technique in which votes are cast, counted, or recorded via electronic means. Generally speaking, e-voting systems fall into four subcategories:

Punch-card: Designed in the 1960s, these voting cards were modified Hollerith cards that voters punched out chads with a stylus to indicate which candidates they supported. The punched card was placed in a ballot box after voting. A card reader was then used to count these cards[8]. Voter selections are directly recorded into computer memory using a direct recording electronic (DRE) voting method. Voters use knobs, touchscreens, or push buttons to interface with DREs. Voters can verify their selections on paper records using Voter Verified Paper Audit Trail (VVPAT) printers found in certain DREs. These records can be utilized for post-election audits or record.

### **c- Voting Systems Requirements**

Any system for the purpose of its creation must be subject to requirements in order for it to be integrated and for each system to have advantages. We can classify the features of these systems into two groups: functional requirements (FR) and non-functional requirements (NFR).As per the references [9][10], an

electronic voting system must meet several prerequisites in order to be taken into consideration as a substitute for conventional voting methods.

Drawing from the aforementioned references, we In this research, we present two groups of requirements for the purpose of system integration: one of these requirements is security, which is considered a functional and non-functional requirement at the same time, and functional and non-functional non-security requirements on the one hand.. Our classification creates a systematic foundation of attributes to which we will subsequently turn when discussing the advantages, difficulties, implications, and directions for further research.

### 3- Functional requirement

- User-Centric Voting Design: The idea that everyone should be able to easily use a voting system. It should, therefore, have an easy-to-use interface and present options without favoring any candidate over another.
- Flexibility: This describes the system's capacity to adjust to various voting ballot formats, languages, and platforms, hence enabling compatibility with a range of technologies. This phrase emphasizes meeting deadlines, being flexible and adaptive to give an electronic voting experience, and allowing a variety of ballot question forms, including open-ended inquiries.

### 4- Non-Functional Requirements

**Equality:** It prioritizes fair and uniform voter access, guaranteeing that every voter has the same information and opportunities and is granted equal voting rights and opportunities regardless of the voting procedure.

- **Accessibility:** This word emphasizes how important it is to give people with disabilities or functional limitations the ability to vote, guarantee that voters have unrestricted access to Physical and logical access to the elective system via infrastructure

- **Directness:** The hardware and software of an electronic voting system should operate in a transparent manner, allowing citizens to comprehend and confirm its functionality.

The term "auditability" refers to the requirement of having accurate and credible election records with a (potentially) physical but always permanent audit trail that guarantees voter confidentiality, as well as the ability to confirm that every vote in the final tallying is accurately accounted for.

- **Cost-effectiveness:** It satisfies the need for reusable, fundamentally low-cost systems with reasonable setup and upkeep expenses that are on par with traditional voting methods.

- **Interoperability:** In order to ensure harmonious integration and compatibility with the components of the system and multiple technologies, it ensures the following (importing system data, voting, issuing data or reporting it in a visually operable form using recognized communication interfaces and protocols that are simply available to users.

### - E-Voting Challenges

By using cutting-edge technologies that improve accessibility and utility while lowering costs, electronic voting seeks to improve traditional voting procedures by minimizing and avoiding fraud by decreasing the participation of election employees, speeding up the processing of results, and increasing involvement in democratic election processes. Nevertheless, the implementation of an electronic voting system presents numerous procedural, legal, and technical obstacles [11].

The prevalent issues with electronic voting systems include: Lack of widely recognized standards for electronic voting systems.

- The original purpose of the system is defeated because the traditional E-voting technique is difficult to comprehend and utilize, which erodes public confidence in the suggested solution.
- Fraud and manipulation by hackers or insiders with special access.



Various approaches have been devised to address the issues related to electronic voting, each utilizing a distinct blend of technologies and algorithms. Blockchain technology has been shown to have the potential to improve electronic voting systems in recent years. A more recent addition to blockchain technology is voting. Scholars working in this area try to leverage desirable characteristics including immutability, anonymity, and openness for voting applications. The potential of blockchain technology to safeguard and fix elections has recently drawn a lot of interest due to the growth of blockchain-based electronic voting systems[12].

Numerous countries have initiated investigations and implemented electronic voting systems based on blockchain technology. Blockchain technology offers a decentralized node for electronic voting. Databases are changeable by nature, allowing a predefined set of entities to add or modify data. These entities are recognized by their identities despite their distinct roles. Administrative roles have the ability to modify the hosted information's structure and content, regardless of their centralization. Blockchain data's immutability and reliability make it unnecessary for databases to rely on reliable third parties, which increases the veracity and credibility of the information they hold. Electronic voting systems are currently being created using distributed ledger technologies like blockchain since end-to-end verification is so beneficial. This feature of blockchain technology could be used to develop an electronic voting system that allows voters to independently verify results instead of relying on centralized authorities. Several countries have already started looking at and creating blockchain-based electronic voting systems[13].

## 5-- Literature review

Numerous publications have been published about electronic voting and blockchain technologies. These publications present a variety of approaches and goals, which are attained in different ways.

A voting protocol built on the blockchain was introduced. Complete attestation of the validity of each vote is submitted before it is made public in an encrypted manner. Therefore, it is possible for the public to verify the election results. To ensure that no one could decrypt the votes and that anybody could confirm the

validity of the votes and the outcomes of the tallying procedure, they proposed a novel encryption technique [14] .

In order for electronic voting to become widely used, the proposed system needs to be reliable and secure. It is suggested to implement a safe, decentralized, and transparent electronic voting system using the hyperledger sawtooth blockchain platform. Voters' faith in the integrity of the electoral process is bolstered by the ability to cast ballots in the immutable blockchain state through regulated access to the system via election polling places, which makes vote manipulation impossible [15].

Created a framework for a self-tally voting system in decentralized Internet of Things using blockchain technology. They provided a detailed design and proved that the recommended solution satisfies all security needs, including maximal ballot confidentiality, dispute-free voting, and fairness [16]

unveiled Secure Ballot, an open-source, cryptographically secure electronic voting system that totally separates voter data from voting data.[17]

A new voting protocol called SIVP (Secure Internet Voting Protocol) has been proposed for Colombia's national elections. To safeguard voting, it combines blind signatures with public key cryptography. The six steps of this technique are: declaring, enrolling, authenticating, voting, tallying, and validating. Different voting steps are included in the proposed protocol, which offers security properties including eligibility, privacy, democracy, robustness, accuracy, verifiability, fairness, and receipt-freeness. It is also coercion-resistant [18].

Paper-based voting: Using this method, voters usually handwrite their selections next to the candidate or option they want to support on the ballot paper. The ballots are then manually counted [19] . It is further subdivided into on-site and remote voting. As we know, paper voting in a geographical location is voting and writing the candidate on paper and at the polling station, while remote paper voting is the process of affixing the vote to the ballot card via mail or other means of delivery..[20]

This system is meant for all governmental and private agencies, not only governments. For instance, governments can hold elections or referendums, and anyone who is of voting age and has a government-issued voting card can cast a ballot. This eliminates the need for ballot boxes, lengthy lines, and postponing the counting of votes, which costs governments a lot of money, time, and effort. Additionally, any organization or private company that wants to survey members of the public or carry out a particular study to gather their opinions can easily contact them using this method. The technology helps the relevant authorities get results promptly and without delay while accounting for the variations in the voting procedures between public and private organizations. [21]

A heterogeneous deniable authentication (HDA) technique for online voting systems was suggested. Messages between sender and receiver can be sent in a certificateless cryptography (CLC) environment and public key infrastructure (PKI). This technique permits security proofs in the random oracle model with the computational Diffie Hellman (CDH) and the bilinear Diffie Hellman (BDH) hypotheses. [22]

offered a revolutionary state-machine replication method that could tolerate Byzantine errors, function in asynchronous systems, and offer a significant speed boost over previous techniques. The authors also cover BFS, a Byzantine-fault-tolerant version of NFS that performs almost as well as an unreplicated service because of enhancements like message authentication codes and incremental checkpoint-management techniques. The ability of byzantine-fault-tolerant algorithms to maintain system functionality even in the face of software flaws makes them essential. The authors intend to reduce the quantity of resources required to execute their algorithm by reducing the number of replicas and copies of the state [23].

## 6- Disussion

Utilizing smart contracts to automate contractual obligations address scalability problems and mitigate privacy and security risks associated with sensitive IoT generated data represent some of the cutting edge applications in technology , By leveraging blockchain, these smart contracts ensure transparent and secure

data processes, fostering trust specially when combined with Artificial Intelligence (AI) and Machine Learning (ML) Through decentralized execution (AI )and( ML) applications can become more collaborative and scalable, fostering innovative ecosystems.. Blockchain adoption and application in a number of sectors, including supply chain management, banking, and healthcare, might shed light on the technology's possible effects. In general, further research, All things considered, more research can examine how blockchain technology may be used to overcome obstacles and offer fresh perspectives on how it can be applied. The possible effects of blockchain technology on Internet of Things ecosystems are highlighted in this review study. The basic features of blockchain are covered, such as its structure, classification, kinds, essential elements, and distributed ledger technology. The paper also covers the many blockchain layers, as well as the technology's salient features and range of applications. Also discussed are the drawbacks and restrictions of blockchain technology, including issues with scalability and interoperability.

## 7- Conclusion

Digital technology have significantly altered people's daily lives and improved the intelligence of many aspects of our lives. These days, all users—humans and devices alike—are linked to centralized systems. It is feasible for untrusted individuals to trade vital information and money because these servers function as the authority, trusted by all users. Large server maintenance is expensive, though, and if these digital systems for vital city infrastructures are compromised, it becomes unaffordable. The technology revolution known as blockchain, which began in 2014, has the ability to address these issues. is basically a tool that logs each and every digital event and transaction that takes place in the virtual world. Every user has access to every record, and information asymmetries between users are kept to a minimum. As a result, it is impossible for one user to deceive another or withhold information. Stated differently, there is no need for two strangers to be concerned about deceiving one another. They can now do business without a centralized authority for the first time in history. These two issues go away on their own since a centralized

authority is no longer required. This assessment presents the blockchain's tremendous applications in the Internet of Things, e-governance, and e-democracy after explaining how it works its magic.

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## **Study of Some Types of Congenital Anomalies in Mosul City**

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**Abstract:** Some malformations can be diagnosed early within the first three months of embryonic organ development. Others, particularly those associated with appearance, might be identified as late as six months during the pregnancy or even after delivery. There are several abnormalities that involve organ function that may not be observed for some time after birth. Deformities come in many varieties and varying degrees of severity. Minor deformities are those that can be corrected surgically after birth, including cleft lip. Others, classified as moderate malformations, like Down syndrome, can be treated and repaired, enabling those who are affected to participate in life. On the other side, major malformations are those that make life impossible, like a brain of fetus. The current investigation was started in different Mosul hospitals to determine the sorts of abnormalities that occurred in 2021 and 2022. The study covered 38 instances for 2021 and 51 for 2022. The study's data included the gender of babies, birth weight, and number of deaths. The study found that males were more affected by abnormalities than females. This is because the majority of female children with anomalies die before or soon after birth. There was no statistically significant difference in birth weight between male and female infants born with abnormalities. In terms of deaths, the study indicated that females had a greater mortality rate. The investigation discovered several abnormalities impacting numerous body systems, with the cardiovascular system being most afflicted. The study suggested that pregnant women take caution when exposed to environmental influences, particularly during the first three months of pregnancy. It also underlined the significance of regular prenatal care at healthcare facilities, with at least monthly check-ups throughout the pregnancy.

**Key words:** **Congenital Anomalies**, Mousl, Pregnancy

## 1.Introduction

Congenital anomalies are abnormalities, including anatomical and functional, that are present from birth and result from womb disturbances. Certain

conditions, including hearing impairments, can be detected prior to birth, while others might only become noticeable after delivery (1). Congenital abnormalities, which rank among the major causes of newborn illnesses and disabilities, can be acquired during fetal development or come from the genetic composition of the parents (2). Furthermore, miscarriages and infant mortality are primarily caused by these defects (3). These defects frequently cause long-term disability if they do not result in mortality (4). Congenital abnormalities are divided into several categories. They are divided into two types: simple faults, which have a small influence on key organ functions and frequently require minimal therapeutic intervention (5), and complex. Alternatively, complicated malformations are serious and life-threatening, necessitating prompt medical attention. Another division groups congenital anomalies into single-system anomalies, which affect just one organ or body component, and multisystem malformations, which affect numerous organs or body parts (6). The International Statistical Classification of Diseases and Related Health Problems (ICD) classifies these anomalies based on their occurrence rates. For example, brain malformations were recorded at a rate of 10 per 1000 live births, but heart anomalies occurred at a rate of 8 per 1000 live births. Kidney anomalies occurred at a rate of 4 per 1000 live births, while limb malformations were reported at 1 per 1000 live births. The overall prevalence of congenital abnormalities has been calculated at 6 per 1000 live births (7). Congenital abnormalities are caused by a complex combination of parental and environmental risk factors, including the pregnant woman's living environment, geographic region, and ethnicity (8). Anomalies are largely caused by a combination of environmental and genetic variables, including consanguinity, the mother's age, and pre-existing medical disorders (9). The World Health Organization estimates that congenital abnormalities cause 260,000 deaths worldwide (10;11). These abnormalities account for 20% to 30% of all childbirth-related deaths (12). The majority of congenital defects occur more frequently in low- and middle-income countries, where women are more vulnerable to malnutrition and insufficient healthcare (13). Infants with congenital anomalies have physical, behavioral, sensory, and auditory difficulties throughout their lives, particularly if their conditions are not

adequately addressed (14). Objective: The study aimed to identify the types of congenital anomalies in Mosul within a specific timeframe.

## 2. Methodology:

This study was conducted in several maternity hospitals in Mosul. Data for congenital anomaly cases for the years 2021 and 2022 were collected. These cases were diagnosed by specialized physicians. The number of cases for the year 2021 was 38, and for the year 2022, it was 51. The collected data included gender, birth weight, type of anomaly, and the number of deaths among infants with congenital anomalies.

## 3. Results and Discussion:

### 3.1. Gender of Infants with Congenital Anomalies:

The recent study discovered that the percentage of male infants with anomalies was larger than that of females, with rates of 8% and 16.3%, compared to 6.5% and 9.7% for females in 2021 and 2022, respectively. Our findings are consistent with Black *et al.*, (2020), who found that males had a higher occurrence of abnormalities than females. Our findings, however, vary from those of Hermanto *et al.*, (2020), who reported no significant variations in the number and proportion of male and female babies with abnormalities. The higher prevalence of male children with defects compared to females could be due to a considerable proportion of female infants with malformations not surviving beyond delivery (15). According to studies, males are more prone to malformations during organ creation, whereas females are sensitive during the amniotic sac stage. The latter stage might cause major difficulties during pregnancy, perhaps including fetal loss. Exposure during organ formation, on the other hand, increases the risk of congenital abnormalities (16).

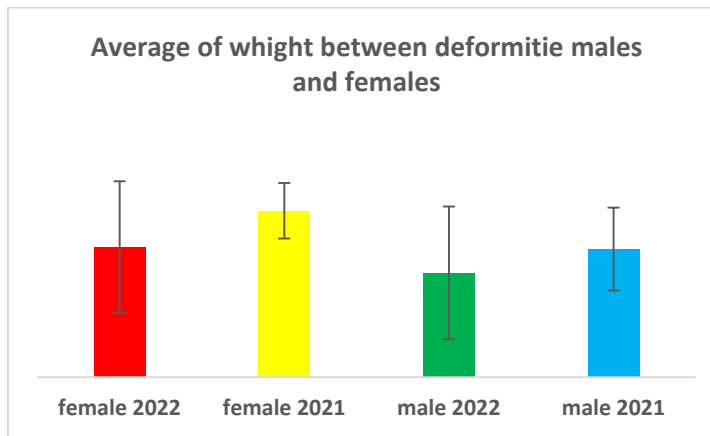


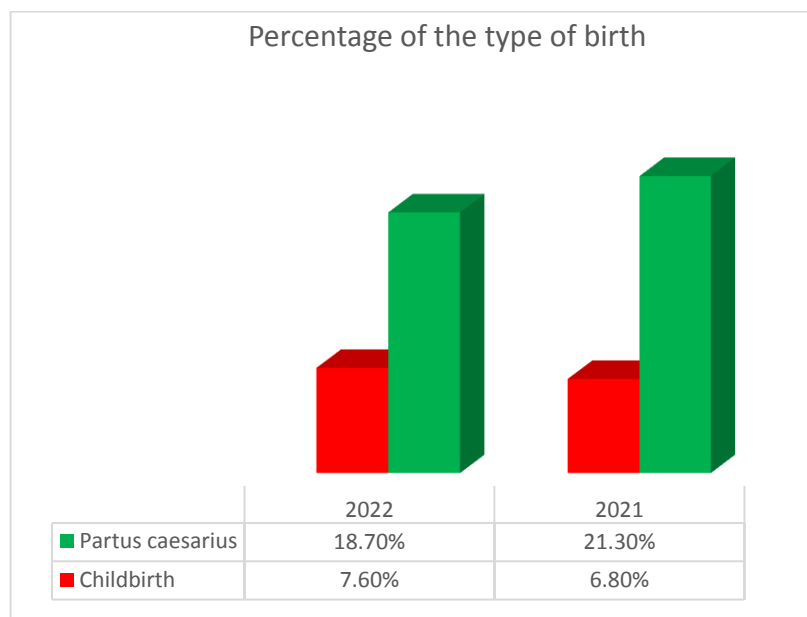
Figure 1: Average Weights of Male and Female Infants with Congenital Anomalies Over the Study Years

### 3.2. Weights of Infants with Congenital Anomalies

The study found no statistically significant differences in weight between males and girls over the study period. In 2021, males and females had an average weight of  $847 \pm 617.2$  and  $587 \pm 2400$ , respectively. In 2022, the average weights were  $1356 \pm 130.2$  for men and  $1343 \pm 660.2$  for women. According to studies, low birth weight is caused by defects that prevent normal fetal growth (17;18). Most studies imply that reduced birth weight is caused by fetal exposure to congenital defects, as well as the mother's age, nutritional habits, and overall prenatal care (19; 20). Furthermore, Sharma *et al.*, (2014) concluded that low birth weight is a result of congenital defects impacting infants rather than a cause.

### 3.3. Type of Birth

According to the present survey, the number of deliveries by cesarean section is rising. According to the data, the percentage for natural births was 6.8% in 2021 and 7.6% in 2022, whereas it was 21.3% and 18.7% in 2022, respectively.



**Figure 2: Percentage Distribution of Birth Types**

Our findings are consistent with Hermanto *et al.*, (2020), who reported a higher rate of cesarean section births among moms of infants with congenital abnormalities. Cesarean section births are intended to reduce mother and fetal mortality (22). There is no precise reason for the high percentage of cesarean section births, however it could be due to the difficulties of naturally delivering a kid with defects. Natural birth may be difficult because the infant has structural malformations or substantial head defects, making a cesarean section a viable option to prevent placing pressure on the newborn or endangering its life during natural birth.

### 3.4. Type of Anomalies

The current investigation found a variety of anomalies, including cardiovascular, reproductive, neurological, and digestive malformations, as shown in Table 1. According to the study, cardiovascular abnormalities accounted for the largest rate. These results are consistent with those published by Ali *et al.*, (2022), who found a higher prevalence of cardiovascular

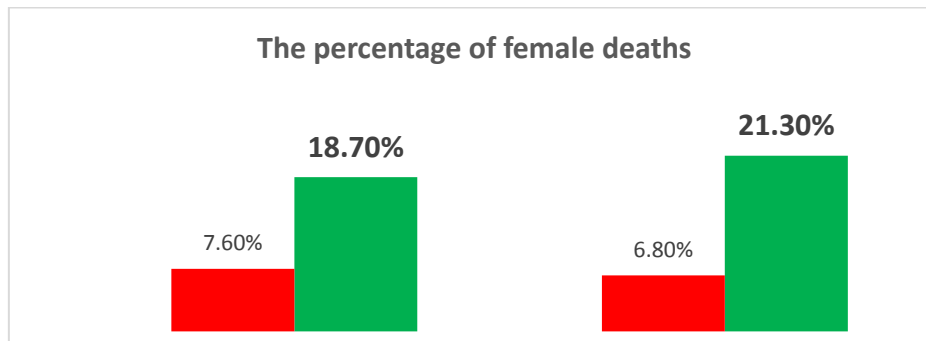
abnormalities. Furthermore, our findings are congruent with Taksande *et al.*, (2010), who discovered that cardiovascular anomalies were the most prevalent, followed by digestive and neurological anomalies. Most studies indicate that heart and neural tube defects are among the most serious types of anomalies (25). Anomalies are generally caused by genetic and environmental variables, such as maternal illnesses, maternal age, and medication use during important fetal development stages (26). One of the disorders impacting the mother and directly influencing abnormality occurrences is gestational diabetes, especially during the first eight weeks, a critical period for organ differentiation (27). According to Correa (2016), fetal growth suffers by embryonic abnormalities linked to gestational diabetes, and this results in elevated glucose levels in infants. Neural tube abnormalities are caused by a diet low in foods loaded with folic acid. Chromosome abnormalities, like chromosomal deviations, are important genetic variables. Fetal development abnormalities are also significantly influenced by gene diseases (29). Maternal age is linked to a number of fetal developmental problems.

**Table (1) below illustrates the percentage of anomalies in different body systems among newborns.**

The systems	Deformities	٢٠٢١		٢٠٢٢	
		Male	Female	Male	Female
Central Nervous System	Cleft Lip	2.3%	-	3.1%	-
	Meningomyelocele	1.2%	2.9%	2.1%	3.2%
	Hydrocephaly	1.2%	-	3.4%	-
	Anencephaly	2.5%	4.1%	-	-
	Eye defects	2.3%	1.1%	3.2%	-
Digestive System	Aproctia	1.1%	-	-	1%
	Gastroschisis	2.3%	1.2%	-	-
	Atreto Lemia	1.4%	1.3%	-	1.1%
Cardiovascular System	Congenital Heart disease	6.5%	5.1%	4.2%	3.9%
	Heart Protrusion	5.7%	4.9%	3.2%	-
	Terato logy Fallout	4.3%	3.8%	2.2%	1.7%
Reproductive system	Abnormalities ah external Genitalia	5.3%	5.1%	4.2%	3.3%
	Limb deformities	3.1%	2.7%	-	-

### 3.5. The Mortality

The study discovered that the percentage of mortality among infants with abnormalities was greater among females, reaching 3.1% and 5.6% in 2021 and 2022, respectively. Meanwhile, male death rates were (1.1%) and (2.3%) for the same years. These results correlate with the work of (15), demonstrating that the incidence of anomalies is higher in males due to the elevated death rate among females, affected by environmental factors during the amniotic sac stage (16). Our findings are comparable with those of Gon Calves *et al.*, (2021), who found a decrease in the number of live births among those with congenital abnormalities. Furthermore, the study by Nhoncane *et al.*, (2014) discovered that low birth weight and premature birth are significant indications of congenital defects, which contribute to the mortality of affected newborns. Furthermore, (31) underlined that congenital abnormalities are a prominent cause of neonatal fatal outcomes, accounting for (67%) of deaths in their study sample. Other studies highlight the impact of pregnant mothers missing to go on regular visits to healthcare centers, resulting in a lack of awareness about the nature and degree of fetal malformations, which significantly contributes to increased mortality rates, accounting for almost fifty percent of cases (32).



**Figure (3): Percentage of Deaths among Females**

**Conclusion:** The study concluded that the highest occurrence of congenital anomalies was observed in males compared to females, revealed a decrease in the weights of infants with anomalies, but no statistically significant differences were found in weights between males and females, The



percentage of resorting to cesarean section was higher than that for natural childbirth, The study indicated the presence of various anomalies obtained from the study samples, including cardiovascular anomalies, reproductive system anomalies, followed by neurological and digestive system anomalies, The mortality rate among females was the highest in the study sample.

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تأثير اضافة المستخلص المائي لبذور الرمان على الصفات الفيزيوكيميائية  
والحسية لبيرغر الدجاج

**Study of the chemical composition of pomegranate seeds  
and its introduction in extension the shelf life of burgers**

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قسم علوم الاغذية / كلية علوم الهندسة الزراعية / جامعة بغداد

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## Abstract

The study aimed to estimate the chemical composition of pomegranate seed powder and its content of protein, fat, ash, moisture and phenolic compounds (5.25, 18.23, 0.968, 4.926, 683.7), respectively. Then a aqueous extract was prepared from the pomegranate seed powder and added to the chicken meat burger product, as the aqueous extract was added to the burger mixtures with three concentrations, 0.5, 1, 1.5%. Burger after storage for 1, 2, 3, 4 weeks at a temperature of 5 ° C . the effect of the addition on the physical and sensory characteristics was studied, as well the estimation of the peroxide number and the value of malonaldehyde (TBA) for the burger samples after storage for 1, 2, 3, 4 weeks at a temperature of 5 ° C . The results showed that the addition of aqueous extract of pomegranate seeds improved the physical properties of burger nettles ( Thawing Loss, change in diameter after cooking, change in thickness after cooking) compared to the control model without any addition. the value of the peroxide number, it was for the burger models of the control group and the models to which the aqueous extract was added at a rate of 0.5, 1, 1.5% immediately after manufacturing, it reached (0.85, 0.83, 0.75, 0.74) mEq, respectively. As for the values of the peroxide number after 4 weeks of Storage, it increased in the samples of the control group and the models to which the aqueous extract was added by 0.5, 1, 1.5% and it was (1.20, 1.13, 1.09 and 1.12), respectively. the value of the TBA, it was for the burger models of the control group and the models to which the aqueous extract was added at a rate of 0.5, 1, 1.5% immediately after manufacturing (0.698, 0.681, 0.682, 0.676), respectively, while the value of the TBA increased after preservation for 4 weeks at a temperature 5 ° C percentages of the burger models for the control group and the models to which the aqueous extract was added at a percentage of 0.5, 1, 1.5%, and it amounted to (1.15, 0.95, 0.982, 0.935) respectively. The results of the sensory evaluation of the burger models, there was no clear effect on the sensory characteristics of the burger, and the highest scores were obtained by the D model (containing a aqueous extract of 1.5%), and then the rest of the manufactured models came.

**Key words:** Pomegranate seeds, aqueous extract, burger, TBA, peroxide value



## المقدمة

يعد الرمان ( *punica granatum L* ) من أحد أكثر المحاصيل الوظيفية اقتصاديا في العالم . نظرا لقدرته الواسعة على التكيف مع الظروف البيئية المختلفة وهو محصول مريح للغاية إذ يتم زراعة الرمان على نطاق تجاري واسع في جميع المناطق المناخية ( المناخات شبه الاستوائية و الاستوائية المعتدلة ) . فهو يزرع على نطاق واسع في ايران و أفغانستان و الهند و دول البحر الأبيض المتوسط ، و يزرع نوعا ما في الولايات المتحدة الأمريكية و الصين و اليابان و روسيا . ( Saeed et al 2013 ) . أن المناخات التي تكون مشابهة لمناخ البحر الأبيض المتوسط مثالية لنمو شجرة الرمان ، فهي تستهلك مباشرة كبذور طازجة ، و يمكن استعمالها أيضا في صنع العصير او الجيلي أو كمواد النكهة أو التلوين . فضلا عن الخصائص العلاجية التي تمتلكها و لها أهمية اقتصادية و بيئية ( Fischer et al ., 2011 ) . فهي تعد واحدة من أقدم الفاكهة الصالحة للأكل و التي تحتوي على تركيز عالي من إجمالي المركبات الفينولية مقارنة بالفواكه الأخرى التي تمت دراستها ( Elfalleh et al 2011 ) . وللمناخ دور كبير في مدى زراعة اي محصول او نبات اذ يجب التأكد من مدى ملائمة المناخ لزراعة المحاصيل Abdul Rahman et al (2023) ، أن المناخات التي تكون مشابهة لمناخ البحر الأبيض المتوسط مثالية لنمو شجرة الرمان بعض اصناف بذور الرمان غنية بالدهون و التي تتراوح بين 140 - 270 غم /كغم من المادة الجافة ) ( Hernandaz et al 1998 ) . اذ اكد Straccia et al ( 2016 ) على احتواء زيت بذور الرمان على ١٠-٢٠% من إجمالي وزن البذور ، مع نسبة عالية من الأحماض الدهنية غير المشبعة وخاصة نشاط حامض اللينوليك المتمثلة وفعالية المضادة للأكسدة والالتهابات . تحتوي بذور الرمان على الألياف الخام و الفيتامينات و البروتينات و البكتين و المعادن و السكريات و البولي فينولات و الايزوفلافون و الزيت المشتق منها يتميز بمحتوى عالي من الأحماض الدهنية المتعددة غير المشبعة مثل حمض اللينوليك و اللينولينيك ، ( Siano et al ., 2016 ) . و اشار Boroushaki et al (2016) الى محتوى زيت بذور الرمان من الاحماض الدهنية غير المشبعة اذ تم تحديد ٣٣ نوع من الأحماض الدهنية في زيت بذور الرمان اذ بلغت نسبة الاحماض الدهنية المتعددة غير المشبعة (PUFA) بنسبة ٨٣,١٦% . اذ لوحظ أن محتوى الزيت في تركيب البذور و الأحماض الدهنية يتأثر بمواقع الزراعة ووقت الحصاد والأنماط الجينية للفاكهة والظروف المناخية Ahmadvand et al (2015) . و اشار Elfalleh et al (٢٠١١) الى محتوى المستخلص المائي من المركبات الفينولية TPC لبذور الرمان صنف Gabsi التونسي تتراوح بين ١٣٤,٥٨ ملغ / مكافئ حامض الكاليك من الوزن

الطازج مقارنة مع المستخلص الكحولي اذ بلغت ٣٢٦,٥٦ ملغم / مكافى حامض الكاليك . و ارتبط استهلاك نظام غذائي نباتي أو نظام غذائي غني بالكيميائيات النباتية بتقليل مخاطر الإصابة بالأمراض البشرية المزمنة مثل أنواع معينة من السرطانات والالتهابات وأمراض القلب والأوعية الدموية بما في ذلك الفلافونويد والأنثوسيانين والتانينات ، هي المجموعة الرئيسية من المواد الكيميائية النباتية المضادة للأكسدة ذات الخصائص المثيرة للاهتمام ولها قيمة كبيرة بسبب أنشطتها البيولوجية وكسح الجذور الحرة (Mahmed *et al* 2021). ويعد ممارسو الطب التقليدي أن الرمان مزود بالفوائد الطبيعية المضادة للفيروسات والفطريات والبكتيريا اذ ان منذ العصور القديمة تم استخدام عصير الرمان كمادة قابضة طبيعية لعلاج الإسهال والطفيليات الداخلية الضارة ، يعتبر الرمان (*Punica granatum L*) ، الذي ينتمي إلى عائلة Punicaceae ، مصدرًا غذائيًا كثيفًا غنيًا بالمركبات الكيميائية النباتية (Seeram *et al*.,2006 ، Miguel *et al* .,2010). وأشار Lazeeza S. O (٢٠٢١) الى دور بذور الرمان لست اصناف من الرمان كمادة مضادة للاكسدة وذلك من خلال قياس محتوى تلك البذور من المركبات الفينولية فضلا عن قابيلتها على كبح الجذور الحرة، يُستهلك الرمان بشكل شائع كفاكهة طازجة ، كمشروبات (على سبيل المثال ، العصائر والنبيد) ، وكمنتجات غذائية (على سبيل المثال ، المربى والهلام) ، وكمستخلصات حيث يتم استخدامها كمكونات نباتية في الأدوية العشبية والمكملات الغذائية. المصدر الرئيسي للمواد الكيميائية النباتية الغذائية للرمان هو الفاكهة (قشر ، بذور وعصير). Liu *et al* (2012) و بين Zhao *et al* (٢٠١٤) الى محتوى بذور الرمان من المركبات الفينولية التي تلعب دورا مهما كمادة طبيعية مضادة للاكسدة . اللحوم مصدرًا أساسيًا بالبروتينات والدهون وبعض الفيتامينات والعناصر المعدنية، و ترتبط القيمة الغذائية لها بمحتواها الجيد من هذه المكونات (Abdulrahem *et al* 2022) ويكمن اهتمام المنتجين والمستهلكين في المحافظة على نوعية اللحوم ومنتجاتها من خلال الحد من التغيرات الفيزيائية والكيميائية والميكروبية لها وبالتالي المحافظة على قيمتها الغذائية وإطالة عمرها الخزني (Weber,.. and Antipatis 2001) اذ تتعرض الاغذية ذات المحتوى العالي من الدهون الى خطر عملية الاكسدة و تتزنخ الدهون بشكل سريع عند تعرضها للاوكسجين (et al 2012) وان اكسدة الدهون لها تاثيرات سلبية على جودة اللحوم المصنعة اذ تسبب تغير في الصفات الحسية والتغذوية (Trefan *et al.*, 2011) ويمكن حفظ اللحوم ومنتجاتها باستخدام المواد الحافظة الصناعية ومنها النترت و حامض البنزويك التي تؤدي الى تاخير او منع حدوث التغيرات الكيميائية و الميكروبية والنوعية وإطالة مدة خزنها الا ان مدى سلامة تلك المضافات والحدود المسموح بيها تثير العديد من التساولات ومدى خطورتها على المدى البعيد لذلك بدا التوجة نحو استخدام البدائل الطبيعية

كالنباتات ومستخلصاتها كبديل للمواد الحافظة وازادتها بشكل مباشر للاغذية (Kryževič et al 2017). لذلك هدفت الدراسة الى معرفة التركيب الكيميائي لبذور الرمان المجففة ومحتواها من المركبات الفينولية ودراسة تأثير اضافة مستويات مختلفة من المستخلص المائي لبذور الرمان في بعض الصفات الفيزيائية والحسية لاقراص بيرغر لحم الدجاج ومدى الاحتفاظ بهذه الصفات لفترات مختلفة فضلا عن دراسة تأثير الاضافة على الرقم البيروكسيدي ونسبة TBA خلال فترة الخزن .

### المواد وطرق العمل

١- اعداد العينة : تم شراء الرمان لفصل البذور والقشور باليد. تم غسل ثمار الرمان وتقطيعها يدويًا ، وتم استخلاص البذور وغسلها جيدًا وتجفيفها في حاضنة عند ٥٠ درجة مئوية لمدة ٣ ساعات. بعد تجفيف البذور ، تم طحنها جيدًا للحصول على مسحوق بذور الرمان ، حففت بعدها في درجة حرارة الغرفة ٢٥ درجة مئوية حتى إجراء الاختبارات.

### ٢- دراسة التركيب الكيميائي

تم اجراء التحليل الكيميائي لمسحوق بذور الرمان. اذ قدرت نسب البروتين والدهون والرماد والرطوبة والمركبات الفينولية في مختبرات الدراسات العليا في كلية علوم الهندسة الزراعية جامعة بغداد.

### ٢-١- تقدير نسبة البروتين:

تم تقدير نسبة البروتين باستخدام طريقة Micro Kildahl AOAC 2000

### ٢-٢- تقدير نسبة الدهن:

تم تحديد نسبة الدهن في عينات بذور الرمان باستخدام جهاز Soxhlet وباستخدام الهكسان مذيبا باتباع طريقة (Pearson 1972) تم وزن ٥ غرام من العينة ، ثم تم وضعها في دورق ترشيح وتم تغليف العينة بشكل جيد بورقتي ترشيح ، ثم تم تفكيكها. وضعت في الجزء المخصص من الجهاز وأضيف إليها ٢٥٠ مل من الهكسان. تم ضبط درجة حرارة الجهاز على ٥٠ م لمدة ٦ ساعات ، ثم تم تبخير المذيب من العينة باستخدام جهاز المبخر الدوار ، وتم حساب وزن الدهن على النحو التالي:

$$\text{نسبة الدهن} = \text{وزن الدهن} / \text{وزن العينة}$$

### ٢-٣- تقدير نسبة الرطوبة:

تم تقدير نسبة الرطوبة حسب ما ورد في AOAC 2005 حيث تم وزن ٥ غرام من مسحوق بذور الرمان ووضعها في وعاء خاص في فرن كهربائي على درجة حرارة ١٠٥ م حتى يستقر الوزن وتم تطبيق المعادلة التالية:

$$\text{نسبة الرطوبة} = \text{وزن العينة} - \text{وزن العينة بعد التجفيف} / \text{وزن العينة} \times 100\%$$

٢-٤- تقدير نسبة الرماد:

٥ غرام من العينة تم وزنها ووضعها في إناء خزفي ذي وزن معلوم وحرق في محرقة كهربائية. عند درجة حرارة ٦٠٠ درجة مئوية لمدة ٦ ساعات ، تم حساب نسبة الرماد من الفرق في الوزن على النحو التالي:

$$\text{نسبة الرماد} = \text{وزن النموذج قبل الحرق} - \text{وزن النموذج بعد الحرق} / \text{وزن العينة} \times 100\%$$

٢-٥- تقدير محتوى المركبات الفينولية الكلية:

اتبعت طريقة (Ayoola et al., 2008) تم تحديد إجمالي الفينولات باستخدام طريقة - Folin Ciocalteu وتم استخدام حمض الكاليك كمكافئ قياسي (ملغم / غم). تم خلط ٥٠٠ ميكرو لتر من كاشف (Folin-Ciocalteu) مع ١٠٠ ميكرو لتر من مستخلصات الرمان المخففة. بعد ٣ أو ٥ دقائق ، تمت إضافة ٤٠٠ مايكرو لتر كربونات الصوديوم بتركيز ٧,٥ % إلى الخليط وتبقى لمدة ٣٠ دقيقة في درجة حرارة الغرفة. تم قياس الامتصاصية بواسطة مقياس الطيف الضوئي عند طول موجي ٧٦٥ نانومتر.

٣- تحضير المستخلص المائي لمسحوق بذور الرمان : حضر المستخلص المائي حسب ما جاء في Gülçin et al., (٢٠٠٤) إذ اخذ ٢٥ غم مسحوق بذور الرمان مع ٢٥٠ مل من الماء المقطر وترك لمدة ساعتين على المازج المغناطيسي، رُشح بواسطة قمع بخنر خلال ورق ترشيح (Whatman No. 1) مع التفريغ بعد ذلك تُرك الراشح ليُجف وذلك بوضعه في اطباق في الفرن على درجة حرارة ٤٠ الا ان يجف ثم وضع في قناني معتمة وحفظت في الثلاجة لحين الاستعمال.

إدخال بذور الرمان في التصنيع الغذائي:-

١- تصنيع اقراص البيرغر :-

اتبعت طريقة (احمد ٢٠١٢) في تصنيع البيرغر و الجدول رقم ١ ادناه يبين نسبة المكونات الخلطة القياسية الداخلة في تصنيع البيرغر

جدول رقم ١ المكونات الرئيسية الداخلة في تصنيع اقراص بيرغر لحم الدجاج

المادة	الكمية (غم)
لحم	٨٠
دهن (شحم بطن)	١٠
مادة مالئة (طحين، فتات صمون)	٢
بهارات	١
ملح	(١,٥-١)
ثوم و بصل مطحون	٠,٥

### مكونات البيرغر

استعملت المواد التالية في تحضير البيرغر و التي شملت لحم صدر دجاج ، شحم بطن ، بهارات خاصة بالبيرغر ، فتات الخبز ، ملح طعام ، و مسحوق ثوم و بصل مطحون و مسحوق مستخلص الرمان ، تم الحصول على جميع المكونات من الاسواق المحلية اما بالنسبة لمسحوق مستخلص فتم تحضيره سابقا .

### أعداد البيرغر :

حضر البيرغر حيث تم ثرم و خلط لحم صدر الدجاج مع لحم الشحم وتم وضعها في اناء زجاجي دائري متوسط الحجم وتم اضافة الملح ، مسحوق الثوم والبصل المطحون ، البهارات وفتات الصمون ثم تم تقسيمها إلى ٤ مجاميع و حسب التالي بأستعمال مسحوق مستخلص بذور الرمان إذ تم تصنيع أربع نماذج من البيرغر، حيث يمثل النموذج A المكونات القياسية للبيرغر كعينة ضابطة ثم النموذج B تم اضافة ٠,٥ g من مسحوق مستخلص بذور الرمان مع المكونات القياسية ، النموذج C تم اضافة ١g من مسحوق مستخلص بذور الرمان مع المكونات القياسية للبيرغر ، النموذج D تم اضافة ١,٥ g من مسحوق مستخلص بذور الرمان مع المكونات القياسية . تم تشكيل العينات على شكل أقراص دائرية بواسطة قالب خاص حيث تم تقسيم كل نموذج إلى خمس مكررات بوزن ١٠٠ g و تم وضعها في قوالب و تغليفها بورق البيرغر الخاص ثم تم إجراء الاختبارات الحسية و حفظها في درجة حرارة ٥ مئوية لمدة ٣ أسابيع .

### جدول رقم ٢ تركيب نماذج البيرغر

النموذج	بهارات غم	ملح غم	بصل و ثوم غم	فتات غم	شحم غم	لحم غم	مستخلص بذور الرمان %
A	5	5	2.5	10	100	٤٠٠	---

B	5	5	2.5	10	100	400	٠,٥
C	5	5	2.5	10	100	٤٠٠	١
D	5	5	2.5	10	100	٤٠٠	١,٥

## ٢- دراسة الصفات الفيزيائية لأقراص البيرغر

### ٢-١. الفقد في الوزن أثناء الاذابة Thawing Loss

قدرت النسبة المئوية الفقد أثناء الاذابة حسب طريقة ( *et al/ Nam* ) (٢٠٠٠) إذ تم وزن أقراص البيرغر لكل معاملة وهي جامدة ، ثم وضعت على مشبك سلكي في الثلاجة لمدة ٢٤ ساعة حتى تمام الذوبان أزيل الماء الناضح واعد وزنها ثانية ، استخرجت النسبة المئوية الفقد أثناء الاذابة حسب المعادلة الآتية :

نسبة الفقد (%) = وزن العينة المجمدة g - وزن العينة بعد ازالة الماء الناضح غم / وزن العينة المجمدة غم × ١٠٠%

### ٢-٢. الفقد في الوزن أثناء الطبخ Cooking loss

قدرت النسبة المئوية الفقد أثناء الطبخ حسب طريقة ( *et al/ Nam* ) (٢٠٠٠) ، إذ تم وزن أقراص البيرغر قبل قليها، ثم قليت بكمية دهن بسيطة في مقلاة واسعة لحين النضج ثم وزنت أجريت عملية شواء قطع البيرغر باستعمال شواية خاصة بعد طليها بالزيت باستعمال فرشاة وعلى درجة 180م لمدة ٢ دقيقة لكال الجهتين من البيرغر على أن تقل درجة حرارة مركز قرص البيرغر عن ٨٠ مئوية للوصول إلى درجة الشوي المتجانس والمتكامل . وتم حساب النسبة المئوية الفقد أثناء الطبخ حسب المعادلة الآتية :

الفقد أثناء الطبخ % = الوزن قبل القلي g - الوزن بعد القلي غم / الوزن قبل القلي غم × ١٠٠ %

### ٢-٣- التغيير بالقطر بعد الطبخ :

تم حساب النسبة المئوية التغيير بقدر أقراص البيرغر بعد القلي حسب طريقة ( *et al/ Nam* ) (٢٠٠٠) إذ تم قياس قطر ٤ أقراص بعد كل معاملة و بواقع ثلاث قراءات للقرص الواحد قبل القلي و بعده و بأستعمال أداة الفيرنية و احتسبت النسبة المئوية التغيير بالقطر بعد الطبخ حسب المعادلة الآتية :

التغيير بالقطر % = القطر قبل الطبخ Cm - القطر بعد الطبخ Cm / القطر قبل الطبخ Cm × ١٠٠%

### ٢-٤ - التغيير بالسلك بعد الطبخ :

تم احتساب النسبة المئوية التغيير بسلك أقراص البيرغر بعد الطبخ حسب طريقة *et al/ Nam* (٢٠٠٠) ، إذ تم قياس سلك ٤ أقراص بعد كل معاملة و ع ثلاث قراءات للقرص الواحد قبل القلي و بعده و بأستعمال أداة الفيرنية و احتسبت النسبة المئوية التغيير بالسلك بعد الطبخ حسب المعادلة الآتية :

$$\% \text{ التغيير بالسلك} = \frac{\text{السلك قبل الطبخ Cm} - \text{السلك بعد الطبخ سم}}{\text{السلك قبل الطبخ سم}} \times 100$$

### ٣-دراسة تاثير اضافة المستخلص على الرقم البيروكسيدي و حامض الثايوباربيتوريك

#### ٣ - ١ - رقم البيروكسيد :

هو عدد ملي مكافئات البيروكسيد الموجودة في ١ كغم زيت أو دهن قدر الرقم البيروكسيدي وفقا للطريقة المعتمدة من قبل AOAC (2005) يؤخذ ٥ غم عينة ويضاف لهم ٢٥ مل مخلوط مذيبات ( حامض الخليك الثلجي و الكلوروفورم بنسبة ٢:٣ ) + ١ مل يوديد بوتاسيوم مشبع ويغطي الدورق ويرج رج رحوى لمدة ٢ق . يضاف ٣٠ مل ماء مقطر لإيقاف التفاعل و أفراد اليود الذى يعادل بواسطة ثايوسلفات الصوديوم ٠,١ ع فى وجود دليل النشا . تجرى التجربة البلانك بدون عينة. يتم حساب رقم البيروكسيد من المعادلة الآتية:

$$\text{قيمة البيروكسيد (مليمكافيء/كغم زيت)} = \frac{1000 \times N \times S}{g}$$

S = مل من ثايوسلفات الصوديوم Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub>

N = عيارية ثايوسلفات الصوديوم

g = عدد غرامات النموذج

#### ٣-٢ - تقدير رقم حامض الثايوباربيتوريك

تم تقدير رقم حامض الثايوباربيتوريك على وفق طريقة AOAC (2005) وذلك بأخذ ١٠ غم اللحم المثلوم ونقع لمدة ٢ دقيقة في ٥٠ مل ماء مقطر وأضيف إليه ٥ مل محلول حامض الهيدروكلوريك (٤ عياري) لخفض الأس الهيدروجيني إلى ٥,١ وأكمل الحجم إلى ١٠٠ مل ماء مقطر نقل المزيج إلى دورق تقطير سعة ١٠٠ مل وأضيف ٢ مل زيت البارفين و ١ غم حجم جاف لتنظيم الغليان ومنع الفوران. ربط جهاز التقطير وتم التسخين لغاية جمع ٥٠ مل من مادة التقطير، وحضر محلول البلانك في الوقت نفسه من الماء المقطر. قدرت الامتصاصية بواسطة المطياف الضوئي على طولها ٥٣٨ نانوميتر و تم حسبت TBA على أساس ملغم مالونالديهاد / كغم لحم بضرب قراءة الامتصاص بالعامل ٨,٧.

## ٤- التقييم الحسي

أجرى التقييم الحسي لعينات البيرغر بعد التصنيع مباشرة من قبل ١٢ مقيما و استخدمت استمارة استمارة التقييم الصفات الحسية ( اللون ، الرائحة ، النكهة ، القوام و التقبل العام )

## النتائج والمناقشة

## ١- دراسة التركيب الكيميائي لمسحوق بذور الرمان

يبين الجدول ٣ نتائج اختبارات التركيب الكيميائي لبذور الرمان حيث كانت نسبة البروتين ٥,٢٥٪ ونسبة الدهن ١٨٪ والمحتوى الرطوبي ٤,٩٢٦٪ ونسبة الرماد في العينة ٠,٩٦٨٪. ونسبة الكاربوهيدرات ٧٠,٥٦. المحتوى الكلي للمركبات الفينولية ٦٨٣,٧ ملغم / كغم وأشار Anesini et al (٢٠٠٨) الى ان نتائج التركيب الكيميائي لبذور الرمان كانت ، نسبة البروتين الخام ١٣,٢٪ ، الدهن ٢٧,٢٪ ، الرماد ٢,٠٪ و محتوى الرطوبة ٨,٦٪. وهي اقل من النتائج التي حصل عليها في الدراسة وقد يعود السبب الى اختلاف الصنف المستعمل في الدراسة فضلا عن الظروف التصنيعية التي ممكن ان تؤثر على تركيب البذور ومنها عمليات التجفيف والانبات والترطيب كل تلك العوامل من الممكن ان يكون لها تأثير على التركيب الكيميائي للبذور (Hmsa and Mahommed 2023).

## جدول ٣ يبين التركيب الكيميائي لمسحوق بذور الرمان

النسبة %	التركيب الكيميائي
18.23	الدهن
4.926	الرطوبة
0.968	الرماد
5.25	البروتين
70.56	الكاربوهيدرات
683.7 ملغم / كغم	المركبات الفينولية

## ٢- دراسة الصفات الفيزيوكيميائية لأقراص البيرغر

تعتمد نسبة الفقد في الوزن البيرغر بعد الطبخ على عدة عوامل تبدأ من نوعيه المكونات ومن ثم التصنيع وتنتهي بطريقه الطبخ اذا لوحظ ان المزج الجيد يساعد على ربط مكونات اللحم ببعضها كذلك زياده قابليه البيرغر على حمل الماء وبالتالي تقلل من نسبة الفقد الكلي من الوزن بعد الطبخ وتؤثر درجه حراره طبخ في احداث تغيرات في البروتين والكولاجين بسبب زياده ذوبانه لذا فان طبخ اللحم بوجود



الرطوبة يؤدي الى تشبع الكولاجين بالماء وتحلله بالحرارة الى جيلاتين ويصبح اكثر طراوة وتزداد قابليته على حمل الماء وهناك ايضا تاثير لدرجه الحرارة الطهي في مقدار الرطوبة المفقودة من اللحم اذا تناسب كميته الفقد طرديا مع درجه الحرارة يرافق الرطوبة اثناء الطهي فقدان في الوزن الناجم عن نضوح سوائل اللحم وتبخر الماء وتبخر المواد المتطايرة والفقدان في بعض العناصر الغذائية وما ينجم عنها من فقدان بعض صفات الاستساغة وخروج عصاره اللحم بفعل الانكماش اثناء الطبخ وفقدان العناصر الغذائية الذائبة في الماء. ان الزيادة في فقدان السائل بعد الطبخ تؤدي الى انخفاض الطراوة والعصيرية ودرجه تقبل اللحم (العاني ٢٠٠٤). ويلاحظ من النتائج ان اعلى فقد بالوزن بعد الاذابة كان في الخلطة القياسية (A) وبعدها جاءت الخلطة C ، B ، D ، وايضا حصلت اعلى فقد بالوزن بعد الطبخ للخلطة القياسية (A) وبعدها جاءت الخلطات C ، B ، D ، اما التغير بالسلك فقد حصلت الخلطة القياسية A على اعلى نسبة وكانت ١٨,٧٩ % وبعدها جاءت باقي الخلطات كما موضح في الجدول اما نسبة التغير بالقطر فقد حصلت الخلطة القياسية على اعلى النتائج وبعدها جاءت باقي الخلطات من النتائج الفحوصات الفيزيائية يشير الى مدى دور المستخلصات في تحسين الصفات الفيزيائية في نماذج البيرغر مقارنة بالخلطة القياسية التي لم تحتوي على اي اضافة (عجينة ٢٠٠١)، وجاءت النتائج مقارنة لما توصل اليه Estrella et al (٢٠٢٠) الذي اكد على تحسين خصائص السلك بعد الطبخ لنماذج البيرغر عند اضافة مستخلص نوى التمر فضلا عن زيادة العمر الخزن لنماذج البيرغر. وبين التميمي و ابو المعالي (٢٠١١) الى حدوث تغيرات بالصفات الفيزيائية المتمثلة بالفقد بالاذابة والتغير بالقطر والتغير بالسلك عند اضافة الزنجبيل بنسب مختلفة الى نماذج البيرغر

جدول ٤- الفحوصات الفيزيائية لنماذج البيرغر بعد التصنيع

النموذج	الفقد بالوزن بعد الاذابة	الصفات الفيزيائية	
		التغير بالسلك %	التغير بالقطر %
A	4.23	45.15	18.79
B	3.36	33.6	18.56
C	3.75	37.66	17.45
D	2.89	34.13	18.45

٣- - تأثير اضافة المستخلص المائي على الرقم البيروكسيدي وقيمة TBA

يبين الجدول ٥ قيم الرقم البيروكسيدي لنماذج البيرغر بعد التصنيع مباشر وبعد اجراء الخزن لمدة ٢١ يوم يلاحظ من النتائج ان قيم الرقم البيروكسيدي لنماذج البيرغر A ، B ، C ، D قد بلغت ( 0.85 ، 0.83 ، 0.75 ، 0.74 ) ملي مكافي /كغم زيت على التوالي ، ثم بدت القيم بالارتفاع خلال فترة الخزن ولكن كانت اعلى نسبة في النموذج القياسي الخالي من اي اضافة مقارنة بنماذج البيرغر التي احتوت على المستخلص المائي لبذور الرمان . ويستعمل اختبار الرقم البيروكسيدي للكشف عن اكسدة الدهون في اللحوم ولاحظ *Sallam et al* (٢٠١٠) ارتفاع قيم البيروكسيدي في عينات الصوصج المخزون بالتبريد في درجة حرارة ٣ لمدة ٢١ يوم اذ بلغ ٢,٧١ بينما ادت اضافة كسبة جنين القمح بنسبة (٠,٩ غم / كغم ) الى تثبيط الاكسدة ، واكدت *Mohammed et al* (٢٠٢٣) الى امكانية تحسين قيم الرقم البيروكسيدي باضافة مستخلص بذور المعدنوس الى نماذج البيرغر المصنع من اللحم البقري.

جدول ٥- قيم الرقم البيروكسيدي PV لنماذج البيرغر خلال فترة الخزن في درجة حرارة ٥ مئوية

النماذج				البوم	
D	C	B	A		
0.74	0.75	0.83	0.85	اليوم الاول	
1.03	0.97	1.01	1.08	٧ ايام	
1.07	1.03	1.05	1.12	١٤ يوم	
1.09		1.12	1.13	1.20	٢١ يوم

اما قيم TBA فكانت اعلى قيمة لدى معاملة السيطرة التي ازدادت فيها قيم ال TBA بينما انخفضت في بقية المعاملات التي اضيف اليها المستخلص المائي لبذور الرمان خلال فترة الخزن . ويستخدم اختبار TBA لتحديد درجة تزنخ الدهون في الاغذية اثناء الخزن بالتبريد والتجميد وقد لاحظ *et al SALLAM* (٢٠١٠) حدوث ارتفاع طفيف في قيم ال TBA من ٠,١٤٠ الى 0.214 عند اضافة مسحوق الزنجبيل بمقدار ( 0.9 غم/كغم ) الى صوصج الدجاج المخزون بالتبريد في ٣ لمدة ٢١ يوم في حين سجلت معاملة السيطرة ارتفاعا اكبر بلغ ١,٧١ . ويعود السبب في تحسين الخصاص المضادة للاكسدة لنماذج البيرغر الى محتوى بذور الرمان من المركبات الفعالة (*Gelareh,et al 2009*) ، و اكد ., *Mokhtar, and Youssef* (٢٠١٤) على انخفاض قيمة TBI لنماذج البيرغر اللحم البقري عند اضافة عدد من المستخلصات النباتية والخزن لمدة ١٥ يوم على درجة حرارة ٤ مئوي ، يلاحظ من نتائج اختبار الرقم البيروكسيدي وال TBA ان اضافة المستخلص المائي لبذور الرمان قد ادى الى اطالة فترة حفظ

اقراص البيرغر وذلك من خلال المقارنة مع نموذج السيطرة التي ارتفعت فيه نسبة الرقم البيروكسيدي وال  
TBA .

جدول ٦ قيمة TBA لنماذج البيرغر بعد التصنيع وخلال مدة الخزن في درجة حرارة ٥ مئوية

النماذج				اليوم
D	C	B	A	
0.676	0.682	0.681	0.698	اليوم الاول
0.688	0.694	0.735	0.789	٧ ايام
0.854	0.893	0.895	0.93	١٤ يوم
0.935	0.982	0.95	1.15	٢١ يوم

#### ٤- التقييم الحسي

بينت نتائج التقييم الحسي ان اضافته مستخلص بذور الرمان الى اللحوم في صناعه البيرغر لم يوثر بشكل كبير في الصفات الحسية فقد يلاحظ ان الخلطة D (الذي يحتوي 1.5غم مستخلص ) كانت الافضل من حيث الطعم واللون والقوام والرائحة والقبول العام وبعدها جاء النموذج C (الذي يحتوي على مستخلص مائي بنسبة ١ ) وبعدها جاء النموذج A ، B على التوالي بينت النتائج من امكانيه استخدام مستخلص مسحوق بذور الرمان كماده امنه الاستعمال ورخيصه الثمن لم يوثر على التقييم الحسي لنماذج البيرغر فضلا عن التأثير الايجابي لمستخلصات البذور في الصفات النوعيه للبرغر فضلا عن اطالة العمر الخزني له .واتفقت النتائج مع (Naveena et al) 2001 اذا ارتفعت نتائج التقييم الحسي لنماذج بيركر الدجاج عند اضافة الزنجبيل بنسبة ٣%. وقد اكدت النتائج الحاصل عليها من الدراسة الكثير من الدراسات ان المركبات الفينولية المتواجدة في الكثير من المركبات العطرية منها بذور الكمون ومستخلص العنب والبانونج كان لها دور تأثيرا كبيرا في تحسين نتائج التقييم الحسي. (Cheng. and Ockerman., 1998 ،Al-Rubeii et al, 2009)

#### ٧- التقييم الحسي

النموذج	طعم	لون	رائحه	قوام
A	٧	٨	٦	٥
B	٦	٨	٥	٧
C	٨	٩	٨	٨
D	٨	٩	٩	٩

٥-التوصيات

بينت نتائج البحث ان اضافة مستخلص بذور الرمان وبالمستوى ١,٥ % الى اقراص البيبركر قد حقق افضل النتائج اذ اطال من العمر الخرنى فضلا عن تحسين الخصائص الخرنية والحسية بعد اجراء عملية الخزن من خلال تقدير قيمة الرقم البيروكسيدي وقيمة المالنوالديهايد لذلك يوصى باستعمال المخلفات التصنيعية مثل المستخلص المائي لبذور الرمان في تحسين الخصائص الخرنية لمنتجات اخرى مثل منتجات اللحوم الاخرى تلك التي تتميز بسرعة الاكسدة والتلف والابتعاد قدر الامكان عن مضادات الاكسدة الصناعية ذات التأثيرات الجانبية على صحة المستهلك فضلا عن الاستفادة من مخلفات بعض المنتجات التصنيعية .

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## Exploring The Correlation Between Iron Deficiency Anemia, Dopamine, Vitamin D, And Ferritin Levels: Implications For Neurological Health

استكشاف العلاقة بين فقر الدم الناجم عن نقص الحديد والدوبامين وفيتامين د ومستويات الفيريتين: الآثار المترتبة على الصحة العصبية

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**ABSTRACT**

Iron deficiency anemia arises when the balance of iron intake, iron stores, and the body's loss of iron are insufficient to fully support production of erythrocytes. Iron is an essential micronutrient for several physiological functions, including regulating dopaminergic neurotransmission. At the same time, vitamin D is necessary for cells in CNS, so that thought, there is a relationship between anemia and dopamine. 25 sample was collected from adult patients from 11/2022 to 2/2023 from private medical laboratories. after collect samples have been measured dopamine, vitamin D and iron respectively and by using ELISA Kit; E-EL-0046; Elabscience Biotechnology Inc., 25-OH Vitamin D Total (Vit D- Direct) Test System; 9425-300; Monobind Inc. and Iron Direct Method (Ferene); 92108; Biolabo. Results showed an anemia effect in dopamine and vitamin D with significant differences and there is a relationship among dopamine, vitamin D, and iron with significant differences. At the same time, there isn't a relationship between vitamin D and ferritin. Depending on this study, iron deficiency anemia is correlated with vitamin D and ferritin deficiency and increasing dopamine.

**Key words: Iron deficiency anemia, dopamine, vitamin D, iron, ferritin.**

**الخلاصة**

ان فقر الدم الناتج بسبب نقص الحديد يحدث في حالة عدم وجود توازن في كمية الحديد المتناولة وبين مخزون الحديد في الجسم وهذا النقص الحاصل في الحديد ينتج عنه عدم القدرة على انتاج كريات الدم الحمراء بصورة صحيحة. يعتبر الحديد من المغذيات الدقيقة الأساسية للعديد من الوظائف الفسيولوجية ، بما في ذلك تنظيم النقل العصبي للدوبامين. في الوقت نفسه ، فيتامين د ضروري للخلايا في الجهاز العصبي المركزي ، لذلك يعتقد أن هناك علاقة بين فقر الدم والدوبامين. تم جمع ٢٥ عينة من المرضى البالغين في الفترة من ٢٠٢٢/١١ إلى ٢٠٢٣/٢ من المعامل الطبية الخاصة. بعد جمع العينات تم قياس الدوبامين وفيتامين د والحديد على التوالي وباستخدام ELISA Kit ؛ E-EL-0046 ؛ شركة Elabscience Biotechnology Inc. ، نظام اختبار ٢٥ -OH Vitmin D Total (Vit D- Direct) ؛ ٩٤٢٥-٣٠٠ ؛ شركة Monobind Inc. و Iron Direct Method (Ferene) ؛ ٩٢١٠٨ ؛ بيولابو. أظهرت النتائج تأثير فقر الدم في الدوبامين وفيتامين د مع وجود فروق معنوية وتوجد علاقة بين الدوبامين وفيتامين د والحديد مع وجود اختلافات معنوية. في الوقت نفسه ، لا توجد علاقة

بين فيتامين د والفيريتين. اعتمادًا على هذه الدراسة ، يرتبط فقر الدم الناجم عن نقص الحديد بفيتامين د ونقص الفيريتين وزيادة الدوبامين.

## INTRODUCTION

The key cellular processes of oxygen transport and cellular respiration are two of the many crucial cellular processes iron plays a role in. Iron also functions as a cofactor for many different enzymes. Due to its capacity to produce free radicals through the Fenton reaction, free iron is known to induce oxidative damage in the cellular environment despite its relevance (1,2). Every living thing needs iron, which is a necessary nutrient for several processes like oxygen transport, cellular respiration, immunological response, neurotransmitter metabolism, and DNA synthesis (3). With 30% of the world's population suffering from iron deficiency anemia (IDA), the WHO has identified IDA as the most prevalent nutritional deficit worldwide.(4) The animal model demonstrates the grave and protracted effects of extreme iron deficiency (ID), including modifications to the brain, neurotransmission, myelination, and epigenetics. (5) Phenylalanine is an amino acid that has to be supplied from food in order to be converted into dopamine. Dopamine functions via five different kinds of G-protein-coupled receptors and is primarily recognized as a neurotransmitter involved in nearly all higher executive actions. DA, also known as 4-(2-aminoethyl)-1,2-benzenediol, is a major neurotransmitter in the nervous system of mammals. The so-called dopaminergic neurons, which are distributed throughout the brain but are particularly prevalent in the substantia nigra, are responsible for producing and releasing it in the central nervous system. The substantia nigra pars compacta's dopaminergic neurons project to the striatum, where certain receptors are engaged. From there, the signal is sent to the pallidus, the thalamus, and the substantia nigra pars reticulata via projection neurons and additional circuitry. From motor control to cognition, practically every centrally regulated activity involves DA. (6) The epidermis produces vitamin D3 from the synthesis of vitamin D. (7). Vitamin D is a crucial chemical that regulates the body's calcium and phosphorus levels as well as antioxidant, inflammatory, and immune system functions (8). Vitamin D is

necessary for appropriate brain function and brain growth (9). In the central nervous system (CNS), it also has a significant impact on cell growth and differentiation (10). According to several research, neuropsychiatric disorders such severe depression, schizophrenia, and attention deficit hyperactivity disorder (ADHD) may be linked to vitamin D insufficiency (11).

## MATERIALS AND METHOD

Twenty - five blood samples were collected from adults males who have anemia; from hospitals in Hilla city during December / 2022 to March / 2023. In this study have been measured dopamine, vitamin D3, iron and ferritin.

Dopamine by using DA( Dopamine ) ELISA Kit; E-EL-0046; Elabscience Biotechnology Inc. to measure dopamine (after reagent preparation) by flowed:

1. Determine wells for diluted standard, blank and sample. Add 50  $\mu$ L each dilution of standard, blank and sample into the appropriate wells (It is recommended that all samples and standards be assayed in duplicate. It is recommended to determine the dilution ratio of samples through preliminary experiments or technical support recommendations). Immediately add 50  $\mu$ L of Biotinylated Detection Ab working solution to each well. Cover the plate with the sealer provided in the kit. Incubate for 45 min at 37°C. Note: solutions should be added to the bottom of the micro ELISA plate well, avoid touching the inside wall and causing foaming as much as possible.
2. Decant the solution from each well, add 350  $\mu$ L of wash buffer to each well. Soak for 1 min and aspirate or decant the solution from each well and pat it dry against clean absorbent paper. Repeat this wash step 3 times. Note: a microplate washer can be used in this step and other wash steps. Make the tested strips in use immediately after the wash step. Do not allow wells to be dry.
3. Add 100  $\mu$ L of HRP Conjugate working solution to each well. Cover the plate with a new sealer. Incubate for 30 min at 37°C.
4. Decant the solution from each well, repeat the wash process for 5 times as conducted in step 2.

5. Add 90  $\mu$ L of Substrate Reagent to each well. Cover the plate with a new sealer. Incubate for about 15 min at 37°C. Protect the plate from light. Note: the reaction time can be shortened or extended according to the actual color change, but not more than 30 min. Preheat the Microplate Reader for about 15 min before OD measurement.
6. Add 50  $\mu$ L of Stop Solution to each well. Note: adding the stop solution should be done in the same order as the substrate solution.
7. Determine the optical density (OD value) of each well at once with a microplate reader set to 450 nm.

Vitamin D3 was measured by using 25-OH Vitmin D Total (Vit D- Direct) Test System; 9425-300; Monobind Inc. Iron was measured by using Iron Direct Method (Ferene); 92108; Biolabo. Ferritin was measured in the hospital to diagnose the type of anemia.

## RESULTS

Anemia is a medical condition in which the body lacks enough healthy red blood cells or hemoglobin to carry oxygen to the body's tissues. It can cause symptoms such as fatigue, weakness, shortness of breath, headache, dizziness, and pale skin.

There are several different types of anemia, including iron-deficiency anemia, vitamin deficiency anemia (such as B12 deficiency), hemolytic anemia (where red blood cells are destroyed too quickly), and aplastic anemia (where the body doesn't produce enough red blood cells). in this study, the type of anemia is iron-deficiency anemia and its relationship with dopamine, vitamin D3, iron, and ferritin. Results showed dopamine and iron were increased with anemia with significant differences, while vitamin D3 was decreased with significant differences (Table 1). Dopamine is affected by vitamin D3, iron, and ferritin; also, iron is affected by dopamine, vitamin D3, and ferritin; while vitamin D3 is affected by dopamine and iron but not by ferritin; and ferritin is affected by dopamine and iron but not by vitamin D3 (Table 2).

**Table 1: values of dopamine, vitamin D3, iron and ferritin in patient with iron-deficiency anemia (Mean  $\pm$  SE)**

Test	Mean	Std.
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		<b>Error Mean</b>
<b>Dopamine</b>	<b>1860.08*</b>	<b>89.92</b>
<b>Iron</b>	<b>299.53*</b>	<b>47.34</b>
<b>D3</b>	<b>*٢١,٨٧٣٨٢٣</b>	<b>0.76</b>
<b>Ferritin</b>	<b>*٥,٩٠٩١</b>	<b>0.86</b>

\* significant differences  $p < 0.05$

**Table 2: relationship among dopamine, vitamin D3, iron and ferritin (Mean $\pm$  SE)**

	<b>Mean <math>\pm</math> Difference (I-J)</b>
<b>Dopamine</b>	<b>1576.82225*</b>
	<b>1778.53885*</b>
	<b>1800.14000*</b>
<b>Iron</b>	<b>-1576.82225*</b>
	<b>201.71660*</b>
	<b>223.31775*</b>
<b>D3</b>	<b>-1778.53885*</b>
	<b>-201.71660*</b>
	<b>21.60115</b>
<b>Ferritin</b>	<b>-1800.14000*</b>
	<b>-223.31775*</b>
	<b>-21.60115*</b>

\* significant differences  $p < 0.05$

## DISCUSSION

Iron deficiency anemia is due to the lack of sufficient iron to form normal red blood cells; it is the most common cause of anaemia worldwide. Iron deficiency may be the result of blood loss, inadequate dietary intake or malabsorption(12). As the main iron storage protein in the body, the majority of ferritin is intracellular. However, a soluble form is found in the blood and can be assayed(13). in a similar study, If a patient with a normal complete blood count exhibits signs of iron deficiency anemia, particularly when they are coupled with low ferritin levels, suspicion should be raised. This is especially true if the patient's medical history suggests that they may be iron deficient (14).

Effects of iron restriction on dopamine metabolism have been extensively investigated in human and in animal models, especially in the nigrostriatal pathway(15). one study that refer to the reduction of dopamine metabolites in iron deficient animals is a robust phenomenon and this is similar to recent study(16). In another study that refer the central dopamine pathways is the most sensitive to Iron deficiency (17).

Serum iron is a measure of the amount of iron bound to transferrin in the plasma. Only a small proportion of the body's iron is bound to transferrin at any one time (18), there is a rapid turnover of transferrin-bound iron and circulating iron concentration can be affected by dietary intake; as a result, there is significant variation in iron concentration within each day and between days (19).

An association between vitamin D and anemia has surfaced in recent years, suggesting potential roles for vitamin D in iron homeostasis and erythropoiesis. This association between vitamin D and anemia has emerged as the role of vitamin D in health is still being defined, particularly in terms of extra-skeletal functions. Many observational studies in both healthy and ill groups have described this connection (20). As results, Vitamin D status has been positively associated with hemoglobin concentrations and inversely associated with risk for anemia, particularly anemia of inflammation (21).

Dopamine metabolism in the brain, as well as the operation of monoamine transporters and receptors, are disrupted by iron deficiency(22). As a results but in brain, iron deficiency causes a decrease in the density of dopamine D<sub>2</sub> receptor (D<sub>2</sub>R) in the striatum and nucleus accumbens of rats (23).

VD3 deficiency may have a negative influence on critical processes necessary for brain function, as neurotransmission, synapse formation, synaptic plasticity, and dendritic arborization (24). Recent evidence suggests effects of vitamin D3 on dopamine circuits (25).

## CONCLUSION

In this study, there is a relationship among anemia, dopamine, ferritin, and vitamin D3; except for ferritin and vitamin D3, they are not affected by each other.

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استخدام نموذج تسعير الموجودات الرأسمالية في تقييم الموجودات المالية  
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٢٠١٧-٢٠٢٣

**Using the capital asset pricing model to evaluate financial assets  
An analytical study of a sample of companies listed on the Iraqi  
stock market for the period from 2017-2023.**

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## المستخلص:

نتيجة التطور التكنولوجي والعولمة حظيت الأسواق المالية في الوقت الراهن بمكانه متميزه اذ اصبح مقدار النشاط الاقتصادي للدول يقاس بمدى تعاملاتها في الأسواق المالية من خلال مساهمتها في الاستثمارات المالية واستنادا الى ذلك تهدف هذه الدراسة لفحص نموذج تسعير الموجودات الراسماليه على ٣٠ مصرف وشركة مدرجة في سوق العراق للأوراق المالية خلال الفترة (٢٠١٧-٢٠٢٣) وذلك من خلال الاعتماد على البيانات السنويه المنشورة للعينة وللفترة المدروسة و قياس متوسط العوائد المتحققة لقطاع المصارف والقطاع الزراعي وقطاع التأمين وقطاع السياحة والفندقة خلال الفترة وكذلك قياس المخاطر النظامية التي تتعرض لها هذه القطاعات خلال فترة الدراسة وان النتائج المتحققة تبين ان أعلى متوسط عائد لدى القطاع الصناعي ويعني ذلك ارتفاع في وتيرة النشاط الاقتصادي لهذا القطاع بالمقارنة مع القطاعات الأخرى في سوق العراق للأوراق المالية التي كانت سالبة لذلك فأن أفضل استثمار يتحقق في قطاع الصناعة

**الكلمات المفتاحية:** CAPM ، الموجودات المالية ، عائد محفظة السوق ، معامل بيتا ، المخاطر النظامية.

**Abstract**

As a result of technological development and globalization, financial markets have currently enjoyed a distinguished position, as the amount of economic activity of countries is measured by the extent of their dealings in financial markets through their contribution to financial investments. Based on that, this study aims to examine the capital assets pricing model for 30 banks and companies listed on the Iraqi Stock Exchange. Finance during the period (2017-2023) by relying on the annual data published for the sample and for the period studied and measuring the average returns achieved for the banking sector, the agricultural sector, the insurance sector, and the tourism and hotel sector during the period, as well as measuring the systemic risks to which these sectors are exposed during the study period, and the results achieved It was found that the highest average return is in the industrial sector, and this means an increase in the pace of economic activity for this sector compared to other

sectors in the Iraq Stock Exchange, which were negative. Therefore, the best investment is achieved in the industrial sector.

**Keywords:** CAPM, financial assets, beta coefficient, systemic risk.

## المقدمة

تعد الاسواق المالية من أهم الركائز الاقتصادية في بلدان العالم، حيث يعتبر الاستثمار المالي عملية قائمة بذاتها لها أهدافها ووسائلها، كما تتطلب استخدام استراتيجيات وقدرة كبيرة على قراءة التوجهات المستقبلية كما أصبح من المواضيع التي تحتل مكانة مهمة وأساسية في أولويات الدراسات الاقتصادية و المالية و المصرفية وغيرها من التخصصات نظرا لما لها من أهمية كبيرة بسبب التطورات التي شهدها العالم من عدة نواحي، فقد ظهرت بعض الدراسات المهمة بكيفية التعامل مع المخاطر عند اختيار الاستثمارات المناسبة كما يجد المستثمرون أنفسهم في تردد كبير في اختيار مجال الاستثمار الذي يوظفون فيه أموالهم وكذا اختيار الاداة المثلى في الاستثمار التي تسمح لهم بتحقيق أكبر عائد ضمن مستوى معين من المخاطرة ، اذ يعبر نموذج تسعير الموجودات الرأسمالية عن نظرية للموازنة بين العائد والمخاطرة والتي تبرز أهميته من انه يجمعهما في آن واحد وبهذا فانه قدم الأساس الكمي لقياس المخاطر بدلا من التقديرات الشخصية للمستثمرين مما يجعل أساس التقييم للقرارات المالية أكثر مصداقية وموضوعية.

## المبحث الأول :- منهجية الدراسة

### أولاً:- مشكلة الدراسة

اصبحت الموجودات المالية اليوم هي الخيار الأفضل للمستثمرين بسبب العوائد المجزية التي تحققها وسهولة عملية بيعها عند المقارنه مع بقيه الموجودات الا انها لاتخلو من المخاطرة بالتأكد وبسبب ذلك فهي تحتاج الى عملية تقييم خاصه وان التقييم الجيد يعتمد على القياس الجيد للمخاطر ، وان نموذج تسعير الموجودات الراسماليه ( CAPM ) هو واحد من افضل النماذج التي تستخدم في تقييم الموجودات المالية من خلال دراسته للعلاقة بين العائد والمخاطرة، وبناءا على ذلك فان اشكالية الدراسة الحاليه تتمثل :

مدى كفاءة نموذج CAPM في تقييم الموجودات الماليه لعينه من الشركات المدرجة في سوق العراق  
للاوراق الماليه للفترة من (٢٠١٧-٢٠٢٣) ؟

والتي ينبثق عنها عدة تساؤلات فرعية منها:-

- ١- هل يمكن استخدام نموذج تسعير الموجودات الرأسمالية في تقييم الموجودات المالية؟
- ٢- هل ان معدل العائد المطلوب يتفوق على معدل العائد المتوقع في سوق العراق للاوراق المالية؟
- ٣- هل ان الشركات المدرجة في سوق العراق للاوراق المالية تتميز بأرتفاع معامل بيتا؟

#### ثانيا:- فرضيات الدراسة

بناءا على ماتم طرحه في مشكلة الدراسة يمكن تحديد جملة من الفرضيات التي ترغب الدراسة الحاليه  
في اختبارها:-

- ١- لا يمكن استخدام نموذج تسعير الموجودات الرأسمالية في تقييم الموجودات المالية.
- ٢- ان معدل العائد المطلوب لا يتفوق على معدل العائد المتوقع في سوق العراق للاوراق المالية.
- ٣- ان الشركات المدرجة في سوق العراق للاوراق المالية لا تتميز بأرتفاع معامل بيتا.

#### ثالثا:- أهمية الدراسة

- ١- تسليط الضوء على خصائص البيئة المالية في سوق العراق للأوراق المالية التي هي محط  
اهتمام الكثير من المستثمرين وكذلك الباحثين اذ تعد مجالا ملائم لدراسه ولابراز أهمية علاقه  
بين العائد والمخاطرة .
- ٢- التعرف على المخاطر المالية وكيفية قياسها بواحد من الأساليب الرياضيه المتاحة والتي تساعد  
على تقليلها الى ادنى مستوى ممكن وبعائد مقبول.

#### رابعا:- اهداف الدراسة

هناك مجموعه من الأهداف التي تسعى الدراسة الحالية الى تحقيقها والتي تتمثل بمايلي :-

- ١- التعرف على سوق العراق للأوراق الماليه .
- ٢- المساعدة في فهم سلوك أسعار الأسهم للشركات المدرجة في سوق العراق للأوراق الماليه والتي  
تساعد المستثمرين في كيفية التعامل داخل السوق واختيار الاسهم المراد الاستثمار بها.

٣- التعرف على المخاطر النظامية التي من الممكن يواجهها المستثمر وكيفية التعامل معها ومعرفة تأثيرها على عوائد الأسهم المدرجة في السوق.

٤- معرفه طبيعة القرارات الواجب اتخاذها من قبل المستثمر وباي الحالات يتم اتخاذها.

#### خامسا:- حدود الدراسة

تتمثل الحدود المكانية للدراسة في سوق العراق للأوراق المالية وبالتحديد ٣٠ شركة ومصرف مدرجة في السوق.

اما الحدود الزمانية تتمثل في سلوك الأسعار السنوية لهذه الشركات والمصارف للفترة من ٢٠١٧-٢٠٢٣ وهو مايسمح باختبار نموذج تسعير الموجودات الراسمالية بصورة جيدة .

#### المبحث الثاني :- الاطار النظري للدراسة

نموذج تسعير الموجودات الرأسمالية (CAPM):

أ- مفهوم نموذج تسعير الموجودات الرأسمالية (CAPM):

يعتبر نموذج تسعير الموجودات الرأسمالية احد الاركان الاساسية لنظرية المحفظة الحديثة (Levy& Ritov,2001:1)، ونظرية رئيسة في التمويل الحديث (Bensoussan,2009:299)، يستخدم في تقييم الموجودات المالية والحقيقية المختلفة (Sun& Zhang,2001:617)، ساهم في تطوير النموذج كل من (Markowitz ,1952,1956,1959) ، (Treynor,1961) ، (Sharpe,1,1964)(Lintner,1965) و (Mossin,1966) (Savoia,et ) (Sahadev, et al, 2018:327)(al,2019:150) (Wang& Chen,2012:361) عامل الجذب في النموذج هو قدرته على تقديم تنبؤات قوية ومقبولة بشكل حقيقي حول كيفية قياس المخاطرة والعلاقة بين العائد المتوقع والمخاطرة (Fama& French,2004:1)(Qin,2002:182) ، وقد حصل كل من ماركويتز و شارب على جائزة نوبل مناصفة عام ١٩٩٠ (Vergara-Fernandez,2023,92).

يقوم نموذج تسعير الموجودات الراسمالية على فكرة أن أسواق الأوراق المالية يجب أن تعوض المستثمرين فقط عن مكون واحد من المخاطرة وهي المخاطرة النظامية بأعتبار ان المخاطرة اللانظامية هي قابلة للتنوع عن طريق الاحتفاظ بمحفظة متنوعة بشكل كفاء (Novak,2015:169)، وبالتالي

يوصف على انه نموذج خطي بسيط لتقدير العائد المتوقع والمخاطرة النظامية للموجود، والصياغة الرياضية للنموذج هي كالآتي (Sahadev, et al, 2018:327):

$$RRR = R_F + (R_M - R_F) \beta$$

$RRR$  = معدل العائد المطلوب .

$R_F$  = معدل العائد الخالي من المخاطرة .

$R_M$  = معدل العائد على محفظة السوق .

$\beta$  = الميل ، وهي درجة حساسية عائد السهم للتغيرات الحاصلة في السوق .

يستنتج هذا النموذج أنه في حالة التوازن فإن العائد المتوقع على أي ورقة مالية أو محفظة هو دالة خطية للتباين المشترك في عائدها مع العائد لمحفظة السوق، وتشير معادلة النموذج على أن العائد المتوقع على الورقة المالية أو المحفظة يساوي العائد الخالي من المخاطرة بالإضافة إلى العائد من افتراض المخاطر الإضافية ، حيث يكون المصطلح  $[E(R_M) - R_f]$  هو سعر السوق أو العائد الفائض لكل وحدة مخاطرة (Osteryoung, et al, 1977:48-49) ، اما بيتا تشير الى حساسية العوائد الفائضة المتوقعة للموجود إلى العوائد الفائضة المتوقعة التي يحققها السوق، ويمكن حساب بيتا حسب الصيغة الرياضية الآتية (Bornholt, 2007:71):

$$\beta = \frac{COV(R_1, R_M)}{\sigma_M^2}$$

اذ ان :

$\beta$  = الميل ، وهي درجة حساسية عائد السهم للتغيرات في السوق .

$COV(R_1, R_M)$  = التباين بين عائد السهم وعائد السوق .

$\sigma_M^2$  = تباين السوق .

وهي أداة رياضية لقياس مخاطرة السوق النظامية او المخاطرة الغير قابلة للتنويع، وهو بهذا المعنى هي مؤشر لمدى تحرك عائد الورقة المالية استجابة للتغيرات في السوق ككل، وبالتالي اذا هي مقياس لتلقب

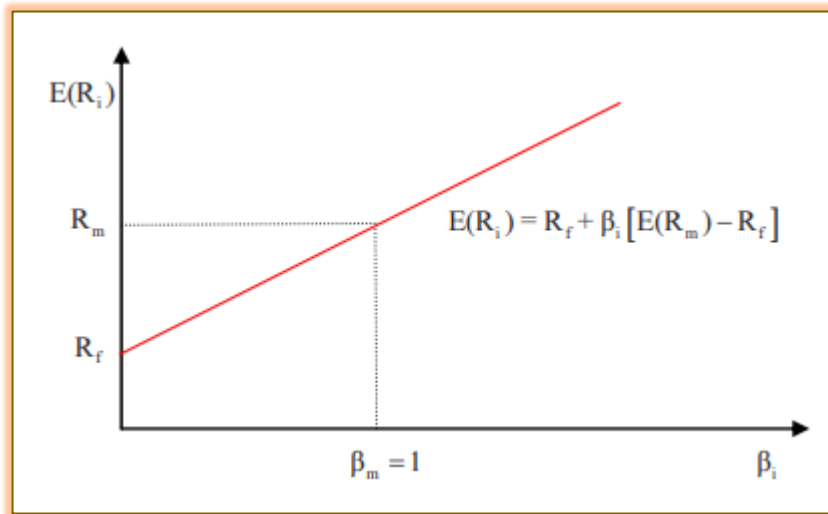


الأوراق المالية وحسب حالة السوق ويمكن أن تكون قيمة بيتا موجبة أو سالبة (Alhabeeb,2012:411).

#### ب- افتراضات نموذج تسعير الموجودات الرأسمالية:

هناك مجموعة من تسعة افتراضات ضرورية تم من خلالها اشتقاق النموذج وهي كالآتي (Novak,2015:169) (Boďa& Kanderová,2014:1138):

- ١- يهدف المستثمرين هو تعظيم الاستفادة من ثروتهم النهائية.
  - ٢- يقوم المستثمرون باختياراتهم من خلال مقارنة العائد والمخاطر. في حين يتم قياس العائد من خلال متوسط العوائد المتوقعة من محفظة الأصول ، يتم قياس المخاطر من خلال الانحراف المعياري لعائدات المحفظة هذه.
  - ٣- يتسم المستثمر بالرشد وتجنب المخاطرة.
  - ٤- لدى المستثمرين توقعات متجانسة للمخاطر والعائد.
  - ٥- لدى المستثمرين مدة زمنية متطابقة للاستثمار.
  - ٦- المعلومات متاحة ومجانية بنفس الوقت لجميع المستثمرين وتنعكس على الفور في أسعار الموجودات(السوق الكفوء).
  - ٧- هناك مجود خالي من المخاطرة، اي يمكن للمستثمرين الاقتراض والإقراض بسعر فائدة خالي من المخاطرة وبدون أي قيود.
  - ٨- لا توجد ضرائب أو تكاليف معاملات أو قيود على البيع القصير أو غيره من أشكال عيوب السوق.
  - ٩- جميع الموجودات قابلة للتسويق والتجزئة.
- يتم وصف نموذج تسعير الموجودات الرأسمالية بيانياً من خلال صيغة (SML) والذي يسمى بخط سوق الاستثمار او خط سوق الورقة المالية (Vergara–Fernández,Et Al,2023:91)، كما في الشكل(١) هناك محفظة واحدة فقط معامل بيتا يساوي ١ ، وهذه المحفظة هي محفظة السوق. المحافظ الأخرى لها معامل بيتا مختلف وهذا يضعها في علاقة مميزة بمحفظة السوق.



شكل (١) يوضح خط سوق الورقة المالية

Bod'a, M., & Kanderová, M. (2014). Linearity of the Sharpe–Lintner version of the capital asset pricing model. *Procedia–Social and Behavioral Sciences*, 110, 1136–1147.P(1139)

ويوضح الشكل (١) بياناً العلاقة الخطية بين العائد المتوقع والبيتا وهي مقياس المخاطرة النظامية وتسمى هذه العلاقة بخط سوق الورقة المالية (Dempsey,2013:192)، حيث يمثل المحور الأفقي المخاطر النظامية أو مخاطرة السوق (بيتا) ويمثل المحور العمودي العائد المتوقع، يوضح خط سوق الورقة المالية أن المستثمرين يحتاجون إلى عائد أعلى لتحمل مخاطر إضافية (نظامية)، علاوة المخاطر المحددة للموجود هي دالة في بيتا، فكلما ارتفعت بيتا ارتفعت علاوة المخاطرة والعائد المطلوب على التوالي (Doppegieter,2015:1)، السهم الذي يحتوي على بيتا ١,٠ له نفس التعرض للمخاطر تماماً مثل السوق. من ناحية أخرى، فإن السهم الذي يحتوي على بيتا ١,٥، على سبيل المثال، ١,٥ لديه ملف مخاطر أعلى من السوق. إذا كان السوق سيرتفع بنسبة ١٪، فمن المتوقع أن يرتفع عائد السهم بنسبة ١,٥٪ (والعكس صحيح). ومن ثم، فإن هذا النوع من الأسهم سوف يتفوق في الأداء في السوق الصاعد ويكون أدائه دون المستوى في السوق الهابطة (Doppegieter,2015:2).

يعتبر نموذج تسعير الموجودات الرأسمالية ذو الفترة الواحدة والعامل الواحد الأبسط والأكثر استخداماً في كل من الممارسة والبحث، وكما هو موضح في تقرير نتائج الاستطلاع من قبل منظمة (The

(Association for Financial Professionals,2013)، تقرير صادر عن شركة خدمات مالية رائدة ( The Credit Suisse,2013)(Pham& Phuoc,2020:1)، إذ جعل النموذج التمويل موضوع مناسب لدراسات الاقتصاد القياسي، وأصبحت الصناعة تعتمد على CAPM لتحديد معدل الخصم لتقييم الاستثمارات داخل الشركة ولتقييم الشركة نفسها ولتحديد أسعار المبيعات وكذلك يستخدم في تقييم أداء مديري الصناديق وتعيين المدراء التنفيذيين(Dempsey,2013:2).

### ت- استخدامات نموذج تسعير الموجودات الرأسمالية

يستخدم نموذج CAPM في العديد من المجالات ومن بينها تقييم البدائل المقترحة ووضع معايير للقرارات الاستثمارية وتقدير تكلفة التمويل كذلك يمكن استخدام النموذج من الناحية العملية فيما يلي (Chen,2021:921)(زينب، ٢٠٢١: ٩٠)،(الصعيدي، ٢٠١١:٤٣) :-

١- حساب تكلفة رأس المال للأسهم العادية حيث يعتبر معدل العائد المطلوب على الأسهم من قبل المستثمرين هو تكلفة رأس المال للأسهم العادية من وجهة نظر الشركة المصدرة لهذه الأسهم .

٢- تحديد أسعار الأسهم الحقيقية .

٣- تقييم الاستثمار في الأوراق المالية ويتم ذلك من خلال اعتبار معدل العائد المطلوب الذي يتم احتسابه من خلال تلك النماذج كمعدل خصم يتم احتساب به صافي القيمة الحالية ومعدل المردود الداخلي.

### المبحث الثالث:- الجانب التطبيقي للبحث

#### ١- اسهم عينة المصارف

بين الجدول (١) سلسلة من متوسطات العوائد المتحققة في قطاع المصارف للفترة من (٢٠١٧-٢٠٢٣) و نلاحظ من الجدول ان مصرف بغداد قد حقق اعلى متوسط عائد إذ بلغ (٠,٠٢٠٤٦٤٧) مقارنة مع متوسط عائد القطاع البالغ (٠,٠٠١٤٨٩-) و يعني ارتفاع في وتيرة النشاط الاقتصادي لهذه الشركة على الرغم من ان متوسط عائد القطاع سالب و يرجع ذلك الى ان متوسط عائد الشركة كان موجب ، أما أدنى متوسط عائد كان في المصرف الإسلامي إذ بلغ (٠,٠١٧٢-) مقارنة مع متوسط عائد القطاع البالغ (٠,٠٠١٤٨٩-) و هذا يعني انخفاض في مستوى النشاط الاقتصادي لهذه الشركة و حسب الجدول الآتي:

## جدول (١)

متوسطات العائد المتحققة في قطاع المصارف للفترة من (٢٠١٧-٢٠٢٣)

المتوسط	2023	2022	2021	2020	2019	2018	2017	السنة اسم الشركة
0.0012283	0.031734	-0.00486	0.015509	-0.0037	0.00562	-0.00917	-0.02654	التجاري العراقي
0.0204647	0.064163	0.021328	0.072956	0.023974	0.002825	-0.06196	0.019973	مصرف بغداد
-0.0172	0.006176	0.010217	-0.01932	0.002924	-0.03178	-0.07003	-0.0186	مصرف الاسلامي
-0.018163	-0.02533	0.006176	0.010217	-0.01932	0.002924	-0.03178	-0.07003	الاستثمار العراقي
0.0177345	0.047378	-0.0016	0.037439	0.009196	0.040286	-0.01994	0.011381	الاهلي العراقي
-0.012996	-0.04248	-0.05776	-0.00427	-0.02025	-0.0464	-0.00093	0.081121	مصرف اشور
-0.001489	0.013607	-0.00442	0.018755	-0.0012	-0.00442	-0.0323	-0.00045	المتوسط

المصدر : من اعداد الباحث بالاعتماد على مخرجات الحاسبة الالكترونية.

## ٢- اسهم عينة قطاع التأمين :-

بين الجدول (٢) سلسلة العوائد المتحققة في قطاع التأمين للفترة من (٢٠١٧-٢٠٢٣) و نلاحظ من الجدول أن أعلى متوسط عائد كان في شركة الأمين للتأمين اذ بلغ (٠,٠٠٤٥٩٢-) مقارنة مع متوسط عائد القطاع البالغ (٠,٠٠٣١٦٢-) و نلاحظ ان هذه المتوسطات هي سالبة و هذا يعني انخفاضاً في مستوى النشاط الاقتصادي و الاستثماري لهذا القطاع خلال هذه المدة ، اما أدنى معدل عائد كان في شركة الاهلية للتأمين اذ بلغ (٠,٠٠٣١٦٢-) مقارنة مع متوسط عائد القطاع البالغ (٠,٠٠٣١٦٢-) و حسب الجدول الاتي:

## جدول (٢)

متوسطات العائد المتحققة في قطاع التأمين للفترة من (٢٠١٧-٢٠٢٣)

المتوسط	2023	2022	2021	2020	2019	2018	2017	السنة اسم الشركة
-0.004592	-0.00312	-0.01719	0.00585	0.011344	0.041992	-0.04539	-0.02562	الأمين للتأمين
-0.004218	0.014077	-0.05422	0	0	0	-0.00441	0.015022	دار السلام

								للتأمين
-0.000678	0		0	0	0	0.004274	-0.00834	الاهلية للتأمين
-0.003162	0.003654	-0.03571	0.00195	0.003781	0.013997	-0.01518	-0.00631	المتوسط

المصدر : من اعداد الباحث بالاعتماد على مخرجات الحاسبة الالكترونية.

### ٣- اسهم عينة قطاع الصناعة:-

بين الجدول (٣) سلسلة العوائد المتحققة في قطاع الصناعة للفترة من (٢٠١٧-٢٠٢٣) ونلاحظ من الجدول ان أعلى متوسط عائد كان في شركة المعدنية و الدراجات اذ بلغ (٠,٠٢٣٨١٤) مقارنة مع متوسط عائد القطاع الذي بلغ (٠,٠٠٦٧٩٣٥) ونلاحظ أيضا أن متوسط عائد القطاع هو متوسط موجب ويعني ذلك ارتفاع في وتيرة النشاط الاقتصادي لهذا القطاع بالمقارنة مع القطاعات الأخرى في سوق العراق للاوراق المالية التي كانت سالبة لذلك فإن أفضل استثمار يتحقق في قطاع الصناعة أما أدنى متوسط عائد كان في شركة العاب الكرخ اذ بلغ (٠,٠٠٠٢٤-) بالمقارنة مع متوسط عائد القطاع البالغ (٠,٠٠٦٧٩٣٥) وهذا يعني انخفاض في النشاط الاقتصادي لهذه الشركة وحسب ما موضح في الجدول الآتي:

### جدول (٣)

متوسطات العائد المتحققة في قطاع الصناعة للفترة من (٢٠١٧-٢٠٢٣)

المتوسط	2023	2022	2021	2020	2019	2018	2017	السنة اسم الشركة
-0.00024	0.050896	-0.00475	-0.03037	0.010004	-0.00575	-0.00575	-0.01596	العاب الكرخ
0.0195182	0.023749	0.118449	0.016509	0.001894	-0.00236	-0.00453	-0.01708	المعمورة العقارية
0.0060845	0.013686	-0.00283	0.035899	0.011433	0	-0.00705	-0.00855	النخبة للمقاولات
0.0119615	-0.0048	-0.00594	0.041277	0.010459	0.01423	-0.01057	0.039066	العراقية للسجاد
0.0009926	0	0	0	0.00878	0.027762	-0.00741	-0.02218	بغداد لمواد التغليف
0.0017657	-0.02098	-0.00155	0.006378	0.004374	-0.00555	0.028039	0.00165	بغداد للمشروبات الغازية
0.0131418	-0.00307	-0.01598	0.008191	0.039245	0.060956	0.006779	-0.00413	الصناعات الكيميائية
0.0075607	0.005242	0.000597	0.001208	-0.0155	0.023136	0.041465	-0.00323	الكندي للفاحات
-0.016664	-0.03037	-0.08257	0.012511	0.010637	-0.00457	0.005749	-0.02804	انتاج الالبسة

0.023814	0.017385	0.01756	-0.00467	0.007458	0.024567	0.085138	0.019259	المعدنية والدرجات
0.0067935	0.005174	0.0023	0.008693	0.008879	0.013242	0.013187	-0.00392	المتوسط

المصدر : من اعداد الباحث بالاعتماد على مخرجات الحاسبة الالكترونية.

#### ٤- أسهم عينة قطاع الزراعة:-

يبين الجدول (٤) سلسلة العوائد المتحققة في قطاع الزراعة للفترة من (٢٠١٧-٢٠٢٣) ونلاحظ من الجدول ان أعلى متوسط عائد كان في شركة العراقية للبذور اذ بلغ (٠,٠٠٩١٦٥) مقارنة مع متوسط عائد القطاع البالغ (٠,٠٠٠٩٨٧) و يعني ذلك ارتفاع في وتيرة النشاط الاقتصادي لهذه الشركة على الرغم من أن متوسط عائد القطاع سالب ويرجع ذلك الى ان متوسط عائد الشركة كان موجب اما أدنى متوسط عائد كان في شركة الشرق الاوسط اذ بلغ (٠,٠٠٠٤٩٤) مقارنة مع متوسط عائد القطاع البالغ (٠,٠٠٠٩٨٧) و يعني ذلك ارتفاع في وتيرة النشاط الاقتصادي لهذه الشركة و حسب الجدول الاتي:

#### جدول (٤)

سلسلة العوائد المتحققة في قطاع الزراعة للفترة من (٢٠١٧-٢٠٢٣)

المتوسط	2023	2022	2021	2020	2019	2018	2017	السنة اسم الشركة
-0.010327	0	0	0	0	-0.01453	-0.02314	-0.03463	الحديثة للإنتاج الحيواني
0.000494	-0.00082	-0.00982	-0.00318	0.005527	-0.00902	0.013921	0.006839	الشرق الاوسط
0.009165	0.021861	-0.01108	0.044255	0.013866	0.021148	0.007758	-0.03365	العراقية للبذور
-0.003281	-0.11918	0.015921	0.025448	0.036819	0.007251	0.006839	0.003929	المنتجات الزراعية
-0.000987	-0.02453	-0.00124	0.016631	0.014053	0.001213	0.001345	-0.01438	المتوسط

المصدر : من اعداد الباحث بالاعتماد على مخرجات الحاسبة الالكترونية.

#### ٥- أسهم عينة قطاع الفنادق و السياحة

يبين الجدول (٥) سلسلة العوائد المتحققة في قطاع الفنادق و السياحة للفترة من (٢٠١٧-٢٠٢٣) و نلاحظ من الجدول أن أعلى معدل عائد كان في سهم شركة فندق بابل اذ بلغ (٠,٠١٢٦١٧٢) وهو متوسط موجب وهذا يعني ارتفاع

في وتيرة النشاط الاقتصادي لهذه الشركة مقارنة مع متوسط عائد القطاع الذي بلغ (٠,٠٠١٧٤٠١) اما ادنى معدل عائد كان في سهم شركة فندق بغداد اذ بلغ (-٠,٠٠٠٢٥) بالمقارنة مع متوسط عائد القطاع البالغ (٠,٠٠١٧٤٠١) وحسب الجدول الآتي:

جدول (٥)

سلسلة العوائد المتحققة في قطاع الفنادق و السياحة للفترة من (٢٠١٧-٢٠٢٣)

المتوسط	2023	2022	2021	2020	2019	2018	2017	السنة اسم الشركة
0.0126172	0.000707	0.008482	0.005114	0.010079	0.037563	0.022614	0.00376	فندق بابل
-0.00025	0.009853	0.002924	0.004588	-0.00379	-0.00178	0.001984	-0.01553	فندق بغداد
0.0041121	0.005426	0.018595	0.012032	-0.01203	0.023974	0.002506	-0.02172	الاستثمارات السياحية
-0.004883	0.000918	0.011014	0.012695	-0.0061	-0.01354	-0.00641	-0.03275	فندق كربلاء
-0.002895	0.001352	0.016225	0	-0.0023	-0.00187	-0.02115	-0.01252	فندق السدير
0.0017401	0.003651	0.011448	0.006886	-0.00283	0.008867	-9.1E-05	-0.01575	المتوسط

المصدر : من اعداد الباحث بالاعتماد على مخرجات الحاسبة الالكترونية.

جدول (٦) يوضح معدل العائد الشهري لسوق العراق للاوراق المالية للفترة من (٢٠١٧-٢٠٢٣)

المتوسط	2023	2022	2021	2020	2019	2018	2017	السنة
0.0027812	0.028046	0.002417	0.009474	0.002374	-0.00272	-0.01078	-0.00935	عائد السوق

المصدر : من اعداد الباحث بالاعتماد على مخرجات الحاسبة الالكترونية.

يبين الجدول متوسط العائد لمحفظه السوق للفترة من (٢٠١٧-٢٠٢٣) اذ نلاحظ من خلال الجدول ان اعلى معدل عائد لمحفظه السوق كان في سنة ٢٠٢٣ اذ بلغ (٠,٠٢٨٠٤٦) مقارنة مع متوسط عائد السوق البالغ (٠,٠٠٢٧٨١٢) و نلاحظ ان المؤشر العام في سوق العراق للاوراق المالية في حالة صعود خلال الفترة من (٢٠١٧-٢٠٢٣) على الرغم من الاداء السيئ للشركات المدرجة في سوق العراق للاوراق المالية و يليه متوسط عائد محفظه السوق سنة ٢٠١٨ اذ بلغ (-٠,٠١٠٧٨) اما ادنى متوسط عائد لمحفظه السوق كان في سنة ٢٠٢٠ اذ بلغ (٠,٠٠٢٣٧٤) يليه سنة ٢٠٢٢ اذ بلغ (٠,٠٠٢٤١٧)

■ العائد المتوقع

- بلغ معدل العائد المتوقع لمصرف التجاري العراقي (٠,٠٢٣٢٢٦٨١) بينما بلغ معدل العائد المطلوب (٠,٠٠٣) اذ يتبين ان معدل العائد المتوقع هو اكبر من العائد المطلوب مما يعني ان هذه الشركة مرغوبة في الاستثمار

- بلغ معدل العائد المتوقع لمصرف بغداد (٠,٠٢٣٢٢٦٨١) بينما بلغ معدل العائد المطلوب (٠,٠٠٣١٠٨) اذ يتبين ان معدل العائد المتوقع هو اكبر من العائد المطلوب مما يعني ان هذه الشركة مرغوبة في الاستثمار
- بلغ معدل العائد المتوقع للمصرف الاسلامي (-٠,٠٠٢٥٠٠٣) بينما بلغ معدل العائد المطلوب (٠,٠٠٣١٠٢) اذ يتبين ان معدل العائد المطلوب هو اكبر من العائد المتوقع مما يعني ان هذه الشركة غير مرغوبة في الاستثمار فيهدر بسبب انخفاض معدل العائد المتوقع
- بلغ معدل العائد المتوقع لمصرف الاستثمار العراقي (-٠,٠١٨٠٥٩٦٨٤) بينما بلغ معدل العائد المطلوب (٠,٠٠٣١٠٢) اذ يتبين ان معدل العائد المتوقع هو اكبر من العائد المطلوب مما يعني ان هذه الشركة مرغوبة في الاستثمار
- بلغ معدل العائد المتوقع للمصرف الاهلي العراقي (٠,٠١٨٩٩٦٣١٣) بينما بلغ معدل العائد المطلوب (٠,٠٠٣١٠٣) اذ يتبين ان معدل العائد المتوقع هو اكبر من العائد المطلوب مما يعني ان هذه الشركة مرغوبة في الاستثمار
- بلغ معدل العائد المتوقع لمصرف اشور (-٠,٠١٠٩٥٤٣٦) بينما بلغ معدل العائد المطلوب (٠,٠٠٣١٠٦) اذ يتبين ان معدل العائد المتوقع هو اكبر من العائد المطلوب مما يعني ان هذه الشركة مرغوبة في الاستثمار .

**جدول (١١) يوضح العائد المتوقع للشركات المدرجة في قطاع المصارف**

المتوسط	2023	2022	2021	2020	2019	2018	2017	السنة اسم الشركة
0.0015737	0.001916	0.001569	0.001665	0.001568	0.001499	0.00139	0.001409	التجاري العراقي
0.022961	0.0434	0.022666	0.028376	0.022632	0.018514	0.011993	0.013146	مصرف بغداد
-0.002553	0.001479	-0.00261	-0.00148	-0.00262	-0.00343	-0.00472	-0.00449	مصرف الاسلامي
0.01888	0.027823	0.018751	0.021249	0.018736	0.016934	0.014081	0.014586	الاستثمار العراقي
0.0027812	0.028046	0.002417	0.009474	0.002374	-0.00272	-0.01078	-0.00935	الاهلي العراقي
-0.011151	0.00394	-0.01137	-0.00715	-0.01139	-0.01443	-0.01925	-0.0184	مصرف اشور
0.0054154	0.017768	0.005237	0.008688	0.005216	0.002728	-0.00121	-0.00052	المتوسط

المصدر : من اعداد الباحث بالاعتماد على مخرجات الحاسبة الالكترونية.



- بلغ معدل العائد المتوقع لشركة العاب الكرخ (٠,٠٠١٤٩٠٩٧٧-) بينما بلغ معدل العائد المطلوب (٠,٠٠٣١٠٢) اذ يتبين ان معدل العائد المطلوب هو اكبر من العائد المتوقع مما يعني ان هذه الشركة غير مرغوبة في الاستثمار فيهدر بسبب انخفاض العائد المتوقع
- بلغ معدل العائد المتوقع لشركة المعمورة العقارية (٠,٠١٦٤٥٩٠٦٨) ينما بلغ معدل العائد المطلوب (٠,٠٠٣٠٩٧) اذ يتبين ان معدل العائد المتوقع هو اكبر من العائد المطلوب مما يعني ان هذه الشركة مرغوبة في الاستثمار
- بلغ معدل العائد المتوقع لشركة النخبة للمقاولات (٠,٠٠٢٩٣٤٢١٨) بينما بلغ معدل العائد المطلوب (٠,٠٠٣٠٩٨) اذ يتبين ان معدل العائد المطلوب هو اكبر من العائد المتوقع مما يعني ان هذه الشركة غير مرغوبة في الاستثمار فيهدر بسبب انخفاض العائد المتوقع
- بلغ معدل العائد المتوقع لشركة العراقية للسجاد (٠,٠١٣١١٥٦١١) بينما بلغ معدل العائد المطلوب (٠,٠٠٣٠٩٧) اذ يتبين ان معدل العائد المتوقع هو اكبر من العائد المطلوب مما يعني ان هذه الشركة مرغوبة في الاستثمار
- بلغ معدل العائد المتوقع لشركة بغداد لمواد التغليف (٠,٠٠١٠٢٩٤٠٣) بينما بلغ معدل العائد المطلوب (٠,٠٠٣١) اذ يتبين ان معدل العائد المطلوب هو اكبر من العائد المتوقع مما يعني ان هذه الشركة غير مرغوبة في الاستثمار فيهدر بسبب انخفاض العائد المتوقع
- بلغ معدل العائد المتوقع لشركة بغداد للمشروبات الغازية (٠,٠٠٢٧٧٤٥٩٦) بينما بلغ معدل العائد المطلوب (٠,٠٠٣١٠٢) اذ يتبين ان معدل العائد المطلوب هو اكبر من العائد المتوقع مما يعني ان هذه الشركة غير مرغوبة في الاستثمار فيهدر بسبب انخفاض العائد المتوقع
- بلغ معدل العائد المتوقع لشركة الصناعات الكيماوية (٠,٠١٣٨٢٥٧٩٩) بينما بلغ معدل العائد المطلوب (٠,٠٠٣١٠١) اذ يتبين ان معدل العائد المتوقع هو اكبر من العائد المطلوب مما يعني ان هذه الشركة مرغوبة في الاستثمار
- بلغ معدل العائد المتوقع لشركة الكندي للقاحات (٠,٠٠٧٨٣٣٣١٤) بينما بلغ معدل العائد المطلوب (٠,٠٠٣١٠٢) اذ يتبين ان معدل العائد المتوقع هو اكبر من العائد المطلوب مما يعني ان هذه الشركة مرغوبة في الاستثمار
- بلغ معدل العائد المتوقع لشركة انتاج الالبسة (٠,٠١٥١٧٥٧١-) بينما بلغ معدل العائد المطلوب (٠,٠٠٣١٠٢٥٥٧) اذ يتبين ان معدل العائد المتوقع هو اكبر من العائد المطلوب مما يعني ان هذه الشركة مرغوبة في الاستثمار

- بلغ معدل العائد المتوقع لشركة المعدنية و الدراجات (٠,٠١٨٨٤٠٢٠١) بينما بلغ معدل العائد المطلوب (٠,٠٠٣٠٩٩) اذ يتبين ان معدل العائد المتوقع هو اكبر من العائد المطلوب مما يعني ان هذه الشركة مرغوبة في الاستثمار

جدول (١٢) يوضح العائد المتوقع للشركات المدرجة في قطاع الصناعة

2023	2022	2021	2020	2019	2018	2017	السنة اسم الشركة
0.004491	-0.00166	3.57E-05	-0.00167	-0.00289	-0.00482	-0.00448	العاب الكرخ
0.007953	0.016695	0.014288	0.01671	0.018446	0.021195	0.020709	المعمورة العقارية
-0.00238	0.003082	0.001578	0.003091	0.004175	0.005892	0.005589	النخبة للمقاولات
0.00459	0.013353	0.01094	0.013367	0.015107	0.017863	0.017376	العراقية للسجاد
-4.8E-05	0.001059	0.000754	0.001061	0.001281	0.001629	0.001568	بغداد لمواد التغليف
0.006701	0.002665	0.003777	0.002659	0.001857	0.000588	0.000813	بغداد للمشروبات
							الصناعات الكيميائية
0.016222	0.013759	0.014437	0.013755	0.013266	0.012492	0.012628	الكندي للقاحات
0.011963	0.007719	0.008887	0.007712	0.006869	0.005534	0.00577	انتاج الالبسة
-0.00867	-0.01536	-0.01352	-0.01537	-0.0167	-0.0188	-0.01843	المعدنية والدرجات
0.015665	0.018928	0.01803	0.018934	0.019582	0.020608	0.020427	

المصدر : من اعداد الباحث بالاعتماد على مخرجات الحاسبة الالكترونية.

- بلغ معدل العائد المتوقع لفندق بابل(٠,٠١٣٨٧٥٦٨) بينما بلغ معدل العائد المطلوب (٠,٠٠٣١) اذ يتبين ان معدل العائد المتوقع هو اكبر من العائد المطلوب مما يعني ان هذه الشركة مرغوبة في الاستثمار
- بلغ معدل العائد المتوقع لفندق بغداد (٠,٠٠٠١٢٢٨٤٤) بينما بلغ معدل العائد المطلوب(٠,٠٠٣١٠١) اذ يتبين ان معدل العائد المطلوب هو اكبر من العائد المتوقع مما يعني ان هذه الشركة غير مرغوبة في الاستثمار فيهدر بسبب انخفاض العائد المتوقع
- بلغ معدل العائد المتوقع لشركة الاستثمارات السياحية(٠,٠٠٣١٨٣٠٧٥) بينما بلغ معدل العائد المطلوب(٠,٠٠٣١٠٢) اذ يتبين ان معدل العائد المتوقع هو اكبر من العائد المطلوب مما يعني ان هذه الشركة مرغوبة في الاستثمار
- بلغ معدل العائد المتوقع لفندق كربلاء(٠,٠٠٥٢٠١٦٦-) بينما بلغ معدل العائد المطلوب (٠,٠٠٣١٠١) اذ يتبين ان معدل العائد المتوقع هو اكبر من العائد المطلوب مما يعني ان هذه الشركة مرغوبة في الاستثمار
- بلغ معدل العائد المتوقع لفندق السدير(٠,٠٠٣٢٠٢٤٨٥-) بينما بلغ معدل العائد المطلوب (٠,٠٠٣١٠٢) اذ يتبين ان معدل العائد المتوقع هو اكبر من العائد المطلوب مما يعني ان هذه الشركة مرغوبة في الاستثمار

جدول (١٢) يوضح العائد المتوقع للشركات المدرجة في قطاع الفنادق والسياحة

2023	2022	2021	2020	2019	2018	2017	السنة اسم الشركة
0.014306	0.013864	0.013985	0.013863	0.013775	0.013636	0.013661	فندق بابل
0.002819	4.79E-05	0.000811	4.33E-05	-0.00051	-0.00138	-0.00122	فندق بغداد
0.007388	0.003066	0.004256	0.003059	0.002201	0.000841	0.001082	الاستثمارات السياحية
-0.00266	-0.00527	-0.00455	-0.00527	-0.00579	-0.00661	-0.00647	فندق كربلاء
0.001123	-0.00332	-0.0021	-0.00333	-0.00421	-0.00561	-0.00536	فندق السدير

المصدر : من اعداد الباحث بالاعتماد على مخرجات الحاسبة الالكترونية.

- بلغ معدل العائد المتوقع لشركة الحديثة للانتاج الحيواني (٠,٠١٠٧٠٩٨٨٤) بينما بلغ معدل العائد المطلوب (٠,٠٠٣١) اذ يتبين ان معدل العائد المتوقع هو اكبر من العائد المطلوب مما يعني ان هذه الشركة مرغوبة في الاستثمار
- بلغ معدل العائد المتوقع لشركة الشرق الاوسط (٠,٠٠١٠١٣١٤٨) بينما بلغ معدل العائد المطلوب (٠,٠٠٣١٠١) اذ يتبين ان معدل العائد المطلوب هو اكبر من العائد المتوقع مما يعني ان هذه الشركة غير مرغوبة في الاستثمار فيهدر بسبب انخفاض العائد المتوقع
- بلغ معدل العائد المتوقع لشركة العراقية للبيدر (٠,٠٠٩٠٢١٠٦٨) بينما بلغ معدل العائد المطلوب (٠,٠٠٣١) اذ يتبين ان معدل العائد المتوقع هو اكبر من العائد المطلوب مما يعني ان هذه الشركة مرغوبة في الاستثمار
- بلغ معدل العائد المتوقع لشركة المنتجات الزراعية (٠,٠٠٥٣٢٤٨٥٩) بينما بلغ معدل العائد المطلوب (٠,٠٠٣٠٩٦) اذ يتبين ان معدل العائد المتوقع هو اكبر من العائد المطلوب مما يعني ان هذه الشركة مرغوبة في الاستثمار

جدول (١٤) يوضح العائد المتوقع للشركات المدرجة في قطاع الزراعة

المتوسط	2023	2022	2021	2020	2019	2018	2017	السنة اسم الشركة
-0.010705	-0.01111	-0.0107	-0.01081	-0.0107	-0.01062	-0.01049	-0.01051	الحديثة للانتاج
0.000992	0.002587	0.000969	0.001415	0.000967	0.000646	0.000137	0.000227	الشرق الاوسط
0.00901	0.009854	0.008998	0.009234	0.008997	0.008827	0.008557	0.008605	العراقية للبيدر
-0.005182	-0.01619	-0.00502	-0.0081	-0.005	-0.00279	0.000726	0.000105	المنتجات الزراعية
-0.001471	-0.00372	-0.00144	-0.00207	-0.00143	-0.00098	-0.00027	-0.00039	المتوسط

المصدر : من اعداد الباحث بالاعتماد على مخرجات الحاسبة الالكترونية.

جدول (١٥) يوضح العائد المتوقع والبيتا والعائد المطلوب في سوق العراق للاوراق المالية

اسم الشركة	البيتا	العائد المتوقع	العائد المطلوب
مصرف التجاري العراقي	0.013566	0.02322681	0.0031
مصرف بغداد	0.808985	0.02322681	0.003108
المصرف الاسلامي	0.159592	-0.0025003	0.003102
الاستثمار العراقي	0.171098	-0.018059684	0.003102
الاهلي العراقي	0.353963	0.018996313	0.003103
مصرف اشور	0.597281	-0.01095436	0.003106
الامين للتأمين	0.293406	-0.004045524	0.003103
دار السلام للتأمين	0.007756	-0.003704995	0.0031
الاهلية للتأمين	0.66423	0.002152511	0.003104
العاب الكرخ	0.23988	-0.001490977	0.003102
المعموره العقارية	-0.3411	0.016459068	0.003097
النخبة للمقاولات	-0.21303	0.002934218	0.003098
العراقيه للسجاد	-0.34188	0.013115611	0.003097
بغداد لمواد التغليف	-0.0432	0.001029403	0.0031
بغداد للمشروبات الغازية	0.157459	0.002774596	0.003102
الصناعات الكيماوية	0.09609	0.013825799	0.003101
الكندي للقاحات	0.16559	0.007833314	0.003102
انتاج الالبسة	0.260773	-0.01517571	0.003102557
المعدنية و الدراجات	-0.12733	0.018840201	0.003099
فندق بابل	0.017242	0.01387568	0.0031
بغداد	0.10812	0.000122844	0.003101
الاستثمارات السياحيه	0.168639	0.003183075	0.003102
كربلاء	0.101736	-0.005200166	0.003101
السدير	0.173445	-0.003202485	0.003102
الحديثة	-0.01609	-0.010709884	0.0031
الشرق الاوسط	0.063094	0.001013148	0.003101
العراقيه للبذور	0.033389	0.009021068	0.0031
المنتجات الزراعية	-0.43578	-0.005324859	0.003096

المصدر : من اعداد الباحث بالاعتماد على مخرجات الحاسبة الالكترونية.

ويتضح من التحليل السابق ان نموذج تسعير الموجودات يوضح بسهولة واضحة المقارنة بين معدل العائد المتوقع ومعدل العائد المطلوب وهذه هي ميزة هذا النموذج، اذ يمكن المستثمرين من المقارنة بسهولة وكفاءة بين العائد المتوقع والمطلوب وبالتالي اتخاذ القرار بالاستثمار في الشركات، وبالتالي عدم رفض الفرضية الرئيسية والفرضية الاولى، كما يتبين من التحليل ان معدل العائد المطلوب في سوق العراق للاوراق المالية قد تفوق على معدل العائد المتوقع على مستوى اغلب الشركات وهذا معناه ان الشركات في سوق العراق للاوراق المالية غير صالحة للاستثمار وهذا يعني رفض الفرضية الثانية. اما معامل بيتا فكانت تتراوح بين الصفر والسالب وهذا معناه ان معامل بيتا للشركات في سوق العراق للاوراق

المالية هي بيتا الدفاعية وان الشركات في سوق العراق للاوراق المالية تعاني بشكل كبير من انخفاض الاداء وذات مخاطرة بين العائد والمخاطرة وهذا يعني عدم رفض الفرضية الثالثة.

### المبحث الرابع :- الاستنتاجات والتوصيات

#### أولاً:- الاستنتاجات

من خلال الدراسة تم التوصل الى مجموعة من النتائج يمكن اجمالها فيمايلي:-

- ١- ان متوسط العائد المتحقق في قطاع المصارف خلال الفتره يبين ان مصرف بغداد حقق اعلى متوسط عائد مقارنة مع متوسط عائد القطاع ويدل ذلك على الارتفاع في وتيرة النشاط الاقتصادي مقارنة مع متوسط عائد القطاع .
- ٢- اما العوائد المتحققة في قطاع التأمين خلال الفتره تبين أن أعلى متوسط عائد كان في شركة الأمين للتأمين مقارنة مع متوسط عائد القطاع بالرغم من كون هذه المتوسطات هي سالبة والذي يدل على انخفاض في مستوى النشاط الاقتصادي و الاستثماري لهذا القطاع خلال مدة الدراسة.
- ٣- من خلال سلسلة العوائد المتحققة في قطاع الصناعة يلاحظ ان أعلى متوسط عائد كان في شركة المعدنية و الدرجات مقارنة مع متوسط عائد القطاع ويعني ذلك ارتفاع في وتيرة النشاط الاقتصادي لهذا القطاع بالمقارنة مع القطاعات الأخرى في سوق العراق للاوراق المالية التي كانت سالبة .
- ٤- تبين سلسلة العوائد المتحققة في قطاع الزراعة ان أعلى متوسط عائد كان في شركة العراقية للبذور و يعني ذلك ارتفاع في وتيرة النشاط الاقتصادي لهذه الشركة على الرغم من أن متوسط عائد القطاع سالب بذلك ارتفاع في وتيرة النشاط الاقتصادي لهذه الشركة مقارنة مع الشركات الأخرى.
- ٥- اما في قطاع الفنادق و السياحة للفترة من (٢٠١٧-٢٠٢٣) تبين أن أعلى معدل عائد كان في سهم شركة فندق بابل وهذا يعني ارتفاع في وتيرة النشاط الاقتصادي لهذه الشركة مقارنة مع متوسط عائد القطاع .

#### ثانياً:- التوصيات

- ١- يعد سوق العراق للاوراق المالية من الاسواق المهمة على مستوى الاقتصاد العراقي لما له من اهمية في تعبئة المدخرات وتعزيز مستوى النشاط الاقتصادي، لذلك يجب على ادارة السوق السعي الدائم لتطويره من جميع الجوانب حتى يحقق الهدف الاساسي له.
- ٢- يجب على الحكومة العراقية تقديم الدعم المالي لسوق العراق للاوراق المالية من اجل تنشيط حركة النشاط فيه بالاضافة الى ذلك مراقبة عمل السوق وتعزيز الاجراءات والقوانين ومتابعة عمل السوق من اجل جعله اكثر فاعلية في دعم التنمية الاقتصادية في البلد.

- ٣- يجب على ادارة السوق وضع قوانين صارمة تنظم عمل الشركات المدرجة في السوق، اذ من غير المعقول مرور اكثر من ست عشر سنة على تأسيسه مع ذلك نلاحظ هذا المستوى المتذبذب والمنخفض من اداء السوق والشركات العاملة فيه.
- ٤- على المستثمرين في سوق العراق للاوراق المالية استخدام نموذج تسعير الموجودات المالية لما له من اهمية كبيرة في تقييم الموجودات المالي، فضلاً عن دقة النموذج والسهولة والبساطة التي يتميز بها.
- ٥- يجب على ادارة السوق فتح المجال امام الشركات الاجنبية والمستثمرين الاجانب في الدخول الى الاستثمار في العراق وادراج هذه الشركات في السوق والتنسيق مع الجهات ذات العلاقة بالبلد من اجل تسهيل عملية الاستثمار لهذه الشركات والمستثمرين.

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دراسة بايولوجيه وكيميائيه للمكونات السامه لنبات خروب *Anagyrus foetida*

**Biological and chemical studying for poisonous compound  
of *Anagyrus foetida***

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العراق، بغداد، الجامعه العراقيه

**abstract**

This study was conducted at the laboratories of Field Crop Department of Agriculture college in Tikrit University from April 2013 till January 2014 to study effect for aquatic extracts of root and vegetative parts for each sun flower and sorghum on germination and growth of Bean clovor poisonous plant, sun flower and sorghum recycle (rooting and vegetative parts) were collected from Hawija area of Kirkuk governake and also Bean clovor fruit was collected from the same area and seeds were gained after cleaning and drying.

pot experiment was conducted , included using aquatic extracts of rooting and vegetative parts for each sun flower and sorghum in (2,4 and 8%) to Bean clovor poisonous plant, experiment was included 16 treatment with comparison treatments (addition distel water only) , The experiment was designed according to Complete Randomized Design (C.R.D.) with three replicates.

calculated of concentration active compounds (alkaloids) for each leaves and seeds and the results were Aquatic extracts for sun flower and sorghum affected on quantity of active compounds (alkaloids) in leaves and seeds for poisonous plant bean clovor and reduce its active.

**المقدمه****المكونات السامة في النبات**

تعتبر المركبات السامة في النباتات المسؤول الرئيسي عن التأثيرات السمية التي تحدثها النباتات بعد التغذية عليها فبعضها عرف منذ فترة طويلة واعطي اسماء مشتقة في الغالب من الإسم العلمي للنبات مثل الهيدرِن Hederin الموجود في نبات اللبلاب الذي اشتق من الإسم العلمي للنبات *Hedera helix* وبعضها الآخر خليط من مركبات عدة كما أن بعض المكونات السامة لم تعين بشكل دقيق [١] وأهم المركبات السامة في النبات هي القلويدات Alkaloids ، والكلايكوسيدات Glycosides والمواد المهيجة Chemical irritats ومسببات الارجية Allergens ، الحماضات Oxalates ، الفينولات Phenolies ، النترات والنترت Nitrites and Nitrates ، عوامل التحسس الضوئي Photosensitizing agents والمواد العفصية Tannins وغيرها [٢]، يعتقد أن المكونات السامة

تشكلت خلال تطور النبات كوسيلة دفاعية ضد الحشرات والكائنات الدقيقة وان تأثيرها السمي في الحيوانات وبخاصة الثديية منها هو تأثير عارض [١].

تحتوي النباتات السامة على نسبة معينة من مواد فعالة ومنتجة لها في الظروف الإعتيادية وتؤثر تأثيرا سيئا في الإنسان والحيوان ومنتجاته ، إن الدراسة العلمية لهذه المركبات ونوعها والعناصر السامة الموجودة في النبات يعتبر الطريق الأمثل لتشخيص الأعراض ومعرفة طرق معالجتها ومن هذه المركبات الكيماوية او العناصر الفعالة الفلويدات والكلايكوسيدات والتاتينات ومواد اخرى [٣].

ومن النباتات التي تحوي على المكونات السامة خروب الخنزير وهو عبارة عن شجيرة صغيرة معمرة وفضية رائحتها غير مستحبة وتتراوح إرتفاعها بين متر الى مترين وساقها الفتية خضراء اللون ومغطاة بشعيرات مبيضة [٤] والأوراق مركبة تحتوي ١٢-٥ وريقة والوريقات رمحية وتغطي الشعيرات سطحها السفلي والنورة عنقودية والأزهار صفراء مخضرة اللون يصل طولها الى ٥,٢ سم والثمرة قرن يتراوح طوله بين ١٠ و ١٨ سم ويحتوي على عدد كبير من البذور يزهر في اذار وينتشر في المناطق الساحلية الجافة كما يوجد في بعض الجبال الداخلية مثل جبل الحص كما ينتشر في حوض البحر المتوسط والعراق وتركيا ويسمى علوي الأحناء النتن [٥] وينتشر ايضا في المناطق الشمالية من العراق كمحافظة دهوك ومحافظة صلاح الدين ونيوى وجد أن هذا النبات سام جدا وغير مخدر اذ ان بذور واوراق هذا النبات تحتوي على مواد سامة للإنسان تسبب الإسهال الشديد والتقيؤ المستمر وبعدها يحدث الموت نتيجة توقف التنفس [٣] أما المكونات السامة فتحتوي اجزاء النبات كافة على قلويدات سامة اهمها قلويد الأنأجرين Anagryne وقلويد الساييتيسيين Cytisine [٦]

### طريقة العمل

تم جني كمية كافية من ثمار خروب الخنزير في مرحلة النضج في شهر تشرين الثاني ٢٠١٢ من قضاء الحويجة في محافظة كركوك وقد تم اخراج البذور منها وغسلت جيدا وازيلت جميع اثار الأنسجة الثمرية وحفظت في قنينة بلاستيك لحين الأستعمال.

### جمع النماذج النباتية

تم جمع نباتات زهرة الشمس *Helianthus anuus L*. والذرة البيضاء *Sorghum bicolar L*. خلال الموسم الزراعي ٢٠١٣ من الحقول الزراعية من قضاء الحويجة في محافظة كركوك وكانت مرحلة النمو للنباتات هي مرحلة النمو الخضري حيث قلعت مع الجذور (مجموع جذري ومجموع خضري)

وغسلت النباتات جيدا لإزالة الشوائب العالقة بها وبعد ذلك تم فصل المجموع الجذري عن المجموع الخضري لكل نبات وجففت تحت اشعة الشمس ثم قطعت إلى قطع صغيرة بعد ذلك جففت بالفرن الكهربائي تحت درجة حرارة (٧٠ م) لمدة ٣ ايام ثم طحنت النماذج بواسطة مطحنة كهربائية من نوع مولينكس وحفظت في عبوات بلاستيكية مغلقة بإحكام لحين إستخدامها وحفظت في مكان بارد وجاف.

### ٣تحضير المستخلص المائي

تم تحضير المستخلص المائي وبتراكيز (٢و٤و٨%) لكل معاملة من المعاملات المستخدمة في التجربة باخذ ٢ غم من مسحوق الأجزاء النباتية المختلفة ومزجت مع ١٠٠ مل من الماء المقطر حسب طريقة [٧] ووضع الخليط (الماء المقطر والمسحوق النباتي) في الخلاط الكهربائي لمدة ربع ساعة ثم رشح النموذج بثلاث طبقات من قطع الشاش وبعدها رشح المحلول بورق ترشيح من نوع Whatman ١.No ووضع المحلول الخاص بكل تركيز نوع من انواع النباتات ولكل جزء نباتي في قناني زجاجية محكمة الغلق داخل أكياس سوداء وحفظت في الثلاجة بدرجة حرارة (٥م) لحين الإستعمال.

### تجربة الاصل

تم تطبيق تجربة حقلية استخدم فيها اكياس بلاستيكية خلال الموسم الزراعي ٢٠١٣ في أرض البيوت البلاستيكية من كلية الزراعة في جامعة تكريت اذ تضمنت إستخدام المستخلصات النباتية كمادة رش خضري بعد الإنبات و كانت المعاملات التي طبقت في التجربة كالآتي :-

١-المستخلص المائي للمجموع الجذري لزهرة الشمس بنسبة (٢و٤و٨%)

٢-معاملة السيطرة Control

٣-المستخلص المائي للمجموع الخضري لزهرة الشمس بنسبة (٢و٤و٨%)

٤-معاملة السيطرة Control

٥-المستخلص المائي للمجموع الجذري للذرة البيضاء بنسبة (٢و٤و٨%)

٦-معاملة السيطرة Control

٧-المستخلص المائي للمجموع الخضري للذرة البيضاء بنسبة (٢و٤و٨%)

٨-معاملة السيطرة Control

استخدمت أكياس بلاستيكية للزراعة بقطر ٢٠ سم وارتفاع ٢٠ سم وملئت بالتربة المزيجية النظيفة بعد خلطها بكمية متساوية من البتموس ثم وضعت البذور في السنادين اذ بلغ عدد البذور ٢٥ بذرة لكل معاملة ثم خفت النباتات إلى ٥ نباتات في كل معاملة، اضيفت المستخلصات المائية للمعاملات المذكورة إلى السنادين بعد ذلك تم ري السنادين كلما دعت الحاجة

تشخيص المواد الفعالة (القلويدات) في خروب الخنزير

تم وزن ١ غم من (الأوراق والبذور) كل على حدة ولجميع المعاملات بالميزان الألكتروني الحساس ثم سحقت باستخدام المدقة والهاون إلى مسحوق دقيق بعد ذلك اذيب في ١٠ مل من قلويد الميثانول باستخدام هيدروكسيد البوتاسيوم حتى يصل PH الى ٨,٢ ثم اخذ النموذج وتم رجه وهزه في جهاز حمام الأمواج فوق الصوتية لمدة ١٠ دقائق ثم رشحت العينة لإزالة الألياف بعد ذلك جمع الراشح بتبخير المذيب بإسالة النتروجين حتى يصل قريب من ٠,٥ مل ثم حقن في اسطوانة جهاز كروماتوغرافيا السائل عالي الأداء (HPLC (High Performance Liquid Chromatography) ، ثم حدد كمية التركيز لكل مركب بموازنة اعلى قمة من حزمة القياس لذلك النموذج تحت نفس الظروف المنعزلة، [٨]

حساب تركيز المادة الفعالة (القلويدات)

تم حساب تركيز القلويدات لكل من الأوراق والبذور حسب المعادلة التالية:-

التركيز من النموذج (ملغم/مل) = مساحة النموذج / مساحة القياس × تركيز القياس × العامل المخفف لمساحة القياس وحسب الجدول الاتي [٩].

التسلسل	اسم المادة	الإحتجاز الزمني (بالدقيقة)	مساحة القياس	حزمة تركيز القياسي (ملغم/مل)
1	Cytisine	1.22	59437	ملغم امل 15
2	aporphine	2.39	87383	
3	anagyrene	3.57	82563	

التحليل الأحصائي

اجريت التجربة وفق التصميم العشوائي الكامل (C.R.D.) Completely Randomize Design باستخدام تحليل التباين (ANOVA) واختبرت الفروق بين المتوسطات الحسابية عند مستوى احتمالية ٠,٠٥ باستخدام إختبار دانكن متعدد الحدود [١١].

### النتائج والمناقشة

#### نتائج فصل وتشخيص القلويدات من الأوراق

اظهرت نتائج التحليل الكيماوي وجود ثلاث مركبات قلويدية في اوراق خروب الخنزير وهي الاناغرين والساييتيسين والابورفين (جدول ١) الصيغته الكيماوية للابورفين :  $C_{17}H_{17}N$  وزنه الجزيئي (٢٣٥,٣٢٤ غم/مول) [١١]

ويلاحظ من الجدول ان مستخلصات المجموعين الخضري والجذري لنبات زهرة الشمس ادى الى خفض مستوى هذه القلويدات في اوراق خروب الخنزير مقارنة بالسيطرة علما ان التركيز %٨ ولنوعي المستخلصات وبصورة عامة هو الاكثر تاثيرا باتجاه خفض مستوى القلويدات المذكورة انفا في اوراق خروب الخنزير عدا ذلك تذبذب انخفاض مستوى هذه القلويدات في حالة التركيزي (٢ و٤%) ولكلا نوعي المستخلصات ، ويلاحظ كذلك من (جدول ١) ان هناك تقاربا بين تاثير نوعي مستخلصات زهرة الشمس في محتوى القلويدات لاوراق خروب الخنزير، وبالنسبة لمستخلصات الذرة البيضاء ادت الى خفض مستوى القلويدات المشخصة بالجدول عن المقارنة، اذ وجد ان استخدام مستخلصات زهرة الشمس بمجموعها الجذري والخضري يعيق إمتصاص المواد الغذائية وبدوره يخفض الفعاليات الحيوية ويخفض النمو وتجمع المادة الجافة في الجزء الخضري وبالتالي تقل المادة الفعالة [١٢] كما وجد ان فعالية المركبات المتحررة من مخلفات الذرة البيضاء فعالة لاكثر من شهرين [١٣] وقد وجد ان التأثير الاليلوباثي للمتبقيات النباتية للذرة الصفراء والبيضاء والشوفان الموجودة في الحقل يمكن ان يستمر لمدة ٤١ اسبوع [١٤] كما اشار [١٥] الى ان الحوامض الفينولية الناتجة من مخلفات المحاصيل ذات تاثيرات انتخابية وتظهر تاثيراتها بشكل تحفيزي او تثبيطي اعتمادا على التركيز المؤثر وعلى العوامل البيئية اضافة الى استجابة النبات المستلم والجزء النباتي.

جدول (١) تأثير اضافة المستخلصات المائية لزهرة الشمس والذرة البيضاء في قلويدات

اوراق خروب الخنزير.

Anagryrine (ملغم/مول)	Aporphine (ملغم/مول)	Cytisene (ملغم/مول)	التركيز	نوع المستخلص	نوع النبات
8.35	7.61	7.35	2%	مجموع	زهرة
11.19	6.76	9.54	4%	جزري	الشمس
5.81	3.44	7.03	8%		
14.20	12.13	29.22	السيطرة		
6.48	6.32	9.28	2%	مجموع خضري	
5.58	8.21	6.00	4%		
7.47	4.40	3.44	8%		
14.20	12.13	29.22	السيطرة		
7.93	7.17	11.19	2%	مجموع جزري	ذرة
10.38	6.32	4.78	4%		بيضاء
1.06	5.37	7.19	8%		
14.20	12.13	29.22	السيطرة		
14.55	10.43	4.72	2%	مجموع	
8.12	1.73	4.05	4%	خضري	
10.67	7.72	9.84	8%		
14.20	12.13	29.22	السيطرة		

## تشخيص القلويدات في البذور

اظهرت نتائج التحليل الكيماوي وجود ثلاث مركبات قلويدية في اوراق خروب الخنزير وهي الاناغرين والسايثيسين والابورفين (جدول ٢) ويلاحظ من الجدول ان مستخلصات المجموع الخضري لنبات زهرة الشمس بتركيز ٨ و٤% ادى الى خفض مستوى هذه القلويدات في بذور خروب الخنزير مقارنة بالسيطرة عدا ذلك تذبذب انخفاض مستوى هذه القلويدات في حالة المجموع الجذري للذرة البيضاء وبتركيزي (٨ و٢%) ، حيث ان العديد من العوامل الوراثية والبيئية عرفت بتنظيم حركة المركبات من النبات الواهب وكذلك فان عدد من العوامل الوراثية والبيئية سوف تنظم استجابة النبات المستقبل للمركبات التي تدخله، اذ ان اصناف النباتات لاتستلم المركبات الاليلوباثية بصورة متجانسة [١٦] ، كما ان تأثير المركبات الاليلوباثية يعتمد على طبيعة المركبات المتواجدة في الاجزاء النباتية وقد تسبب بعض المركبات خاصة الاحماض الفينولية تاثيرات تثبيطية في النبات [١٧]

## جدول (٢) تأثير اضافة المستخلصات المائية لزهرة الشمس والذرة البيضاء في قلويدات

## البذور.

نوع النبات	نوع المستخلص	التركيز	Cytisine (ملغم/مول)	Aporphine (ملغم/مول)	Anagyrine (ملغم/مول)
زهرة الشمس	مجموع	2%	0	0	0
	جذري	4%	4.49	3.1	4.7
		8%	8.94	2.01	3.02
	السيطرة		10.44	3.32	8.78
مجموع خضري	مجموع	2%	2.14	1.34	4.21
		4%	0	0	0
		8%	0	0	0



8.78	3.32	10.44	السيطرة		
1.91	1.69	6.30	2%	مجموع جذري	ذرة بيضاء
1.17	0	2.18	4%		
1.40	0.51	1.81	8%		
8.78	3.32	10.44	السيطرة		
3.15	4.78	2.51	2%	مجموع خضري	
1.36	0.94	2.40	4%		
0	0	0	8%		
8.78	3.32	10.44	السيطرة		

### الاستنتاجات

1- اظهرت النتائج وجود قلويد ثالث هو الابرورفين بالاضافه الى قلويد الاناغيرين والسيتيزين

٢- المستخلصات المائية للمجموعين الخضري والجذري لنباتي زهرة الشمس والذرة البيضاء تاتي في خفض المحتوى القلويدي لاوراق و بذور خروب الخنزير .

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## إمكانية توظيف الخلطة الخرسانية الحاوية على رماد الورق المطبوعة في الساحات العامة

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## الخلاصة

يواجه العراق تحدياً خطيراً في التخلص من النفايات في العديد من مدافن النفايات في جميع أنحاء البلاد. بسبب ارتفاع التكاليف التخلص من هذه النفايات و المشاكل البيئية المحتملة و الجهد و الوقت المبذولين لذلك . في هذا البحث تم استخدام رماد الورق كمادة استبدال (٥% ، ٧% و ١٠% ) من جزء اسمنت افي الخلطات الخرسانية , نسبة الخلط الوزنية التي تم استخدامها في الكونكريت التقليدي (١ : ١,٦ : ٢,٣٧) من الاسمنت و الرمل و الحصى على التوالي مع نسبة الماء الى الاسمنت ( ٠,٤٨ ) . تم اجراء فحص قابلية التشغيل , الكثافة الجافة , التوصيل الحراري , امتصاص الماء . باستخدام عينات قياسية في الاعمار ( 7, 14 , 28 ) يوماً .

الكلمات المفتاحية: الخرسانة الخضراء ، الخلطة الخرسانية ، رماد الورق.

## مقدمة

التنمية المستدامة هو مصطلح اقتصادي اجتماعي أممي، رسمت به هيئة الأمم المتحدة خارطة للتنمية البيئية والاجتماعية والاقتصادية على مستوى العالم، هدفها الأول هو تحسين ظروف المعيشية لكل فرد في المجتمع، وتطوير وسائل الإنتاج وأساليبه، وإدارتها بطرق لا تؤدي إلى استنزاف موارد كوكب الأرض الطبيعية، حتى لا نحمل الكوكب فوق طاقته، ولا نحرم الأجيال القادمة من هذه الموارد، (تلبية احتياجات الجيل الحالي دون إهدار حقوق الأجيال القادمة)، ودون الإفراط في استخدام الموارد الطبيعية المتبقية على كوكبنا.

إن كثيراً من المصادر الطبيعية التي نستخدمها في خدمة التنمية الشاملة في بلادنا تتناقص مصادرها باستمرار، فهي (غير متجددة)، وخاصة مصادر الطاقة والمياه والمواد الأولية التي يتضاعف استهلاك العالم لها بشكل مضطرب منذ الثورة الصناعية، بينما ظل الاعتقاد الخاطئ السائد بأن الأرض هي مصدر لا ينضب للثروات، وموردٌ لطاقة لا محدودة [1].

لكن جرس الانذار دق بالخطر، وذلك عندما أكدت تقارير الخبراء في اللجنة الدولية لتغير المناخ، أن أنشطة الإنسان هي المسؤولة عما وصلت إليه الأخطار على مستقبل البشرية برمتها، من تلوث للهواء والانبعاثات الغازية في الغلاف الجوي وارتفاع حرارة الكرة الأرضية، ومظاهر ذوبان الجليد في القطبين، والذي يصاحبه ارتفاع منسوب مياه البحار مما يهدد بكوارث طبيعية بالغة الخطورة.

ذلك يعني أن المسؤولية في كل تلك المخاطر تقع على عاتق أنماط التنمية السائدة التي نستخدمها. لذا فقد استنفرت جهود الامم المتحدة وعدد كبير من المنظمات الإقليمية والوكالات الدولية المتخصصة والمنظمات غير الحكومية، والدول لمواجهة مهمة التصدي لهذا الواقع، وتبني تطبيق أهداف التنمية المستدامة نحو إقامة مجتمع عالمي إنساني متضامن لمواجهة كل التحديات العالمية، والقضاء على الفقر، تغيير أنماط الانتاج والاستهلاك في المصادر غير المستدامة، وحماية الموارد الطبيعية وحسن إدارتها ، ومنع تدهور البيئة العالمية، وتراجع التنوع البيولوجي والتصحر، ومعالجة تلوث المياه والهواء والبحار.

مواد البناء تستهلك كمية كبيرة من المواد غير المتجددة . و من ناحية اخرى ، اكثر نفايات الورق تنتهي في مواقع دفن النفايات من تلك اعادة تدويرها، وهذا يكلف اقتصاديا. نتجية لذلك تدوير نفايات الورق لاستخدامها ضمن مواد البناء تشكل خطوة نحو التنمية المستدامة. و من ناحية اخرى خلال عملية تصنيع الأسمنت تتبعث نسبة عالية من غاز ثنائي اوكسد الكربون بالاضافة الى كلفة لتصنيع السمنت . من ما جعل التوجه نحو استعمال مواد بديله بشكل جزئي للسمنت لغرض تصنيع خرسانه الاعتيادية ( ordinary concret ) ، لها اقل ضررا على البيئة و ذات كلفة منخفضة في التصنيع و البناء و بالموصفات جيدة في الخواص الميكانيكية تلبى حاجة المجتمع . في هذا بحث تم استخدام الالياف الورق ( نفايات الورق ) كمادة المضافة للحجم الخرسانه .

يدخل هذا نوع من الخرسانه في بناء البيوت المنخفضة الكلفة كذلك مناسب لبناء المحلات و احواض الزهور و الاثاث في الساحات العامة . ان استخدام الخرسانة ذات حشوات الورقية كجدران مائة تلقي اقبال اكثر من قبل متخصصين في مجال البناء .

يواجه العراق مشكلة كبيرة في التخلص من مخلفات البيئة في العديد من مدافن النفايات في ارجاء البلاد. بسبب كثرة التكاليف التخلص من هذه المخلفات البيئية و عوائق البيئية المحتمله و الجهد و

الوقت المصروفين لذلك . في هذا البحث تم استعمال مخلفات الورقية الذي تم حصول عليها من المدارس و المكتبات و من الاله ثرم الورق في الخلطات المزيج الخرساني لاستعمالها في مشاريع البناء . [2]

الخرسانة الخضراء هو مفهوم يعبر عن استعمال مواد صديقة للبيئة في صناعة الخرسانة، لجعلها دائمة لفترة أطول. تُعتبر الخرسانة الخضراء شائعة جداً ورخيصة أيضاً في إنتاج، لو ذلك على سبيل المثال ل تُستخدم منتجات النفايات كبديل جزئي للإسمنت لتجنب عبء التخلص من النفايات، وللتقليل من استهلاك الطاقة أثناء عملية الإنتاج، كما أنها أكثر متانة. ولا يجب ربط هذه الخرسانة بلونها. يمكن استخدام المخلفات لإنتاج منتجات جديدة أو يمكن استخدامها كإضافات حيث تحد من استخدام المصادر الطبيعية وتجعلها قابلة للاستغلال بكفاءة أكبر؛ وبذلك يتم حماية البيئة من الأضرار الناتجة عن التخلص من المخلفات [3].

الخرسانة الخضراء هو مفهوم يعبر عن استخدام مواد صديقة للبيئة في تصنيع الخرسانة، لجعلها دائمة لفترة أطول. تُعتبر الخرسانة الخضراء شائعة جداً ورخيصة أيضاً في الإنتاج، لأن وعلى سبيل المثال تُستخدم منتجات النفايات كبديل جزئي للإسمنت لتجنب عبء التخلص من النفايات، وللتقليل من استهلاك الطاقة أثناء عملية الإنتاج، كما أنها أكثر متانة. ولا يجب ربط هذه الخرسانة بلونها. يمكن استخدام المخلفات لإنتاج منتجات جديدة أو يمكن استخدامها كإضافات حيث تحد من استخدام المصادر الطبيعية وتجعلها قابلة للاستغلال بكفاءة أكبر؛ وبذلك يتم حماية البيئة من الأضرار الناتجة عن التخلص من المخلفات. ويمكن استخدام المواد غير العضوية المتبقية مثل غبار الحجر، والخرسانة المكسرة، والنفايات الرخامية كزكام أخضر في صناعة الخرسانة [11]. بالإضافة إلي ذلك فإن إبدال الإسمنت بكميات كبيرة من الرماد المتطاير وغبار السيليكا من أجل تطوير إسمنت أخضر جديد ومواد متماسكة؛ يُزيد من استخدام المواد الخام البديلة والوقود البديل عن طريق تطوير أو تحسين الإسمنت مع استهلاك أقل للطاقة أثناء التصنيع. وقد أجريت أبحاث كبيرة على الاستخدامات الصناعية المختلفة للمنتجات والمواد الصغيرة المألوفة في الخرسانة. ولم تكن التكلفة فقط هي مصدر القلق الرئيسي من استخدام المخلفات البوزولانية، ولكن أيضاً تحسين خصائص الخرسانة وخاصة المتانة. قبل كل شيء فإن الأكثر نجاحاً في هذا الصدد هو استخدام البدائل المناسبة للإسمنت البورتلاندي، خاصة هذه التي تنتج من العمليات الصناعية مثل الرماد



المتطاير، وخبث الحديد، وغبار السيليكا. وأيضاً تكتسب الجهود المبذولة أهمية كبيرة لاستخدام مواد مناسبة مُعاد تدويرها كبديل لركام الخرسانة، مثل الركام المُعاد تدويره.

الاستخدام رماد الورق كمادة استبدال (٥٪، ٧٪ و ١٠٪) من جزء اسمنت ا في الخلطات الخرسانية , نسبة الخلط الوزنية التي تم استخدامها في الكونكريت التقليدي (١ : ١,٦ : ٢,٣٧) من الاسمنت و الرمل و الحصى على التوالي مع نسبة الماء الى الاسمنت ( ٠,٤٨ ) . تم اجراء فحص قابلية التشغيل , الكثافة الجافة , التوصيل الحراري , امتصاص الماء .باستخدام عينات قياسية في الاعمار ( 7, 14 , 28 ) يوما .

### تصميم الخلطة الخرسانية

إن الغرض من تصميم المزيج هو الحصول على نسب مزيج اقتصادي للمواد المتاحة التي تتوافق مع الكثافة المطلوبة لهذا العمل ولديها قابلية تشغيل كافية لوضعها في القالب. تم إجراء العديد من الخلطات التجريبية لتحديد مزيج مناسب يحتوي على الخصائص المرغوب فيها في الحالة الجديدة والمتعززة. كما هو موضح في جدول رقم (١).

الجدول (١) : رموز الخلطات الخرسانية

Mix symbol	Details
A	Conventional Mix
F-5	Conventional Mix+5% ash wastepaper
F-7	Conventional Mix+7% ash wastepaper
F-10	Conventional Mix+10% ash paper

## عملية الخلط و رص الخرسانة :

تم انجاز عملية الخلط الخرسانه داخل مختبر الخرسانه في مختبر بغداد ا مركز الوطني، للمواد الانشائية وزارة الاعمار و الاسكان العراقية باستخدام خلاطة ذات سعة (١.٠) م<sup>٣</sup> . بعد تحضير الاوزان

المطلوبة لكل خلطة تتم وضع حصى و الرمل و الاسمنت و وضعها في الخلاطة و من ثم خلط المواد و هي جافة لمدة دقيقة للحصول على تجانس القوام و من ثم اضافة المادة البديلة و من ثم ماء حتى يتم تجانس الخلط و توزيع نفايات الورق بصورة جيدة . بعد ذلك يتم صب الخرسانة في القوالب الحديدية معكبة ذات الابعاد (١٠٠\*١٠٠\*١٠٠) مليمترا معكب ، و الاسطوانية ذات الابعاد (١٠٠\*٢٠٠) مليمترا معكب و المواشير ذات الابعاد (٤٠٠\*١٠٠\*١٠٠) مليمترا معكب، ( بعد دهن السطح الداخلي للقوالب بدهن المحركات و بطبقة خفيفة بواسطة فرشاة) على شكل ثلاثة طبقات، حيث تم رص كل طبقة بواسطة المنضدة الكهربائية و لمدة ٨ ثواني قبل صب الطبقة الاخرى . بعد ذلك اتمام صب و رص الخرسانه تمت المعالجة السطح النماذج بالمالج للحصول على سطح مستو .

### الأسمنت

تم استعمال الأسمنت البورتلندي الاعتيادي ( النوع الاول ) في البحث و المعروف محليا ب ( الاسمنت الماس بازيان ) ، و المطابق للمواصفات العراقية الخاصة بالاسمنت البورتلندي م.ق.ع ١٥ ١٩٨٤ [٥] . الخواص الفيزيائية و الخواص الكيميائية للأسمنت في الجدول (٢) و (٣). تم اجراء الفحوصات في المركز الوطني للمختبرات الانشائية وزارة الاسكان العراقية ا مختبر بغداد

جدول (٢) : : التركيب الكيميائي والمركبات الرئيسية للأسمنت البورتلندي العادي (OPC)

Oxide composition	Abbreviation	% by weight	Limit of IQS No.5\1984
<b>Lime</b>	CaO	64.6	-
<b>Silica</b>	SiO <sub>2</sub>	20.63	-
<b>Alumina</b>	Al <sub>2</sub> O <sub>3</sub>	5.4	-
<b>Iron oxide</b>	Fe <sub>2</sub> O <sub>3</sub>	3.65	-
<b>Magnesia</b>	MgO	0.7	≤ 5%
<b>Sulphate</b>	SO <sub>3</sub>	2.4	≤ 2.8%
<b>Loss of Ignition</b>	L.O.L.	2.55	≤ 4%
<b>Lime saturation factor</b>	L.S.F.	1	0.66-1.02
<b>Insoluble residue</b>	I.R.	0.9	≤ 1.5

Main compound ( Bouge eq.)		By weight of cement	
Tricalcium silicate	C <sub>3</sub> S	54.02	-
Dicalcium silicate	C <sub>2</sub> S	18.41	-
Tricalcium aluminate	C <sub>3</sub> A	8.36	-
Trtracalcium aluminoferrite	C <sub>4</sub> AF	11.36	-

## جدول رقم (٣) : الخواص الفيزيائية للأسمنت البورتلاندي العادي (OPC)

Physical properties	Result	Limit of IQS. No.5
Specific surface ( m <sup>2</sup> \ kg)	330	> 230
Setting time ( Vicat's method )		
- Initial setting ( hrs:min )	2:45	≥ 45 min
- Final setting ( hrs:min)	5:00	≤ 10 hrs
Compressive Strength of Mortar		
- 3 Days	30.02	≥ 15
- 7 Days	35.31	≥ 23
Autoclave ( Soundness)	0.01%	≤ 0.8

## الركام الناعم (الرمل)

تم استخدام الرمل الطبيعي الذي تم تجهيزه من منطقة الاخضر . اجريت الفحوصات من معامل النعومه و تدرج الحبيبي و محتوى الكبريتات، موضحا في جدول رقم (٤) و كانت مطابقة للمواصفات القياسية العراقية [6] . تم اجراء الفحص الركام الناعم في المركز الوطني للمختبرات الانشائية \ مختبر بغداد . التدرج الفيزيائي للرمل موضح في الجدول رقم (٥).

## جدول (٤) : الخواص الفيزيائية والكيميائية للركام الناعم

Properties	Test Results	Limits of IQS No.45\1984
Specific gravity (SSD)	2.5	

Fineness modulus	3.01	
Sulphate content	0.137%	≤ 0.5%
Absorption	1.6	
Clays and Fine material	2.6%	≤ 5%

## جدول (٥) : تدرج الركام الناعم

Sieve size (mm)	Percentage passing %	Limit of IQS No.45\ 1984
10	100	100
4.47	96	90-100
2.36	78	75-90
1.18	61	55-90
0.6	40	35-55
0.3	16	8-30
0.15	5	0-10

الركام الخشن ( الحصى )

تم استخدام الحصى المكسر بمقاس ( ١٩-٥ ) مم ، تم تجهيزه من منطقة النباعي شمال محافظة بغداد . تم تنظيف الحصى و غسله من الاتربة و الشوائب و تجفيفه قبل الخلط . جدول (٦) يظهر الخواص الفيزيائية للركام الخشن حسب المواصفة العراقية ( رقم ٤٥ \ ١٩٨٤ ) [6] . تدرج الحصى موضح في جدول رقم (٧). تم اجراء الفحص الركام الناعم في المركز الوطني للمختبرات الانشائية \ مختبر بغداد.

## جدول (٦) : الخواص الفيزيائية الركام الخشن

properties	Tests Results	Limit of IQS No.45\1984
Specific gravity	2.6	-
Sulphate content	0.023%	< 0.1%

Water absorption	0.8%	-
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جدول (٧) : تدرج الركام الخشن.

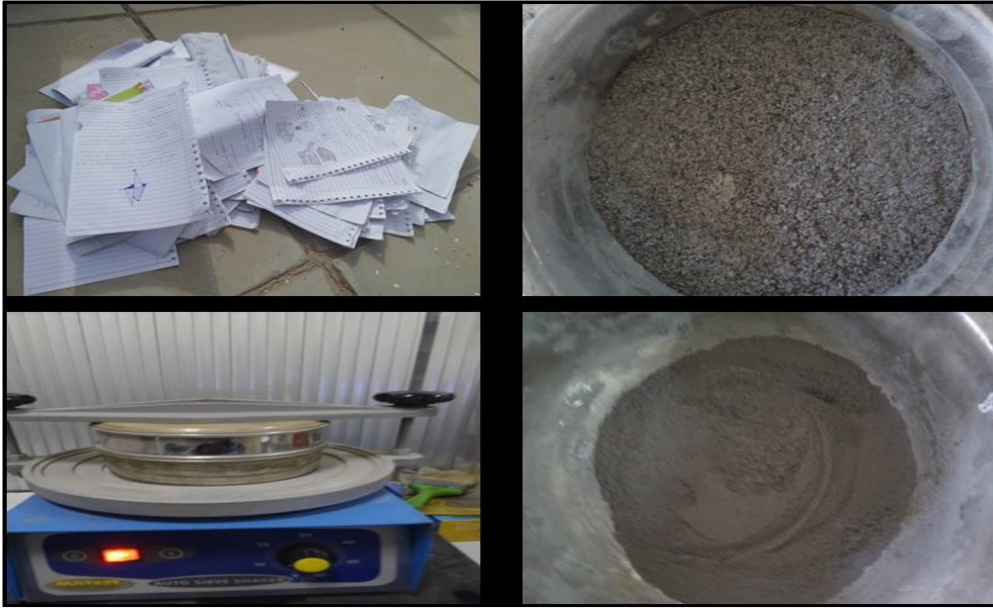
Sieve size (mm)	Accumulated percentage passing %	Limits of IQS.No.45\ 1984 (%)
37.5	100	100
20	92	90-100
12.5	75	40-80
9.5	40	30-60
4.75	2	0-10

## الماء

استعمل ماء الشرب الاعتيادي لمدينة بغداد لجميع الخلطات اثناء عمليات المعالجة و الخلط .

## رماد الورق

تم تجميع نفايات الورق ( ورق الطباعة ) من المدراس ، الجامعات في بغداد . تم حرق الورق في الفرن عند درجة الحرارة ٥٢٥ م° لمدة ٦٠ دقيقة وفقاً لمواصفة ASTM D 586 [12] . بعد الحرق تم غربلة رماد ناتج من الحرق في الميزان كهربائي بواسطة غربال (600 μm) للحصول على رماد الورق. بالاضافة الى الخواص الفيزيائية للرماد موضحة في جدول (٨) . اما التحليل الكيميائي بواسطة جهاز (EDX X Flash 6110 –Model) موضحة في جدول (٩). لقد تم اجراء الفحص في مختبر SEM \ القسم العلوم الفيزياء في جامعة النهريين .



شكل(1): خطوات تحضير رماد مخلفات رماد الورق.

الجدول (8) : الخواص الرماد ورق الفيزيائية

Physical properties	Results	Requirements of ASTM C618
Specific Gravity	2.64	.....
Loss on Ignition L.O.I (%)	5.03	Max. 10
Strength Activity Index (%)		
7 days	80.91	Min 75%
28 days	85.94	

الجدول (9): التحليل الكيميائي لرماد الورق بواسطة جهاز EDX X Flash 6110-Model.

Oxide composition	Percentage content %
CaO	82.19
SiO <sub>2</sub>	4.83
Fe <sub>2</sub> O <sub>3</sub>	0.67
Al <sub>2</sub> O <sub>3</sub>	3.062
MgO	4.08

## النتائج و المناقشة

### فحص قابلية التشغيل ( الهطول)

تم اجراء فحص الهطول على الخرسانة بعد اكمال عملية الخلط مباشرة لكل من العينة الاساس ( بدون اي اضافة ) ،الخلطات الخرسانية الحاوية الرماد الورق عند الثلاث النسب (٥% ، ٧% ، ١٠% ) ، كان فحص الهطول لعينة الاساس ٩٠ ملم . في حين عند الخلطات الخرسانية الحاوية على (رماد الورق ( عند نسب ( ٥% ، ٧% ، ١٠% ) كبديل جزئي لسمنت نسبة الهطول تقل بنسبة تتراوح بين ( ٧٠- ٥٢ ) ملم في الخلطات حاوية على رماد الورق كبديل جزئي لسمنت مقارنة مع الخلطة الاساس، ذلك سبب في ذلك لكون حبيبات رماد الورق يحتوي على مواد عضوية غير متطايرة تمتص الماء اكثر من السمنت فيقل ماء الخلط مما يسبب نقصان في قابلية التشغيل. الشكل (٢) يوضح طريقة فحص الهطول للخلطات الخرسانية .

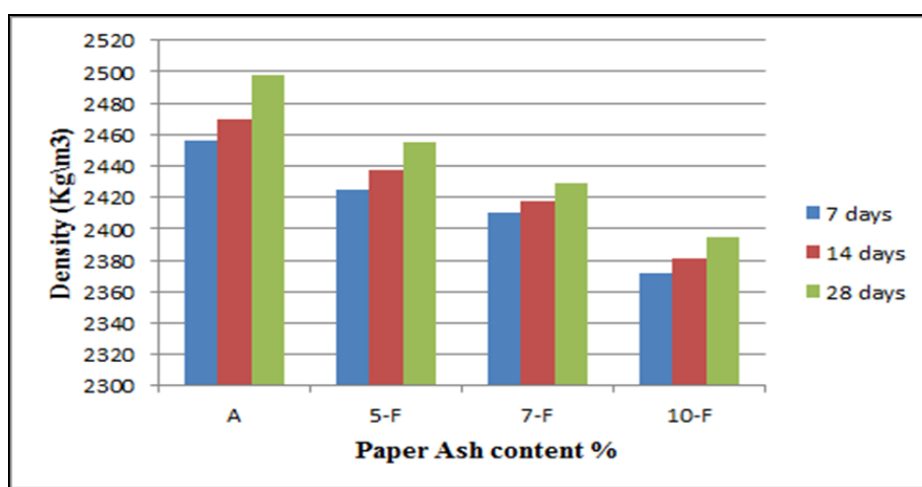


الشكل (٢) : فحص الهطول

### الكثافة

تم تحديد كثافة الخرسانة باستخدام معكبات بوزنها بعد تجفيفها بالهواء . وفقا لمعايير البريطانية ( B.S 1881: part 114: 1989 ) [7]، تم اخذ نتائج ثلاث عينات لكل خلطة بثلاث اعمار معالجة بالماء ( 7 , 14 , 28 ) يوم الشكل (٣)، يوضح فحص الكثافة الخلطات الخرسانية الحاوية على رماد الورق كبديل جزئي

لسمنت (٥% ، ٧% ، ١٠%) للخرسانة مقارنا بالخلطة الاساس . حيث اظهرت النتائج زيادة الكثافة مع عمر معالجة بالماء و ذلك بسبب استمرارية عملية الاماهة للحصول على متانة كاملة للخرسانة . انخفضت كثافة بنسبة (4.123%) عنداستخدام (١٠%) من رماد الورق كبديل لسمنت بعمر المعالجة (٢٨) يوم . يعود سبب نقصان في الكثافة الى كون الوزن النوعي لرماد الورق اصغر من وزن النوعي الاسمنت و كثافة الورق قليلة جدا مقارنة بكثافات مكونات الخرسانة الاخرى ، اي تأثيرها يكون قليل بسبب قلة وزن الورق مقارنة بوزن المواد الاخرى المكونة للخلطة الخرسانية .



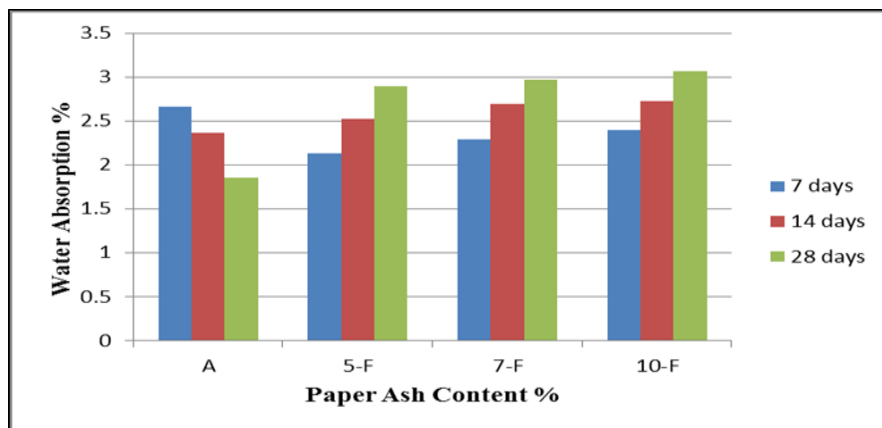
الشكل (٣) : نتائج فحص الكثافة لجميع خلطات الخرسانية عند عمر ٧ و ١٤ و ٢٨ يوما

### فحص امتصاص الماء

فحص امتصاص الماء هو واحد من اكثر الفحوصات الفيزيائية المؤثرة لقياس متانة الخرسانة ، و التي تعتمد على الكمية الكلية لامتصاص الماء في الخرسانة. اجري الفحص المختبري على ثلاث نماذج معكبة الشكل بأبعاد (١٠٠\*١٠٠\*١٠٠) مم لكل عمر من الاعمار المعالجة بالماء (٧ ، ١٤ ، ٢٨) يوم لجميع الخلطات الخرسانية لمعرفة بموجب المواصفة الامريكية (ASTM C642-06) [8] . تم اجراء الفحص امتصاص الماء في مختبر الخرسانة / مختبر بغداد / مركز الوطني للمختبرات و المواد الانشائية في وزارة الاسكان. الشكل (٤) يوضح النتائج الفحص الامتصاص الماء للخلطات الخرسانية التي حاوية على الرماد ورق كمواحد بديلة للسمنت. حيث اظهرت النتائج بصورة عامة زيادة امتصاص الماء في



الخرسانة بزيادة نسبة المواد البديلة للسمنت ، و ذلك بسبب احتواء حبيبات الرماد على مواد عضوية غير متطايرة لها القابلية على امتصاص الماء.



الشكل (٤) : فحص امتصاص الماء لجميع الخلطات الخرسانية الورقية عند عمر ٧ و ١٤ و ٢٨ يوماً

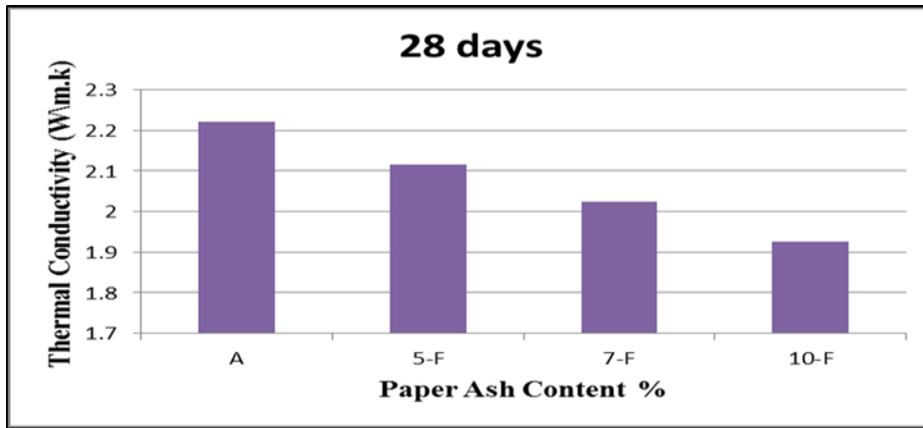
## فحص التوصيل الحرارة

تعتبر الخواص الحرارية لمواد البناء عامل مهم يشير اليه بواسطة التوصيل الحراري . حيث اجري الفحص المختبري على ثلاث النماذج المعكبة الشكل بابعاد (١٠٠\*١٠٠\*١٠٠) مم في عمر ٢٨ يوم لجميع الخلطات الخرسانية بموجب المواصفة الامريكية (ASTM C-1113) [9] . باستخدام جهاز [10] QTM-500 لفحص التوصيل الحرارة كما موضح في الشكل (5) . و الشكل (6)، يوضح نتائج الفحص التوصيل الحرارة الخلطات الخرسانية حاوية على رماد الورق كالبديل للسمنت و الخرسانة بدون اي اضافة . تم اجراء الفحص التوصيل الحراري في مختبر الخرسانة / مختبر بغداد / مركز الوطني للمختبرات و المواد الانشائية في وزارة الاسكان .



الشكل (5) : جهاز فحص توصيل الحراري

الشكل (6)، يوضح النتائج الفحص التوصيل الخلطات الخرسانية الحاوية على رماد الورق كموايد بديلة للسمنت و الخرسانة بدون الاضافة في المعالجة بالماء ( ٢٨ ) يوم . حيث اظهرت النتائج بصورة عامة الانخفاض التوصيل الحرارة في الخرسانة كلما زادت نسبة المواد البديلة للسمنت ، وذلك يعود بسبب الورق مادة سليلوزية تزيد الفجوات و الفراغات في تركيب الخرسانة فتتخفص الكثافة فينخفض التوصيل الحرارة.



الشكل (6) : نتائج فحص التوصيل الحراري لجميع الخلطات الخرسانية عند عمر ٢٨ يوما.

## الاستنتاجات

١. ان المواد المركبة السمنتية – النفايات القابلة للتدوير يمكن استخدامها في تطبيقات مختلفة، مثل تصنيع مونة اسمنية وخرسانه خضراء ولها مقاومة عالية مقارنة مع الخرسانة الاعتيادية اثناء العمل والخلط والتشكيل.
٢. الخرسانة الورقية التي يتم تصنيعها تمتلك خاصية عزل الحراري و صوتي جيد و الاقتصاد بمادة الاسمنت المستعملة للخلط .
٣. المواد الخام غير مكلفة وموجودة بصورة حرة.
٤. لها دورا مهما في نشر ثقافة البناء الأخضر (المستدام).
٥. مناسبة لبناء البيوت واطئة الكلفة مع عمر وديمومة متوسطتين. مناسب ايضا لبناء المحلات، وكابينات التليفون وأحواض الزهور والأثاث في الساحات العامة والمخازن.
٦. أن استخدام الخرسانة الورقية كجدران مألثة يلقى قبولا اكثر من متخصصي مجال البناء.

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## الخصائص والعوامل المؤثرة على طلاء الفولاذ الحيوي بطريقة EPD

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## Characteristic and Factors Affecting on the 316 bio-stainless steel Coating via EPD

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**ABSTRACT**

Stainless steel 316L is a metal which used as bone plate, however this metal has low biocompatibility in a human body. For increasing their biocompatibility, the stainless steel 316L need to be coated with YSZ and HA was deposited by electrophoretic deposition (EPD) using stainless steel 316L as anode and cathode. Powders was coated on stainless steel substrate from (30 to 90) volt and deposition time from (1to 10) minutes. Thickness of biocomposite layer on substrate increased, as the time deposition and voltage increased.

The purpose of this research is to study the effect of applied voltage, deposition time, type of solvent and materials' concentration on the properties of the coated layer by Electrodeposition technique used to form protective layer on bio - stainless steel type 316.

The extreme vastly utilized substance for implant production for implementations of orthopedic is Austenitic stainless steel, especially stainless steel kind 316 L. the incident of important centralized corroding crevice and pitting corrosion discover by happenings of failing of implant equipment of stainless steel. The best method to improve the performance of orthopedic equipment is coating of surface stainless steel with bio ceramics to decrease the liberation of ions of metal and make it very resistance to the corrosion. The highest purpose of present study is to discover appropriate biomaterials layer coating and discussing the most significant factors which provide the greatest features for this layer in expression of thickness.

The results confirm that the best thickness was obtained from a suspension containing (1:1) %Vol. at time deposition is (5 min), the minimum applied voltage is (30 V), and the substance that is acting as solvent for the suspension is isopropanol. While 17%water+ +83% ethanol was not used in the EPD procedure because of in the period of the electrophoretic deposition process, the less quantity of hydrogen grew on the surface of cathode

**Keywords.** Hydroxyapatite; Nanocomposite, Electrophoretic deposition, Coatings, Ytria stabilized Zirconia, Chitosan.

## الخلاصة

الفولاذ المقاوم للصدأ L٣١٦ هو معدن يستخدم كصفيحة عظمية، إلا أن هذا المعدن يتمتع بتوافق حيوي منخفض في جسم الإنسان. ولزيادة التوافق الحيوي، يجب طلاء الفولاذ المقاوم للصدأ L٣١٦ بـ YSZ و HA والتي تم ترسيبها بواسطة الترسيب الكهربائي (EPD) حيث تم استخدام الفولاذ المقاوم للصدأ L٣١٦ كأنود وكاثود. تم طلاء المساحيق على ركيزة من الفولاذ المقاوم للصدأ من (٣٠ إلى ٩٠) فولت وزمن ترسيب من (١ إلى ١٠) دقائق. زاد سمك الطبقة المركبة الحيوية على الركيزة مع زيادة زمن الترسيب والجهد المسلط.

الغرض من هذا البحث هو دراسة تأثير الجهد المسلط وزمن الترسيب ونوع وتركيز المواد على خواص الطبقة المطلية بتقنية الترسيب الكهربائي المستخدمة لتشكيل طبقة واقية على الفولاذ الحيوي المقاوم للصدأ نوع L٣١٦.

المادة المستخدمة على نطاق واسع لإنتاج الغرسات لتطبيقات جراحة العظام هي الفولاذ المقاوم للصدأ الأوستنايتي، وخاصة الفولاذ المقاوم للصدأ من النوع L ٣١٦. تم ملاحظة حدوث التآكل الصدعي والتآكل النقري والذي يؤدي إلى فشل الزرعة من الفولاذ المقاوم للصدأ. أفضل طريقة لتحسين أداء معدات تقويم العظام هي طلاء سطح الفولاذ المقاوم للصدأ بالسيراميك الحيوي لتقليل تحرير أيونات المعدن وجعله مقاومًا جيدًا للتآكل. الهدف الأساسي من الدراسة الحالية هو ترسيب طبقة طلاء من المواد الحيوية المناسبة ومناقشة أهم العوامل التي تؤدي إلى الحصول على أفضل المميزات لهذه الطبقة ومدى تأثيرها على السُمك الناتج.

تؤكد النتائج أن أفضل سمك تم الحصول عليه من المعلق الذي يحتوي على (١:١) %Vol. في وقت الترسيب (٥ دقائق) عند الجهد (٣٠ فولت)، والمحلول المستخدم هو الأيزوبروبانول. بينما لم يتم

استخدام ١٧% ماء + ٨٣% إيثانول في إجراء الترسيب بطريقة EPD لأنه خلال فترة عملية الترسيب الكهربي، زادت كمية الهيدروجين المتحرر على سطح الكاثود .

الكلمات الدالة. هيدروكسي ابيتايت. المواد النانوية المركبة، الطلاء الكهربي، الياتريا المثبتة بالزركونيا، الشيتوزا

### Abstract.

Stainless steel 316L is a metal which used as bone plate, however this metal has low biocompatibility in a human body. For increasing their biocompatibility, the stainless steel 316L need to be coated with YSZ and HA was deposited by electrophoretic deposition (EPD) using stainless steel 316L as anode and cathode. Powders was coated on stainless steel substrate from (30 to 90) volt and deposition time from (1to 10) minutes. Thickness of biocomposite layer on substrate increased, as the time deposition and voltage increased.

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coating and discussing the most significant factors which provide the greatest features for this layer in expression of thickness.

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## 1. INTRODUCTION

The procedure of electrophoretic deposition (EPD) recognized for several years as a way for production film layers with different performances and various implementations [1, 2, 3].

(EPD) process permits control of the rate of deposition, uniformity, thickness of layer. Utilizing this process for production of film layer it was known for a variety of coating applications [2, 3]. One of the interesting applications includes surface modification of metallic bone implant materials [4, 5]. Electrophoretic deposition (EPD) is flexible method for treating colloidal suspensions of particulate materials. It has been applied to a wide range of applications, including thin film manufacturing, multi-layered composites, mechanically graded materials Additional advantages of using this process as: the low fee of the essential equipment, easiness; Electrophoretic deposition

(EPD) is the most widely used technique for producing composite coatings, since it allows the control of deposition parameters to obtain films with specific properties on substrates. EPD is carried out at room temperature and finally the potentiality production of film layer on complex forms substrates [1, 6, 7].

The deposition of suspended solid particles from suspensions occurs immediately under settled state due to the effect of an electrical domain. This method called Electrophoretic deposition [7, 8].

The charged particles motion under the carrying out electrical domain (electrophoresis) and the deposition process of these particles to the electrode surface lead to form layer of coating [9, 10]. (EPD) is a vital way to produce thick and thin layer of film [11, 12]. Most research has focused on the use of chitosan with hydroxyapatite (HA) and studying the effect of them on biological properties, but in this research the addition of Ytria Partially Stabilized Zirconia (YSZ) was studied to produce a composite material characterized by good biological properties, since hydroxyapatite has a structure similar to the human body, but its mechanical properties are weak, and to overcome on this problem, a composite material was produced by the EPD method and the effect of variables of this method on the properties of the resulting layer was studied.

The deposition rate can be organized via changing specified factors, as the features of conductivity, substances of electrode, voltage of electrode, size of particles, the solutions/suspensions specification such as the pH, and finally time of deposition [12, 13].

S. Dor, S. Rühle et.al in 2009 [14], study the he influence of suspension composition on the electrophoretic deposition of TiO<sub>2</sub>. Our research exhibits

that this process is suitable for the film layer formation at specified thickness in each technique of controllable and reproducible, reducing of the density of layer lead to the rising of thickness of layer, that if prove to us the profile of density aren't rely on the concentration of particle or solvent. When thickness of layer exceeds 5-10  $\mu\text{m}$ , the layer density stays steady at somewhat over 1 g/cm, this lead to forms films at high porosity.

Israa Zuhair and his companions [15] in 2022, studied the effect of Hydroxyapatite-chitosan (HAP-CS) coating on the 316L SS utilizing a pulsed electrophoretic deposition (PEFD) to improve biocompatibility of the surface at a constant voltage (30 V) and frequency (50 Hz).. The results discovered that a uniform, HA coating free-crack, and thick can be obtained by electrophoretic deposition. The aim of this work is concerned on the investigate the effect of deposition parameters, such as applied voltage, deposition time, the concentration and type of solvent on the thickness of the coated layer electrophoretically deposited on 316L stainless-steel.

## 2. EXPERIMENTAL PROCEDURES

### 2.1. Sample preparation

In our research, we were utilized alloys of stainless steel of type AISI 316 L as samples of try out (anode and cathode) at (30\*15\*0.2) mm of dimensions. By the means of (BANDELIN SONOREX RK 100, made in Germany) these samples had been cleaned ultrasonically, together with acetone for interval of time 20 min, then desiccated by gas of N<sub>2</sub>. A balance at 0.1mg of accuracy had been utilized for weighting

the samples after and before procedure of coating, 316L Stainless Steel chemical composition utilized in the study are shows in Table (1).

**TABLE 1.** Chemical composition of 316 L SS

Standard	Measured	Elements
0.03	0.025	% C
16-18	18.010	% Cr
10-14	10.642	% Ni
2	2.358	% Mo
-	0.314	% Cu
-	0.444	% Si
-	1.350	% Mn
-	0.079	% N
-	0.019	% Ta
-	0.079	% V
-	Remain	% Fe

By means of weighting, every mass coating was estimated. The variance in weight of sample after and before method of electrophoretic deposition was the milligrams of depositing coat weight. The yield of the deposit was estimated of unit (mass of deposit per unit area) by defining the deposit area ( $15 \times 20$ ) mm<sup>2</sup>, according to equation below:

$$W_d = ((w_c - w_o))/A \quad \dots\dots\dots (1)$$

Where:-

$w_c$ : the coated substrates weight

$w_o$ : the uncoated substrates weight

A: area of the deposit,

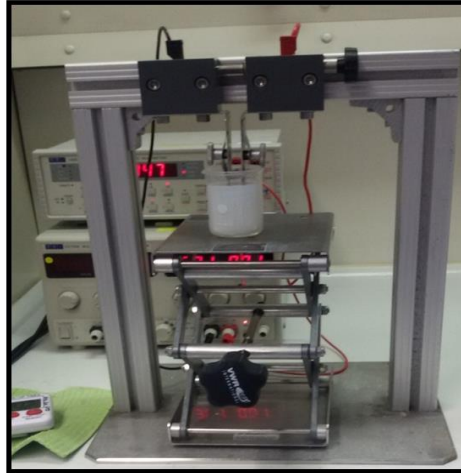
## 2.2. Preparation of Suspension

The preparation of suspension had been done by the means of dissolving of 0.5g/ L of chitosan (MW=80kDa) at deacetylation degree approximately 85 % (Sigma-Aldrich, Germany) in 1% of acetic acid at purity higher than 98%. Various quantities of (1,0.8,0.5,0.2)vol.% and (2,1.5,1,0.5) from HA and YSZ utilized respectively. Preparation of suspension by using three types of solvents: 83%ethanol+ 17%water, 100% ethanol (>99%) and 100% isopropanol (>99%). The pH of the suspensions is fitted at 4.5. After stirring for 24 hours, the suspension was further dispersed ultrasonically for 20 min by using ultrasonic processor. LASER PARTICAL SIZE ANALYSER JL-1197, which is made in China, has been used to determine the distribution of particle size in various solvents, and substances particle size which are utilized in this research

### 2.3. Operation of experimental electrophoretic deposition

electrophoretic deposition set at different values of applied voltage are (90, 70, 50, 40, and 30) volts by means of a laboratory Power supply (DC), with various time of deposition from 1to 10 min, the space between the two electrodes in cell of electrophoretic deposition was constant at 10mm. The substrate area that is exposed to deposition was (20\*15) mm, and composites of YSZ-Chitosan-HA, HA-Chitosan, and YSZ-Chitosan, were deposited on alloy of 316LSS by electrophoretic deposition process, after completing EPD process, after the completing EPD process; the samples were dried overnight in atmosphere. For every condition, repeated EPD process three times and the deposition average was determined. The instrument which was utilized in the coating of EPD shown in Figure (1), the practical part and the rest of the tests were done in the

EPD Laboratory, Biomaterials Institute chief at the Materials Science and Engineering Department, Erlangen-Nuremberg University in Germany.



**Figure (1):** The instrument which was utilized in the coating of EPD

### 3. CHARACTERIZATION TECHNIQUES

#### 3.1. Influence of the stability of suspensions and concentration

The multilayer coatings deposition needs the study of deposition kinetics and composition of deposit at various experimental conditions. Cathodic deposits were got from all suspensions, and to produce a good coating layer homogeneous in terms of microstructure, and to get suspensions at extremely steady , we don't used ethanol-17% water , because the electrolysis of water recognized during the EPD process and has a baleful effect on the homogeneity. Obtained coatings adhesion lead to the production of bubbles of gas. Through the many experiments that were conducted, the results showed that Isopropanol is the greater stability of particle of inorganic /polymer in comparing to others solutions. The occurrences of suspensions having different ratios of mixing of HA nanoparticles and YPZ disseminated by using a homogenizer of ultrasonic

shown in Figure (2). After the dispersion, the suspension remained for one week. The suspension tends to be stable and a tenuous sedimentation noticed for the suspensions including (1:0.8 and 1:1) vol. % from YPZ: HA, whereas the concentration of chitosan kept at 0.5 g/ L, which is obviously observed via a naked eye. There is a raised propensity in the stabilization of suspension as the solvent varied to isopropanol from ethanol, which is what the results obviously exhibit it. Therefore, suspension with isopropanol was found to be the most stable one. Only a slight sedimentation was observed after one week of aging, as shown in figure 2(a &c). The tubes from right to left have (2, 1, 1.5, and 0.5) ml of YPZ in the solution of isopropanol as presented in figure 2 a. The tubes from right to left have ratio of particle of YPZ: HA as (1:2), (1:1) and (2:1) in the solution of ethanol 17%-water as presented in figure 2 b. The tubes from right to left have ratio of particle of YPZ: HA as (2:1), (1:1), and (1:2) in the solution of ethanol as presented in figure 2 c.



**Figure 2:** stabilization of suspension after preparation in a solution of. (a) Isopropanol, (b) ethanol–17% water, and (c) Ethanol.

### 3.2. Solvents effect

The method of deposition carried out in media of isopropanol and ethanol to test the solvent influence that is used as media of suspension. In ethanol media, the

electrophoretic layer production was so considerable, however in step of the extraction of sample from the suspension, many of particles disseminate in the suspension. Whereas, the deposition in media of isopropanol was slight, thus, the yield of deposition was lesser. Likewise, the layer achieved in suspension of isopropanol was orderly and perfect .during sample extracting process, there was some diffusion in the suspension. The distribution of particle sizes was determined for every solvent to analyses the solvent influence on the particles conglomerate. So, their effect on coatings layer specification, inasmuch particle size in systems of conglomerate powders consider the most significant factors dominating the processing of ceramic. The results for this trial show in table 2. The results exhibit that the particles sizes distribution in the suspension at in various rates in two collections. Similarly, It was observed that in the ethanol state, as solution exhibited some conglomerates in the percentage topped 70% and the size was  $4.5 \times 10^1 \mu\text{m}$ . thus, in the isopropanol suspension state, there was wide distribution

of particle size in the suspension of starting . When the voltage was applied to the cell of electrophoretic, particles at altered electrophoretic velocities had been noticed. Therefore, we can be concluded, both effect of precipitation time and applied voltage selecting the YSZ and HA deposition of particles size. Usually, pH of the suspension, materials particle size, additives species, and zeta potential are the most significant parameters effecting the suspension stabilization.

**TABLE 2.** Particle size mean factors for powders of YSZ-Cs-HA

<i>Solven</i>	1st collection	2nd collection
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<i>t</i> <i>sort</i>	Ran ge ( $\mu\text{m}$ )	Aver age value ( $\mu\text{m}$ )	Cumul ating %	Rang e ( $\mu\text{m}$ )	Average value( $\mu\text{m}$ )	Cumulati ng %
<b>Ethan ol</b>	4*10 <sup>-2</sup> - 8*10 <sup>0</sup>	1*10 <sup>0</sup>	28	0.8*10 <sup>0</sup> - 0.8*10 <sup>2</sup>	4*10 <sup>1</sup>	60
<b>Isopro panol</b>	4*10 <sup>-2</sup> - 4*10 <sup>0</sup>	1*10 <sup>0</sup>	28	1*10 <sup>1</sup> - 9*10 <sup>1</sup>	5*10 <sup>1</sup>	55

### 3.3. Zeta potential influence

The values of zeta potentials for the three types of suspensions comprising 1:1 HA nanoparticles and YSZ with chitosan 0.5 (g.L-1) are show in Table (3).

It can be noticed, the values of zeta potentials for the three types of suspensions have positive values at the employed pH of 4.5, indicative of that the particles are positively charged, which also believes a particles catholic deposition.

The results shows, using an isopropanol solution introduce a clear behavior of the stability of suspensions. This relatively great value of zeta express the phenomenal suspension stability and also believes a deposition of catholic, indication that the suspension of isopropanol is appropriate for electrophoretic deposition. As an end result, the suspension was first described in expressions of its zeta potential. So,  $\zeta$ - potential is a significant parameter exhibiting

steadiness of colloid and by acting  $\zeta$ - value of potential on the organized suspension, we could get facts on the conglomeration of particle in the prepared suspension. Generally, a great value of positive zeta potential shows the well-spread suspension existence [17].

**TABLE 3.** The values of zeta potentials for the three types of suspensions.

Type of suspension	Zeta potential (mV)
Ethanol+17%H <sub>2</sub> O	28.45
100% Ethanol	39.4
100% Isopropanol	45.7

### 3.4. Deposition voltage influence

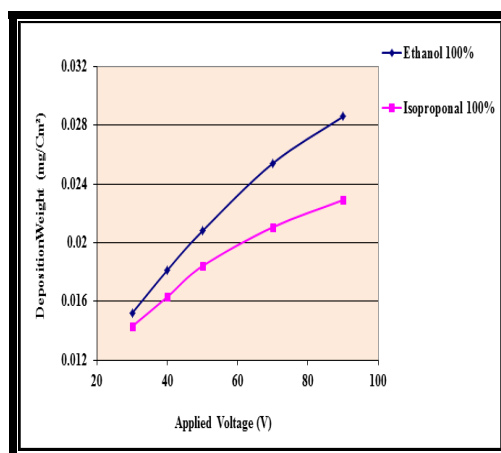
The weight for every unit area of the deposit and the deposition thickness as a function of applied deposition voltage are shown by Figures 3 (A) and (B) show the thickness of deposition and The weight for every deposit unit area as function of applied deposition voltage. The results presented that, at all applied voltage, the weight of deposition increased, but when rising applied voltage, the curve slope decreased, this means level of deposition is decrease. The reaching to the case of saturation and yield occurs when the coated sample at applied voltage of 90 V, and after 5 min of deposition. Alike results are probable for the coated sample at applied voltage of 50 and 30 V in a period of deposition higher than 5min.

In addition, the weight of deposition of the coated samples at applied voltage 50, and 30 V are near together. Nevertheless, the efficiency of the coating for

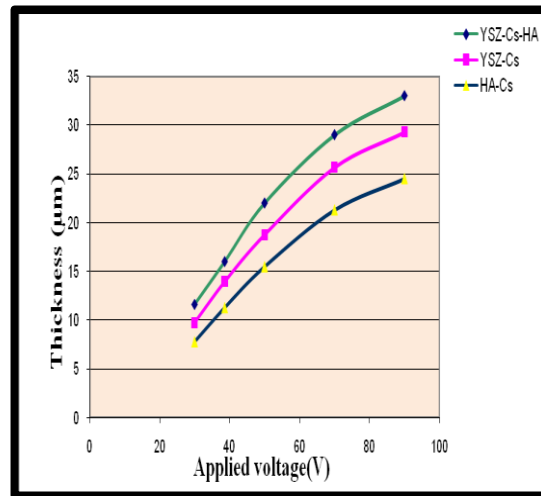
the coated samples at 90 V, is in the same line to those coated at 50, and 30 V at short periods of deposition.

Whereas there is a significant alteration among the coating efficiency of the samples ordered at 90 V with the rest samples for a period of deposition higher than 5min. The suspension of ethanol give the greatest thickness of film and rate of deposition. Electrophoretic deposition process that is done at 30 V for 5 min produce quantity of deposition  $0.0152 \text{ mg.cm}^{-2}$ , but when the process 2 at 90V for YSZ-Cs-HA in suspension of ethanol, the amount increase to  $0.0298 \text{ mg.cm}^{-2}$ . Normally, the deposit quantity rise directly with growing of applied potential. If large fields of applied voltage are utilized, powders can be deposited more rapidly, but the deposit quality is not enough. Additional uniform films were achieved, at intermediate applied fields (30–40) V. if fields applied higher than 50 V are used, the quality of the film weakens. Therefore, the details of particulate film on the electrode represents as a kinetic case, the particles conglomeration degree impacts their behaviors of packing in coating. The coating may be upset by flows in the medium of surrounding, also in its deposition when large field is applied because happening of turbulence in the suspension. Additionally, particles can be transporting so rapidly that they can't take enough time to catch the smallest sites to compose a structure of close-packed and then affects the deposit structure and the rate of deposition. Furthermore, at so great applied electrical field, the particles jostle for the duration of deposition and motion could likewise produce in random. Estimating the factors of deposition and then the deposit quality that is made by electrophoretic deposition process have evaluated by data of stability. The thicknesses achieved that are studied were at applied voltages (90, 70, 50, 40 and 30) for a time of 5min. In general the coating thickness raised with the

applied voltage, 11.6 $\mu\text{m}$  thickness of coating was obtained at 30 V, but at 50 V, thickness improved to 22  $\mu\text{m}$ , at 90 V and period of 5 min, we can get mostly thicker (33 $\mu\text{m}$ ) but not-adherent coating. Generally, the voltage growing will raise the thickness as prophesy, and this approves with Laxmidhar Besra and Meilin Liu [16] work. This is due to greater electrical field used between the counter electrode and the substrate, which will pull most positive charged surface of Nano particles substance to the surface of substrate. Likewise, greater applied voltage works to organize nanoparticles in an extra porous structure. The samples that has got at applied voltage (70-90) V exhibited clefted, random, unsteady coatings, and very porous. So, fluffy coating is most required because dense coatings were stated to be disposed to fractionation and crack through service and supplement.



(A)



(B)

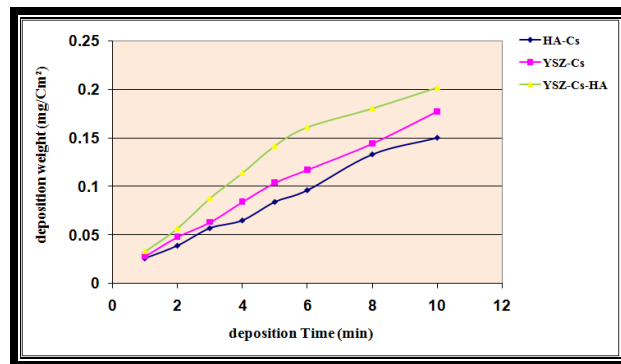
**Fig.3:** Effect of voltage on (A) weight of deposition and (B) coating thickness

### 3.5. Deposition Time Influence

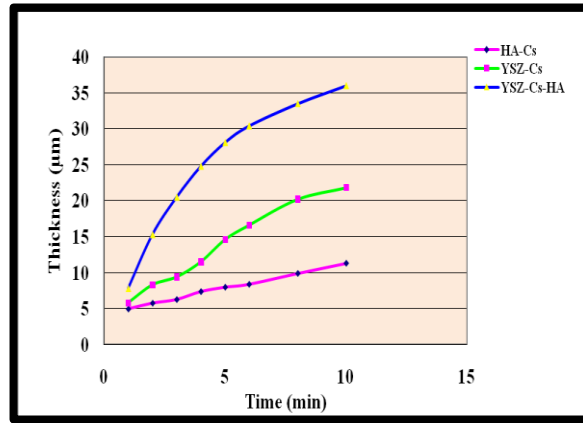
The weight of deposit and the coatings thickness at various time of deposition with applied voltage 30V. have shown in Figure 4 (A) and (B) , a quantity of deposition was  $0.22 \text{ mg.cm}^{-2}$  was achieved when process of electrophoretic deposition was done for 10 min at 30 V, this quantity decreased to  $0.04 \text{ mg.cm}^{-2}$  for 1 min for YSZ-Cs-HA in suspension of isopropanol. The rise in the weight of deposit with growing time of deposition is at qualitative approval with the equation of Hamaker. It is obvious that the rate of deposition is direct with the deposition primary time. Nevertheless when time increase more and more that is lead to decreases the rate of deposition and reaches a mesa at so great times of deposition. The variation of potential between the two electrodes is kept fixed, the electrical field affecting EPD process, reduces with time of deposition due to the forming of isolating layer of particles on the surface of electrode. For the duration of the primary period of electrophoretic deposition,

there is normally a direct relation between time and weight of deposition and the reduction in rate of deposition is recognized to the rise in the voltage fall through the layer of deposited.

The quantity of deposition can be simply organized via either varying the voltage or the deposition time as shown in Figure 3 and 4. A grouping of the voltage and the deposition time can be utilized not only to attain the wanted thickness and quantity but as well to obtain optimal adherence. Generally thickness and the rate of deposition of the coating improved together with the applied voltage and time as can be anticipated by equation of Hamaker [13]; nevertheless, for all conditions the decrease in weight of deposit was showed at period of deposition exceeding 6 min, with applied voltage greater than 40 V. These are referred to spalling of deposit. The spalling of deposit is connected to lesser deposits adherence with the substrate.



(A)



(B)

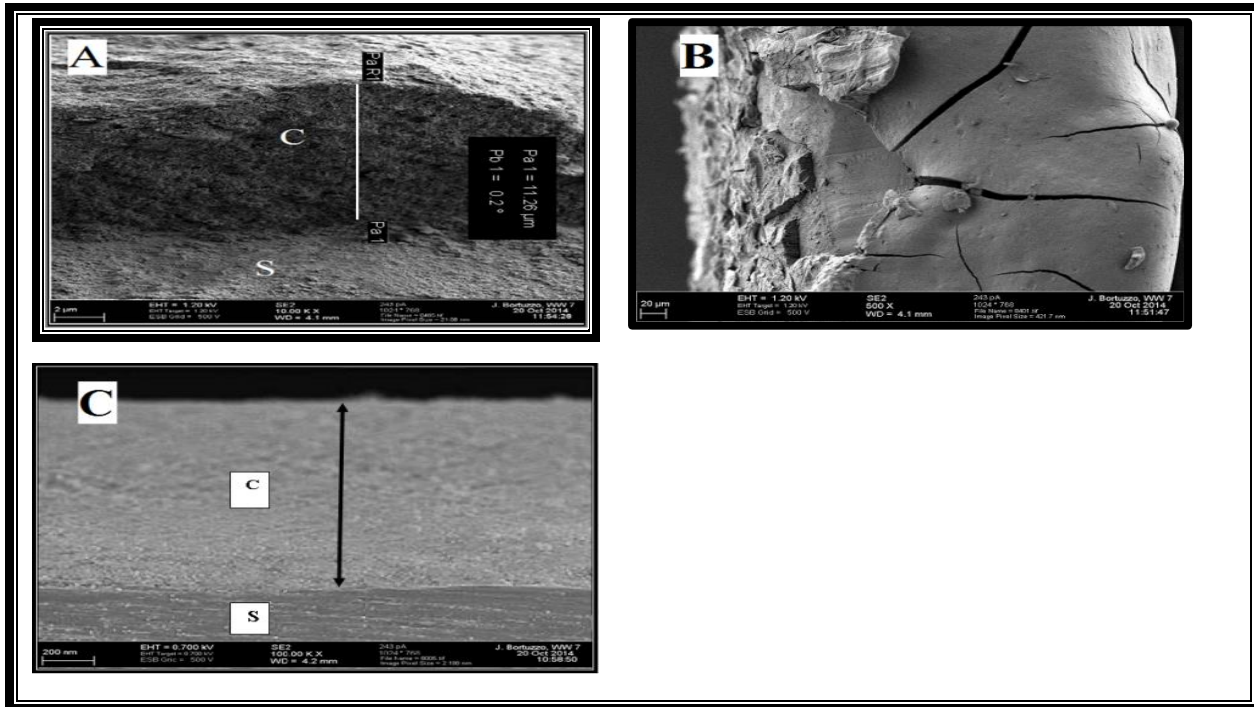
**Figure. 4:** (A) Time influence of on weight of deposition and (B) time deposit influence on coating thickness

### 3.6. Evaluation of microstructure

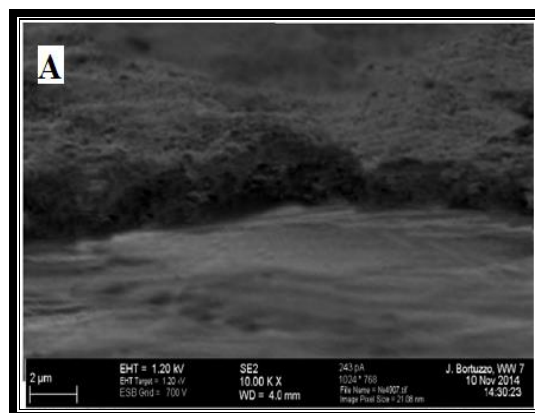
Growing the deposition time will raise the thickness also that is suitable. We have extra time for the EPD method which permits additional particles. These particles deposited to the substrate. Test of the coating cross-section of YSZ-Cs that is coated on 316L stainless steel for period of time 5 min at 30 V indicated comparatively uniform deposits and fine compacted layer of the coated on the substrate and thick layer is attained, at the interface no indication of coating limitation was noticed, showing that the coating is heavy sufficient to bear supposed tensions which results from the reduction of restricted volume for the duration of the cycle of dehydrating. While it is possible to show a highly coarse filling and fracture on the substrates when the cross section examine for period of time 5 min at 90 V, likewise determinations of thickness shows that coarseness of the surface improved with rising of thickness. SEM analysis exhibit this phenomenon in Figure 5(A) that is show layers at thin 11.26 µm devoid of cracks whereas Figure 5(B) that is show thick layers of 21.8 µm with

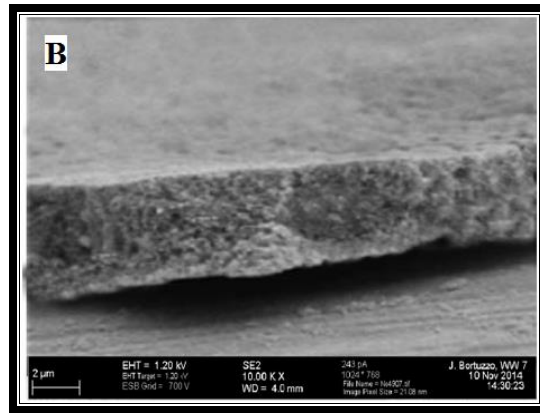
crack at the whole surface area. The thick coating has a propensity to fracture that is what the results assured it. Figure 5(C) , shows the micrographs of The cross-section have continued, thinning ( $\sim 5\mu\text{m}$ ) of hydroxyapatite layers onto substrate of 316L stainless steel, confirmed that the PED process makes a fixed-thicken deposits onto substrates, neglected the profile of surface or the shape of substrate. Figure 6 exhibits the cross section of the morphologies of the coatings that is attained concentrations of YSZ-Cs-HA of (1:1 and 1:0.8) vol. %. The coating prepared thickness with 1:0.8 in suspensions of isopropanol is about  $15\mu\text{m}$  at applied voltage 30V and time 5min, in figure 6a and as expecting that the greater concentration of the particles of ceramic produces the greater rate of deposition, the samples of the coating arranged using in suspension 1:1(HA: YSZ) offered a greater thickness about  $25\text{--}28\mu\text{m}$  as shown in figure 6b. In together states, thickness is slightly regular, microstructure was completely homogenous, and the appearance of the coatings to be thick, because of the process of machining of SEM annotations, so that the thickness of sample perhaps seems to be deviant as shown in Figures (5b) & (6 a & 6b).





**Figure 5: images of SEM analysis, shows the YSZ-Cs coating cross-section Deposited onto 316L stainless steel; (A) at applied voltage 30 V and period of time 5 min. (B) at applied voltage 90 V and period of time 5 min. (C) The micrographs of cross-section for HA Deposited onto 316L stainless steel at applied voltage 30 V and period of time 5 min**





**Figure 6: images of SEM of cross sections of coatings. Coatings were obtained by electrophoretic deposition process via using concentrations of 1:0.8 (A) and 1:1 (B) YSZ-Cs-HA in the suspension.**

The samples have been tested by using optical microscopy too. Photographs of micrographs have been taken of both the cross-section and the surface of samples. For the current condition, additional three samples have taken so as to analysis them. The forms of the three samples surface were different, from parts of coarse as islet to so smooth, lesser in pores. The various conditions of deposition for the samples lead to these differences. So as to note the coatings structure, performance of micrographs of greater resolution should be done in the state of deposits of well-feature too. Performances of micrographs of greater resolution have exposed various kinds of structures of coating, reaching between layers at large absorbency, layers without micro pores to layers with micro porous, and continued layers. The coating of hybrid formed from HA and YSZ in the solution of electrolyte has sight of usual cross-sectional as shown in Figure 7. The view of cross-section show no fractures and clear errors over the coating cross-section. Figure (7A) exposes no outstanding limit amidst the substrate and coating layer was noticed. Whereas, the cross section has the layer of coating with some fractures shows in figure (7 B). A number of sporadic in

coating layer displays in figure (7C) and finally figure (7D) displays a number of sporadic coating layer, porosity, and cracks this matches the search result of [18].

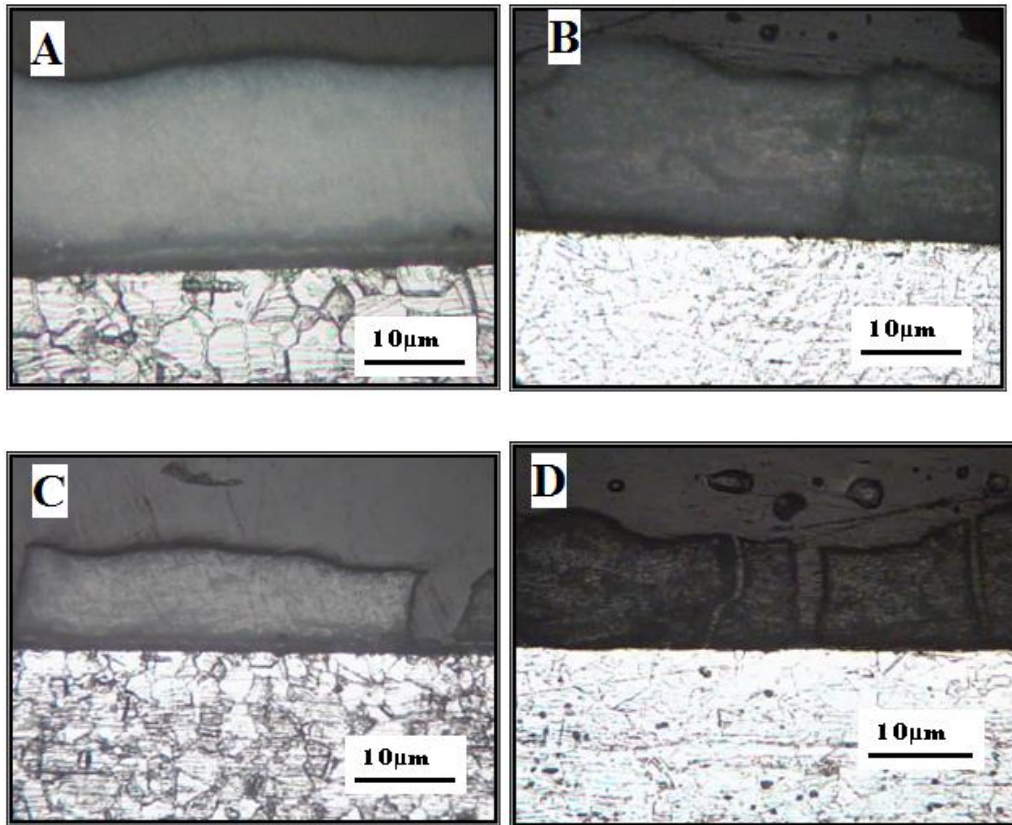


Figure 7: display a compound coating pictures by optical microscopy

#### 4. CONCLUSIONS

The important conclusion reached obtained from this work are summarized below:-

1. an uniform and thinning coating achieved with applied voltage 30 V, but when exceeded this voltage a coating with non-adhesive, non-uniform and denser is attained, that is what the series of trial-and-error showed it

2. The results of the solutions used indicated that isopropanol is suitable for the coating process
3. The better morphology of obtained coatings in voltage of 30 V and time of 5 min.
4. It has proven that time of deposition and applied voltage have an obvious influence on morphology and microstructure of coating, at low voltage, the coatings were free from crack and the size of particle was small.
5. The rate of deposition drops with growing time of deposition because of the voltage increasing fall through the layer of deposited.
6. No presence of fractures or clear shortcomings happened on the layer of coating and the adhesive of layers to the substrate was very well. Micrographs of SEM showed morphology with specification of continued, soft, and without flaw when process of EPD done at applied voltage 30V for period of time 5 min.

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ايجاد درجات مئنية للقوة الانفجارية للذراعين والرجلين للاعبين المركز الوطني  
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للتدريب

*They rely mainly on the athletic strength of the arms and legs of the players of  
the National Center for Determining Sports Talent in Handball at the ages of  
(12-14) years as a guiding basis for trainees*

*Doctor teacher Mustafa Essa Eqab<sup>1</sup>, Doctor teacher Ali Awadd Aziz<sup>2</sup>, Assistant teacher  
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## مستخلص البحث باللغة العربية

يهدف البحث الى ايجاد درجات مئوية للقوة الانفجارية للذراعين والرجلين للاعبين المركز، الوطني لرعاية، الموهبة الرياضية، بكرة اليد بإعمار (١٢\_١٤)، سنة، وكذلك تقييم عنصر القوة الانفجارية للذراعين والرجلين للاعبين المركز، الوطني لرعاية، الموهبة الرياضية، بكرة اليد بإعمار (١٢\_١٤)، سنة.

ولتحقيق الهدف استخدم الباحثون المنهج الوصفي، بالأسلوب المسحي لملائمته مع مشكلة البحث، وتكون مجتمع البحث من لاعبي المركز الوطني لرعاية الموهبة، الرياضية بكرة اليد بأعمار (١٢\_١٤) سنة، موزعين على (٦) مراكز وتشمل (بغداد، كربلاء، الديوانية، ديالى، المثنى، الموصل) والبالغ عددهم (٤٢) لاعب وهم مجتمع الاصل، واختيرت العينة بالطريقة، العمدية والبالغ عددهم (٤٢) لاعباً والذي يمثلون نسبة (١٠٠%) من مجتمع الاصل. واختير (٥) لاعبين لعينة التجربة الاستطلاعية، وتم استخدام اختبار رمي كرة، طبية (١ كغم) لقياس القوة الانفجارية للذراع الرامية، وكذلك اختبار القفز العمودي من الثبات لقياس القوة الانفجارية للرجلين، وتم تطبيق الاختبارات في التجربة الرئيسية على عينة البحث البالغ عددها (٤٢) لاعباً خلال مهرجان الربيع الذي نظّمته وزارة الشباب والرياضة على قاعات مراكز الموهبة الرياضية في بغداد للمدة من (٢٠٢٤/٣/٧) ولغاية (٢٠٢٤/٣/٩)، واجريت المعالجات الإحصائية المناسبة، واستنتج الباحثون بايجاد درجات مئوية في متغير القوة الانفجارية للذراعين والرجلين للاعبين المركز، الوطني لرعاية، الموهبة الرياضية، بكرة اليد بإعمار (١٢\_١٤)، سنة، ووجود انخفاض في متغير القوة الانفجارية للذراعين للاعبين المركز، الوطني لرعاية، الموهبة الرياضية، بكرة اليد بإعمار (١٢\_١٤)، سنة، ويوصي الباحثون بالاعتماد على الدرجات المئوية التي توصل اليها الباحثون في تقييم القوة الانفجارية للذراعين والرجلين للاعبين المركز، الوطني لرعاية، الموهبة الرياضية، بكرة اليد بإعمار (١٢\_١٤)، سنة وتعميمها، والاهتمام بتدريبات القوة الانفجارية للذراعين والرجلين للاعبين كرة اليد بإعمار (١٢\_١٤) سنة.

الكلمات المفتاحية: القوة الانفجارية للذراعين، القوة الانفجارية للرجلين، كرة اليد.

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The research aims to find percentile scores for the explosive power of the arms and legs for the National Center for Sports Talent Welfare handball players aged (12-14) years, as well as to evaluate the explosive power



component of the arms and legs for the National Center for Sports Talent Welfare handball players aged (12-14) years.

To achieve the goal the researchers used the descriptive approach using the survey method to suit it with the research problem. The research community included players from the National Center for Handball Sports Talent Care, aged (12-14) years, distributed among (6) centers, including (Baghdad, Karbala, Diwaniyah, Diyala, , Al-Muthanna,, Mosul) and their number is (42) players and they are the community of origin. The sample was chosen intentionally and the number is (42) players who represent (100%) of the community of origin. And (5) players were chosen for the exploratory experiment sample, The test of throwing a medicine ball (1 kg) was used to measure the explosive power of the throwing arm, as well as the vertical jump test from a standstill to measure the explosive power of the legs. The tests were applied in the main experiment to the research sample of (42) players during the Spring Sports Forum organized by the Ministry of Youth. And sports in the halls of the Sports Talent Centers in Baghdad for the period from (3/7/2024) to (3/9/2024), and appropriate statistical treatments were conducted, The researchers concluded by finding percentile scores in the explosive power variable of the arms and legs for the National Center for Sports Talent Welfare handball players aged (12-14) years, and the presence of a decrease in the explosive power variable of the arms for the National Center for Sports Talent Welfare handball players aged (12-14) years. The researchers recommend adopting the scores The percentage reached by researchers in evaluating the explosive power of the arms and legs of the National Center for Sports Talent Handball players aged (12-14) years and generalizing it, and paying attention to training the explosive power of the arms and legs for handball players aged (12-14) years.

**Keywords:** *The explosive power of the arms, the explosive power of the legs, handball.*

## المقدمة

إن للاختبار والقياس أهمية كبيرة في تحقيق أفضل إنجاز، فالتطور في المستويات الرقمية التي نراها في كثير من الألعاب هي بالتأكيد ناتجة من خلال تطور علوم الرياضة وإتباع العاملين في مجال التدريب التقويم العلمي الصحيح، وتعد لعبة كرة اليد واحدة من الألعاب التي لاقت اهتماماً كبيراً من المعنيين وأخذت نصيباً وافراً من التطور عالمياً من خلال الجهود التي بذلها المختصون إذ تعتمد على الانتقاء العلمي والفني الصحيح المعتمد على الاختبارات البدنية وكذلك على القياسات الجسمانية المناسبة لنوع الفعالية من أجل البدء بصورة صحيحة مع الناشئين والوصول إلى تطور مستوى الرياضي مما يؤدي إلى الوصول للمستويات العليا، إذ إن التخطيط المبني على مبادئ علمية لتحقيق الانجاز العالي في لعبة كرة اليد، لا يرتبط فقط بالعملية التدريبية وبرامج الإعداد المختلفة بل يتخطى ذلك ليشمل الاستعدادات والقابليات والقدرات الخاصة الموهوبة لدى الأفراد، مما يتوجب على القائمين استغلال هذه الاختبارات الملائمة واتخاذ الخطوات الواسعة في إعداد اللاعبين ورعايتهم خلال مراحل نموهم وبما يتلاءم ومميزات هذه المرحلة التي تمثل طورا من أطوار التقدم، والعمل على تهيئة الظروف التي تساعدهم على تطور واكتساب المهارات والخبرات لتنمية مختلف قدراتهم البدنية والوظيفية والحركية والعقلية وصقلها معتمدين بذلك على الاختبارات والقياسات للكشف عن هذه القدرات واعتمادها في التدريب الرياضي لتحقيق التطور البدني المتزن للعبة كرة اليد التي يمكن الوقوف بصورة واقعية على المستويات المتحققة والوصول إلى المستوى المطلوب للحصول على النتائج العالمية مستقبلا في المشاركات المحلية والمحافل الدولية، أهمية البحث تكمن بإيجاد درجات مئنيه للقوة الانفجارية للذراعين والرجلين للاعبين المركز الوطني لرعاية الموهبة الرياضية بكرة اليد بإعمار (١٢\_١٤) سنة، ليكون دليلاً يساعد القائمين على العملية التدريبية في تقويم اللاعبين وايضا الاستفادة من هذه الدرجات لتعميمها على كافة المراكز الخاصة بكرة اليد الموجودة في العراق.

أما مشكلة البحث فتعد القوة الانفجارية للذراعين والرجلين واحدة من العناصر البدنية الأساسية الضرورية للاعبين كرة اليد، ومن خلال إطلاع الباحثون على الاختبارات الخاصة بكرة اليد وكذلك اطلاعهم على العديد من البحوث والدراسات التي تناولت موضوع الاختبارات والقياسات في كرة اليد تبين عدم وجود دراسات تبين الدرجات المئنيه لبعض انواع الاختبارات وبصورة خاصة اختبارات القوة الانفجارية للذراعين والرجلين وتعميمها على هذه المرحلة العمرية في العراق، لذلك عمل الباحثون على

دراسة هذه المشكلة وإيجاد درجات مئينية تكون دليلاً علمياً يمكن الرجوع له ومقارنة المستويات المتحققة مع هذه الدرجات.

لذا كان هدفاً للبحث

- إيجاد درجات مئينية للقوة الانفجارية للذراعين والرجلين للاعبين المركز الوطني لرعاية الموهبة الرياضية بكرة اليد بأعمار (١٢\_١٤) سنة.
- تقييم عنصر القوة الانفجارية للذراعين والرجلين لأفراد عينة البحث.

أما مجالات البحث

١-٤-١ المجال البشري: لاعبي المركز الوطني لرعاية الموهبة الرياضية بكرة اليد بأعمار (١٢\_١٤) سنة.

٢-٤-١ المجال الزمني: من (٣٠٢٤/٢/١) ولغاية (٢٠٢٤/٣/٢٥).

٣-٤-١ المجال المكاني: القاعة الرياضية المغلقة الخاصة بمركز الموهبة لكرة اليد الخاصة بوزارة الشباب والرياضية.

إجراءات البحث

استخدم الباحثون المنهج الوصفي بالأسلوب المسحي لملاءمته مع مشكلة البحث، واشتمل مجتمع البحث على لاعبي المركز الوطني لرعاية الموهبة الرياضية بكرة اليد بأعمار (١٢\_١٤) سنة، موزعين على (٦) مراكز وتشمل (بغداد، كربلاء، الديوانية، ديالى، المثنى، الموصل) والبالغ عددهم (٤٢) لاعب وهم مجتمع الاصل، واختيرت العينة بالطريقة العمدية والبالغ عددهم (٤٢) لاعباً والذي يمثلون نسبة (١٠٠%) من مجتمع الاصل.

ادوات البحث

- المصادر والمراجع العربية والاجنبية.
- المقابلات الشخصية.
- استمارة تفريغ البيانات.
- شبكة المعلومات العالمية (الانترنت).

- الاختبارات والقياس.
- التجربة الاستطلاعية.
- ساعات توقيت الكترونية رقمية نوع (Casio) عدد(٣).
- جهاز حاسوب (لابتوب) نوع (Lenovo).
- ملعب كرة يد القانوني.
- صافرة يابانية الصنع.
- كرة طبية زنة ١ كغم.
- شريط قياس جلدي.

الاختبارات المستخدمة في البحث:

اختبار رمي كرة طبية (١)كغم باليد الرامية من الوقوف (محمد صبحي حسانين وحمدى عبد المنعم، ١٩٩٧، ٢٠٠).

❖ **الهدف من الاختبار:** قياس القوة الانفجارية للذراع الرامية.

❖ **الأدوات المستخدمة:** (منطقة فضاء مستوية، كرات طبية وزن (١كغم)، شريط جلدي للقياس).

❖ **وصف الأداء:** يقف اللاعب خلف خط البدء مواجهاً لقطاع الرمي ممسكاً بالكرة الطبية باليد الرامية بحيث تكون الكرة فوق الكتف بجانب الرأس، كما يجب أن يكون الجذع مستقيماً، وعند الإشارة يقوم اللاعب برمي الكرة الطبية لابتعد مسافة ممكنة بدون حركة الجذع.

❖ **طريقة تسجيل:** يعطى للاعب محاولات ثلاث، تحتسب أفضلها لأبعد مسافة رمي.

القفز العمودي من الثبات (أبو العلا احمد عبد الفتاح ومحمد صبحي حسانين، ١٩٩٧، ٢٢٠)

❖ **الهدف من الاختبار:** قياس القوة الانفجارية لعضلات الرجلين.

❖ **الأدوات المستخدمة:** (مكان خاص لأداء الاختبار، شريط جلدي للقياس، قطعة طباشير، جدار بأرتفاع مناسب).

❖ **وصف الأداء:**

✓ يقف اللاعب قرب الجدار بحيث يواجه الجدار بأحد كتفيه.

✓ يقوم اللاعب من وضع الوقوف الثابت على امشاط الرجلين برفع ذراعيه التي تكون قريبة من الجدار عالياً لعمل علامة على الجدار عند أقصى نقطة تصل إليها اليد وتسجل المسافة بعد ذلك بخفض ذراعه ثم يقفز للأعلى بعد أن يثني مفصل الركبة لعمل علامة أخرى بيده على الجدار عند

أقصى نقطة وصلت إليها ذراعه وتسجل المسافة بين التأشير الأولى والثانية على أن يتم الدفع بكتا الرجلين.

#### ❖ طريقة التسجيل:

- ✓ تعطى للاعب محاولتان وتسجل المحاولة الأفضل.
- ✓ تقاس المسافة الواقعة بين العلامة الأولى التي تحدث نتيجة تأشير البدء والعلامة الثانية التي تعبر عن القوة الانفجارية لعضلات الأطراف السفلى.

اجرى الباحثون التجربة الاستطلاعية على عينة من لاعبي كرة اليد في محافظة بغداد، والبالغ عددها (٥) لاعبين، في يوم (السبت) الموافق (٢٠٢٤/٢/٣) وفي تمام الساعة (الثالثة عصراً)، وعلى قاعة المركز الوطني لرعاية الموهبة الرياضية الخاصة بكرة اليد التابعة لوزارة الشباب والرياضة، وتم تحقيق الهدف من التجربة هو:

- المدة الزمنية المستغرقة لأداء الاختبارات.
  - صلاحية الأدوات المستخدمة في البحث.
  - تشخيص الأخطاء والمعوقات التي ستظهر في التجربة الاستطلاعية وتجاوزها.
- وتم اجراء الاختبارات في التجربة الرئيسية على عينة البحث البالغ عددها (٤٢) لاعباً خلال مهرجان الربيع الذي نظّمته وزارة الشباب والرياضة على قاعات مراكز الموهبة الرياضية في بغداد للمدة من (٢٠٢٤/٣/٧) ولغاية (٢٠٢٤/٣/٩).

واستخدم الباحثون الحقيبة الإحصائية الجاهزة (IBM.SPSS.Ver20) للحصول على الآتي:

- ✓ الوسط الحسابي.
- ✓ الانحراف المعياري.
- ✓ معامل الالتواء.
- ✓ الدرجات المئينية.

#### النتائج

بعد الانتهاء من تطبيق الاختبارات على عينة البحث تم الحصول على النتائج واجراء المعالجات الاحصائية لها، حصل الباحثون على الاحصاء الوصفي (الوسط الحسابي، الانحراف المعياري، معامل الالتواء، اعلى قيمة واقل قيمة) لاختبار القوة الانفجارية للذراعين والرجلين، وان الحصول على الدرجات الخام هي الخطوة الاولى لوضع الدرجات المعيارية والدرجات الخام لا تعطي نتائج حقيقية الا اذا ما تم المقارنة بينها وبين المعايير او المستويات

ليتمكن اللاعب من معرفة مستواه بمقارنته مع بقية اللاعبين، إذ يحتوي هذا الفصل تحويل الدرجات الخام التي تم الحصول عليها من تنفيذ الاختبارات الى درجات مئوية، إذ ان الدرجات الخام المستخلصة من تطبيق الاختبارات ليس لها أي مدلول الا اذا رجعنا الى معيار يحدد معنى هذه الدرجات" (قاسم المندلوي وآخرون، ١٩٨٩، ٣١).

### الجدول (١)

يبين قيم الاوساط الحسابية والانحرافات المعيارية ومعامل الالتواء واعلى قيمة واقل قيمة لاختبار القوة

#### الانفجارية للذراعين والرجلين

ت	اسم الاختبار	وحدة القياس	الوسط الحسابي	الانحراف المعياري	الالتواء	اقل درجة	اعلى درجة
١	القوة الانفجارية للذراعين	متر	٧,٧٠٧ ٣	.7130 5٠	٠,٢٢٣	٦,٦٠	٩,٣٠
٢	القوة الانفجارية للرجلين	سم	٢٨,٥٣ ٦	٢,٨٥٥ ٦	٠,٣٧٣	٢٥	٣٥

وتم تحويل الدرجات الخام المستحصلة من الاختبارات لجميع افراد العينة الى درجات مئوية بواسطة برنامج (SPSS) وحصل الباحثون على النتائج:

### الجدول (٢)

يبين الدرجات المعيارية المئوية لاختبار القوة الانفجارية للذراعين والرجلين

الدرجة المئوية	القوة الانفجارية للذراعين (م)	القوة الانفجارية للرجلين (سم)
١٠	٦,٧٧٠٠	٢٥
٢٠	٦,٩٠٠٠	٢٥
٢٥	٦,٩٥٠٠	٢٥
٣٠	٧,١٥٠٠	٢٦,٢٠٠٠

٢٨	٧,٥٦٠٠	٤٠
٣٠	٧,٩٠٠٠	٥٠
٣٠	٨	٦٠
٣٠	٨,١٠٠٠	٧٠
٣٠	٨,٢١٠٠	٨٠
٣٠	٨,٦٦٠٠	٩٠

## مناقشة النتائج:

من الجدول السابق الخاص باختبار القوة الانفجارية للذراعين والرجلين يتبين ان اعلى درجة تحققت في الدرجة المئينية (٩٠) بمتغير القوة الانفجارية للذراعين بلغ (٨,٦٦٠٠) في حين ان ادنى درجة تحققت في الدرجة المئينية (١٠) وقد بلغت القوة الانفجارية للذراعين (٦,٧٧٠٠)، اما الدرجة المتوسطة (٥٠) تحققت في الدرجة المئينية (٧,٩٠٠٠)، اما القوة الانفجارية للرجلين يتبين ان اعلى درجة تحققت في الدرجة المئينية (٩٠) بمتغير القوة الانفجارية للذراعين بلغ (٣٠) في حين ان ادنى درجة تحققت في الدرجة المئينية (١٠) وقد بلغت القوة الانفجارية للذراعين (٢٥)، اما الدرجة المتوسطة (٥٠) تحققت في الدرجة المئينية (٣٠).

من خلال دراسة المؤشرات فكانت تميل الى انخفاض في القوة الانفجارية للذراعين والرجلين لدى عينة البحث، ان القوة الانفجارية للذراعين والرجلين له علاقة بقدرات اجسام اللاعبين على التكيف والنمو لكي تكون على استعداد لمواجهة أي حالة لأداء التمارين ويشير (سعد محمد قطب ولؤي غانم) الى ان "العناصر التي من خلالها يستطيع الفرد على التكيف والتأقلم مع التمرينات المعطاة له سواء أكانت تمرينات قوة أم مطاولة أم سرعة أم رشاقة أم مرونة، وعودة أجهزة الجسم الوظيفية لحالتها الطبيعية في أسرع وقت ممكن بعد الانتهاء من المجهود" (سعد محمد قطب ولؤي غانم، ١٩٨٥، ١٨٣)، ومن خلال النتائج نلاحظ التفاوت في نسب الدرجات المئينية عن المقرر لها وضعف في اغلب النتائج المتحققة عن النسبة المئوية المقررة للتوزيع الطبيعي والذي يشير بأنه مؤشر سلبي إذ إن العينة ومن خلال النتائج نجد أن هناك ضعفاً واضحاً في ثقة القوة الانفجارية للذراعين والرجلين، وهنا يؤكد

(Charles) ان نمو وتطور عناصر اللياقة البدنية يتطلب ممارسة التدريبات خاصة بالمرحلة الزمنية لتطوير عنصر القوة بإشراف مدربين اخصائيين " (Charles، ٢٠٠٩، ١٤٣) إذ تبين أنّ النسبة الكبيرة من اللاعبين لديهم ضعف القوة الانفجارية للذراعين والرجلين وهذا دال على ضعف الاهتمام بالتمارين الخاصة لتطوير القوة الانفجارية للذراعين والرجلين داخل المركز او المجتمع وهنا يؤكد كل من (عباس السامرائي وبسطويسي أحمد) ان هدف الإنسان عند تحقيقه يجب اختيار الوسيلة الملائمة وذلك يتحقق عن طريق التدريب، نستطيع من خلاله تطوير الفرد بدنياً وحركياً فالتمرين هو عبارة عن حركات منتظمة وهادفة تحصل من خلالها على تنمية الصفات البدني والحركية والمهارية في مجال الحياة والرياضة (عباس السامرائي وبسطويسي أحمد، ١٩٨٤، ٢٣٥). لذلك كانت النتائج منطقية.

٥- الاستنتاجات والتوصيات:

٥-١ الاستنتاجات:

- ايجاد درجات مئينية للقوة الانفجارية للذراعين للاعبين المركز الوطني لرعاية الموهبة الرياضية بكرة اليد بإعمار (١٢\_١٤) سنة.
- وجود انخفاض للقوة الانفجارية للذراعين للاعبين المركز، الوطني لرعاية، الموهبة الرياضية، بكرة اليد بإعمار (١٢\_١٤)، سنة.
- ايجاد درجات مئينية للقوة الانفجارية للرجلين للاعبين المركز، الوطني لرعاية، الموهبة الرياضية، بكرة اليد بإعمار (١٢\_١٤)، سنة.
- وجود انخفاض للقوة الانفجارية للرجلين للاعبين المركز، الوطني لرعاية، الموهبة الرياضية، بكرة اليد بإعمار (١٢\_١٤)، سنة.

٥-٢ التوصيات:

- الاعتماد على الدرجات المئينية التي توصل اليها الباحثون في تقييم القوة الانفجارية للذراعين والرجلين للاعبين المركز، الوطني لرعاية، الموهبة الرياضية، بكرة اليد بإعمار (١٢\_١٤)، سنة وتعميمها.
- الاهتمام بتدريبات القوة الانفجارية للذراعين والرجلين للاعبين كرة اليد بإعمار (١٢\_١٤) سنة.
- اجراء دراسات اخرى ولجميع الفئات العمرية وكذلك لعناصر اللياقة البدنية الغير مبحوثة.



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الملاحق

الملحق (١)

اسماء فريق العمل المساعد

ت	الاسم	الصفة	مكان العمل
١	د. محمد هاشم سادة	مدرس دكتور	مديرية تربية بغداد الرصافة الثانية
٢	احمد فليح حسن	مدرس مساعد	طالب دكتوراه
٣	محمد وفي ياسر	مدرب	وزارة الشباب والرياضة
٤	صلاح علي عبد	مدرب	وزارة الشباب والرياضة

الملحق (٢)

أسماء الأساتذة الخبراء والمختصين الذين تم إجراء المقابلات الشخصية معهم

ت	اسم الخبير	اللقب العلمي	الاختصاص	مكان العمل
١	د. صريح عبد الكريم	استاذ	بايوميكانيك_ العاب قوى	كلية اشور الجامعة
٢	د. ثائر داود	استاذ	اختبارات_ كرة السلة	كلية التربية البدنية وعلوم الرياضة_ جامعة بغداد
٣	د. عبد الوهاب غازي	استاذ	علم التدريب_ كرة يد	كلية التربية البدنية وعلوم الرياضة_ جامعة بغداد
٤	د. زهرة شهاب	استاذ	اختبارات وقياس	كلية التربية البدنية وعلوم الرياضة_ جامعة بغداد
٥	د. احمد خميس	استاذ	علم التدريب_ كرة يد	كلية التربية البدنية وعلوم الرياضة_ جامعة بغداد

## Estimation of Anti-oxidant Enzyme Action and LSA in Plasma of benignant and Pernicious Chest Neoplasm

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## Summary

In this research, the effectiveness of antioxidant enzymes and lipid-bound sialic acid (LSA) levels in the serum of volunteers from normal women, those with mamma cancer with various cases were studied. The study was conducted on 70 volunteer women and was divided into four groups, including a control group and three groups of mamma cancer patients, each group containing 20 patients. Moreover, our research showed that the efficiency of the SOD enzyme in women with breast cancer is less when compared to women with benignant swellings and healthy people, while the result is exactly the opposite for the efficiency of LSA (in women with breast cancer is higher when compared to women with benignant swellings and healthy people).

The statistic results for the SOD enzyme were as follows:  $1.39 \pm 0.11$  for the premenopausal group,  $1.20 \pm 0.15$  for the postmenopausal group,  $1.60 \pm 0.17$  for the benignant swellings group, respectively compared with the control group,  $1.80 \pm 0.13$ . As for the LSA values, they were as follows:  $29.61 \pm 3.85$  for the premenopausal group. Menopause,  $27.63 \pm 5.67$  for the postmenopausal group,  $19.44 \pm 2.38$  for the benignant swellings group, compared to the control group,  $17.32 \pm 2.19$ . Conclusion: the amounts of sera superoxide dismutase and LSA in normal cells show variations in the levels of membrane glycolipids and the efficiency of superoxide dismutase for them, and we can utilized them into consideration as two important vital signs in monitoring the health status of normal body cells.

**Keywords:** LSA, benignant, Pernicious, Chest Neoplasm; mamma carcinoma.

## 1. Introduction

The first cause of cancer death for women is breast cancer<sup>(1)</sup>, which is similar to the danger of Corona pandemic<sup>(2)</sup> and smoking & drinking alcohol that the third world cause of death for people<sup>(3)</sup>, as estimates indicate that the number of women suffering from mamma cancer reaches one and a half million and deaths will reach half a million in the mid-2000s. At present, the number of breast cancer survivors has increased to 90% due to early screening, the development of devices, and progress in the use of breast cancer treatments<sup>(4)</sup>.

Antioxidants are generally categorized to normal and manufacture according to their produce provenance. Antioxidants produced by living organisms are called natural antioxidants, while those manufactured in the laboratory are called synthetic antioxidants. Moreover, they can be divided according to their biological activity (into enzymatic antioxidants and non-enzymatic

antioxidants), according to their size<sup>(5)</sup> (into small-molecule anti-oxidants and large-molecule antioxidants) and according to their solubility (into water-soluble and fat-soluble antioxidants), They can also be classified to internal & external antioxidants and primary & secondary antioxidants<sup>(6)</sup>. Antioxidant enzymes break down and remove free radicals by converting harmful oxidant products into hydrogen peroxide, where the catalase enzyme will further metabolize it into water in the presence of cofactors<sup>(7)</sup>.

Superoxide dismutase enzymes are a group of enzymes that contain metal ions found in all living organisms from prokaryotic to eukaryotic<sup>(8)</sup>. This group of enzymes constitutes the first line of defense against infections caused by different types of oxygen (ROS)<sup>(9,10)</sup> and maintains its anti-inflammatory actions<sup>(11)</sup>. This group of enzymes stimulate, the breakdown of superoxide resulting from the aerobic respiratory process that occurs in the body of living organisms into oxygen and peroxide molecules, as shown in the following figure 1a, also it reduce the amount of oxygen which destroys cells at superabundant concentration<sup>(12)</sup>. Such reaction occurs with alternative redox reaction to mineral Cation exist at the effective position of superoxide dismutase enzymes<sup>(13,14)</sup>:

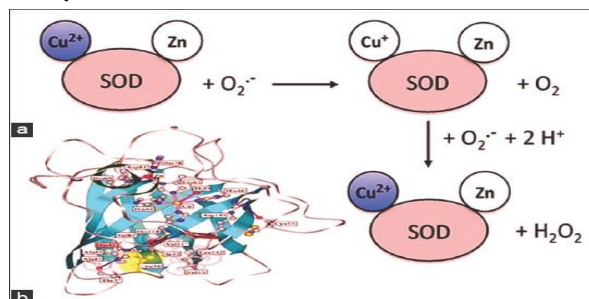


Figure 1: (a) show the general mechanism of converting free radicals by the enzyme superoxide dismutase into oxygen molecules in present of copper and zinc ions. (b) Show the structure of cow bovine.

Superoxide dismutase enzymes can be classified based on the type of metal ions present in the active site into four main groups: copper-zinc superoxide, figure b1, iron superoxide, manganese super oxide, and nickel superoxide, and their distribution is uneven in the various biological cells of living organisms<sup>(15)</sup>.

Many studies have shown the physiological and therapeutic importance of the group of dismutase enzymes, as it acts as an anti-inflammatory and prevents changes in cancer cells<sup>(16)</sup>. Studies have also indicated that levels of this enzyme in the body decrease with age<sup>(17)</sup>. Moreover, studies have shown that the enzyme superoxydesmutase is linked to many diseases such as malignant and benign mamma diseases, nephrotic syndrome, nerve cell death, and other diseases<sup>(18-20)</sup>. It has also been found that superoxide dismutase enzymes are effective synthetic

compounds that reduce the damage of free radicals. This is done by converting it into hydrogen peroxide, which in turn is converted into a water molecule by catalase<sup>(15)</sup>. Other studies have shown that the enzyme regulates cancer development<sup>(21-24)</sup>. Moreover, copper, zinc-SOD were utilized as a curative to myeloma<sup>(25)</sup>.

2 .Substances and procedures:

2.1 Samples collection:

We pulled blood from a vein from seventy subjects 25-55 years old, were divided into four categories such follows:

collection1: control people (ten volunteer).

collection2: Twenty women with breast cancer before climacteric.

collection3: Twenty women with breast cancer after climacteric.

collection4:twenty women with benignant cancer swellings.

Blood specimens were collected from patients and healthy volunteers, as patients suffering from other diseases that might interfere with the results of our research were excluded. After collecting venous blood specimens from the volunteers, the specimens were left for half an hour to coagulate at room temperature, then the specimens were separated in a centrifuge at 4000 rpm, then the serums for all specimens were withdrawn and stored in sterile tubes at a temperature of -20°C until the analysis was performed.

2.2 Determination of sera Superoxide Dismutase Activity

Superoxide Dismutase Activity was determ ined in all Volunteers serum with using spectrophotometer<sup>(26)</sup>. The method depends on the ability of the enzyme superoxide dismutase to inhibit the reduction of nitroblue tetrazolium.

2.2.1 Method:

- a. Add 200µL from EDTA/NaCN Mixture into 100 µL from serum specimen; next add 100µL from nitroblue tetrazolium.
- b. Bring test specimens to a typical temperature (20-22°C), then add 50 µL of riboflavin solution to each specimen. Increase the volume to 3000 µL using a buffer solution with a concentration of 0.067 M with a basic medium (7.8).
- c. The samples were irradiated with the same intensity for 1/3 hour with an 18-Watt fluorescent tube connected to the cover. The intensity of the rays was adjusted through a special x-ray box, and then the samples were read with a spectrometer against DW.
- d. The absorbance of another set of samples was read against water. Whereas, the samples were contain the same mixture above and reads took immediately after mixed it with riboflavin and buffer (riboflavin is added

after adding buffer to the mixture) for the purpose of determining the control value.

- e. To determine the superoxide dismutase unit, we took 10 tubes, nine of which contained (0.01, 0.02, 0.04, 0.06, 0.1, 0.2, 0.3, 0.4, 0.5 ml) of normal sera specimens, and another tube that did not contain normal serum, and then we applied the above steps to them from a, b, and c.

#### 2.2.2 Accounts:

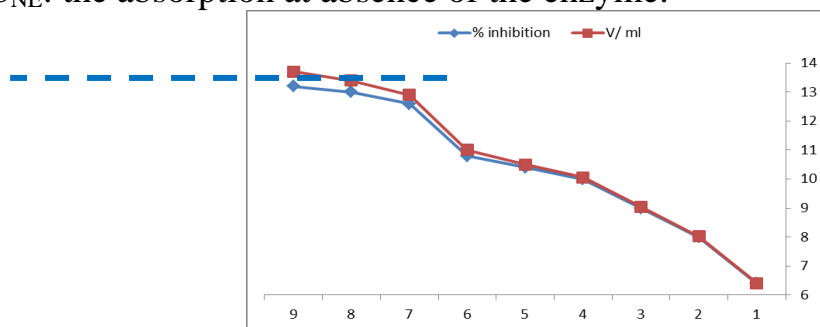
For all absorptions, their % inhibition was measured in the existence and lack of the enzyme:

$$\text{Inhibition \%} = (\text{Ab}_E - \text{Ab}_{NE}) \times 100$$

whereas:

$\text{Ab}_E$ : the absorption with variable quantities of the enzyme.

$\text{Ab}_{NE}$ : the absorption at absence of the enzyme.



**Figure I.** Explain typical curve of the % of superoxide dismutase inhibition to define the enzyme unit.

Serum quantity was sketch against %inhibition as showed in figureI. In addition, the unit of the enzyme superoxide dismutase was measured from figureI, as follows: The quantity of sera estimated in units of volume (V ml) that award 1/2 the extreme limit of inhibition of nitroblue tetrazolium decrease, (one unit=0.01 ml). The effectiveness of SOD in patients' sera is determined by multiplying the variation among absorption of sample without radiation & absorption of sample after radiation) with the concentration of the enzyme (SOD).The quantity of sera was drawing against the conformable % of inhibition, figureI.

#### 2.2.3 Estimation of sera LSA:

Sera LSA was measured<sup>(26)</sup>.

#### Results and Discussion:

**Table I:** Explain average worth of the dismutase enzyme action and LSA amount in sera of control group and sufferer with mamma carcinoma, groups.

Figure II: illustrate, diffusion for the effective- ness of SOD in various kinds of mamma carcinoma Infected women.

**TableI:** Shows a comparison between the *average* worth of the enzyme superoxide dismutase effectiveness for the healthy group and three volunteer patient's groups with mamma carcinoma, and their LSA values.

collections	No.	SOD effectiveness (average $\pm$ SD)	LSA mg/dl (average $\pm$ SD)	LSA/SOD (average $\pm$ SD)
Healthy (control)	10	1.80 $\pm$ 0.13	17.32 $\pm$ 2.19	9.62 $\pm$ 2.36
mamma carcinoma:				
Benignant	20	1.60 $\pm$ 0.17	19.44 $\pm$ 2.38	12.15 $\pm$ 3.26
Premenopausal	20	1.39 $\pm$ 0.11	29.61 $\pm$ 3.85	21.30 $\pm$ 3.63
Postmenopausal	20	1.20 $\pm$ 0.15	27.63 $\pm$ 5.67	23.81 $\pm$ 6.98

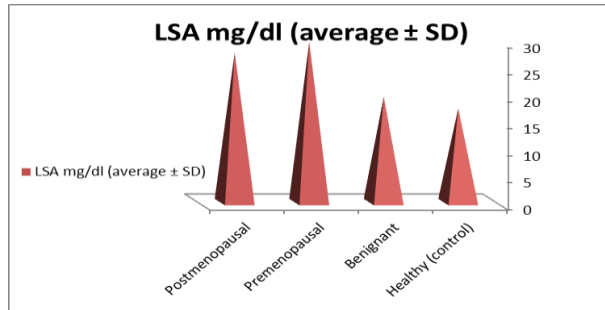
Note that the worth of the superoxide dismutase enzyme in the serum of patients with mamma carcinoma was greatly different from their worth for the healthy group and showed a large effect factor ( $P > 0.0001$ ), while the worth of the enzyme in the serum of patients with benignant swelling did not show any significant differences compared to the control group (healthy people).

**TableI:** shows that the effectiveness values of the antioxidant enzyme in the serum of patients with cancer were leaser than in the serum of healthy people (premenopausal 1.39  $\pm$  0.11 and postmenopausal 1.20  $\pm$  0.15). The activity values of the antioxidant enzyme in the serum of patients with benignant swellings were higher than in the serum of people with mamma carcinoma ( $P > 0.0001$ ). But the LSA values in the serum were opposite, where those with mamma carcinoma had higher LSA values in the serum compared to the LSA values in the serum of the healthy group and benignant swellings.

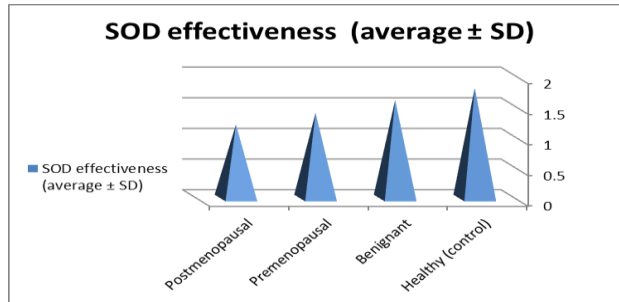
We noticed that LSA values in the serum of healthy people and those with benignant carcinoma were no statistical alteration between them, and no statistical alteration between the two groups of women with carcinoma premenopausal and postme- nopausal too.



Moreover, we noticed in TableI that the enzyme/LSA ratio for the healthy group and those with benignant carcinoma was lower compared to the values for those with cancer premenopausal and postmenopausal respectively. Many studies of malignant swelling had showed that values of the enzyme SOD were least in women with carcinoma compared to healthy people<sup>(27, 28)</sup>.



**FigureIIA.** Explain average of the LSA values in sera of effected with different types of mamma carcinoma and normal healthy.



**FigureIIB.** Explain average of the SOD values in sera of effected with different types of mamma carcinoma and normal healthy.

Although, the diagnosis of leukemia based on the decrease amounts of superoxide dismutase is not preferable<sup>(27,29)</sup> it has been noted that carcinoma cells contain a small amount of the enzyme compared to healthy people (TableI), and that exposing cancerous lymphocytes in the mamma carcinoma to radiation (X-rays)<sup>(28)</sup> increase the amount of the enzyme antioxidants in their serums. These outcomes are compatible with the same outcome of other research<sup>(30)</sup>.

Collec- tions	N o .	Mar- ker	ne- gat- ive ou- tco- me	Sp- eci- fic ity % co	po- siti- ve ou- tco- me	Se- nsi- bil- ity %
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			s	rre ct ne gat ive	s	rre ct po siti ve
Healt hy (cont rol)	1 0	LBS A Sup erox ide	8 7	89 79	2 3	11 21
Beni gnant	2 0	LBS A Sup erox ide	13 18	61 86	7 2	39 14
Prem enop ausal	2 0	LBS A Sup erox ide	2 4	6 16	18 16	94 84
Post meno paus al	2 0	LBS A Sup erox ide	1 2	1 6	19 18	99 94

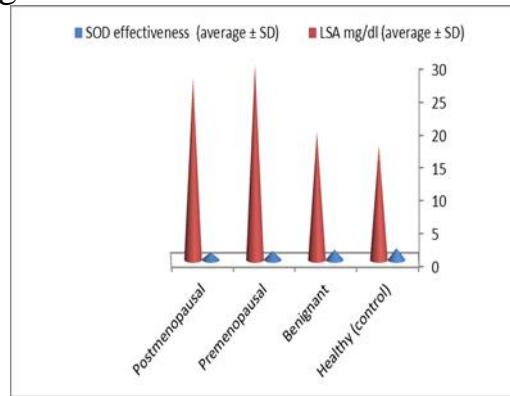
**TableII:** Specificity and sensibility of LSA and Super oxide efficiency of healthy controls and of women with carcinoma.

TableII: Explain the specificity and sensibility of LSA & superoxide dismutase to the healthy group and the other three diseased groups. In this table we saw the sensibility and specificity for fixation of the enzyme superoxide dismutase efficiency with benignant carcinoma as follows: the sensibility are (84% premenopaus and 94% postmenopaus) sequentially and the specificity are (16% premenopaus and 6% postmenopaus sequentially), wheras sensib- ility of LSA for fixation of benignant from Pernicious Neoplasm is (94% premenopaus & 99% postmenopaus). And like to SOD efficiency determined is leaser than its sensibility as explained for (premenopaus 6% and postmenopaus 1%) sequentially.

The outcomes variation, in the efficiency of superoxide dismutase are due to the variation in the amounts of the enzyme in the serum of women with pernicious cancer compared to those with benignant cancer, where the amount of the enzyme is small in cells infected with pernicious cancer<sup>(28)</sup>. This deficiency appears when the level of cancer cells increases in the serum (LSA) of women with pernicious cancer to suppress the body's immunity<sup>(31)</sup>

From these outcomes, it possible to conclude that the amounts of sera superoxide dismutase and LSA in normal cells show variations in the levels of membrane glycolipids and the efficiency of superoxide dismutase for them, and we can take them into consideration as two important vital signs in monitoring the health status of normal body cells.

Some researchers in cancer cell tumors support that cancer cells have a closed system with the cells surrounding them, as the membrane of malignant cells has an oily component that changes in its composition and arrangement, which causes weak protection against oxidation<sup>(32,33)</sup>.



**FigureIII.** Explain relation between super oxide dismutase (SOD) efficiency and the amounts of LSA in sera of effected with different types of mamma carcinoma and normal healthy.

FigureIII: Explain this figure the inverse relationship for women with cancer before and after menopause, as it shows the inverse relationship between LSA and superoxide dismutase, and this relationship does not exist for women with benignant swelling. This supports studies that confirm that this inverse relationship exists only in pernicious cancer cells, not benignant ones<sup>(34)</sup>. These outcomes submit that superoxide dismutase and LSA are perfect swelling signs.

**Conclusion:** the amounts of sera superoxide dismutase and LSA in normal cells show variations in the levels of membrane glycolipids and the efficiency of superoxide dismutase for them, and we can utilized them into consideration as two important vital signs in monitoring the health status of normal body cells.

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## **The Therapeutic effect of functional cheese in vivo parameters of blood**

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## Abstract

In this study synbiotic functional cheese was prepared using four different types of powder skim milk origins which include commercial brands (MP modhish – Omani origin, RP Regilait-French origin, LP LandozDutch origin, SP Spry Irish origin). and used two types of probiotic bacteria (*Lactobacillus*, *Bifidobacterium*) and two types of prebiotic (inulin, modified starch), the logarithm of *Lactobacillus* bacteria reached 9.00 log/gm, while logarithm of *Bifidobacterium* bacteria reached 9.49 log/gm in synbiotic cheese made from landoz mixture pre and probiotic, thus fed to mice as emulsified to 60 white albino in rate 1ml/day at 60 days. The results of characteristics of blood cellular show significant in grouped on synbiotic cheese in parameters of RBC red blood cell, Hb hemoglobin, MCHC mean concentration of hemoglobin cell, MCH mean cell hemoglobin, MCV mean cell value, PCV compacted blood value, PLT platelet count, and in biochemical characteristics the significant in the same group in HDL high density lipoprotein.

Key words: Therapeutic effect, functional cheese vivo

## Introduction

The use of therapeutic cheeses has become popular recently, and it has become part of the diet rich in basic nutrients such as protein, fat, vitamins and mineral elements such as calcium, which has a role in maintaining, strengthening and ones from fragility. ) Probiotic bacteria for enhanced health protecting the b benefits Kwak *et al.*, 2012 )



Miano(2016) showed that functional food achieves many physiological benefits that enhance the health of the host as it has the properties of probiotics that produce organic compounds that reduce chronic diseases , the material which Has the status of functional food and biological synergy synbiotic has beneficial effects on health of the consumer by improving the microbial balance of intestinal increase in the metabolic activity of one or more flora and inducing of the beneficial bacteria , present in the colon.(Hererra *et al.*,2020)

#### Materials and methods

Making cheese according to the method described by Al-Dahan(1983) with some modification ,using four types of powder skim milk available in the local markets with in the shelf life,they are (MP. Modhish Omani – origin,RP.Regilait French-origin ,LP.Landoz Dutch origin,SP.Spry Irish –origin )and used freeeze dried culture probiotic bacteria(*Lactobacillus acidophilus*,*Bifidobactrium animals*) ,prebiotic two type (inulin ,modified starch ),the fungal microbial rennet used (*Rhizomucor mucor*) with in the shelf life ,the number of *Lactobacillus acidophilus* bacteria was estimated as described by Dave and Shah(1996) ,the numberof them were count logarithm at 9.00 log /gm ,and the number of ( *Bifidobactrium animals*) bacteria was estimated as described by Moriya *et al.*(2006), the numberof them were count logarithm at 9.49 log /gm,in synbiotic functional cheese made from LP 3 –mixture pro and prebiotic and selected for the purpose completing the animal experiment by using 60 Albino Balb/C mice ,about 4 weeks old were divided into 5 groups

G1-control was fed the standard diet free of cholesterol +distilled water for the duration of the experiment

G2-group was fed the standard diet( cholesterol + skim milk 1ml/day +distilled water for the duration of the experiment

G3-group was fed the standard diet( cholesterol + synbiotic cheese supplemented with a mixture of prebiotics 1ml/day+ distilled water for the duration of the experiment

G4- group was fed the standard diet( cholesterol + synbiotic cheese supplemented with a mixture of probiotics 1ml/day+ distilled water for the duration of the experiment

G5- group was fed the standared diet( cholesterol + synbiotic cheese supplemented with a mixture of probiotics and mixture of prebiotics 1ml/day+ distilled water for the duration of the experiment,blood samples were collected at zero time before the start of experiment ,the first month ,the second month of the experiment by anesthetizing the animal with chloroform and opening the abdominal cavity from the lower part towards the phyarynx then with drawing blood from the heart directly by using a medical syringe disposable 3ml , then dividing the drawn blood into two sections ,the first section of blood was placed in EDTA anticoagulant tubes to estimate cellular blood and biochemistry parameters .

## Results and discussion

Table 1:Logarithm of numbers of *L.acidophilus* in cheese made using different types of skimmed powder milk during different storage periods,shows Logarithm of numbers of *L.acidophilus* in LP3 cheese the moral superiority in the storage period (28)day as it reached 9.00 log / gm compared to the lowest value of the

treatment of RP cheese with three blends(1.2.3),at the level of amounting to 7.00 log/gm significance

( $p < 0.05$  ),inulin addition have played a role in encouraging the activity of probiotic microorganisms,which is reflected in achieving health benefits as an mixture alternative to fats ,especially in the synbiotic mixture (chaiyasut.,2017)

Table 1: logarithm of *L.acidophilus* bacteria in cheese during different period storage

<i>L.acidophilus</i> log/gm					day /Storage treatment
٢٨	٢١	١٤	٧	٠	
7.10	7.64	8.13	8.16	8.16	Powder milk MP1
7.10	7.64	8.13	8.16	8.16	MP2
7.21	8.00	8.21	8.16	8.15	MP3
7.32	8.10	8.31	8.17	8.25	LP1
8.82	9.67	10.44	11.42	11.63	LP2
9.00	9.66	10.43	11.42	11.63	LP3
8.77	9.52	10.54	11.63	11.81	RP1
7.00	7.56	8.13	8.15	8.14	RP2
7.00	8.00	8.22	8.16	8.11	RP3
7.00	7.00	8.21	8.15	8.43	SP1
7.22	8.10	8.22	8.15	8.43	SP2
8.40	9.13	9.44	10.17	9.83	SP3
0.28					LSD

Table 2 represent result of the logarithm of *Bifidobacterium* in cheese made from powder skim milk LP blend 3 which reached at 9.49 log/gm as the highest value in the storage 28 days

Table2: logarithm of bacteria *Bifidobacterium* in cheese during different peiod storage

<i>B.animalis</i> log/gm					day /storage treatment
٢٨	٢١	١٤	٧	٠	
8.00	8.06	9.43	9.03	9.11	powder milk MP1

8.02	8.05	9.00	9.12	9.21	MP2
8.04	8.06	9.41	9.23	9.34	MP3
8.00	9.00	9.10	9.62	9.66	LP1
8.00	9.01	9.11	9.63	9.66	LP2
9.49	10.67	11.64	11.45	12.15	LP3
7.00	8.00	9.32	9.03	9.10	RP1
8.00	8.03	9.21	9.11	9.28	RP2
7.00	8.00	9.30	9.31	9.20	RP3
7.00	8.00	9.00	9.52	9.50	SP1
8.00	9.00	9.00	9.52	9.55	SP2
8.00	9.00	10.32	10.53	11.45	SP3
0.27					LSD

The factors affecting the therapeutic bacteria represented by duration of storage and the type of treatment and the interaction of the workers had no effect on that ,and the rest of values fluctuated between treatments but remained within the Therapeutic ,the previous results indicate an increase in the number of therapeutic bacteria in mixture treatment and significance compare with rest treatments, but this result disagree with Escobar *et al.*(2012) with what was found in the lack of effect of adding starch in improving bacterial growth *L.acidophilus* and *Bifidobacterium* during the storage period in panela cheese ,the temperature and pH factors can contribute in affect in growth of bacteria ,thus the resistant starch and added inulin increase bacteria growth of the moisture which improves water retention and results in high humidity ,which causes in level rates of pH accompanied by a change in level in level lactic acid which is diluted with captive water , as a result of high humidity due to prebiotics added ,this change depend on type and cocentration of added which makes cheese a promising food for probiotic bacteria Abu el-magd *et al.*(2018)

Effect feeding of functional cheese on mice blood cellular characteristic

Table 3 shows the effect of feeding in functional cheese in values of RBC during the period of dosing ,in the period zero time the highest value was

$9.9 \times 10^6$  in G5 at significance  $P < 0.05$  , at the end of the dose period 60 days value reached to  $8.7 \times 10^6$  in G5 .

Effect of functional cheese nutrition on cellular blood characteristics : Table 3

LS D	totals															the days sadjective
	G5			G4			G3			G2			G1			
١,٠ ٢	٨,٧	٨,٧	٩,٩	٨,٤	٧,٧	٨,٦	٨,٣	٨,٥	٨,٢	٨,٠	٩,٩	٩,٦	٨,٣	٨,٥	٨,٧	RBC $\times 10^6$
١,٠ ٠	١٢,٧	١٢,٢	١٤,٣	١١,٨	١١,٢	١١,٥	١١,٥	١٣,٧	١١,٧	١٢,٠	١٣,٢	١٩,٩	١١,١	١٢,٠	١٢,٦	Hb (g/dl)
٢,٤ ٠	٤٤,٦	٤٢,٣	٣٥,٥	٣٨,٤	٣٦,٥	٣٥,٣	٤٤,٥	٥٢,٤	٣٧,٤	٤٠,٧	٣٧,٨	٣٧,١	٣٨,٨	٣٦,٤	٣٧,٤	PCV%
٢,٧ ٠	٤٧,٥	٤٨,٩	٤٧,٣	٤٥,٧	٤٦,٤	٤٥,٦	٤٤,٨	٤٥,٩	٤٣,٢	٤٦,٤	٤٦,٥	٤٧,٢	٤٧,٢	٥١,٠	٥٠,١	MCH(g/l)
١,١ ٢	٣٠,٨	٢٨,٦	٣٠,٩	٢٩,٩	٢٨,٧	٢٩,٣	٣٠,٣	٣٤,٩	٣٣,٠	٢٩,٣	٢٨,٦	٢٨,٠	٢٨,٢	٢٧,٣	٢٨,٩	MCHC(g/l)
١,٤ ٢	٥٣,٠	٤٨,٩	٤٧,٠	٤٥,٧	٤٦,٤	٤٥,٦	٤٤,٨	٤٥,٩	٤٣,٢	٤٦,٤	٤٦,٥	٤٧,٢	٥٢,٠	٥١,٠	٥٠,١	MCV(f/l)
٣,١ ٢	١٠١ ٧	٧١٢	٥٤٥	٣٦١	٦٢٦	٣٩٨	٨١٣	٥٣٠	٦٧٢	٣٦٨	٧٥٥	٨٠٦	٧٤٢	٨٩٩	٦٦١	PLT $\times 10^3$

The effect of feeding functional cheese on values of Hb(g/dl) during the period of dosing as it reached at level significance  $P < 0.05$  at the end of dosing days 60, the highest value was 12.7g/dl in G5 and the lowest value in G1 at 11.1g/dl , and for effect of functional cheese in values of PCV % in blood of mice at end of dosing 60 days, the highest value in G5 44.6% compared with the lowest value in G4 38.4% at signi ficnt  $p < 0.05$ , effect of feeding functional cheese on values of MCHC in the end of dosing 60 days the table shows the highest value were in G5 reached to 30.8 g/dl ,and the lowest value in G1 reached to 28.2 g/dl at level of significance  $P < 0.05$

Effect functional cheese in the values of MCV shows level of significance  $P < 0.05$  in the end of dosing days 60 at highest level in G5 reached 53.0 f /l, and the lowest values in G3 reached 44.8 f /l at level of significance  $P < 0.05$  , In the values of  $PLT \times 10^3$  for experimental mice In the period of dosing (60) days , the G5 group was significantly superior with a value  $1017 \times 10^3$  ,the lowest value was  $361.0 \times 10^3$  in G4

The specific increase in Hb indicate that the blood capacity of the mice was not limited (Nnamona etal.,2020) synegetic action of prebiotic and probiotic as enhancers reflected its positive effect in two directions ,red blood cells and

availability of hemoglobin which corresponded nutrients and their readiness (Alhamdain.,2019)

Probiotics have a role in enhancing the immune response in invitro . studies and the vivo The mechanism of effect varies according to the type of strain, and he attributed this variation and difference to the sources of isolation, the genotype, the presence of substances that inhibit the growth of bacteria, and the different components of the bacterial cell wall, as well as indicating that it is not possible to achieve all the health benefits of one strain.

Effect of feeding functional cheese on blood biochemical characteristics in the serum of mice

Table 4 shows significant effect in different values of serum experiment mice ,the value of LDL g/dl in G5 the lowest in end of dosing days 60 reached 6.0g/dl while the highest values was in G4 reached at16.0 g/dl at level of significance  $P<0.05$  ,the values of HDL ,the highest value was in G 5 in the end on dosing days 60 reached to 70.0g/dl compaired with the lowest value in G3 reached 34 g/dl at significance  $P<0.05$  ,the value of total cholesterol result shows significance  $P<0.05$  in G5 at lowest value in the end of dosing days 60 reached 100.0g/dl ,while the highest value was in G2 reached 119 g/l,in the value of triglecerol the highest value was in 98 g/dl in G4 and the lowest value in G5 reached to 59.0g/dl in the end of dosing days 60 ,

Abdullah (2018)found the synergistic milk and prebiotic inulin as concentration 2.5% caused a significant decrease in totalHDL during feeding rats with synbiotic yogurt and decreased in level of cholesterol , and this agree with our result in this study ,and the same result with Hussein(2004) research by use mixture of therapeutic bacteria cultures in yoghurt and led to contol of high total cholesterol in the serum of rabbit,but our result didn't agree with the study of Wa et al.(2019)as the group of rats fed on the mixture of probiotics had alower value compared to control group and this differenceprobiotic group to a stimulating factor for its may due to the lack of thebetter survival as well as the effect of the duration of the experiment .

LSD	totals															the days adjective s
	G5			G4			G3			G2			G1			
	٦٠	٣٠	٠	٦٠	٣٠	٠	٦٠	٣٠	٠	٦٠	٣٠	٠	٦٠	٣٠	٠	
١,٣٠	٦,٠	٩,٠	٢٤,٠	١٦,٠	٢٠,٠	٢٠,٠	٨,٠	٩,٠	١٠,٠	١١,٠	١٠,٠	٢٠,٠	٧,٠	١١,٠	١٠,٠	LDL g/dl

٢,٣٠	٧٠,٠	٦٦,٠	٥٨,٠	٣٧,٠	٤١,٠	٤٨,٠	٣٤,٠	٣٥,٠	٥٩,٠	٤٨,٠	٥٠,٠	٥١,٠	٤٢,٠	٤٤,٠	٥٠,٠	HDL g/l
٢,٠١	١٠٠	١٣٥	١٤٣	١١٦	١١٥	١٣٤	١٠١	١٠٣	١٣١	١١٩	١٢٣	١٣١	١١٧	١٢٤	١١٩	TC g/dl
٣,٣٢	٥٩,٠	٨٠,٠	١٠٠	٩٨,٠	٩٨,٠	٨٢,٠	٧٩,٠	٨٦,٠	١٣٤	٩٧,٠	٩٤,٠	١٠٩	٦٩,٠	٨٨,٠	١٣٣	TG g/dl

- 1- Conducting nutritional experiments on volunteers to confirm and support the results of scientific research obtained from animal experiments
- 2- The use of other types of probiotics and biostimulants in the manufacture of functional cheeses
- 3- other types of powdered milk and mixing it with certain concentrations with raw milk and using it

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## تسخير الذكاء الاصطناعي من أجل التنمية في البيئة الزراعية

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## الخلاصة

التنمية المستدامة، كما عرفتها الأمم المتحدة، هي ممارسة تلبية احتياجات الحاضر دون المساس بقدرة الأجيال القادمة على تلبية احتياجاتها الخاصة. ويشمل الأبعاد الاقتصادية والاجتماعية والبيئية، بهدف خلق توازن متناغم بين التقدم والحفاظ. يتطلب تحقيق أهداف التنمية المستدامة مناهج مبتكرة وتكامل التقنيات المتقدمة، مما يجعل الذكاء الاصطناعي مرشحاً واعداً لقيادة التغيير الإيجابي في هذا المجال. برز الذكاء الاصطناعي (AI) كأداة قوية لديها القدرة على إحداث ثورة في مختلف جوانب الحياة البشرية. وأحد هذه المجالات هو التنمية المستدامة، حيث يمكن للذكاء الاصطناعي أن يلعب دوراً حاسماً في معالجة التحديات المعقدة المتعلقة بالحفاظ على البيئة، وإدارة الموارد، والعدالة الاجتماعية. يستكشف هذا المقال التقاطع بين الذكاء الاصطناعي والتنمية المستدامة، ويسلط الضوء على المساهمات والتطبيقات المحتملة والآثار المستقبلية لتسخير الذكاء الاصطناعي لتحقيق الصالح العام للإنسانية والكوكب. سيكون الذكاء الاصطناعي قادراً على فهم وتخزين وتعلم كمية هائلة من البيانات، مما يسمح له بالاستجابة لها لتحسين الكفاءة. يستطيع الذكاء الاصطناعي تحليل البيانات باستخدام إنترنت الأشياء المعرفي لتقديم رؤى رائعة لتحسين إنتاجية المحاصيل. تجمع حلول الأجهزة بين برامج جمع البيانات والروبوتات لإعداد أفضل الأسمدة لحقول محددة لزيادة الإنتاج إلى أقصى حد. وذلك لجعل الزراعة أكثر إنتاجية وربحية وأقل ضرراً على البيئة وأقل استهلاكاً لموارد الأراضي. وتمثلت مشكلة البحث في التساؤل التالي: كيف تساهم الزراعة الذكية في إحداث "ثورة خضراء" تتفقد البشرية من تبعات النمو السكاني والتدهور البيئي وإمكانية استدامة الإنتاج الزراعي؟ والإجابة على الفرضية هي أن الزراعة الذكية ستشهد نمواً متزايداً في السنوات القادمة، مثل كافة التقنيات الذكية الحديثة التي تسعى إلى تنمية ورفاهية المجتمع، وتأمين احتياجاته الأساسية. إن انتشار التقنيات الحديثة، ووصولها إلى مختلف الفئات، وسهولة استخدامها من قبل نسبة كبيرة من جيل ثورة المعلومات، سيساهم بشكل كبير في تبني الممارسات الزراعية الذكية وبالتالي سد الفجوة الغذائية الناتجة عن زيادة في عدد السكان وندرة الموارد. وتهدف الدراسة إلى تسليط الضوء على الفرص الزراعية وإمكانية تطبيق الزراعة الذكية.

## ١. المقدمة

التكنولوجيا الرقمية التي تشير الى جميع التقنيات الالكترونية بأدواتها المختلفة والانظمة الالية والاجهزة والموارد التكنولوجية التي تنتج المعلومات او تعالجها او تخزنها نمت أضعافا مضاعفة وصار استخدامها على مستوى دولي، كما أن اتصالها صار مستمرا في كل مكان، ووصل إلى كثير من البشر بفضل استحوذهم شامل على الهواتف الذكية وما يترتب على ذلك من إمكانية الوصول إلى المعلومات، الشبكات الاجتماعية، والترفيه السمعي والبصري. تسريع التقدم الفني في استخدام العالم الرقمي الاجهزة [1] والتطبيقات باستخدام الحوسبة السحابية [2]، تحليل البيانات الضخمة ويعتقد العديد من المزارعين أن الذكاء الاصطناعي لا ينطبق إلا في المجال الرقمي [3, 4]. وقد يفشلون في فهم كيف يمكن للتكنولوجيا أن تساعدهم في زراعة الأرض الفعلية ومع ذلك، فإن الذكاء الاصطناعي ليس تكنولوجيا قائمة بذاتها. يمكن للذكاء الاصطناعي أن يدعم التكنولوجيا بينما تنتقل من الزراعة التقليدية إلى الزراعة الإبداعية. الذكاء الاصطناعي يمكن للذكاء الاصطناعي أن يغير نظرتنا في العديد من المجالات منها يدخل في مجال الطبي والعسكري والزراعي. دخول الذكاء الاصطناعي لتسخير التنمية المستدامة في البيئة الزراعية من خلال تمكين المزارعين من إنتاج المزيد بعمل أقل مع تقديم مزايا متنوعة [5-8].

## ٢. الذكاء الاصطناعي

يشير الذكاء الاصطناعي إلى محاكاة الذكاء البشري في الآلات المبرمجة للتفكير والتصرف مثل البشر. يتضمن ذلك عمليات مثل التعلم والاستدلال وحل المشكلات والإدراك وفهم اللغة. لقد تطورت تقنيات الذكاء الاصطناعي، مثل التعلم الآلي، ومعالجة اللغات الطبيعية، ورؤية الكمبيوتر، بسرعة في السنوات الأخيرة، مما مكن الأنظمة من تحليل كميات هائلة من البيانات، وتحديد الأنماط، واتخاذ قرارات مستقلة. يعمل الذكاء الاصطناعي على تغيير العديد من جوانب حياتنا بسرعة. يتم استخدامه في مجموعة واسعة من الصناعات، بما في ذلك الرعاية الصحية والتمويل والتصنيع والنقل. ومع استمرار تطور الذكاء الاصطناعي، فمن المرجح أن يكون له تأثير أكبر على عالمنا [9-11].

## ٣. إنترنت الأشياء IOT

من أعظم الإنجازات التي حققتها التكنولوجيا في الزراعة هي دخول أجهزة إنترنت الأشياء، إذ يمكنها إعطاء تصور كامل للمزارع، من نوعية التربة إلى مستوى الرطوبة وشدة الرياح، ومن شأن هذه الوسائل

أن تساعد في تحديد عدد كبير من العوامل التي يمكن للمزارعين بناء قراراتهم عليها، وساهمت بزيادة حجم الإنتاج بنسب عالية ستكون أجهزة استشعار إنترنت الأشياء قادرة على مراقبة مستويات المغذيات في الحقل وتزويد المزارعين برؤى دقيقة فيما يتعلق بموعد ومكان زراعة المحاصيل لتحقيق أقصى قدر من المكسب وتجنب هدر المحاصيل [12-14].

#### ٤. أهداف التنمية المستدامة

حددت الأمم المتحدة ١٧ هدفا من أهداف التنمية المستدامة التي يتعين تحقيقها بحلول عام ٢٠٣٠ [15]:

- لا يوجد فقر
- لا توجد مجاعة
- صحة جيدة وعافية
- تعليم ذو جودة
- المساواة بين الجنسين
- المياه النظيفة والصرف الصحي
- طاقة نظيفة وبأسعار معقولة
- العمل اللائق والنمو الاقتصادي
- الصناعة والابتكار والبنية التحتية
- الحد من عدم المساواة
- المدن والمجتمعات المستدامة
- تضامن المسؤولية بين الاستهلاك والإنتاج
- العمل المناخي
- الحياة تحت الماء
- الحياة على الأرض
- السلام والعدالة والمؤسسات القوية
- الشراكة من أجل الأهداف

وتشمل هذه الأهداف مجموعة واسعة من القضايا، بما في ذلك القضاء على الفقر، والعمل المناخي، والطاقة النظيفة، والاستهلاك المسؤول، والحفاظ على البيئة. ويمكن للذكاء الاصطناعي أن يساهم بشكل كبير في تحقيق هذه الأهداف من خلال توفير حلول وروى مبتكرة يمكن أن تفيد عملية صنع السياسات وتخصيص الموارد والممارسات المستدامة [16].

#### ٥. مساهمة الذكاء الاصطناعي في التنمية المستدامة

يمكن للذكاء الاصطناعي أن يساهم في التنمية المستدامة بعدة طرق. على سبيل المثال، في مجال الحفاظ على البيئة، يمكن للأنظمة التي تعمل بالذكاء الاصطناعي تحليل صور الأقمار الصناعية لرصد إزالة الغابات، وتتبع التغيرات في استخدام الأراضي، وتحديد المناطق المعرضة لخطر التدهور البيئي. وفي الزراعة، يمكن للذكاء الاصطناعي تحسين إنتاجية المحاصيل، وتقليل استخدام المياه، وتقليل الاعتماد على المدخلات الكيميائية من خلال تقنيات الزراعة الدقيقة. علاوة على ذلك، في التخطيط الحضري، يمكن للذكاء الاصطناعي تسهيل تصميم المدن الذكية مع الاستخدام الفعال للطاقة، وأنظمة النقل الذكية، وتحسين إدارة النفايات [17].

#### ٦. تطبيقات الذكاء الاصطناعي في التنمية المستدامة

إن تطبيقات الذكاء الاصطناعي في التنمية المستدامة متنوعة ومؤثرة. على سبيل المثال، يمكن للتحليلات التنبؤية القائمة على الذكاء الاصطناعي أن تساعد في توقع الكوارث الطبيعية والتخفيف من تأثيرها، وبالتالي تعزيز القدرة على الصمود في وجه الكوارث. في مجال الرعاية الصحية، يمكن لأدوات التشخيص المدعومة بالذكاء الاصطناعي وتوصيات العلاج الشخصية تحسين الوصول إلى الرعاية الصحية ونتائجها، مما يساهم في تقدم أهداف التنمية المستدامة المتعلقة بالصحة. بالإضافة إلى ذلك، يمكن للذكاء الاصطناعي دعم الجهود المبذولة لمكافحة تغير المناخ من خلال تحسين أنظمة الطاقة، والتنبؤ بأنماط الطقس، وتطوير تقنيات الطاقة المتجددة [18, 19].

#### ٧. الذكاء الاصطناعي في الزراعة

أصبح دمج تقنيات الذكاء الاصطناعي في التنمية المستدامة، وخاصة في الزراعة، منتشرًا بشكل متزايد. تهدف هذه الورقة البحثية إلى استكشاف دور الذكاء الاصطناعي في مواجهة التحديات المرتبطة بالزراعة

المستدامة، مع التركيز بشكل خاص على مراقبة التربة، واستخدام الطائرات بدون طيار، وإنترنت الأشياء، وصور الأقمار الصناعية الميدانية. ومن خلال دراسة إمكانات الذكاء الاصطناعي لتحويل الممارسات الزراعية، ستسلط الورقة الضوء على التأثير الكبير للذكاء الاصطناعي في تعزيز التنمية المستدامة في القطاع الزراعي (الشكل رقم ١) [20].



الشكل ١. ممارسات الذكاء الاصطناعي في الزراعة

تعد التنمية المستدامة في مجال الزراعة شاغلا عالميا هاما نظرا للحاجة إلى ضمان الأمن الغذائي والحفاظ على الموارد الطبيعية والتخفيف من التدهور البيئي. ويوفر ظهور الذكاء الاصطناعي فرصة واعدة لمواجهة هذه التحديات من خلال تحسين الإنتاجية وكفاءة الموارد والاستدامة البيئية. وعلى هذه الخلفية، فإن تطبيق الذكاء الاصطناعي في مراقبة التربة والعمليات الزراعية يجذب الاهتمام. إن دمج الذكاء الاصطناعي في الزراعة لا يؤدي إلى زيادة الإنتاجية وكفاءة الموارد فحسب، بل يساهم أيضا في الاستدامة البيئية. ومن خلال تمكين اتخاذ القرارات المستندة إلى البيانات والعمليات الآلية، تمكن تقنيات الذكاء الاصطناعي المزارعين من اعتماد ممارسات أكثر استدامة مثل الحراثة المحافظة على البيئة، والإدارة المتكاملة للآفات، والحفاظ على التنوع البيولوجي. بالإضافة إلى ذلك، يسهل الذكاء الاصطناعي



تطوير أنظمة الزراعة الذكية التي تعزز التوازن والمرونة البيئية والاستدامة طويلة المدى للمناظر الطبيعية الزراعية.

#### ٨. مراقبة التربة بالطائرات بدون طيار وإنترنت الأشياء وصور الأقمار الصناعية ميدانياً

أحدثت التقنيات التي تعمل بالذكاء الاصطناعي مثل الطائرات بدون طيار وأجهزة إنترنت الأشياء وصور الأقمار الصناعية ثورة في طريقة مراقبة التربة وإدارتها في الزراعة. يمكن للطائرات بدون طيار المجهزة بأجهزة استشعار التصوير المتقدمة وخوارزميات الذكاء الاصطناعي أن توفر مراقبة دقيقة وفي الوقت الحقيقي لظروف التربة وصحة المحاصيل وتفشي الآفات. من المتوقع أن يصل سوق الطائرات بدون طيار في الزراعة إلى ٤٨٠ مليون دولار بحلول عام ٢٠٢٧ [21]، ورغم أن تاريخها يعود لثمانينيات القرن الماضي، فإن استخدامها توسع بشكل كبير في الأعوام المنصرمة. إذ يمكن استخدامها للمراقبة ورش المبيدات وتلقيح الأشجار. ومن خلال دمج الذكاء الاصطناعي، يمكن لهذه الأجهزة تحليل كميات هائلة من البيانات وتزويد المزارعين برؤى قابلة للتنفيذ، مما يؤدي بالتالي إلى تحسين استخدام الموارد وتقليل الآثار البيئية. مراقبة الاستخدام النموذجي للذكاء الاصطناعي هي مراقبة المحاصيل والتربة. ويمكن استخدام الطائرات بدون طيار، وإنترنت الأشياء، وصور الأقمار الصناعية الميدانية لجمع البيانات، والتي يمكن بعد ذلك متابعتها وتحليلها بواسطة التطبيقات المستندة إلى الذكاء الاصطناعي لتحديد أفضل الإجابات. تدعم التطبيقات المدعومة بالذكاء الاصطناعي معرفة عيوب التربة والآفات النباتية والأمراض. يتم تحليل البيانات بشكل سريع ومباشر بمساعدة خوارزميات ML. قد تساعد تطبيقات الزراعة المتنقلة المزارعين على تقييم بيانات المحاصيل، ومتابعة عملياتهم، ومراقبة التغيرات المناخية، وإدارة مزارعهم بشكل أكثر فعالية. يهدف الاستخدام الأمثل لمبيدات الأعشاب ومبيدات الآفات إلى زيادة الكفاءة الزراعية والاستدامة مع ضمان سلامة الأغذية (الشكل رقم ٢). تقوم أنظمة الذكاء الاصطناعي بمراقبة النشاط الحالي للأعشاب والحشرات وتكييف استخدام مبيدات الأعشاب والمبيدات الحشرية معه بدلاً من تنفيذ الإجراءات وفقاً لجدول زمني محدد. يمكن التنبؤ بهجوم الآفات من خلال تحليل صور الأقمار الصناعية أو صور الطائرات بدون طيار، وتحديد الاتجاهات في نشاط الآفات ومراقبة البيانات الجديدة لاكتشاف المؤشرات التحذيرية لهجوم وشيك. [22]



الشكل ٢. رش المبيدات الزراعية بالطائرات المسيرة.

### ٩. حل المشاكل في الزراعة من خلال الذكاء الاصطناعي

ويمتد اعتماد الذكاء الاصطناعي في الزراعة إلى ما هو أبعد من مراقبة التربة ليشمل مجموعة واسعة من التطبيقات، بما في ذلك التحليلات التنبؤية والزراعة الدقيقة وأنظمة الزراعة المستقلة. تستطيع خوارزميات الذكاء الاصطناعي تحليل البيانات التاريخية وأنماط الطقس وتكوين التربة للتنبؤ بإنتاجية المحاصيل وتحديد المخاطر المحتملة وتحسين استخدام الري والأسمدة. بالإضافة إلى ذلك، يمكن للآلات المستقلة والأنظمة الروبوتية المعتمدة على الذكاء الاصطناعي أداء المهام بدقة لا مثيل لها، مما يقلل من العمالة المطلوبة والبصمة البيئية للعمليات الزراعية (الشكل رقم ٣).



الشكل (٣): تطبيقات الكشف عن الامراض الزراعية.

يمكن للمزارعين الذين لديهم اتصال Wi-Fi استخدام تطبيقات الذكاء الاصطناعي لتلقي خطة مزرعة مصممة خصيصًا للذكاء الاصطناعي. وباستخدام الحلول القائمة على الذكاء الاصطناعي والتي تعمل على تعزيز الإنتاج والدخل دون تقليص الموارد الطبيعية التي لا تقدر بثمن، يستطيع المزارعون تلبية الحاجة العالمية لزيادة الإمدادات الغذائية والريحية. يمكن للمزارعين استخدام الذكاء الاصطناعي للحصول على رؤى في الوقت الفعلي من حقولهم، وتحديد المناطق التي تحتاج إلى الري أو التسميد أو المعالجة بالمبيدات الحشرية. قد تساعد الممارسات الزراعية المبتكرة، مثل الزراعة العمودية، على زيادة إنتاج الغذاء مع استخدام موارد أقل. ونتيجة لذلك، يتم استخدام مبيدات الأعشاب بشكل أقل، وتحسن جودة الحصاد وتزداد الأرباح، ويتم تحقيق وفورات كبيرة في التكاليف. تقوم أدوات الذكاء الاصطناعي بجمع صور جوية عالية الدقة وبيانات حول أنظمة الري اللازمة للحقول. يساعد الذكاء الاصطناعي في اكتشاف مشكلات التربة مثل الانسدادات والتسريبات. يقوم بتقييم حالة التربة السيئة؛ يساعد الذكاء الاصطناعي في زيادة إنتاجية المزرعة. يتم تحسين صافي الإنتاج من الحقل من خلال عمليات الزراعة الآلية والمستقلة، والإنتاج المدعوم بالذكاء الاصطناعي، وإدارة الإنتاجية (الشكل رقم ٤). يعمل الانتقاء والتعبئة والفرز بمساعدة الذكاء الاصطناعي على تحسين إنتاج الأغذية وتعبئتها وفرزها. يستفيد المزارعون من مساعدته في فهم رؤى البيانات الزراعية المتعلقة بدرجة الحرارة وهطول الأمطار وسرعة الرياح والإشعاع الشمسي. ويمكن حل مشاكل المزارعين، مثل تغير المناخ وتقشي الحشرات والأعشاب

الضارة التي تقلل الإنتاجية، من خلال حلول الذكاء الاصطناعي. سيتم استخدام الذكاء الاصطناعي في الزراعة لتحسين العملية الزراعية بأكملها [23, 24].



الشكل ٤. استخدام الروبوت لرش المبيدات الزراعية.

#### ١٠. الآثار المستقبلية

ومع استمرار الذكاء الاصطناعي في التطور، فإن قدرته على دفع التنمية المستدامة على وشك التوسع. ومع ذلك، فمن الضروري النظر في الآثار الأخلاقية والاجتماعية والاقتصادية لنشر الذكاء الاصطناعي في هذا السياق. إن ضمان الشفافية والمساءلة والإنصاف في أنظمة الذكاء الاصطناعي أمر بالغ الأهمية لتجنب تفاقم أوجه عدم المساواة القائمة أو خلق معضلات أخلاقية جديدة. علاوة على ذلك، يعد التعاون بين أصحاب المصلحة، بما في ذلك الحكومات والصناعة والأوساط الأكاديمية والمجتمع المدني، أمراً حيوياً لتسخير الذكاء الاصطناعي لتحقيق التنمية المستدامة بطريقة مسؤولة وشاملة.

#### ١١. الاستنتاجات

وفي الختام، الذكاء الاصطناعي AI هو تقنية ثورية تلعب دوراً رئيسياً في تحويل القطاع الزراعي نحو تنمية مستدامة. يعدّ الذكاء الاصطناعي أداة قوية لتحقيق تنمية مستدامة في القطاع الزراعي. مع

التغلب على التحديات التي تواجه هذا المجال، يمكن للذكاء الاصطناعي أن يلعب دوراً رئيسياً في زيادة الإنتاجية، تقليل التكاليف، وتحسين الاستدامة في الزراعة. ومن خلال الاستفادة من قدرات الذكاء الاصطناعي بطرق مبتكرة، يمكن للبشرية أن تقترب من تحقيق رؤية عالم مستدام وعادل.

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## التنفيذ الفعال لتكنولوجيا التعلم الرقمي من منظور مجتمع المعرفة

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## الخلاصة

شهد القرن الحادي والعشرون تطورات غير مسبوقة في العلوم والتكنولوجيا، أدت إلى ظهور مجتمع المعرفة. وفي هذا السياق، تأثر مجال التعليم بشكل كبير، حيث كان دمج تكنولوجيا التعلم الرقمي بمثابة تطور ملحوظ. لقد أحدثت تكنولوجيا التعلم الرقمي ثورة في النظام التعليمي التقليدي من خلال توفير الوصول إلى المعلومات وموارد التعلم خارج حدود الفصل الدراسي الفعلي. يهدف هذا المقال إلى استكشاف مزايا وتحديات استخدام تكنولوجيا التعلم الرقمي في سياق مجتمع المعرفة، مع التأكيد على ضرورة اتباع نهج منظم لضمان جودتها وفعاليتها.

## مقدمة:

لقد أدى دمج تكنولوجيا التعلم الرقمي في التعليم إلى إحداث تحولات كبيرة في طريقة إنشاء المعرفة ومشاركتها ونشرها. في مجتمع المعرفة، تعمل التكنولوجيا كمحفز لخلق المعرفة ومشاركتها، وبالتالي تلعب دوراً محورياً في تعزيز التنمية الفكرية ومجتمعات المعرفة. علاوة على ذلك، أحدثت تكنولوجيا التعليم ثورة في أساليب التدريس، حيث جعلت التعلم أكثر تفاعلية وفعالية، في حين عملت أيضاً على تسهيل التعلم مدى الحياة. بالإضافة إلى ذلك، تعمل التكنولوجيا كمحرك للابتكار والنمو الاقتصادي، مما يساهم في تقدم الاقتصادات المحلية والعالمية. ومع ذلك، فمن الأهمية بمكان إخضاع الحلول التكنولوجية لتقييم دقيق ووضع سياسات تعطي الأولوية لتعزيز الابتكار والنمو الاقتصادي.

يقدر مجتمع المعرفة خلق المعرفة ونشرها، وقد أصبحت التكنولوجيا فعالة في تسهيل هذه العمليات. ومع ظهور تكنولوجيا المعلومات والاتصالات، أصبح الوصول إلى المعرفة ومشاركتها أكثر سهولة من أي وقت مضى [١]. وقد تبنت المنظمات التكنولوجية لتصميم القواعد التي تعزز التطور الفكري وتبادل المعرفة، مما يساهم في نمو وتطور مجتمعات المعرفة [٢]. وهذا يؤكد أهمية التكنولوجيا كأداة لتعزيز خلق المعرفة ومشاركتها في مجتمع المعرفة.



وفي مجال التعليم، أحدثت تقنيات التعلم الرقمي ثورة في الأساليب التقليدية لنقل المعرفة، مما جعل التعلم أكثر تفاعلية وجاذبية للطلاب. لقد مهدت تكنولوجيا التعليم الطريق لأساليب واستراتيجيات تدريس جديدة، مما أدى إلى تعزيز تجربة التعلم الشاملة [٣]. علاوة على ذلك، فقد سهل التعلم مدى الحياة، مما سمح للأفراد باكتساب معارف ومهارات جديدة بشكل مستمر طوال حياتهم [٤]. وعلى هذا النحو، تقف التكنولوجيا كقوة دافعة للتعليم والتعلم مدى الحياة في مجتمع المعرفة، وتلبي احتياجات التعلم المتنوعة للأفراد.

وإلى جانب تأثيرها على التعليم، تعمل التكنولوجيا كمحرك حاسم للابتكار والنمو الاقتصادي. يلعب التقدم التكنولوجي دورًا أساسيًا في تحفيز التنمية الاقتصادية وتحسين الاقتصادات المحلية والعالمية بوتيرة متسارعة [٥]. علاوة على ذلك، فإن التكنولوجيا والابتكار ضروريان لحل المشكلات المجتمعية المشتركة وتحقيق أهداف التنمية المستدامة [٦]. ومع ذلك، لا بد من إخضاع الحلول التكنولوجية لتقييم دقيق للتأكد من كفاءتها وتأثيرها [٧]. وينبغي لسياسات العلوم والتكنولوجيا والابتكار أن تعطي الأولوية لإنشاء صناديق لتعزيز الابتكار والنمو الاقتصادي، وبالتالي تسخير الإمكانيات الكاملة للتكنولوجيا في النهوض بمجتمع المعرفة [٨].

إن دمج تكنولوجيا التعلم الرقمي في التعليم قد أحدث تغييرات تحويلية في مجتمع المعرفة. تعمل التكنولوجيا كحافز لخلق المعرفة ومشاركتها، وإحداث ثورة في أساليب التدريس، وتسهيل التعلم مدى الحياة، ودفع الابتكار والنمو الاقتصادي. ومع ذلك، من الضروري التعامل مع الحلول التكنولوجية من خلال تقييم دقيق ووضع سياسات تعطي الأولوية لتعزيز الابتكار والنمو الاقتصادي. ومن خلال القيام بذلك، يمكن لمجتمع المعرفة الاستفادة بشكل فعال من فوائد تكنولوجيا التعلم الرقمي مع التغلب على التحديات المرتبطة بها.

خلفية البحث:

مجتمع المعرفة هو مصطلح تمت صياغته في السبعينيات لوصف مجتمع مدفوع بالمعرفة والابتكار والتكنولوجيا. يعتبر التعليم في مجتمع المعرفة أداة هامة للتنمية الاقتصادية والتقدم الاجتماعي وتمكين الأفراد. يعد دمج التكنولوجيا في التعليم محركاً مهماً لمجتمع المعرفة.

يشير التعلم الرقمي إلى استخدام الوسائط الرقمية وتكنولوجيا المعلومات لتقديم البرامج والدورات التعليمية والمواد التدريبية. يمكن للمتعلمين الوصول إلى المواد التعليمية في أي وقت وفي أي مكان باستخدام أجهزة مثل أجهزة الكمبيوتر والأجهزة اللوحية والهواتف الذكية. يمكن أن يتخذ التعلم الرقمي أشكالاً عديدة، بما في ذلك الدورات عبر الإنترنت والفصول الدراسية الافتراضية والتعلم المتنقل.

في حين أن تقنيات التعلم الرقمي تجلب العديد من الفوائد لأنظمة التعليم في مجتمع المعرفة، إلا أنها تشكل أيضاً تحديات تتطلب دراسة متأنية. ومن خلال معالجة هذه التحديات من خلال التحسينات الاستراتيجية واتباع نهج منظم لتنفيذ التعلم الرقمي، يمكن للمؤسسات تسخير الإمكانيات الكاملة للتكنولوجيا لإنشاء بيئات تعليمية شاملة وجذابة وفعالة.

### الحاجة الى استخدام التعلم الرقمي:

أصبحت بيئة التعلم أكثر ديناميكية من أي وقت مضى. ونتيجة لذلك، يتعلم طلاب اليوم بطرق مختلفة تماماً عن الطريقة التي تم بها تصميم نظامنا التعليمي في الأصل. مع تقدم الذكاء الاصطناعي وظهور التعلم عن بعد/الهجين، تتم إعادة تصميم فكرة الفصل الدراسي وإعادة تعريفها بعدة طرق لتناسب الاحتياجات المتطورة للمتعلمين الرقميين المعاصرين.

تقوم العديد من مؤسسات التعليم العالي باستبدال الموارد التقليدية بالتقنيات التعليمية لمواكبة مجتمع التعلم الرقمي الخاص بها. أدناه، قمنا بإدراج الأسباب التي تجعل اعتماد استراتيجية التعلم التي تحتضن التكنولوجيا في بيئة الفصل الدراسي يمكن أن يؤدي إلى تحسين المشاركة وزيادة معدلات نجاح الطلاب. ومن اهم أسباب الحاجة الى التعلم الرقمي:

## ١. استخلاص رؤى قابلة للتنفيذ من تعليقات الطلاب باستخدام الذكاء الاصطناعي

غالبًا ما توفر تعليقات الطلاب رؤية أكثر تمثيلاً ودقة لتجاربهم من التعليقات الكمية وحدها. في حين أن التقييمات الرقمية يمكن أن توفر نقاط بيانات قيمة، فإن تعليقات الطلاب تعكس ثراء وجهات نظرهم وعواطفهم واقتراحاتهم بكلماتهم الخاصة. ومع ذلك، فإن استخلاص الرؤى القابلة للتنفيذ من كميات هائلة من التعليقات غير المنظمة يمكن أن يكون مهمة شاقة للمعلمين والإداريين.

وقد نجحت تكنولوجيا الذكاء الاصطناعي مثل Explorance MLY في تحويل هذا التحدي من خلال أتمتة تحليل التعليقات غير المنظمة، مما يسمح للمؤسسات باستخلاص رؤى قيمة بكفاءة وفعالية. وهذا يمكن المؤسسات من الاستفادة من الحكمة الجماعية للطلاب، واكتساب فهم دقيق لاحتياجاتهم ونفضياتهم. من خلال استخدام التوصيات من أسفل إلى أعلى، يتجاوز MLY تحليل المشاعر البسيط إلى حشد المدخلات القيمة حول الإجراءات التي يجب على المعلمين البدء بها أو الاستمرار فيها أو إيقافها داخل البيئة التعليمية.

## ٢. الوصول إلى المعلومات والموارد

توفر التكنولوجيا للطلاب إمكانية الوصول الفوري إلى كمية هائلة من المعلومات والموارد. يتيح الإنترنت والأدوات الرقمية للطلاب استكشاف مواضيع مختلفة وإجراء البحوث والوصول إلى المواد التعليمية التي قد لا تكون متوفرة في الكتب المدرسية التقليدية. وفيما يلي بعض الأمثلة الملموسة لكيفية استخدام الطلاب للتكنولوجيا لتعزيز تعلمهم:

- المكتبات الرقمية: تتيح المكتبات الرقمية أو قواعد البيانات عبر الإنترنت للطلاب الوصول إلى العديد من المواد الأكاديمية والبحثية، بما في ذلك الكتب الرقمية والمقالات العلمية والمجلات ومحتوى الوسائط المتعددة التي يمكن أن تدعم تعلمهم.
- المنصات عبر الإنترنت: توفر المنصات التعليمية وأنظمة إدارة التعلم (LMS) موقعًا مركزيًا للمعلمين لمشاركة الموارد وللطلاب للوصول إلى المعلومات. يمكن لهذه المنصات استضافة الكتب المدرسية الرقمية ومحتوى الوسائط المتعددة والوحدات التفاعلية والواجبات.

- الموارد التعليمية المفتوحة (OER) تشير الموارد التعليمية المفتوحة إلى المواد التعليمية المتاحة مجانًا والتي يمكن الوصول إليها عبر الإنترنت. يمكن للمدرسين الاستفادة من منصات الموارد التعليمية المفتوحة للعثور على الكتب المدرسية وخطط الدروس ومقاطع الفيديو والموارد الأخرى التي تتوافق مع المنهج الدراسي وتزود الطلاب بمصادر معلومات إضافية.

### ٣. يربط تجربة الفصل الدراسي بالعالم الحقيقي

تأخذ أستاذة الجيولوجيا طلابها في جولة افتراضية في احد المتنزهاة. مدرس تاريخ يرشد طلابه عبر ممرات بناء تاريخي وشرح المعالم التاريخية. تسمح التكنولوجيا للمعلمين بإزالة الحواجز المادية في الفصل الدراسي، مما يوفر للطلاب طريقة لربط المنهج الدراسي بالعالم الحقيقي ومجالات التركيز الأكاديمي التي يمكن أن تثري تجربة الطالب بشكل حقيقي. يمكن للتكنولوجيا أيضًا تسهيل جلسات المتحدثين الافتراضية، مما يسمح للطلاب بالتواصل مع الخبراء والمهنيين من مختلف المجالات من خلال مؤتمرات الفيديو، وتوسيع نطاق وصولهم إلى المعلومات ووجهات نظر العالم الحقيقي.

### ٤. إعداد الطلاب لمكان العمل الحديث

لتحقيق النجاح في مكان العمل في القرن الحادي والعشرين، يحتاج الطلاب إلى أكثر من مجرد المعرفة العملية بالأدوات التكنولوجية الحالية. يجب عليهم التعرف على الأدوات والمهارات التي من المحتمل أن يواجهوها في مكان العمل الحديث. ومن خلال دمج هذه التقنيات في المناهج الدراسية العادية والأنشطة المستمرة، تضمن المؤسسات أن طلابها جاهزون للقوى العاملة بأكثر من طريقة:

- محو الأمية الرقمية: هناك طلب كبير على مهارات القراءة والكتابة الرقمية في مكان العمل. ومن خلال دمج التكنولوجيا في الفصل الدراسي، يتعلم الطلاب كيفية التنقل بين المنصات الرقمية، واستخدام أدوات الإنتاجية، والتعاون عبر الإنترنت، والتواصل الفعال باستخدام الوسائط الرقمية.

- إدارة المعلومات: تمكن التكنولوجيا الطلاب من الوصول إلى كميات كبيرة من البيانات وتنظيمها وتحليلها. غالبًا ما يحتاج الموظفون إلى جمع البيانات وإجراء الأبحاث لاتخاذ قرارات مستنيرة. تعمل تكنولوجيا الفصل الدراسي على تعريف الطلاب بأدوات وتقنيات إدارة المعلومات، وإعدادهم لهذه المهام.
  - القدرة على التكيف والمرونة: يُعزّض التكامل التكنولوجي الطلاب لمختلف الأدوات والمنصات الرقمية. تساعد هذه التجربة الطلاب على أن يصبحوا قادرين على التكيف والمرونة في استخدام التقنيات المختلفة، حيث تتطلب أماكن العمل غالبًا من الموظفين التعلم والتكيف مع التقنيات والبرامج الجديدة.
  - الإبداع والابتكار: يمكن للطلاب استخدام التكنولوجيا لإنشاء عروض تقديمية متعددة الوسائط، وتصميم المشاريع، وتطوير النماذج الأولية، والتعبير عن أفكارهم بشكل مبتكر. تحظى هذه المهارات بتقدير كبير في العديد من الصناعات التي يكون فيها حل المشكلات الإبداعي والتفكير الابتكاري أمرًا ضروريًا.
  - تشجع التعاون والتواصل: توفر العديد من الأدوات التعليمية مجموعة متنوعة من الوظائف التي تعزز التعاون. على سبيل المثال، تسمح أدوات مؤتمرات الفيديو مثل Zoom و Microsoft Teams و Slack و Skype للطلاب بعقد اجتماعات افتراضية مع زملاء الدراسة من أي مكان في العالم. باستخدام حلول التخزين المجانية عبر الإنترنت مثل Google Drive ، يمكن للطلاب مشاركة المشاريع وتعديلها بسهولة مع بعضهم البعض، مما يساعد على تعزيز التعاون الشامل بشكل أفضل في كل من المجال الأكاديمي وعالم العمل. وهذا يعكس مهارات العمل الجماعي والتواصل المطلوبة في أي مكان عمل.
٥. يدعم أنواع مختلفة من أساليب التعلم

لا يتعلم طالبان بنفس الطريقة، ولكن يمكن للمعلمين التعامل مع التنوع في أساليب التعلم والخبرات باستخدام الأدوات المناسبة. يمكن أن تساعد منصة Student Insight Solution مثل Explorance Blue في تحديد احتياجات الطلاب بناءً على التعليقات في الوقت الفعلي. يدعم برنامج Explorance Blue تعلم الطلاب من خلال السماح للمعلمين بالتواصل والتفاعل مع كل طالب، بغض النظر عن مكان وجودهم أو التحديات التي يواجهونها.

## ٦. يعلم الطلاب كيفية تحمل المسؤولية عبر الإنترنت

مع وفرة مواقع التواصل الاجتماعي، أصبح معظم الطلاب مواطنين رقميين بالفعل. ومع ذلك، من خلال دمج التكنولوجيا في الفصل الدراسي، يمكن للطلاب تعلم كيفية تحمل المسؤولية في العالم الرقمي وفي تصرفاتهم الرقمية. يصبح الفصل نموذجًا مصغرًا للمشهد الرقمي الأوسع حيث يمكن للطلاب ممارسة التواصل والبحث والتفاعل مع المواطنين الرقميين الآخرين.

## ٧. يضيف عامل المتعة للتعلم

خارج الفصل الدراسي، يستخدم الطلاب التكنولوجيا في جميع جوانب حياتهم. داخل الفصل الدراسي، يمكن للتكنولوجيا أن تجعل التعلم أكثر متعة وإثارة. فيما يلي بعض الطرق الممتعة لدمج التكنولوجيا في أنشطة الفصل الدراسي:

- الألعاب والاختبارات التعليمية: استخدم مواقع أو تطبيقات الألعاب التعليمية التي تقدم اختبارات تفاعلية وألغاز وتحديات تتعلق بالموضوع. يؤدي ذلك إلى إشراك الطلاب في بيئة ممتعة وتنافسية مع تعزيز تعلمهم.
- استطلاعات الرأي والاستطلاعات عبر الإنترنت: استخدم أدوات الاقتراع عبر الإنترنت أو منصات الاستطلاع لجمع تعليقات الطلاب أو إجراء استطلاعات الفصل أو تسهيل المناقشات الصفية. وهذا يشجع المشاركة النشطة ويسمح للطلاب بالتعبير عن أفكارهم.
- البرمجة والبرمجة: تقديم أنشطة البرمجة والبرمجة باستخدام منصات أو تطبيقات البرمجة التعليمية. يمكن للطلاب تعلم أساسيات البرمجة من خلال البرامج التعليمية القائمة على الألعاب ومن ثم تطبيق مهاراتهم لإنشاء برامج أو رسوم متحركة بسيطة.
- الواقع المعزز (AR) والواقع الافتراضي (VR): استكشف تقنيات الواقع المعزز والواقع الافتراضي لإنشاء تجارب تعليمية غامرة وتفاعلية. يمكن للطلاب استخدام أدوات AR/VR لاستكشاف المواقع التاريخية، أو تشريح الكائنات الافتراضية، أو تصور المفاهيم المعقدة في مساحة ثلاثية الأبعاد.

يستفيد المعلمون الفعالون من التكنولوجيا لتحسين تعليمهم وإشراك الطلاب. ومع ذلك، من الضروري التأكد من توجيه الطلاب نحو البحث الفعال عن المعلومات، وتقييم المصادر بشكل نقدي، واستخدام

التكنولوجيا بمسؤولية. يلعب المعلمون دورًا حاسمًا في مساعدة الطلاب على التنقل في المشهد الرقمي وتطوير مهارات القراءة والكتابة المعلوماتية.

### الدراسات السابقة و تحديات تكنولوجيا التعليم الرقمي في مجتمع المعرفة:

يتميز مجتمع المعرفة في العصر المعاصر بالتركيز على المعلومات والمعرفة كأساس للعمل والبناء. ومن الأمور المركزية في هذا الإطار الثقافي دمج تقنيات التعلم الرقمي في العملية التعليمية. يعد التعلم الرقمي، الذي يعتمد على تكنولوجيا المعلومات والاتصالات، بمثابة وسيلة لنقل المحتوى التعليمي ونقل المهارات والمفاهيم إلى المتعلمين. وتتجذر في مبادئ تكنولوجيا التعليم والتطبيق العملي للعلوم التربوية، مما يجعلها عنصراً حيوياً في مجتمع المعرفة [٩].

توفر تكنولوجيا التعلم الرقمي العديد من المزايا في مجتمع المعرفة. فهو يسهل التفاعل المباشر بين المعلمين والمتعلمين من خلال السبورات الرقمية، مما يعزز بيئة تعليمية ديناميكية وجذابة [١٠]. علاوة على ذلك، فإنه يوسع مفهوم التعليم الاجتماعي المستمر والتواصل التقني، ليشمل التعلم عبر الإنترنت، والتعلم القائم على الكمبيوتر، والتدريس التقليدي في الفصول الدراسية [١١].

إن تعدد استخدامات التعلم الرقمي له دور فعال في نشر المعرفة وتطويرها، وبالتالي المساهمة في تقدم مجتمع المعرفة [١٢]. على الرغم من فوائدها، تواجه تكنولوجيا التعلم الرقمي تحديات وقيوداً في مجتمع المعرفة. وتتمثل إحدى العقبات الحاسمة في الحاجة إلى البنية التحتية والموارد الكافية لدعم مبادرات التعلم الرقمي بالإضافة إلى ذلك، فإن ضمان حصول المعلمين والمتعلمين على التدريب والدعم اللازمين للاستخدام الفعال لتقنيات التعلم الرقمي يشكل تحدياً كبيراً [١٣-١٤]. علاوة على ذلك، من الضروري الاعتراف بأن التعلم الرقمي قد لا يلبي تفضيلات التعلم لجميع الأفراد، حيث قد يظهر البعض تفضيلاً للتعلم التقليدي القائم على الفصول الدراسية. إن التصدي لهذه التحديات أمر حتمي لتسخير إمكانات تكنولوجيا التعلم الرقمي بشكل كامل في مجتمع المعرفة [١٥-١٧].

ان دمج تكنولوجيا التعلم الرقمي في التعليم أمر محوري في مجتمع المعرفة، حيث يقدم مجموعة كبيرة من الفوائد بما في ذلك التفاعل المعزز، والمفاهيم التعليمية الأوسع، ونشر المعرفة. ومع ذلك، لتعظيم إمكاناتها، من الضروري مواجهة التحديات المرتبطة بالبنية التحتية والتدريب وتفضيلات التعلم الفردي [١٨-٢١]. إن التغلب على هذه العقبات سيمهد الطريق لتحقيق الإمكانيات الكاملة لتكنولوجيا التعلم الرقمي في مجتمع المعرفة، وبالتالي المساهمة في النهوض بالتعليم ونشر المعرفة.

### استراتيجيات تحسين التعلم الرقمي في مجتمع المعرفة:

تتمتع تكنولوجيا التعليم الرقمي بالعديد من المزايا المناسبة لمجتمع المعرفة:

- توفر تكنولوجيا التعلم الرقمي للمتعلمين قدرًا أكبر من المرونة والراحة مقارنة بالتعلم التقليدي في الفصول الدراسية. يمكن للمتعلمين الوصول إلى المواد والدورات التدريبية في أي وقت وفي أي مكان، مما يسمح لهم بمواءمة تعلمهم مع جداول العمل والالتزامات الأخرى. تتيح هذه المرونة لعدد أكبر من البالغين العاملين مواصلة تعليمهم وتوسيع مهاراتهم.
- توفر تكنولوجيا التعلم الرقمي تجربة تعليمية مخصصة، مما يسمح للمتعلمين بالدراسة بالسرعة التي تناسبهم والتركيز على المجالات التي يجدون صعوبة فيها. تم تصميم منصات التعلم الرقمي بميزات تفاعلية تجذب المتعلمين وتعزز تجربة التعلم الخاصة بهم.
- تعمل تقنيات التعلم الرقمي على تعزيز التعاون والتفكير النقدي ومهارات حل المشكلات. توفر الدورات التدريبية عبر الإنترنت والفصول الدراسية الافتراضية للمتعلمين منصة للتواصل والتفاعل مع أقرانهم والمعلمين والخبراء من جميع أنحاء العالم. ويعزز هذا التعاون فهم المتعلمين لوجهات النظر المتنوعة ويعددهم لعالم العولمة.
- تعتبر تقنيات التعلم الرقمي فعالة من حيث التكلفة، وخاصة بالنسبة للمتعلمين الذين يعيشون بعيدا عن المؤسسات التعليمية. مع التعلم الرقمي، لا يتعين على المتعلمين دفع تكاليف السفر والإقامة، ويمكنهم الوصول إلى الدورات والمواد بتكلفة أقل من طرق التعلم التقليدية. هذه الفعالية من حيث التكلفة تجعل التعليم في متناول المتعلمين من خلفيات اجتماعية واقتصادية مختلفة.



- تعمل تكنولوجيا التعلم الرقمي على تعزيز الاستدامة البيئية عن طريق تقليل كمية النفايات التي ينتجها التعلم التقليدي في الفصول الدراسية. تستخدم منصات التعلم الرقمي مواد افتراضية مستدامة وموارد رقمية لتقليل البصمة الكربونية للتعليم.

### تحديات تكنولوجيا التعلم الرقمي في مجتمع المعرفة:

في عالم اليوم سريع الخطى، أصبح التحول الرقمي جانبًا حاسمًا في الأعمال والتعليم. لقد أحدثت تكنولوجيا التعلم الرقمي ثورة في طريقة نقل المعرفة واكتسابها. يهدف هذا المقال إلى استكشاف التنفيذ الفعال لتكنولوجيا التعلم الرقمي من منظور مجتمع المعرفة. يتضمن التحول الرقمي التحويل من العمليات اليدوية والتناظرية إلى العمليات الرقمية لتحقيق نتائج أفضل من خلال ربط الأشخاص والأماكن والأشياء. يعد هذا التحول ضروريًا في قطاع التعليم لأنه يتيح النشر السلس للمعرفة وتجاوز الحواجز الجغرافي (الشكل ١).



الشكل ١: تقنيات التحول الرقمي

لقد مهدت رقمنة العمليات التعليمية الطريق أمام تجارب تعليمية أكثر تفاعلية وجاذبية للطلاب. ومن خلال المنصات الرقمية، يمكن للطلاب الوصول إلى ثروة من المعلومات، والتعاون مع أقرانهم، والتفاعل مع موارد الوسائط المتعددة، وبالتالي تعزيز تجربة التعلم الشاملة لديهم. ومن منظور مجتمع المعرفة، فإن التنفيذ الفعال لتكنولوجيا التعلم الرقمي له دور فعال في سد الفجوة بين الوصول إلى المعلومات واكتساب المعرفة. في مجتمع اليوم القائم على المعرفة، تعد القدرة على الوصول إلى المعلومات وتفسيرها وتطبيقها أمراً بالغ الأهمية. توفر تكنولوجيا التعلم الرقمي منصة للأفراد ليس فقط للوصول إلى المعلومات ولكن أيضاً لتحليل المعرفة وتجميعها بشكل نقدي. وهذا يعزز ثقافة التعلم المستمر وتنمية المهارات، وهو أمر ضروري في مجتمع المعرفة. علاوة على ذلك، فإن تطبيق تكنولوجيا التعلم الرقمي يتيح تجارب تعليمية مخصصة تلبي الاحتياجات المتنوعة وأنماط التعلم للطلاب. ومن خلال منصات التعلم التكيفية وأنظمة التدريس الذكية، يمكن للمعلمين تصميم المحتوى ليناسب احتياجات الطلاب الفردية، وبالتالي تحقيق أقصى قدر من نتائج التعلم. ويتوافق هذا النهج الشخصي في التعلم مع مبادئ مجتمع المعرفة، حيث ينصب التركيز على تمكين الأفراد من اكتساب المعرفة وتطبيقها بشكل فعال. وفي الختام، فإن التنفيذ الفعال لتكنولوجيا التعلم الرقمي من منظور مجتمع المعرفة يحمل إمكانات هائلة في إحداث ثورة في التعليم. ومن خلال تبني التحول الرقمي، يمكن للمؤسسات التعليمية إنشاء بيئات تعليمية ديناميكية تعزز التفكير النقدي والتعاون وخلق المعرفة. مع استمرارنا في التقدم في العصر الرقمي، من الضروري تسخير قوة تكنولوجيا التعلم الرقمي لبناء مجتمع المعرفة والمهارة [22, 23].

على الرغم من فوائد تقنية التعلم الرقمي، إلا أن هناك العديد من التحديات التي تعيق فعاليتها في مجتمع المعرفة:

- التحدي الأول هو الفجوة الرقمية، التي تشير إلى عدم المساواة في الوصول إلى التكنولوجيا واستخدامها بين مجموعات مختلفة من الناس. في أجزاء كثيرة من العالم، وخاصة في البلدان النامية، لا يتم ضمان الوصول إلى الإنترنت وأجهزة الكمبيوتر وغيرها من المعدات اللازمة للتعلم الرقمي. وهذا يخلق اختلالات في التوازن التعليمي ويؤدي إلى تفاقم عدم المساواة الاجتماعية.

- التحدي الثاني هو قلة التفاعل البشري في التعلم الرقمي، مما قد يؤثر على دافعية المتعلمين ومشاركتهم ومهاراتهم الاجتماعية. على عكس التعلم التقليدي في الفصول الدراسية، يفتقر التعلم الرقمي إلى التفاعل وجهاً لوجه الذي يعد ضرورياً للتعلم الاجتماعي والعاطفي. يمكن أن يؤدي ذلك إلى تجربة تعليمية مجزأة لا تساهم في التعليم العام.
- التحدي الثالث هو تعقيد منصات التعلم الرقمي، والذي قد يكون مرهقاً لبعض المتعلمين. ليس كل المتعلمين يتمتعون بالذكاء التكنولوجي، وقد يمنعهم تعقيد منصات التعلم الرقمي من متابعة المزيد من التعليم أو التدريب.

### الاستنتاجات والتوصيات:

تهدف هذه الورقة البحثية إلى بيان نجاح التكنولوجيا ومساهمتها في بناء مجتمع المعرفة من خلال زيادة مستوى تفاعل الطلاب من خلال وسائل الاتصال التكنولوجية. إن ظهور التكنولوجيا في جميع الدول العربية بما فيها العراق هو واقع فرضه النمو والتطور. تطبيقات التكنولوجيا التي يمكن استخدامها لنشر المعرفة.

وكما تشير الأمم المتحدة، فإن مجتمعات المعرفة تقوم على "مبدأ حرية التعبير، والاستخدام الشامل للمعلومات والمعرفة، ونشرها وإنتاجها واستخدامها الفعال في جميع مجالات النشاط الاجتماعي، وتعزيز التنوع الثقافي". وتكافؤ الفرص للاستفادة من التعليم الجيد من خلال النظم المستخدمة في إنتاج المهارات. وفي هذا المقال نحاول توضيح مسألة مهمة، ففي ضوء النماذج الجديدة التي أحدثتها التكنولوجيا فإنها تربط التكنولوجيا بمجتمع المعرفة وتطبيقاته، فالبيئة التعليمية ترتبط بمجتمع المعرفة الذي تشهده البشرية، من خلال الاستثمار في الموارد البشرية وتطبيق الاكتشافات العلمية لتطوير وتحسين السلع أو الخدمات أو العمليات في البيئة التعليمية في العراق، وتعمل المنظمات التي تهدف إلى الاستثمار في التكنولوجيا على تعزيز كفاءاتها الأساسية.

لتحقيق الهدف المتمثل في بناء مجتمع معرفي مثالي متجدد يركز على الأنشطة المعرفية والتكنولوجية المتميزة التي يشهدها العالم:

- تتكامل ثورة الاتصالات مع استخدام أجهزة الكمبيوتر لتخزين ومعالجة ونقل البيانات، ومع كافة العناصر المرتبطة بالعمل الفني.
  - يزيد من إنتاج وتوليد المعرفة ويعتمد على تطبيق المعرفة والخبرة والمعلومات لتحويل الموارد إلى منتجات.
  - الهندسة الوراثية (الاستنساخ) وتقنيات الحياة.
  - كل ما يتعلق بالتكنولوجيا، مثل تطوير الكمبيوتر، واستخدام الرموز البرمجية، واتصالات البيانات، والبريد الرقمي، وما إلى ذلك.
- ومن هذا المنطلق تقترح هذه الورقة ما يلي:
- الاستثمار في نشر المعرفة وتطوير الأفكار حول التطور التكنولوجي ومساهمته في عملية البناء الاجتماعي.
  - اعتماد استراتيجيات فعالة لتحديد الكفايات التعليمية التي تعالج التحول المعرفي المطلوب لمواجهة التحديات التكنولوجية في تكنولوجيا المعلومات والاتصالات والبريد الرقمي.
  - إعادة النظر في المناهج التعليمية وتحديثها لتواكب سوق العمل. وسيطلب ذلك جهدا كبيرا وموارد مالية كبيرة لضمان استجابتها لمتطلبات المجتمع في عصر التكنولوجيا والمعرفة.
  - ويجب الاهتمام بتعزيز ثقافة تنمية المهارات والكفايات الفردية في المجتمع التعليمي، إذ لا يزال التعليم في بعض الأنظمة التعليمية في الدول العربية لا يعتمد على تطوير الوسائل والمهارات التقنية. ويعتبر الاعتماد على تطوير وتعليم المهارات التقنية هدفا وليس وسيلة لتمكين المتعلمين من استخدام المهارات التقنية لتحقيق أهدافهم والاستفادة منها في التطبيقات العملية.
  - ولا بد من اعتماد استراتيجيات للاستثمار في التكنولوجيا كوسيلة أساسية للتعليم الرقمي، بما يتناسب مع طبيعة المتعلم والنظام التعليمي.

باختصار، تمتلك تكنولوجيا التعلم الرقمي القدرة على إحداث تحول في التعليم وتحقيق التنمية الاجتماعية والاقتصادية في مجتمع المعرفة. فهو يوفر العديد من المزايا، بما في ذلك المرونة والتخصيص والتعاون والفعالية من حيث التكلفة والاستدامة البيئية، مما يجعله خياراً قابلاً للتطبيق للمتعلمين من خلفيات متنوعة. ومع ذلك، لتحقيق إمكاناتها الكاملة، يجب أن تعالج تقنيات التعلم الرقمي تحديات الفجوة الرقمية،

والتفاعل البشري المحدود، وتعقيد منصات التعلم الرقمي. ومن خلال القيام بذلك، يمكننا إنشاء نظام تعليمي عادل ومبتكر ومستدام يعد المتعلمين لمواجهة التحديات الحالية والمستقبلية في مجتمعات المعرفة.

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( دراسة حول البصمة الوراثية في الادلة الجنائية )

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- **المقدمة :** تقنية البصمة الوراثية او ما يسمى الفحص الجيني تعد من اهم الاكتشافات التي تم تطويرها حديثا في العديد من التطبيقات مثل اثبات النسب والكشف الجنائي حيث تعتبر كدليل جنائي في اثبات هوية الاشخاص المتهمين وتبرئة المظلومين ، الذي يميز البصمة الوراثية هو ان تكون العينات المأخوذة من مسرح الجريمة مختلفة سواء كانت شعر، بقايا خلايا ، لعاب ، مسحة من سائل منوي، دم، العظام وغيرها حتى لو كانت قليلة جدا او قديمة كما حدث في اكتشاف المجرمين الحقيقيين بعد عشرات السنين من خلال اجراء فحص البصمة الوراثية، تعد البصمة الوراثية من اهم الاساليب الحديثة التي اخذ يستخدمها المحققين في كشف الجناة حيث من الممكن الاستدلال عليهم من خلال تحليل الحمض النووي وكذلك التفريق بين الاشخاص من خلال مقارنة العينة المأخوذة من مسرح الجريمة مع عينة المشتبه به اما بصورة مباشرة او من خلال مقارنتها مع مخزن المعلومات الوراثية.
- **اهمية المقالة :** استخدام البصمة الوراثية في الاثبات الجنائي نظرا لحدثة الموضوع
- **هدف المقالة:** تسليط الضوء على اهم استخدامات البصمة الوراثية في الاثبات الجنائي.
- **مشكلة المقالة :**

١- هل تسبب البصمة الوراثية مشكلة في الفقه الاسلامي

٢- ماهي اهم تطبيقات البصمة الوراثية

٣- كيف يمكن تجنب بعض الاخطاء وماهي الشروط الواجب توفرها في العينة نفسها

والمختبري الذي يقوم بتحليل العينه

- **فرضية المقالة :** استخدام البصمة الوراثية في الكشف عن المتهمين كدليل ادانة مثبت .
- **الاثبات:** استخلاص الحمض النووي وترحيله كهربائيا من ومقارنة تسلسل القواعد النيتروجينية للعينة مع الاشخاص المتهمين واثبات الادانة ضدهم اذا كانت البصمة مطابقة معهم ويتم خزن النتائج واستخدامها عن الحاجة، لذلك اثبتت البصمة الوراثية دورها في اثبات النسب وتحقيق هوية الاشخاص المفقودين، ان لتطبيق البصمة الوراثية في الاسلام شروط تكمن في البصمة نفسها والشخص الذي يعمل على تحليل البصمة الوراثية ليتم التأكد والاطمئنان ان البصمة تعود للشخص المعني ولا يتم التلاعب في النتائج .

**الكلمات الافتتاحية :**

البصمة الوراثية ، عينات ، استخلاص الحمض النووي ، اثبات النسب ، الكشف الجنائي .

## المبحث الاول

## مقدمة عن البصمة الوراثية

البصمة في اللغة مأخوذة من البصم تعني اثر الختم بطرف الاصبع اما الوراثية من علم الوراثة أي انتقال الصفات عبر الاجيال من الاباء الى الابناء عن طريق تسلسل القواعد النايتروجينية في الحمض النووي لتصبح البصمة الوراثية الاثر الذي ينتقل عبر الاجيال ولا يتأثر بالعوامل الخارجية لذلك فإن الاكتشاف من قبل العالمان اليك جيفريز و روي وايت الذي يختصر بأن تكرر تسلسل القواعد النايتروجينية في منطقة من شريط الحمض النووي وهذا التسلسل يكون مختلف من شخص لآخر وهذا الاكتشاف حقق ثورة في العلوم الجنائية منذ القرن التاسع عشر هو البصمة الوراثية او ما يسمى البصمة الجينية حيث ان لكل انسان بصمة خاصة وقد استغل هذا الانفراد في البصمة في مجال التحقيق الجنائي وتحديد الاشخاص المشتبه بهم ، حيث يعتبر تحديد البصمة الوراثية من خلال تركيب الحمض النووي من ادق التقنيات في مكافحة الجرائم لما يمتلكه الحمض النووي من تركيب فريد لكل شخص (1, 2)

## ١- تاريخ البصمة الوراثية

كانت الخطوة الاولى لاكتشاف البصمة الوراثية منذ اكتشاف فصائل الدم في عام ١٩٠٠ حيث ميز العالم كارل لاندشتاينر فصائل الدم الرئيسية ولاحظ أنه يمكن وضع الأفراد فيها ضمن مجموعات مختلفة حسب فصيلة دمهم، في عام ١٩١٥ تم استخدام فصائل الدم ABO لحل قضية الابوه من قبل العالم ليون لاتييه، استمرت البحوث والتجارب لحين الوصول الى الستينات والسبعينات من القرن العشرين حيث تم الوصول الى تطور في علم البايولوجي الجزيئي ومعرفة تسلسل سانجر وتمكن الباحثين من معرفة تسلسل الحمض النووي(3)، في عام ١٩٧٨-١٩٨٣ حدث تطور كبير في معرفة تعدد الاشكال للحمض النووي، في عام ١٩٨٣ حدث تطور حاسم في تاريخ علم الوراثة الشرعي مع ظهور عملية PCR التي يمكنها تضخيم مناطق معينة من الحمض النووي، والتي ابتكرها الكيميائي كاري موليس. في وقت لاحق حصل على جائزة نوبل ، وفي عام ١٩٨٤ قدم أليك جيفري بصمة الحمض النووي في مجال علم الوراثة الشرعي، وأثبت أن بعض المناطق في الحمض النووي لها تسلسلات متكررة، والتي تختلف بين الأفراد. ونتيجة لهذا الاكتشاف، تم حل قضية الطب الشرعي الأولى باستخدام تحليل الحمض النووي(4).



Alec J. Jeffreys

## ٢- الدليل العلمي للبصمة الوراثية

تحتوي خلية كل كائن حي على نواة فيها الحمض النووي الذي يحمل معظم الجينات الوراثية التي تنتقل من الاباء الى الابناء، يتكون الجينوم البشري من ٣ مليارات نيوكليوتيدات، وهي متطابقة بنسبة ٩٩,٩% من شخص لآخر (5) وحسب ما قدم عالم الوراثة ايليك جيفرز حيث يتم تحديد هوية الشخص عن طريق البصمة الوراثية حيث بعد استخلاص وتحليل وتصوير تركيب الحمض النووي وتفسير تسلسلاته التي تظهر مستوى عالٍ من تعدد الأشكال في جميع أنواع الأنسجة، ونتيجة لذلك أثبتت أنها مفيدة جدًا في دراسات الطب الشرعي، التي تعطي معلومات ع-ن العينة ما اذا كانت مأخوذة من حيوان او نبات او بشر حيث يمكن استخدام الاختلاف بنسبة ٠,١% لتمييز فرد عن الآخر، وهذا هو الاختلاف الذي يمكن أن يستخدمه علماء الطب الشرعي لمطابقة عينات من الدم أو الأنسجة أو بصيالات الشعر مع فرد يتمتع بمستوى عالٍ من اليقي (6, 7)

## ٣- دور البصمة الوراثية في الإثبات الجنائي

يملك كل شخص تسلسل فريد من القواعد النيتروجينية في الحمض النووي عدا التوائم المتماثلة وبالتالي فإن بصمة الحمض النووي هي نمط من الحمض النووي له مواقع وراثية تمتلك قوة انفراد عالية تجعل احتمالية التكرار والتشابه مستحيلة يمكن تمييزه عن أنماط الحمض النووي للأفراد الآخرين هذا ما جعل استخدامها في التحقيقات الجنائية وعلوم الطب

الشرعي لما له ثبات ورسوخ في ساحات القضاء حيث يمكن استخدام تسلسل الحمض النووي المأخوذ من مسرح الجريمة من مجموعة متنوعة من العينات البشرية بما في ذلك الدم أو السائل المنوي أو اللعاب أو البول أو الشعر أو الشدق (خلايا الخد) أو الأنسجة الأخرى أو العظام ومتابعته مع تسلسل الحمض النووي للأشخاص المشتبه بهم وكذلك في حالة اثبات النسب أو نفيه (8) ، بشكل عام، تقبل المحاكم في معظم البلدان موثوقية تحليل الحمض النووي، وقد أدرجت هذه النتائج ضمن الأدلة في العديد من القضايا الجنائية (9).



الشكل ١: بصمة الاصبع للإنسان



الشكل ٢: الحمض النووي للإنسان ( البصمة الوراثية )

٤- أنواع البصمة الوراثية

- يمكن من خلال انواع العينات التي تستهدف الحمض النووي الذي يعطينا معلومات عن العينات المأخوذة من مسرح الجريمة للجاني ومعرفته سواء كانت العينة لذكرا ام لأنثى وكذلك لون البشرة وصلة القرابة بينه وبين المجني عليه(10, 11).
- أ. بصمة الرمش: تعتبر بصمة الرمش واحدة من أنواع البصمات الوراثية الأكثر دقة والتي يصعب التلاعب بها. فالجريمة قد لا تتسبب في توضيح الجاني، لكن بإمكان الجرائميين جمع بضع شعرات من الرموش، وتحليل الحمض النووي فيها لتحديد هوية الشخص(12).
- ب. بصمة العرق: تعتبر بصمة العرق نوعاً آخر من البصمات الوراثية الدقيقة التي يمكن استخدامها لحل الجرائم. ويتم جمع العينات من بعد الثلاثين دقيقة من النشاط البدني وتحديد الهوية باستخدام آلة التحليل الجيني (13).
- ت. بصمة المني : تفيد هذه البصمة في حالات الاغتصاب حيث يمكن اخذ مسحه من المجني عليها واسنادها الى الجاني وكذلك تكشف في حالة وجود اكثر من جاني، وكذلك تستخدم في حالة الزنا واثبات ان العينة ليست للزوج (14, 15).
- ث. بصمة الدم: تعد بصمة الدم واحدة من المصادر الرئيسية لتحديد البصمات الوراثية، حيث يتم جمع العينات من الدم وتحليل الحمض النووي للتحقق من هوية المشتبه به(16).
- ج. بصمة اللعاب: يمكن ان توجد بعض العينات من اللعاب على عقب السجائر حيث يتم جمعها وتحليلها لتحديد هوية المشتبه به في الجريمة. ويتم جمع العينات عن طريق رشها على لوح تحليل الحمض النووي(17, 18)
- ح. بصمة الشعر: يمكن من خلال شعره واحدة توجد على مسرح الجريمة يتم تحليل الحمض النووي لتحديد هوية الشخص المقارنة بقاعدة البيانات الوراثية. وتستخدم هذه البصمة الوراثية بشكل متكرر في الجرائم التي تتطلب تحديد هوية المشتبه به.
- عموما كمية الحمض النووي الناتج من العينات يعتمد على نوعها كما مبين في الجدول ادناه :

جدول ١: كمية الحمض النووي من مختلف العينات(19)

نوع العينة	كمية الحمض النووي
الدم	30.000-200.000 ng / ml
اللعاب	200 ng/ cm <sup>2</sup>

الشعر مع البصيلات	1-175 ng / root
السائل المنوي	250.000 ng/ ml
مسحة من الفم	100-1500 ng/ swap
الانسجة	50-500 ng/mg
العظام	3-10 ng/ mg
الادرار	1-20 ng/ml

### المبحث الثاني

#### طرق العمل في المختبرات

##### ١- الضوابط العلمية والفنية للعمل في البصمة الوراثية

- هنالك ضوابط من الضروري اتباعها للمحافظة على عينات البصمات الوراثية ومتابعة الطريقة الفنية للعمل ورفع العينات والمختبر الذي يقوم بالتحليل من اهمها ما يلي (20) :
- أ. ان تكون المختبرات تابعة للدولة وهناك لجان علمية مهمتها متابعة النتائج وتوفير جميع متطلبات المختبر العلمية.
- ب. تجنب استخدام الطرق غير المشروعة في اخذ العينات عن طريق وضع قواعد فنية ودقيقة في حفظ العينات وحمايتها من التلاعب.
- ت. تحليل النتائج يحتاج دقة عالية عن طريق اختيار خبراء لهم مستوى عالي من الدرجة العلمية.
- ث. حماية العينات من الغش والتلاعب وكذلك منع التلوث ودقة المختبرات للحصول على نتائج بعيدة عن الشك واقرب الى الواقع.
- ج. وضع ارشيف خاص بالنتائج ليتم الوصول اليها عند الحاجة مع توثيق العمل مع كل خطوة لضمان دقة النتائج (21-23).

##### ٢- طرق الكشف والتحليل الجيني للبصمة الوراثية

هنالك العديد من الطرق التي يستخدمها العلماء لتحليل البصمة الوراثية حيث لا تحتاج العينات الى ظروف معقمة بل يتم رفع العينات البيولوجية من مكان الحادث حيث ان مثل هذه العينات تحتاج الى دقة وحذر من جانب الخبير للحفاظ على سلامة الحمض النووي

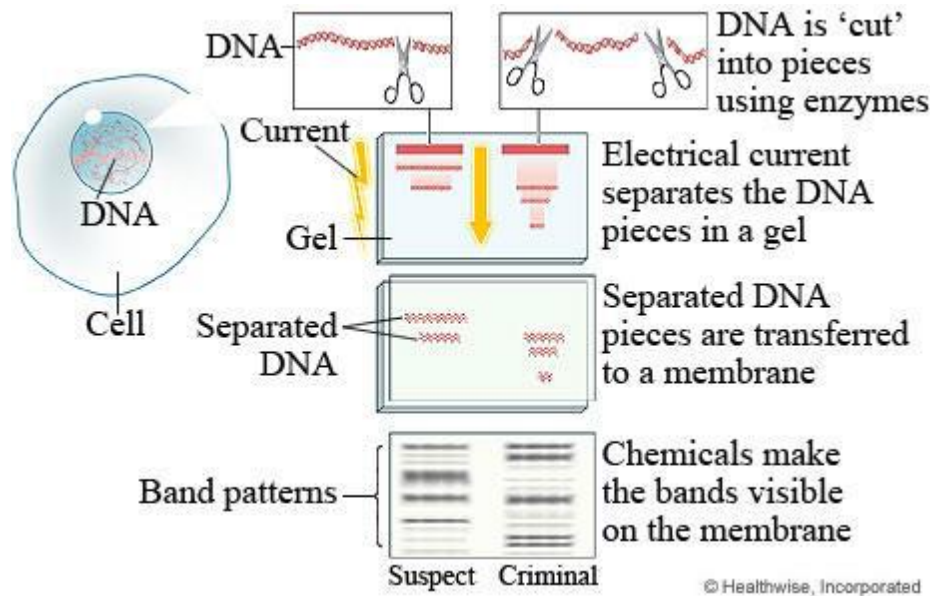
حيث يتم نقل العينات الى المختبر ومن ثم يتم استخلاص الحمض النووي من العينات وبعدها يمر الحمض النووي في مرحلة المضاعفة او التضخيم باستخدام تقنية تسمى تفاعل البوليميراز المتسلسل (PCR) حيث يتم تضخيم تسلسل الحمض النووي للعيينة بشكل كبير مما يسهل تحليل النتائج ومقارنتها.

اما إذا كان هناك ما يكفي من الحمض النووي، يمكن قطع الحمض النووي المستخرج من العينة أو تجزئته باستخدام إنزيمات محددة تسمى restriction endonucleases التي تعمل كمقص جزيئي عن طريق قطع تسلسلات التعرف المحددة الى قطع من الحمض النووي والاختلاف بين هذه القطع الموروثة في الحمض النووي بين عينتين مختلفتين يمكن تمييزها عن طريق تعريضها الى عملية الترحيل الكهربائي (Gel electrophoresis, 24, 25).

تقوم عملية الفصل هذه بالاعتماد على حجم الحمض النووي يتم سكب شظايا الحمض النووي في بئر هلام الاغاروز، يتم توصيل الجل بأقطاب كهربائية ايجابية وسلبية. يعمل الترحيل الكهربائي الهلامي على حقيقة أن الشحنات المتباينة تجذب بعضها البعض وأن الأجزاء الأصغر تتحرك بشكل أسرع من الأجزاء الأكبر. يحتوي الحمض النووي على عمود فقري مصنوع من الفوسفات المشحون بشحنة سالبة. تتجه شظايا الحمض النووي سالبة الشحنة نحو القطب الموجب للجيل (24).

بمجرد إجراء الفصل الكهربائي للهلام، يتم نقل النتائج إلى مرشح النيتروسيليلوز ويتم إضافة المجسات المشعة ذات العلامات. يتم نسخ التهجين بين أجزاء الحمض النووي والمسبار على فيلم الأشعة السينية ويمكن رؤيته تحت الأشعة السينية عندها يسهل تحليلها ومقارنة الحمض النووي للعيينة مع العينات المشتبه بهم.





الشكل ٣: ملخص طريقة استخلاص وفصل الحمض النووي من العينات (26).

### ٣- طرق الكشف عن نواتج تضخيم الحمض النووي

يتم استخدام الطرق الآتية:

#### أ. التتميط التكراري القصير الترادفي (Autosomal short-tandem repeat - (STR)

يعتبر من أهم الأنواع المستخدمة في التحاليل الجنائية والطب الشرعي لمعرفة هوية الإنسان لأنه يعتبر بسيط وسريع ، يتكون STR من أحادي وثنائي وثلاثي ورباعي وخماسي وستاسي التكرارات من النوكليوتيد في التتميط الجيني من أهم استخداماته في اختبار الأبوة / الأمومة، وتحديد مرتكبي الاغتصاب، واختبار القرابة، وتحديد ضحايا الكوارث(27).

#### ب. تحليل كروموسوم Y

الكروموسوم Y بايلوجيا موجود واحد فقط في الذكور ولا يوجد عند الإناث ويمتلك ٥٥ جين وهذا التميز الفريد جعل من السهل التمييز في مسرح الجريمة بين العينات وخاصة عند جرائم الاغتصاب.

#### ت. تحليل الحمض النووي للميتوكوندريا mt-DNA

هذا النوع من الحمض النووي يكون متوارث من الأم وهذا التحليل يساعد في

الكشف عن المتهمين التابعين لنفس العائلة يبقى هذا الحمض النووي على مدى الحياة وتحتوي الخلية الواحدة على ٢٠٠-١٧٠٠ نسخة منه يكون مهم في الكشف عن العينات المتدهورة او القديمة او القليلة جدا(28).

ث. كتابة تعدد الأشكال النوكليوتيدات الجسدية ( Autosomal single-nucleotide polymorphism-SNP)

يكشف هذا النوع من التحليل عن تسلسل الحمض النووي الذي يمتلك تباين في قاعدة واحدة ويحتاج الى قالب من الحمض نووي قليل ما يقارب ٥٠ قاعدة نيروجينية ليتم الكشف عنه مقارنة مع STR الذي يحتاج الى قالب اكبر يصل الى ٣٠٠ قاعدة نيروجينية (28-30).

### المبحث الثالث

#### تطبيقات البصمة الوراثية

##### تطبيقات البصمة الوراثية

نظرا لأهمية البصمة الوراثية في سوق العمل وسرعة انتشارها حيث تحولت من البحوث الاكاديمية الى التطبيق العملي واصبح استخدام البصمة الوراثية (DNA) في الكثير من مجالات الحياة فهي دخلت بقوة في الابحاث المتعلقة بالأمور الطبية والعلاجية المتعلقة بصحة وجسم الإنسان وكذلك في فك النزاعات التي تخص النسب في المحاكم، كما حلت بشكل أساسي في الشؤون القضائية والجزائية، وحسنت الكثير من القضايا المعقدة التي كان حلها بمثابة طلسم، تستخدم البصمة الوراثية في نوعين من التطبيقات(31-35) :

##### أ. تطبيقات البصمة بأثبات النسب والادلة الجنائية والتحقيق الجنائي

اظهرت الدراسات العلمية للبصمة الوراثية اهميتها في اثبات النسب وتحقيق هوية الاشخاص حيث تم استخدامها في الكثير من الدعاوي فيما يخص الحصول على الجنسية كما في حالة حصول الهجرة في دولة ما واثبات انتماء الاشخاص الى تلك العوائل عن طريق تحليل الرفات والبقايا الخاصة بالعوائل واثبات النسب اليها، كذلك في اثبات انتماء الاشخاص او الجثث الغير معروفه الى عوائلهم كما حدث في العراق حادثة سبايكر وحوادث الانفجارات وغيرها وكذلك في الحروب والحوادث الطبيعية(35).

## ب. دورها في البحوث العلمية والعلاج

دخلت البصمة الوراثية والطب الجزيئي في العديد من المجالات البحثية العلمية الذي اعتمد على معرفة التسلسلات للحمض النووي وكذلك معرفة مواطن الخلل واهميته وتأثيره على وظيفته وعلاقته مع امراض معينة ، حيث من خلال معرفة الخلل الجيني يتم تحديد اضراره على صحة الانسان ويمكن تدارك تلك الاضرار وتلافي الاثار الناتجة منه، بالاضافة الى دور البصمة في البحوث العلمية فأنها القت طفرة علمية وتطور سريع في العلاجات وتلافي الامراض كما في مطابقة الانسجة عند زراعة الاعضاء ، وكذلك ساعد اكتشاف البصمة الوراثية على وضع خطة وراثية لتحديد التغيرات، التي تطراً على الحامض النووي للاورام، حيث أمكن رصد إعادة تنظيم جينوم الخلايا السرطانية وتطور الورم(34).

وكذلك تم معرفة الكثير من الامراض مثل مرض هانتجون ، ومرض الهيموفيليا، ومرض تليّف البنكرياس، ومرض الشلل الرعاشي الذي يصيب كبار السن ما بين ٥٠ و ٦٥ من العمر مثل الذي حدث في حالة البطل العالمي للملاكمة المعجزة (محمد علي كلاي) الذي أصيب بهذا المرض، وكذلك مرض الضمور العضلي والسرطان.

## ت- استخدام البصمة الوراثية في الكشف عن الجرائم

أهم المجالات التي تم استخدام البصمة الوراثية فيها، هو المجال الجنائي، وخاصة جرائم القتل والسرقة وبقية الجرائم، كونها استخدمت في الأثبات الجنائي واعتبرت وسيلة نفي وإثبات مؤكدة في مثل هذه المسائل خلاف فصائل الدم وبعض البروتينات ، التي كان يعتمد عليها في السابق في هذا المجال(32).

## ث- استخدام البصمة الوراثية في الكشف عن جرائم الاغتصاب والزنا

أكدت البحوث العلمية والتطبيقات العملية، إمكانية الكشف عن الجناة بطريقة مؤكدة في كثير من الجرائم الجنسية، وخاصة الاغتصاب أو هتك العرض وتحديد شخصياتهم، من خلال تحاليل حامض النووي المستمدة من السوائل والمتلوثات المنوية العالقة بالمجني عليها ، ثم مقارنتها بالبصمة الخاصة بالمشتبه فيهم وتحديد مرتكب الجريمة(36).

## المبحث الرابع

## شروط البصمة الوراثية في الفقه الاسلامي

هذه الشروط تتعلق أما بالبصمة ذاتها أو بالخبير الذي يجري تحليل البصمة للحصول على النتائج،

الشروط الخاصة بالبصمة ذاتها تتضمن الاتي :

الشرط الاول : إن تقبل البصمة الوراثية من أهل الاختصاص، الشرط الثاني : يشترط بالبصمة الوراثية أن تكون قطعية وهي تلك التي تفيد ظناً قوياً واحتمالاً راجحاً، الشرط الثالث: إن تكون البصمة الوراثية ثابتة حتى تكون صالحة لاعتماد الاستدلال بها، الشرط الرابع: الا تستخدم البصمة الوراثية الا عند النزاع ، وبأمر من القضاء، الشرط الخامس : إن لا تخالف البصمة الوراثية حكماً عقلياً مقررًا في الفقه الاسلامي، كأن تثبت بنوة مولود لمن لا يولد لمثله ، مثل الصبي الذي لم يبلغ الحلم(37).

الشروط الخاصة بالخبير الذي يجري التحليل:

الشرط الاول ان يكون الشخص يعمل بادراك علمي بغض النظر لنوع ديانته، الشرط الثاني يجب على الشخص اعادة الفحص اكثر من مره تصل الى اربع مرات خصوصا اذا كانت الجريمة حديثة لتجنب أي نوع من الشك ، الشرط الثالث اعادة التحليل بمختبرين على الاقل فإن كانت النتيجة غير مطابقة يتم ايقاف العمل بالبصمة الوراثية لعدم ثبوت دلالتها ، الشرط الاخير يجب ان يجري الفحص بمنتهى السرية(38).

## ١- قصص في اثبات النسب

أجريت في فرنسا مئات الاختبارات الجينية للتعرف على شخصية ركاب طائرة AIR BUS والتي سقطت في مرتفعات القديس Odile قرب ست ارسبورغ عام ١٩٩٢.

اما في الولايات المتحدة الامريكه عندما سقطت الطائرات على البنايات عام ٢٠٠١ وحدث احتراق تام للجثث ولم يتم التعرف عن هوياتهم الا بأجراء تحليل البصمة الوراثية ومقارنتها مع البصمات الوراثية لعوائلهم وتم التعرف على ٧٠٠ جثة في اليوم الواحد(39).

أما في العراق اجريت الفحوصات على الجثث المستخرجة من المقابر الجماعية وحوادث الانفجارات وسبايكر وغيرها بواسطة التعاون مع منظمات تابعة للامم المتحدة و وزارة حقوق الانسان

ومؤسسة الشهداء من خلال مطابقة العينات التي يتم اخذها من الجثث مع العينات المقدمة من قبل عوائلهم وذويهم.

أشهر القضايا التي استخدمت فيها البصمة الوراثية في مجال جرائم القتل هي قضية (اوجي سيمبسون) لاعب الرياضة الامريكي الاسود، الذي اتهم بقتل زوجته البيضاء، وبعد الاطلاع على نتائج اختبارات البصمة الوراثية، انتهت المحكمة الى براءته ، لعدم تطابق بصمته الوراثية مع آثار الجريمة(٣). وفي بريطانيا حكمت إحدى المحاكم على مواطن بريطاني بالسجن لمدة ثلاثة عشر عاما لاتهامه بسرقة بنك، وقد اعتمدت المحكمة في حكمها على نتائج البصمة الوراثية لعينات من لعاب السارق، عزلت من عمل الشاشة الخاصة بأمن البنك(23).

#### • الاستنتاجات:

نهاية هذه المقالة ، ان معرفة تسلسل الحمض النووي ( التتميط الجيني ) مهم في الكشف الجرائم وتحديد هوية المتهمين وكذلك في قضايا النسب والاعتصاب والزنا وتبرئة المظلومين، يتم اجراء الفحص على جميع انواع الاثار للخلايا التي تحتوي نواة والمنتقية على مسرح الجريمة مع الدقة في العمل ونقل العينات والاحتفاظ بالنتائج وسرية العمل مما يؤدي الى الكشف عن المتهمين كونه دليل قطعي.

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## Multi-Focus Image Fusion Based on Variance Measurement of Edge Contrast

دمج الصور متعددة البؤرة بناءً على قياس تباين الحافة

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## ABSTRACT

Multi-focus image fusion intends to produce an output image that contains all the relevant information from multiple input images that come from multiple visual sensor devices for the same scene. In this paper, a simple and efficient multi-focus image fusion method is proposed. It depends on applying the high pass filter (Laplace Filter) in the spatial domain to extract the edges and details of the multi-focus images. As a measure of contrast, the variance with consistency verification is calculated in the spatial domain of Laplace filter output after dividing it into non-overlapping blocks to combine the sharp regions of the input images, so a fused image is produced. The proposed method is compared with several fusion algorithms. The experimental results indicate better/similar results of this method compared with other comparable efficient algorithms.

**Keywords:** multi-focus image fusion, Laplacian filter, edge contrast measurement, consistency verification, majority filter, decision map.

## الخلاصة

الهدف من دمج الصور متعددة البؤرة هو إنتاج صورة مخرجة تحتوي على جميع المعلومات ذات الصلة من صور الادخال القادمة من أجهزة الاستشعار المرئية متعددة البؤرة لنفس المشهد. في هذا البحث، تم اقتراح طريقة بسيطة وفعالة لدمج هذه الصور. تعتمد الطريقة على تطبيق مرشح التميرير العالي (Laplace Filter) في المجال المكاني لاستخراج حواف وتفصيل الصور متعددة البؤرة. يتم تقسيم الصور الناتجة من مرشح لابلاس الى كتل غير متداخلة بحجم (nxn) ومن ثم يتم احتساب مقياس التباين (variance) للكتل المتناظرة لتحديد درجة الوضوح والتباين ليتم على اثرها اختيار الكتل الأكثر وضوحا من الصور المدخلة لإنتاج الصورة المدمجة النهائية والتي تحتوي على كل التفاصيل بشكل واضح. وللحصول على نتائج دمج أفضل تم اعتماد طريقة التحقق من الاتساق (consistency verification). تمت مقارنة الطريقة المقترحة مع العديد من خوارزميات الاندماج. تشير النتائج التجريبية إلى نتائج أفضل/مشابهة لهذه الطريقة مقارنة بالخوارزميات الأخرى ذات الكفاءة العالية.

الكلمات المفتاحية: دمج الصور متعددة البؤرة، مرشح لابلاس، قياس تباين الحواف، التحقق من الاتساق، مرشح الأغلبية، خريطة القرار.

## INTRODUCTION

Optical lenses are usually used in capturing images. This technique suffers from restricted depth of field. Therefore, images that are captured are not in focus everywhere. Regions with a specific space to the lens will be in focus while regions at other spaces are defocused. This situation makes processes on images like feature extraction, and object detection difficult; also, it is unwanted for human visual perception. To overcome this problem, a fusion algorithm for the captured images can be used to combine the information from every input source image. Fusion algorithms are used in many applications such as multi-modal medical images, visible and infrared images for surveillance, and remote sensing images. Generally, fusion algorithms are implemented in the spatial domain and transform domain. Maximum rule, average rule and weighted average rule, PCA, and Pyramid fusion methods are categorized as spatial fusion methods [1,2], while multi-resolution transforms like wavelet transform, discrete cosine transform, and curvelet transform are categorized as transform domain fusion methods. They are invested in locating the significant image information like details and lines to be transferred to the fused image [2-4]. Algorithms of the transform domain are based on coefficients in the transform domain, these algorithms are considered more sophisticated and consume more time for execution than spatial domain algorithms which are based on pixels of images or blocks immediately. Spatial domain techniques are classified into two categories: pixel-based algorithms and block-based algorithms. In this technique, measurement of focus is easy to perform with low computational cost and the fused output image holds the main focused areas from the multi-focus input images but it suffers from misregistration sensitivity and can be influenced by noise or outliers, spatial resolution limitations, and input image quality [5]. Yet, the present spatial domain fusion algorithms are more sophisticated, like methods based on genetic algorithms [6], and methods based on neural networks [7]. In [5], the input images' energy of Laplacian is used to determine which regions in the multi-focus input images are focused well. A majority filter is

used to spread the focused areas to the vicinity. A guided filter is used to minimize the blocking effect. In [8] a cross-bilateral filter is used to extract details of the input multi-focus images to compute weights in the weighted average fusion rule. In the case of transform domain-based image fusion algorithms, several papers are reviewed. In [1], the authors suggest a unique residual removal-based multi-focus picture fusion technique. First, the initial fused result is generated by designing a structural tensor-based fusion rule in the nonsubsampling contourlet transform domain. Concurrently, a novel multi-scale threshold correction focusing detection method is put forth for the spatial domain. The incomplete decision maps are generated by the pixels with the dominant focus property after all focusing advantages with various scales and focus reliability are considered. In [2], wavelet coefficients' spreading is invested to find blurring degrees in input images. A model of adaptive Laplacian mixture is used to evaluate the distribution of wavelet coefficients, and a proposed measurement of sharpness is followed to fuse the image's coefficients in the wavelet domain. In [3], the fusion process depends on the calculation of variance in the discrete cosine transform domain as a measure of activity level. The majority filter is used as a consistency verification to enhance the fusion process. This paper presents a simple and effective spatial domain fusion algorithm based on passing a high pass filter (Laplace filter) at the multiple input images to be fused to extract the edges and details of them. The variance value indicates the contrast measurement in image processing, so a variance for every block of size  $N \times N$  is calculated. Then blocks with larger values of variance mean regions with better focus, so this criterion is used as a measure of activity level. Consistency verification depends on using a majority filter to locate the desired pixel and overcome the blocking effect.

The organization of this paper is as follows: section 2 states the proposed algorithm. Section 3 demonstrates the experimental results and the analysis of them finally section 4 states the conclusion.

## MATERIALS AND METHOD

Since sharper regions contain more details and edges than blurred ones, a spatial filter, which detects edges, is used to extract those regions of details and lines of the multi-focus input images. Laplacian filter is utilized in this proposed algorithm to detect details, lines, and fine structures of the multi-focus input images. The detection of the image's edges using the Laplacian filter is implemented by locating the zero crossing of the second derivative of the image intensity. (1) represents the Laplacian of an image [9]

$$\nabla^2 Im(x, y) = \frac{\partial^2 Im(x, y)}{\partial x^2} + \frac{\partial^2 Im(x, y)}{\partial y^2} \quad (1)$$

where,  $\nabla^2 Im(x, y)$  denotes the Laplacian of the image,  $Im(x, y)$  represents the image.

The approximations of the digital image for the second derivative are

$$\frac{\partial^2 Im(x, y)}{\partial x^2} = Im(x + 1, y) + Im(x - 1, y) - 2Im(x, y) \quad (2)$$

$$\frac{\partial^2 Im(x, y)}{\partial y^2} = Im(x, y + 1) + Im(x, y - 1) - 2Im(x, y) \quad (3)$$

Hence,

$$\nabla^2 Im(x, y) = [Im(x + 1, y) + Im(x - 1, y) + Im(x, y + 1) + Im(x, y - 1)] - 4Im(x, y) \quad (4)$$

To implement Eq. (4) for all image points, the following mask is used to convolve with the image.

$$\begin{bmatrix} 0 & 1 & 0 \\ 1 & -4 & 1 \\ 0 & 1 & 0 \end{bmatrix}$$

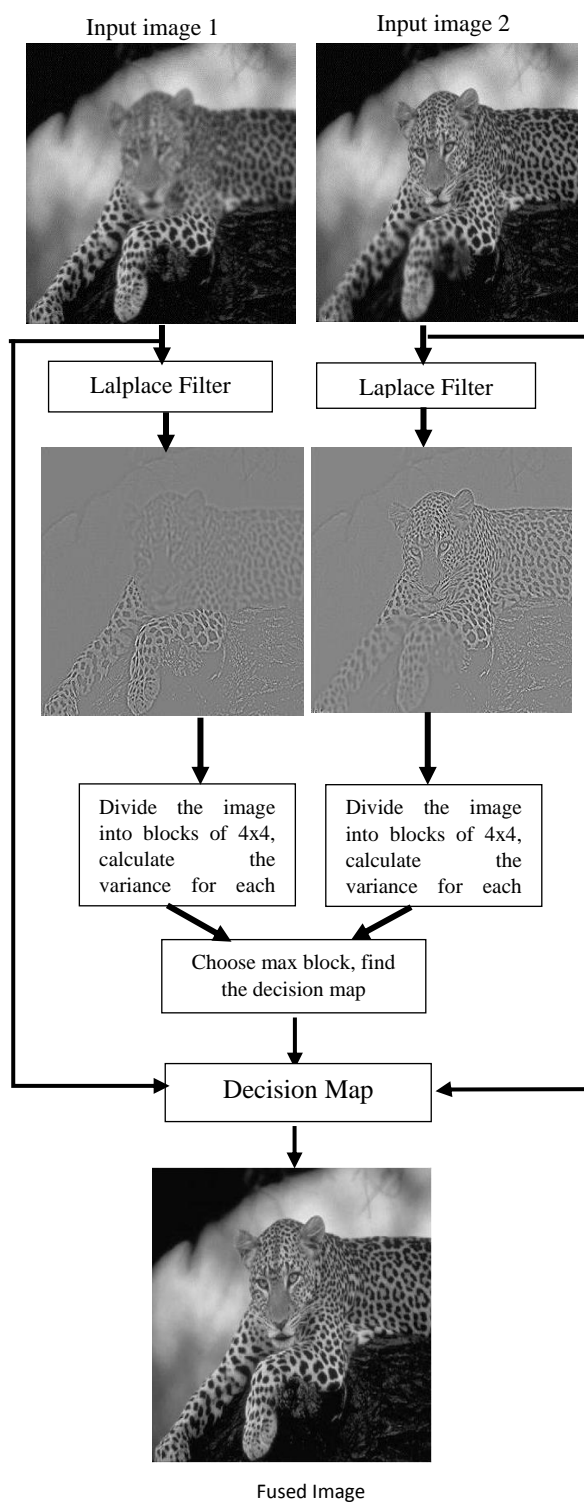
Since focused regions contain more information than defocused ones, their variances are higher than the latter and since the value of the variance represents a measurement of the image contrast [3], the proposed algorithm adopted variance measurement in the spatial frequency domain as an activity level measure. The output of multi-focus input images which resulted from applying the Laplacian filter is divided into blocks of size  $N \times N$ . The variance is applied for each non-overlapping block separately. Eq. (4) represents the variance rule [

$$\sigma^2 = \frac{1}{N^2} \sum_{m=0}^{N-1} \sum_{n=0}^{N-1} x^2(m, n) - \mu^2 \quad (5)$$

$$\mu = \frac{1}{N^2} \sum_{m=0}^{N-1} \sum_{n=0}^{N-1} x(m, n) \quad (6)$$

where  $\sigma^2$  represents the variance and  $\mu$  represents the mean of the  $N \times N$  block. As the variance of each block is calculated by (4), its value is considered as an activity measure. So, the block with the highest level of activity is chosen





## THE EXPERIMENTAL RESULTS AND ANALYSES

The experimental results of the proposed algorithm are explained in this section as well as the evaluation of this algorithm with several existing fusion ones.

### A. Performance Measures

Various parameters are used in the evaluation of fusion algorithms when no reference images are available [1, 2, 8]. In this research, four criteria of quantitative measurement are used. These criteria are: -

- Mutual Information (MI): indicates the amount of information content that correlated in the fused image concerning source input ones.

$$MI = MI_{XF} + MI_{YF} \quad (7)$$

where,  $MI_{XF}$  and  $MI_{YF}$  represent the mutual information between source image X, source image Y, and the fused image F respectively.

$$MI_{XF} = \sum_x \sum_f p_{X,F}(x, f) \log_2 \frac{p_{X,F}(x, f)}{p_X(x)p_F(f)} \quad (8)$$

$$MI_{YF} = \sum_y \sum_f p_{y,F}(y, f) \log_2 \frac{p_{y,F}(y, f)}{p_Y(y)p_F(f)} \quad (9)$$

- The Petrovic Metric Parameter ( $Q^{XY/F}$ ) which used to calculate how much information amount transferred from input source images (X, Y) to fused ones (F). A value of ( $Q^{XY/F}$ ) equal to one means fusion without any information loss, so a closed value of  $Q^{XY/F}$  to one means a precise fusion result. It is proposed by Xydeas and Petrovic [12].
- Visual Information Fidelity for Fusion (VIFF) metric that measures an image's visual information [13].
- Spatial Frequency (SF) indicates the level of activity of the image  $F$  (level of overall information) [1].

$$SF = \sqrt{RF^2 + CF^2} \quad (10)$$

where,

$$RF = \sqrt{\frac{\sum_i \sum_j (f(i,j) - f(i,j-1))^2}{m \times n}} \quad (11)$$

$$CF = \sqrt{\frac{\sum_i \sum_j (f(i,j) - f(i-1,j))^2}{m \times n}} \quad (12)$$

### ***B. Experimental Results***

The evaluation of the proposed algorithm has been implemented by using several test grey-scale multi-focus input images of size 256×256 and with no availability of reference ones. The simulation of the proposed algorithm has been executed by using MATLAB R2011b with Intel core i7, 2.7 GHz processor, and RAM of 4GB. Fig. (2-a) shows five of these input source images, and Fig. (2-b) shows the resulting fused images where one can notice that all the details and edges of the input sources are transferred to the fused one with no blurring effect.



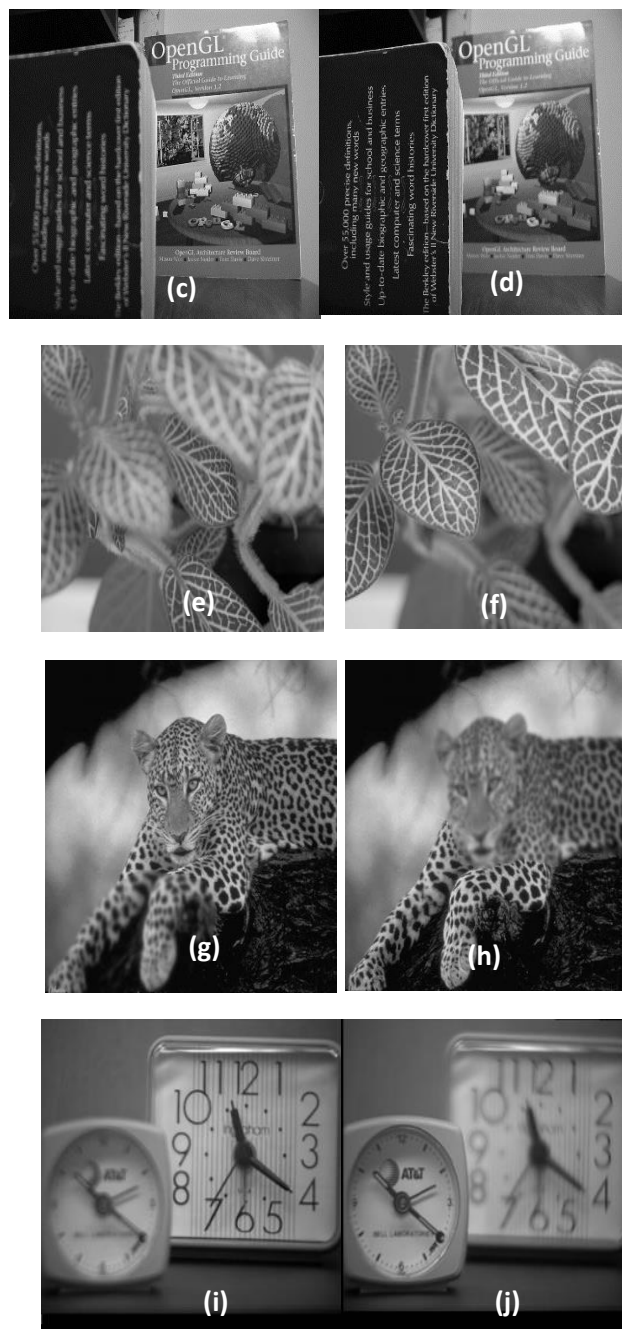


Fig. 2-a. Test multi-focus input images. (a),(b) Aerostat (c),(d) book,(e),(f)Leaf,(g),(h) Leopard, (i),(j) clock



Fig. 2-b. Resulted fused multi-focus test images of the proposed method

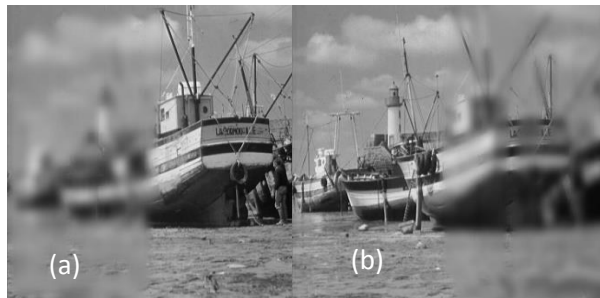
The proposed algorithm has been compared with efficient algorithms, two spatial-based fusion algorithms [5,8], and two transform-based fusion algorithms [3,2]. Table I displays the results of the quantitative criteria of them. The execution of the comparable different algorithms has been done by the software provided by their authors. The objective performance criteria indicate the fusion quality, where larger values mean better quality of fused images. From the results of Table I, the values of (MI) of the proposed algorithm exceed other comparable ones. The values of SF also exceed other comparable algorithms except for the leaf image where the SF value of the proposed method comes in the second step. The other objective performance criteria ( $Q^{XY/F}$ , VIFF) are slightly better or less than the other algorithms.

TABLE I. Comparison results of the proposed and comparable fusion algorithms

<i>Aerostat</i>	MI	$Q^{XY/F}$	VIFF	SF
Proposed	<b>11.5835</b>	0.9767	<b>0.9997</b>	<b>21.4799</b>
Method [5]	11.5399	0.9777	0.9991	21.4420
Method [8]	10.5484	<b>0.9845</b>	0.9682	19.9005
Method [3]	11.5523	0.9769	0.9992	21.4559
Method [2]	11.3872	0.9768	0.9978	21.3670
<i>Book</i>				
Proposed	<b>10.3790</b>	0.9658	0.9045	<b>24.6135</b>
Method [5]	10.3217	0.9678	0.9035	24.3987
Method [8]	9.1735	<b>0.9825</b>	0.9134	22.0043
Method [3]	10.1179	0.9684	<b>0.9456</b>	24.1654
Method [2]	9.9035	0.9660	0.9036	24.5776
<i>Leaf</i>				
Proposed	<b>7.6707</b>	0.8747	<b>0.8136</b>	20.4714
Method [5]	7.0363	0.8468	0.7929	19.5711
Method [8]	5.4612	<b>0.8782</b>	0.7800	19.5126
Method [3]	7.5424	0.8697	0.7951	<b>20.5043</b>
Method [2]	7.0413	0.8720	0.8105	20.4388
<i>Leopard</i>				
Proposed	<b>11.1263</b>	0.9494	<b>0.9991</b>	<b>22.2960</b>

Method [5]		10.9579	0.9498	0.9931	22.0351
Method [8]	9.8211	<b>0.9609</b>	0.9673	21.0651	
Method [3]	11.0990	0.9494	0.9973	22.2769	
Method [2]	10.8730	0.9495	0.9978	22.2719	
<i>Clock</i>					
Proposed	<b>9.1750</b>	0.8959	0.9446	<b>14.4067</b>	
Method [5]	9.0511	0.8878	0.9403	14.1516	
Method [8]	7.9335	0.9040	0.9082	12.8738	
Method [3]	9.1333	0.9015	0.9393	14.3277	
Method [2]	8.0817	<b>0.9441</b>	<b>0.9477</b>	13.5723	

Another experiment has been executed on several standard test images of various levels of focusing that are made artificially by passing a  $7 \times 7$  average filter on the right side and left side respectively. Fig. 3 shows four of these test images. Since reference images are available, PSNR evaluation criteria can be calculated between the reference image and the fused one. Table II shows the results of PSNR of the four test images where the value of PSNR for the proposed algorithm is the highest among other state-of-the-art fusion algorithms.



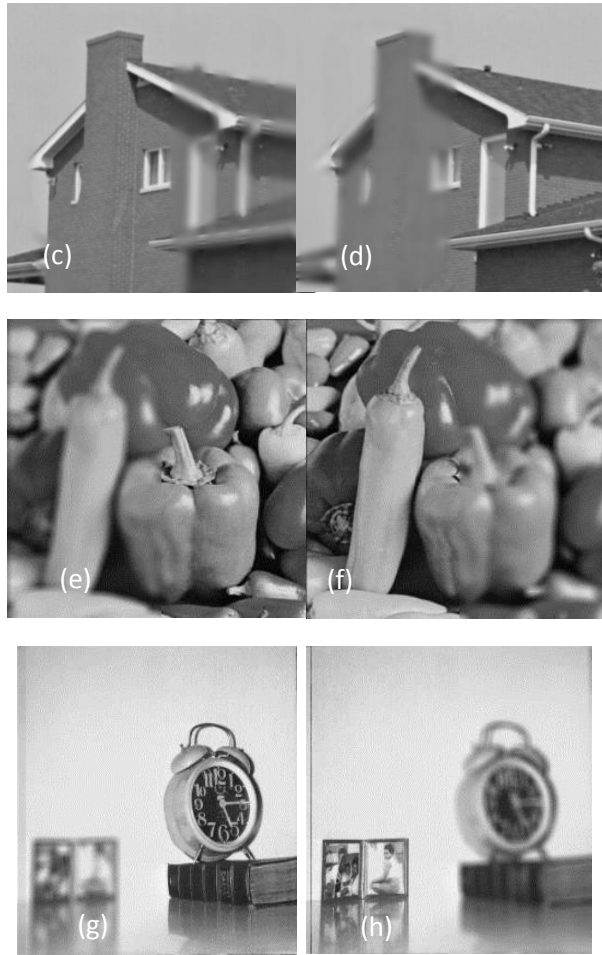


Fig. 3. Multi-focus test images generated artificially. (a), (b) Boat, (c), (d) House (e), (f) Pepper, (g), (h) Clock.

TABLE II. PSNR (dB) of the proposed fusion algorithm and other fusion methods.

<i>Test image</i>	<b>Boat</b>	<b>House</b>	<i>Pepper</i>	<b>Clock</b>
<b>Proposed</b>	<b>39.99</b>	<b>41.43</b>	<b>42.01</b>	<b>40.73</b>
<b>Method [5]</b>	39.45	40.54	41.49	39.05
<b>Method [8]</b>	38.41	38.82	38.14	37.61



<b>Method [3]</b>	<b>39.99</b>	41.15	41.56	40.69
<b>Method [2]</b>	39.72	41.37	41.58	39.05

## CONCLUSION

In this paper, a fusion algorithm of multi-focus images has been proposed. It is a spatial-based fusion method at the pixel level. It is based on extracting edges and sharp regions of input images by using a spatial Laplace filter. Variance criterion is used as an edge contrast measure at the Laplace filter output domain of the input images. It is calculated for every corresponding block. As the laplacian output images are divided into non-overlapped blocks of size  $4 \times 4$ . So blocks of higher variance value mean blocks of higher contrast. To improve the fused image quality and to reduce the blurring effect, a consistency verification by using a majority filter is adopted to make the right decision of choosing blocks from input images. The method offers superior fused images, where edges, lines, and smooth regions are preserved. The method has been compared with four efficient fusion algorithms by using four objective criteria for non-referenced images that are (MI,  $Q^{XY/F}$ , VIFF, and SF) and the PSNR criterion for referenced images. From the obtained results, the proposed method offers better/ similar results for Table (1). In addition, it shows better performance than other comparable methods in Table (2). The average improvement is approximately 1.126 dB.

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## Photodetector fabrication using the blue laser-assisted ZnO chemical bath growth technique

تصنيع الكاشف الضوئي باستخدام تقنية الحمام الكيميائي لنموأكسيد الزنك  
بمساعدة الليزر الأزرق

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## ABSTRACT

In this work, a high response ultraviolet photodetector based on zinc oxide thin film has been fabricated using a continuous wave semiconductor laser with a wavelength of 446 nm and a power of 20 W. Glass substrate coated with Nickel to construct (metal semiconductor metal) UV photodetector with high responsivity were produced using a simple, fast, and reliable blue laser assisted chemical bath growth technique (BLACBGT). Field emission scanning electron microscopy (FESEM), energy dispersive X-ray (EDX) and X-ray diffractometry (XRD) analyses were used to investigate the physical and structural properties of the photodetector active area (ZnO). We have been studying the various laser irradiation growth times of 20, 25, and 30 minutes. Our photodetector of zinc oxide nanostructures in UV detection has also been examined to calculate the significant photodetector parameters. The current-voltage (I-V) characteristics were tested in dark and light situations, confirming the UV photodetector excellent responsiveness and stability. The photosensitivity of the photodetector was calculated to be 109.489, 149.756, and 149.509, respectively, at 380 nm and a bias voltage of (-5V). The photodetector was tested with an on/off UV pulse and the response and fall times were found to be 3.65s/3.70s, 3.46s/3.85s, and 3.45s/3.75s, respectively.

**Keywords:** ZnO nanorods; Nickel buffer layer; BLACBGT; photodetector; Laser; chemical bath

## الخلاصة

في هذا العمل، تم تصنيع كاشف ضوئي عالي الاستجابة للأشعة فوق البنفسجية يعتمد على غشاء رقيق من أكسيد الزنك باستخدام ليزر أشباه الموصلات ذات الموجة المستمرة بطول موجة ٤٤٦ نانومتر وقدره ٢٠ واط. تم إنتاج كاشف ضوئي للأشعة فوق البنفسجية (معدن شبه موصل معدني) ذو استجابة عالية باستخدام تقنية نمو في الحمام الكيميائي بمساعدة الليزر (BLACBGT) البسيطة والسريعة والموثوقة. تم استخدام الفحص المجهر الإلكتروني بالمسح الضوئي للانبعاثات الميدانية (FESEM)، والأشعة السينية المشتتة للطاقة (EDX) (.و) استخدمت تحليلات قياس حيود الأشعة السينية (XRD) للتحقق من الخصائص الفيزيائية والهيكلية للمنطقة النشطة للكاشف الضوئي (ZnO). قمنا بدراسة أوقات نمو التشيع بالليزر المختلفة التي بلغت ٢٠ و ٢٥ و ٣٠ دقيقة. كما تم فحص الكاشف الضوئي للبنى النانوية لأكسيد الزنك في الكشف عن الأشعة فوق البنفسجية لحساب معلمات الكاشف الضوئي المهمة. تم اختبار خصائص التيار-الجهد (I-V) في حالات الظلام والضوء،

مما يؤكد استجابة واستقرار كاشف ضوئي للأشعة فوق البنفسجية بشكل ممتاز. تم حساب الحساسية الضوئية للكاشف الضوئي لتكون ١٠٩,٤٨٩ و ١٤٩,٧٥٦ و ١٤٩,٥٠٩ على التوالي عند ٣٨٠ نانومتر وجهد انحياز (-٥ فولت). تم اختبار الكاشف الضوئي بنبضة تشغيل/إيقاف تشغيل الأشعة فوق البنفسجية وُجد أن أزمدة الاستجابة والاضمحلال كانت ٣,٦٥ ثانية/٣,٧٠ ثانية و ٣,٤٦ ثانية/٣,٨٥ ثانية و ٣,٤٥ ثانية/٣,٧٥ ثانية على التوالي.

الكلمات المفتاحية: الزنك النانوي النانوي؛ طبقة من النيكل؛ BLACBGT؛ كاشف ضوئي؛ ليزر؛ حمام كيميائي.

## INTRODUCTION

zinc oxide semiconductor nanostructures such as nanorods, nanosheets, nanowires, and nanotubes have received a lot of attention[1-3]. Low-dimensional investigations on ZnO are especially popular due to its numerous uses in optoelectronics [4, 5], photodetectors, photocatalysis [5, 6], sensors [7, 8], ultraviolet (UV) lasers [9], and various nanotechnologies. Additionally, ZnO nanoparticles have special medical and environmental applications that benefit society [10, 11]. ZnO nanoparticles can also be used to modify UV sensing. It is less expensive and more environmentally friendly than other metal oxides, it is crucial for many applications[4]. It is feasible to adjust the characteristics of ZnO by doping it with various metal atoms to suit research objectives and applications. Zinc oxide is a low-cost n-type semiconductor with a high exciton, binding energy of 60 meV, and 3.4 eV bandgap [12]. Zinc oxide polymorphic phases include rock salt phase, zinc blende, and wurtzite. The wurtzite structure, in which the Zn and O atoms form discrete hexagonal close-packed (HCP) sublattices with tetragonal coordination for each atom, appears to be the most stable at ordinary temperature and pressure [12]. Laser ablation [13], hydrothermal methods [14], chemical bath deposition [15], electrochemical deposition [16], sol-gel method [17], chemical vapour deposition [18], spray pyrolysis [19, 20], thermal decomposition[21], combustion method [22], and solvothermal method[23] are all used to deposit zinc oxide materials on various substrates. The convenience of solution phase synthesis, which can be carried out at room temperature or somewhat higher temperatures, has led to the majority of solution phase techniques being utilized to synthesize ZnO.

In this study, we generated ZnO nanorods using a laser-assisted chemical bath deposition (LACBD) method and controlled the shape and area deposition of the ZnO nanorods by varying the laser irradiation time[24]. We demonstrate how ZnO NRs grown on a nickel buffer layer/glass are affected by the laser irradiation time in terms of their surface shape, size, crystal structure, UV detection capabilities, and conductivity. We prepared ZnO NRs using the LACBD method from zinc acetate and hexamethylenediamine as precursors, using DI water as the only solvent, and then deposited them at a low temperature over ZnO NRs/Ni/glass. The surface morphology, micro/nanostructures, optical defuse reflection, energy bandgap, and elemental composition of ZnO NRs produced on the Ni buffer layer were examined using X-ray diffraction (XRD), FE-SEM) EDX, SEM, EDX, FTIR, and UV-Vis spectroscopy.

We investigate the electrical characteristics and UV detection capability of the NRs by building a metal-semiconductor-metal (MSM) structure on a glass substrate using a Keithley 2400-meter source. It has been demonstrated that ZnO NRs play a significant role in the quick detection of UV light, which is advantageous for sensing applications.

## MATERIALS AND METHOD

An experiment was done to test the (BLACBGT) process for creating ZnO NRs/Ni/glass devices for sensing applications. By producing a spatially consistent growth rate on the substrate, as seen in Fig. 1. 0.05M of hexamethylenediamine and 0.05M of zinc acetate dihydrate  $Zn(CH_3CO)_2 \cdot (H_2O)_2$  dissolved in 100 mL of DI water. Glass slides were utilized as substrates. RF sputtering magnetron using to deposit nickel (Ni) onto a glass substrate. The solution in the beaker holding the Ni/glass substrate during laser irradiation, where it covers the surface of the glass. The improved crystalline, structural, and morphological properties of the ZnO NRs result in a smaller laser spot and faster response time. Fig. 1 shows the Blue Laser-Assisted Chemical Bath Growth Technique developed in the lab [24].



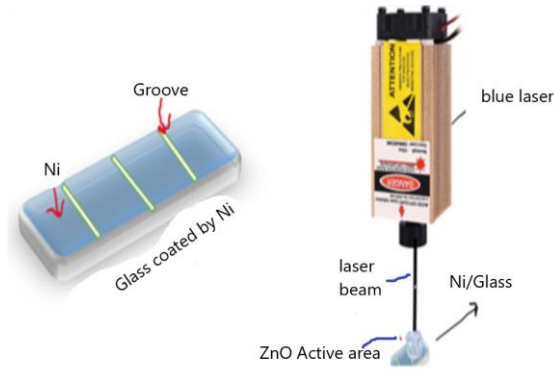
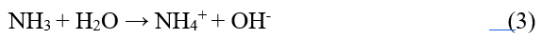
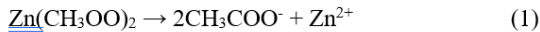


Figure 1: Blue Laser-Assisted Chemical Bath Growth Technique (BLACBGT) setup

### Method:

To create ZnO NRs, zinc and oxygen are necessary as basic reactants. In Eq. 1, Zn was obtained from  $Zn(CH_3COO)_2 \cdot 2H_2O$ . The OH ions generated in the aqueous medium in Eq. 2 were instead sourced from hexamethylenetetramine (HMTA,  $C_6H_{12}N_4$ ) by many many research teams. To release  $NH_3$  when HMTA is dissolved in water, it first interacts with the water molecules. Additionally,  $NH_3$  is created, and when it interacts with water molecules, it creates  $OH^-$  ions. The real synthesis thus mostly produces  $Zn(OH)_2$ , which is then dehydrated to produce ZnO. The mechanism of ZnO production can be described using the following Eqs (1-5). The ability to adjust the properties of the as-grown material greatly depends on the precursor concentration. The properties of the ZnO NRs as-grown structure are greatly influenced by the precursor concentration. The temperature of the reaction is also important for the disintegration of  $Zn(OH)_2$  [25].



It is obvious from Eqs. 1–5 that chemical reactions occurred in the precursor solution during the creation of nanorods and that intermediate chemicals are related to the development of nanorods. The formation of intermediate compounds and, thus, the growth of nanorods may be

impacted by different laser irradiation times [11]. As a result, the process started in deionized water without the use of any other chemicals, yielding crystals of ZnO nanorods free of contaminants.

### **Preparation:**

A precursor solution is formed by combining 200 mL of deionized water (DI), 1.4g of (99.99%) (HMTA, C<sub>6</sub>H<sub>12</sub>N<sub>4</sub>),, and 50 mM of Zn(CH<sub>3</sub>COO)<sub>2</sub>.(H<sub>2</sub>O). The mixture must then be magnetically agitated for one hour at room temperature.

### **Characterizations:**

X-ray diffraction (XRD) patterns were acquired using an XRD instrument to analyze the crystallinity of ZnO nanorod thin films. Equipment for cuK radiation diffraction (= 1.5406, 2 changing between 20o and 80o). EDX spectroscopy, Fourier transform infrared (FT-IR), FE-SEM, JEOL JSM-7600F with a 30 kV accelerating voltage, UV-Vis-NIR spectroscopy, Agilent technologies series No. Cary 5000 UV-Vis-NIR, and current-voltage measurements (I-V). UV photodetectors based on ZnO NRs were examined in C.D.R.H. Class II laser products, with features that minimize prolonged exposure to direct laser light. In full darkness, the amount of UV radiation at 380 nm was measured. To analyze the electrical characteristics of the photodetectors, a Keithley 2400 source unit coupled to a PC was used for data processing.

## **RESULTS**

### **Crystallinity structures:**

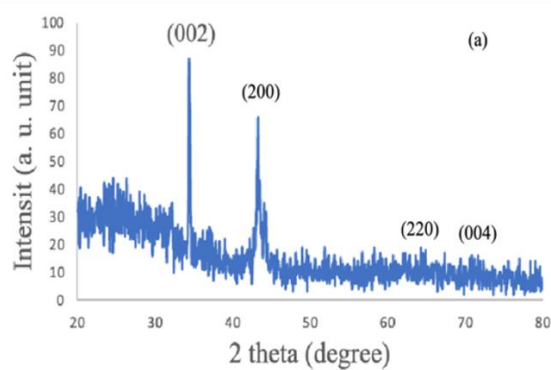
XRD measurements of ZnO nanorods grown on Ni/glass substrate using BLACBGT with various laser irradiation periods of 20, 25, and 30 minutes, respectively, were subjected to XRD measurements. The impact of the laser irradiation period on the crystalline structure is depicted in Fig. 2 (a), (b), and (c), which demonstrate the determination of the ZnO (002) peak of the samples used at irradiation durations of 20, 25, and 30 minutes. (200), and 63.72o NiO (220) planes to the orientations of ZnO NRs samples. Figure 2

depicts an expected feature of XRD spectra. The ZnO (002) diffraction peak is noticeably stronger than the other peaks in each sample. This shows that the created ZnO nanorods' preferred crystallographic orientation is the (002) peak for ZnO provides both the c-axis parameter and a disorder in the crystal lattice of the wurtzite ZnO structure. The structural properties of ZnO nanostructures that have been measured are listed in Table 1.

Based on the broadening of XRD peaks, Scherrer's formula Eq. (6) is used to determine the average crystallite size (d) of the wurtzite of ZnO nanorods [26-29].

$$D = \frac{k\lambda}{\beta \cos\theta} \quad (6)$$

Where  $\beta$  is the XRD pattern's full width at half maximum (FWHM),  $k$  is a Scherrer's constant of 0.94,  $\lambda$  is the used X-wavelength ray's ( $\lambda = 1.5406$ ),  $\theta$  is the Bragg's angle in radians, which corresponds to  $2\theta$  of maximum intensity, and  $D$  is the average crystallinity size Eq. (6)[30] : With increasing laser irradiation periods of 20, 25, and 30 minutes, the dislocation density value steadily decreased, demonstrating a decrease in the number of faults in the crystal. When the laser irradiation time increased due to increasing grain size, lowering defects, and the lattice parameters also improved with increasing density, which followed the improvement in crystal quality. This resulted in the variation of the bond length and cell volume along the diffraction peak



ZnONRs.

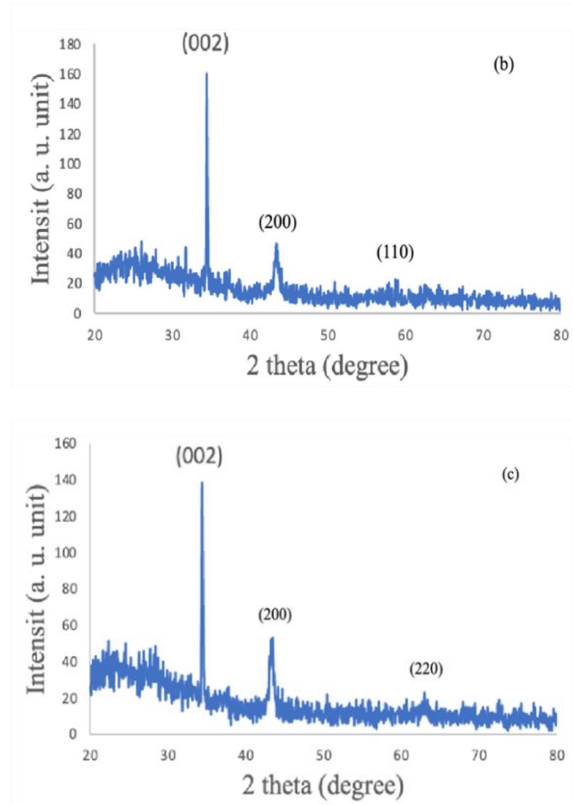


Figure 2 depicts the Glass/Ni/ZnO NRs thin films exposed to laser irradiation for a) 20 minutes, b) 25 minutes, and c) 30 minutes, respectively, in a 3-hour post annealing process at 400 °C.

The quality parameters of the ZnO growing by laser were calculated using following equations [13, 26,31, 32,33].

$$\delta = \frac{1}{D^2} \quad (7)$$

strain ( $\epsilon$ ) of ZnO nanostructures was done using

$$\epsilon = \frac{\beta \cos \theta}{4} \quad (8)$$

the interplanar distance ( $d_{hkl}$ ) is calculated

$$D_{hkl} = \frac{h\lambda}{2 \sin \theta} \quad (9)$$

The diffraction planes Miller indices are hkl, and lattice constants (a) and (c) have been determined.

$$a = \frac{\lambda}{\sqrt{3} \sin \theta} \quad (10)$$

$$c = \frac{\lambda}{\sin \theta} \quad (11)$$

The hexagonal cell volume and bond length, positional parameter (u), volume (v) of the hexagonal cell was calculated using the following equations.

$$L = \sqrt{\frac{a^2}{3} + \left(\frac{1}{2} - u\right)^2} \cdot c^2 \quad (12)$$

$$u = \frac{a^2}{3c^2} + 0.25 \quad (13)$$

$$v = \frac{\sqrt{3}}{2} a^2 c \quad (14)$$

Table 1: ZnO NRs/Ni/glass characteristics derived from (002) plane using XRD data.

Laser irradiation time	Peak 2θ	D (nm)	$\delta \cdot 10^{-4}$ lines/m <sup>2</sup>	Strain (ε) (10 <sup>-3</sup> )	(d) (Å)	a = b (Å)	c (Å)	Posiciona l parameter ar (u) kJ m <sup>-2</sup>	Bond length (L) (Å)	Cell volume (v) (Å <sup>3</sup> )
20 min	34.42°	8.886	0.012665	0.040	1.4959	1.7273	2.9919	0.8749426	0.9769995	0.5972175
25 min	34.44°	12.06	0.00687	0.030	1.4952	1.7365	2.9904	0.8749429	0.9773907	0.5945155
30 min	34.45°	12.16	0.006758	0.029	1.4948	1.7260	2.989	0.87494274	0.9807500	0.5952749

### Structural properties:

Using FE-SEM measurements, the morphology of the created ZnO NRs/Ni/glass thin films was investigated. Figure 3 (S1) 1 depicts the top view morphological region of a sample produced using the LACBD technique after 20 minutes of laser irradiation, which is approximately 918.45 μm in size. The ZnO rods' diameters ranged from 1.145 μm to 3.988 μm, while the nanorods' lengths ranged from 5.768 μm to 7.783 μm. That is a result of the thin film quality being produced using the BLACBGT technique [32].

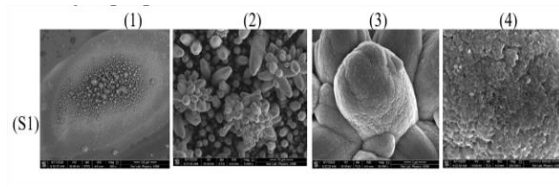


Fig. 3, shows images according to the FE-SEM top view and various magnification the glass/Ni/ZnO sample (S1) was created over a year ago and stored in a container at room temperature.

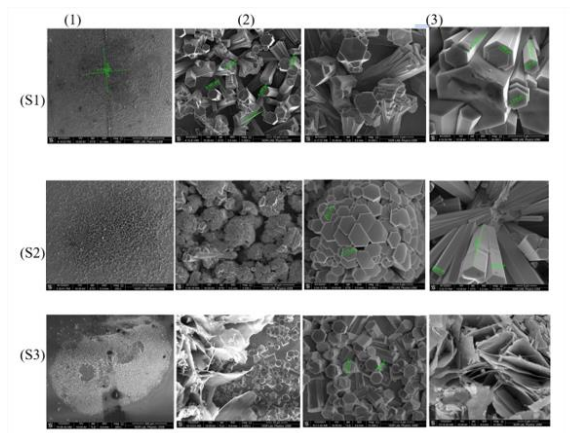


Fig. 4 shows images in accordance with the FE-SEM top view images of ZnO growth at various magnifications at (S1) 20, (S2) 25, and (S3) 30 minutes on a glass substrate covered with a Ni buffer layer using the LACBD technique.

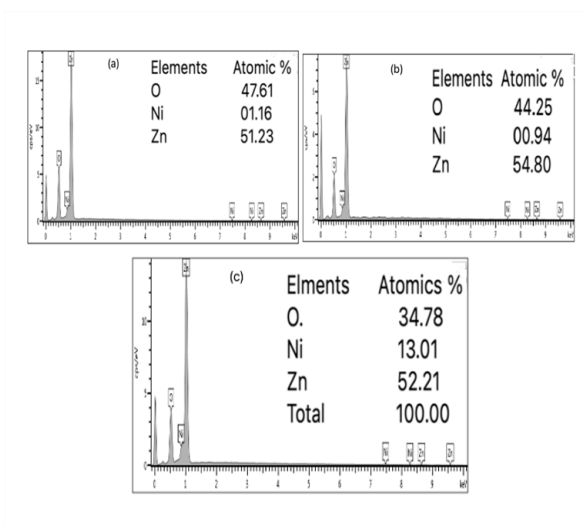


Fig. 5 EDX spectra of ZnO NRs/Ni/glass generated at different laser irradiation times.

(a) 20 min, (b) 25 min and (c) 30 min

The creation of ZnO/Ni/glass films at variable laser irradiation periods illustrated in FE-SEM micrographs with various magnifications, as shown in Fig. 4. As seen in Fig. 4, all manufactured samples reduced in length and diameter. This is because the laser exposure period is longer. Previously, it was 20, 25, and 30 minutes. The results show that when the duration of laser irradiation increases, the variation time has a substantial impact on the morphology of ZnO nanorods. The morphology of this sample clearly demonstrates that all rods in a micro size have top hexagonal ZnO NRs/Ni/glass [24].

The elemental proportion and atomic ratio of ZnO nanorods alter as the thin film thickness increases. To determine the sample stoichiometry, use the EDX to examine ZnO nanorods produced on Ni buffer layers on a glass substrate. Figures 5 (a), (b), and (c) show the maximum values of the elements and the percentages as stated in Table 2. The synthesized materials include the elements as employed and listed in Table 2 because well-defined Zn, O, and Ni peaks are

seen in EDX spectra and are observed using FE-SEM. Covering all surfaces connected to the oxygen content in EDX spectra and extending the laser irradiation time to 20, 25, and 30 minutes, respectively, may be related to the formation of groups on the surface [2].

Table 2: The percentages of atomic elements used to create ZnO NRs/Ni/glass samples using laser irradiation times of 20, 25, and 30 minutes are displayed correspondingly.

Elements	20 (min)	25 (min)	30 (min)
Zn (%)	51.23	54.80	52.21
O (%)	47.61	44.25	34.78
Ni (%)	1.16	0.95	13.01
Total (%)	100	100	100

### MSM UV photodetectors results:

The Schottky behavior of the ZnO/Ni/glass PD I-V curves under 380 nm UV irradiation and in the dark shows that the ZnO NRs and the Ni buffer electrodes have good contact. In the barrier state, the metal-semiconductor junction exhibits Schottky behavior, resulting in a -5V to 5V connection. Usually, the nature of touch determines what a Schottky contact is. The metal used as a contact and the semiconductor's electron affinity.  $I_{dark}$  (dark current) and  $I_{ph}$  (photocurrent) values were respectively 15.20  $\mu$ A, 26.10  $\mu$ A, and 4.43  $\mu$ A, 30.80  $\mu$ A, 155.53  $\mu$ A, and 6.82  $\mu$ A. Current gain ( $I_{ph}/I_{dark}$ ) values were 2.0263, 5.9590, and 1.5395. As indicated in Table 3, the photosensitivity ( $S_{ph}$ ) has been computed using equation Eq. (15). [34]:

$$S_{ph} (\%) = \frac{(I_{ph} - I_{dark})}{I_{dark}} \times 100 \quad (15)$$



ZnO nanorods combined with nickel (Ni) electrodes show effective Schottky connections. Fabricated using the LACBD process and annealed at 400°C for 3 hours, films irradiated for 25 minutes exhibit higher conductance, with a current of 155.53  $\mu\text{A}$  under UV light at 380 nm. The crystalline structure of these nanorods influences their growth, as observed in XRD data. Samples irradiated for 25 minutes display the highest crystallinity, with an average microrod diameter of 3.674  $\mu\text{m}$  and a smaller device surface area of 717.8  $\mu\text{m}$ . Enhanced electrical conductivity is attributed to oxygen vacancies and surface carrier concentration, resulting in superior photosensitivity compared to previous ZnO nanorod films.

The photocurrent ( $I_{ph}$ ) and dark current ( $I_{dark}$ ) levels remain consistent and unchanged after multiple cycles. Figure 6 shows the (I-t) curve for samples irradiated for 20, 25, and 30 minutes at a bias voltage of -5V under UV light (380 nm) that is switched on and off. The highest photocurrent value at -5V bias voltage remains stable across cycles, indicating the stability and repeatability of the photodetectors.

The quantum efficiency ( $\eta$ ) of photodetectors (PDs) can be calculated using Eq. (16), which relates to incident power ( $P_{in}$ ), Planck constant ( $h$ ), electric charge ( $q$ ), and light frequency ( $\nu$ ). The values of  $I_{ph}$ ,  $I_{dark}$ , and  $S_{ph}$  were calculated based on Fig. (6) and Equations (16) and (20), and are listed in Table (3).

$$\eta (\%) = \frac{I_{ph} h \nu}{q P_{in}} \times 100 \quad (16)$$

The three samples, produced with laser exposure times of 20, 25, and 30 minutes, exhibited photosensitivity ( $S_{ph}$ ) values of 102.631, 495.900, and 53.950, respectively, under UV light at 380 nm and -5V bias voltage. Based on

(I-t) characteristics, the PDs demonstrated a maximum current gain of 5.959 under 380 nm UV light at a bias voltage of -5V. The quantum efficiency ( $\eta$ ) increased with higher bias voltage, reaching a maximum value of 495.900 for the sample produced after 25 minutes of laser irradiation. The (I-t) curve and photosensitivity data exhibited strong photodetection properties, excellent repeatability, and noteworthy photodetection features.

The interaction between surface-adsorbed oxygen ions and photogenerated holes leads to the release of oxygen molecules. Conduction improves as photogenerated electrons remain in the conduction band (CB) upon desorption of adsorbed oxygen ions (O-) from the nanorod surface. Photoresponsivity (I)

Laser irradiation time	( $\tau_r$ ) S	( $\tau_d$ ) S	$I_{ph}$ (nA)	$I_d$ (nA)	G	S %	$\eta$ (%)	R (A/W)
20 min	0.036 5	0.370	30.80	15.20	2.0263	102.6 31	3.3519	0.04105
25 min	0.034 6	0.385 3	155.5	26.10	5.959	495.9 00	1.6926	0.3406
30 min	0.034 5	0.0375	6.82	4.43	1.5395	53.95 .509	7.4230	0.00628

of the photodetectors (PDs) was

determined from the photocurrent graph using Eq. (17), where

$$(R) = (I_{photo} - I_{dark}) / P_{inc} \text{ (A/W)}. \quad (17)$$

Table 3 presents properties of ZnO NRs/Ni/glass photodetectors measured under 380 nm illumination: rise time ( $\tau_r$ ), recovery time ( $\tau_d$ ), photocurrent ( $I_{ph}$ ), dark current ( $I_d$ ), current gain (G), photosensitivity ( $S_{ph}$ ), quantum efficiency ( $\eta$ ), and photoresponsivity (R).

Table 3 lists the properties of photodetectors ZnO NRs/Ni/glass measured at 380 nm of illumination light: rise time ( $\tau_r$ ) and recovery time ( $\tau_d$ ), photocurrent ( $I_{ph}$ ), dark current ( $I_d$ ), current gain (G), photosensitivity ( $S_{ph}$ ), quantum efficiency ( $\eta$ ), and photoresponsivity (R) respectively.

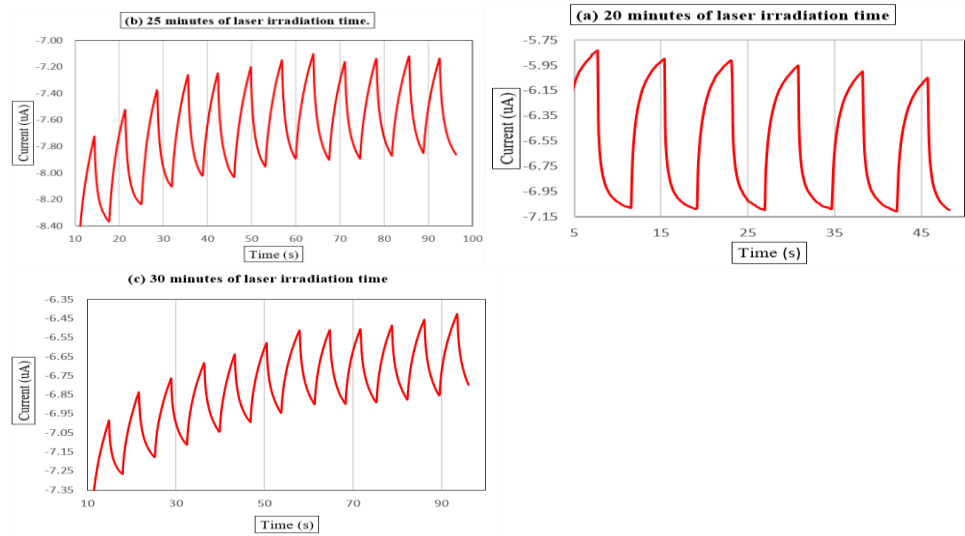


Fig. 6. shows the three distinct samples made at laser irradiation periods of (a) 20, (b), 25, and (c) 30 minutes, correspondingly, the repeatability property ON/OFF of the constructed SMS PDs of ZnO NRs/Ni/glass. **CONCLUSION**

The experimental results reveal several key findings. X-ray analysis shows consistent behavior in bond length and unit cell volume across samples produced with different laser irradiation times, with smaller values observed as irradiation time increases. The linear current-voltage characteristics of the MSM device confirm successful Schottky metal-semiconductor connections using the BLACBGT approach with Ni layers and ZnO film. The ZnO nanorods/Ni/glass device exhibits significant UV photosensitivity, generating a high photocurrent of  $155.53 \mu\text{A}$  at  $-5\text{V}$  under  $380 \text{ nm}$  UV irradiation, contrasting with a dark current of  $26.1 \mu\text{A}$ . Effective Schottky connections are observed between ZnO nanorods and Ni electrodes, with films treated for 25 minutes showing increased conductance and highest crystallinity. This enhanced conductivity is attributed to oxygen vacancies and surface carrier concentration, contributing to superior photosensitivity compared to earlier ZnO nanorod films.

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## CONFLICT OF INTEREST

This work contains no conflicts of interest, according to the authors.

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## Regulation policies, Applications and Challenges for Unmanned Aerial Vehicles: A review

سياسات التنظيم والتطبيقات والتحديات الخاصة بالمركبات الجوية بدون طيار:  
مراجعة

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## ABSTRACT

The proliferation using of Unmanned Aerial Vehicles (UAVs) demands effective regulation policies to ensure safety and responsible use, while challenges such as safety concerns and malicious exploitation must be addressed. In this paper we conducted a comprehensive review to examine regulation policies, applications, and challenges in the UAV domain, drawing from diverse literature and industry insights. The aim is to provide stakeholders with a nuanced understanding of UAV regulation, applications, and challenges, enabling informed decision-making in this dynamic field. Furthermore, clear manufacturing standards and precise utilization laws are essential for mitigating the risks associated with UAV adoption. The paper highlights diverse UAV applications and associated challenges, emphasizing the need for proactive measures to ensure safety and security. Eventually, understanding and adhering to regulation policies will be crucial for responsible UAV integration. By addressing challenges and promoting safety, this paper advocates for a balanced approach to harnessing the potential of UAV technology effectively.

**Keywords: Unmanned Aerial Vehicles, Regulations, Policies, Challenges**

الخلاصة:

يتطلب انتشار المركبات الجوية بدون طيار سياسات تنظيمية فعالة لضمان السلامة والاستخدام المسؤول، كذلك يجب معالجة التحديات مثل المخاوف المتعلقة بالسلامة والاستغلال الخبيث. في هذه الدراسة قمنا بأجري مراجعة شاملة لسياسات التنظيم والتطبيقات والتحديات الخاصة باستخدام الطائرات بدون طيار، مع الاستفادة من البحوث المتنوعة ورؤى المصنعين. الهدف هو تزويد أصحاب المصلحة بفهم دقيق لتنظيم استخدام الطائرات بدون طيار وتطبيقاتها وتحدياتها، مما يساعد في اتخاذ قرارات مستنيرة في هذا المجال المتغير. بالإضافة الى ذلك، ان معايير التصنيع الواضحة وقوانين الاستخدام الدقيقة ضرورية للتقليل من المخاطر المرتبطة باعتماد الطائرات بدون طيار. هذه الدراسة تسلط الضوء على التطبيقات المتنوعة للطائرات بدون طيار والتحديات المرتبطة بها، مع التركيز على الحاجة إلى اتخاذ تدابير استباقية لضمان السلامة والأمن. أخيراً، فان فهم السياسات التنظيمية والالتزام بها أمرًا بالغ الأهمية لتحقيق تكامل مسؤول للطائرات بدون طيار. من خلال معالجة التحديات وتعزيز السلامة، فان هذه الدراسة ترشد إلى اتباع نهج متوازن لتسخير إمكانات تكنولوجيا الطائرات بدون طيار بشكل فعال.

كلمات مفتاحية: المركبات بدون طيار، التنظيم، سياسات الاستخدام، التحديات

## 1. INTRODUCTION

Significant attention has been drawn to UAVs, also known as drones, in recent years owing to their wide range of applications across various fields, including network management, disaster management, remote sensing, hydrology, water management, surveillance, and vector control, among others. Industries stand to be revolutionized, and efficiency stands to be improved in numerous sectors with the potential of UAVs. However, concerns regarding safety, privacy, and regulatory frameworks are raised by their widespread use. Therefore, it is crucial for existing regulation policies to be understood, the applications of UAVs to be explored, and the challenges associated with their deployment to be addressed. In the following sections, a comprehensive review will be provided of the regulation policies, applications, and challenges for UAVs. By examining these aspects, stakeholders will be equipped with a nuanced understanding of UAV technology and its implications, fostering informed decision-making and responsible utilization in the ever-changing landscape of unmanned aerial vehicles (1).

## 2. Regulation Policies for UAVs

The use of UAVs is subject to regulation and policies aimed at ensuring safety, privacy, and responsible operation. Across various countries, regulatory bodies have established guidelines and rules governing UAV operations. These regulations are becoming increasingly vital as the utilization of drones in diverse industries and recreational activities continues to expand. For instance, in the United States, the Federal Aviation Administration (FAA) has instituted comprehensive regulations for UAVs, encompassing registration requirements, airspace restrictions, and pilot certification. These regulations are designed to mitigate accidents, safeguard privacy, and uphold airspace integrity. They address crucial aspects such as flight restrictions in proximity to airports, altitude limitations, and mandatory pilot certification for specific types of operations. Moreover, regulations may vary depending on the intended purpose of UAV operation, whether for recreational use, commercial purposes, or public safety applications. It is imperative for UAV operators and stakeholders to possess awareness of and adherence to pertinent regulations to ensure the safe

and responsible use of UAVs. Before delving into the intricacies of regulatory issues, it is noteworthy that accessing national regulatory documents online can be challenging due to language barriers specific to each country. To address this challenge, international UAV organizations provide pre-compiled lists and summaries of regulations. Table I presents known sources with links to national regulations along with brief descriptions of their content, facilitating access to essential regulatory information for UAV operators and stakeholders.

Table I: A lists and regulations of UAVs those were available in February 2024.

Ref.	National Regulation Name	Description
(1)	Federal Aviation Administration (FAA)	It offers comprehensive information on regulations governing UAV operations in the United States. It includes guidelines for recreational and commercial drone use, registration requirements, airspace restrictions, and safety guidelines.
(2)	European Union Aviation Safety Agency (EASA):	It provides regulations and guidance for drone operations in European Union member states. The website covers rules for drone registration, pilot licensing, operational limitations, and safety standards applicable across the EU.
(3)	Civil Aviation Authority (CAA) - United Kingdom:	It offers regulations and guidance for drone operations in Australia. The website includes information on registration, licensing, operational limitations, and safety requirements for both recreational and commercial drone operators.
(4)	Transport Canada - Civil Aviation:	It provides regulations and resources for UAV operators in Canada. The website covers topics such as registration, pilot certification, airspace restrictions, and safety guidelines for recreational and commercial drone use.

The main contribution of this work lies in its comprehensive examination and categorization of the challenges associated with drone operations. By systematically addressing regulatory, technical, and safety concerns, the study offers valuable insights into the multifaceted nature of integrating drones into various industries. Furthermore, the work emphasizes the importance of collaboration among regulators, industry stakeholders, and researchers to develop effective solutions for ensuring the safe and responsible use of drones.

Through its structured approach and thorough analysis, this study provides a foundation for future research endeavors aimed at advancing the field of drone technology and addressing its associated challenges. The summary outlines key aspects of drone regulatory policies:

- i. Registration and Licensing:** many countries enforce registration and licensing requirements for UAV operators to maintain accountability and record ownership. Regulations also address safety, security, privacy, and airspace issues. The study (5) explains how aviation is regulated at an international and national level, considers the interrelationship between rapidly advancing technology and legislative attempts to keep pace, and reviews existing domestic and international drone laws and issues.
- ii. Operating Restrictions:** regulations specify where and how UAVs can be flown, including restrictions near airports, crowded areas, and sensitive infrastructure. Altitude limitations are imposed to prevent conflicts with manned aircraft. The article (6) explores global UAV regulations, comparing similarities and contrasting elements from past, present, and future trends. Despite aiming to minimize risks to airspace users and ground property, the researchers find distinct variations in all the compared variables, highlighting the need for a comprehensive understanding of UAV regulations.
- iii. Privacy and Data Protection:** regulations establish rules for drone surveillance and data collection, requiring operators to respect privacy rights and obtain consent for personal information collection. In (7), a survey of European drone industry representatives, regulators, and civil society organizations revealed significant gaps in understanding privacy, data protection, and ethics in civil drone operations, highlighting significant gaps in knowledge under European and national laws.
- iv. Counter-Drone Measures:** regulations address unauthorized drone activities by deploying counter-drone technologies to detect and mitigate potential threats. In (8), the study provides a comprehensive survey of anti-drone technologies, outlining their operating processes, regulatory insights, and challenges, offering intriguing research avenues for further study.
- v. Beyond Visual Line of Sight (BVLOS) Operations:** regulations for BVLOS operations enable advanced applications like drone delivery and

infrastructure inspections, focusing on safe airspace integration. In (9), the study explores airspace de-confliction techniques used to test BVLOS capabilities in northwestern Canada. Drone missions were conducted using a Griffon SeaHunter, capturing high-resolution imagery covering over 550 km<sup>2</sup> along 6200 km of flight lines. The BVLOS hourly endurance was nearly double that of light aviation mapping aircraft, enabling extended monitoring operations with less fuel consumption.

- vi. Remote Pilot Certification: some countries mandate remote pilot certification for commercial drone operators, involving a knowledge test on aviation rules, safety, and airspace regulations (1).
- vii. Safety and Airworthiness Standards: UAVs may be subject to safety and airworthiness standards, ensuring they are designed, manufactured, and operated to minimize risks to people and property (3).

### 3. Applications of UAVs

In recent times, there has been a notable surge in the utilization of UAVs across a multitude of civilian and military contexts. For instance, drones have found extensive use in monitoring operations in both civilian and military settings, owing to their adaptability, accessibility, and cost-effectiveness. These UAVs facilitate aerial surveillance, offering real-time data on hostile activities, minimizing risks to personnel, enabling access to remote or hazardous areas, and augmenting situational awareness and strategic decision-making processes. Additionally, they play a pivotal role in threat identification and provide ground forces with real-time video feeds. In a study referenced as (10), researchers employed photogrammetric UAV techniques to capture periodic images for tracking construction progress in a specific project Area-Taman Impiana, Malaysia - spanning over three months. Utilizing 4 Pro V2.0 with Pix4Dmapper and Global Mapper peripherals, the recorded images underwent processing to distinguish active and inactive areas, with orthomosaic images being generated for analysis purposes. The study underscored the viability of UAVs as a viable alternative for visual monitoring and project management, offering a comprehensive overview of the entire construction site area at each stage of progress.

To provide a more structured and comprehensive examination, the civilian and military applications of UAVs will be separately discussed:

#### **a) Civilian Application**

The text encapsulates a vast array of applications and advancements in Unmanned Aerial Vehicle (UAV) technology, showcasing their transformative impact across diverse sectors. UAVs have emerged as indispensable tools across industries such as public security, delivery logistics, geographic mapping, aerial photography, object detection, infrastructure monitoring, healthcare, emergency response, architecture, data sharing, and logistics optimization (11). In the realm of public security, drones are increasingly employed to enhance surveillance, law enforcement activities, and disaster response efforts, offering invaluable real-time insights while also addressing challenges like regulatory constraints and privacy concerns (12). Delivery logistics have witnessed a paradigm shift with the integration of drones, promising enhanced flexibility, safety, and efficiency in transporting goods. Despite challenges such as regulatory hurdles and technological limitations, ongoing advancements in navigation systems and delivery infrastructure augur well for the future of drone delivery services. For instance, in (13) the authors identified several challenges and obstacles faced in drone delivery implementation, such as regulatory constraints, safety, limited battery life, payload capacity, and environmental conditions. The authors also highlighted the advancements in areas such as autonomous navigation, sense-and-avoid systems, swarm technology, advanced sensors, new delivery infrastructure, and potential future applications and trends in drone delivery. Geographic mapping benefits immensely from UAVs, which facilitate the creation of detailed maps, surveys, and geospatial data acquisition with remarkable accuracy and efficiency. In this context, the researchers in (14) used Inspire 2 quad-copter drones with high-quality cameras to create 3D models using photogrammetry. The accuracy of the maps was 98.53%, 95.2%, and 94.4% (94.7%) at different altitudes, proving drones can create high-resolution, accurate maps, especially in limited areas requiring time-series data, using Google Earth information.

Similarly, the proliferation of aerial photography and videography owes much to drones, which offer unparalleled perspectives and dynamic shots, albeit with challenges related to obstacle avoidance and real-time control (15). Object detection and tracking capabilities are significantly enhanced through drones equipped with sensors and cameras, supporting various operations in surveillance, security, and search and rescue. Advances in swarm technology and AI algorithms further bolster target detection and tracking accuracy (16-20). In critical infrastructure sectors like oil rig and power line monitoring, drones play indispensable roles in inspection and maintenance tasks, although challenges such as data overload necessitate innovative solutions like integrating machine learning and vision techniques for efficient data processing (21). Healthcare and emergency response efforts benefit from drones for tasks like medical supply delivery and remote patient monitoring, with optimization algorithms and AI-based solutions promising to revolutionize healthcare delivery systems (22). Architecture and building safety inspection leverage drones for structural assessments, with deep learning models offering non-intrusive and efficient alternatives to traditional surveying methods (23),(24). Furthermore, drones facilitate data sharing and information gathering through behavior-based AI and cooperative swarm systems, with blockchain integration ensuring data integrity and security (25),(26). Despite facing regulatory hurdles and technological challenges, drones hold immense promise in logistics optimization, integrating seamlessly with Internet of Things (IoT) devices to streamline operations and enhance cyber security solutions (27), (28). In summary, the text underscores the multifaceted applications and transformative potential of UAV technology across diverse sectors, while acknowledging the complexities and obstacles inherent in their adoption and implementation.

#### **a) Military Applications**

Unmanned aerial vehicles (UAVs) have significantly transformed military operations by providing unique capabilities and advantages. It's important to note that the specific applications and capabilities of UAVs in military usage can vary depending on the type of UAV, mission requirements, and



technological advancements. The utilization of Unmanned Aerial Vehicles (UAVs) in military operations encompasses a vast array of applications, each playing a pivotal role in enhancing the efficacy and safety of military endeavors. Perhaps most prominently, UAVs serve as stalwart guardians in the realm of surveillance and reconnaissance, offering an unblinking eye in the sky equipped with sophisticated cameras, sensors, and imaging systems (29). Through these technologies, UAVs provide invaluable real-time intelligence on enemy movements, positions, and activities, facilitating informed decision-making and strategic planning. Delving deeper into this domain, on-going research endeavors delve into optimizing UAV base station locations and flight routes, particularly relevant in scenarios such as border patrol, where the need for effective intelligence, surveillance, and reconnaissance is paramount. Moving beyond surveillance, armed UAVs, often referred to as unmanned combat aerial vehicles (UCAVs), wield precision strike capabilities that significantly bolster ground forces. These aerial platforms, armed with guided missiles, bombs, or other munitions, provide essential fire support while minimizing risks to human personnel. Recent advancements in path planning algorithms, exemplified by the development of hybrid solutions like the CIJADE algorithm (30), underscore the concerted efforts to optimize the operational efficiency and effectiveness of these armed UAVs. Furthermore, in the aftermath of engagements, UAVs play a crucial role in conducting battle damage assessments including data acquisition, image processing, and analysis techniques, offering invaluable insights into the effectiveness of strikes and identifying potential remaining threats. Research efforts in this realm explore innovative techniques for UAV-based structural damage mapping, with applications spanning civil infrastructure assessment to disaster response (31).

In the realm of electronic warfare, certain UAVs are specifically tailored to disrupt enemy communication systems, gather electronic intelligence, and counter electronic threats. This domain represents a critical facet of modern military operations, wherein UAVs equipped with advanced technology provide tactical advantages and enhance overall security. Beyond traditional warfare applications, UAVs contribute significantly to force protection and perimeter security, serving as vigilant sentinels over military installations, bases, and

critical infrastructure. These aerial platforms offer early warning capabilities, detect potential threats, and optimize perimeter surveillance strategies, thus fortifying military defences. Moreover, UAVs find utility in a myriad of other military applications, ranging from decoy and distraction tactics to mine detection and clearance operations, combat search and rescue missions, and logistical support endeavors. In each of these domains, UAVs leverage cutting-edge technologies, such as convolutional neural networks, to enhance operational efficiency, effectiveness, and overall mission success. Thus, within the dynamic landscape of modern warfare, UAVs stand as indispensable assets, continually evolving to meet the evolving challenges and demands of military operations (32-35).

#### **4. Challenges of UAVS**

The challenges faced by drones can vary significantly depending on their intended application or the specific industry they operate in. Each sector presents its own unique set of obstacles and considerations that must be addressed. Successfully overcoming these hurdles requires collaboration among regulators, industry stakeholders, and researchers to develop robust solutions that ensure the safe and responsible integration of drones into our society. To better understand and address these challenges, they are often categorized into three main areas: regulatory and legal hurdles, technical and operational obstacles, and safety and security concerns. This classification helps to streamline the discussion and facilitate a deeper exploration of the interconnected complexities involved in drone operations. By identifying and addressing these challenges systematically, we can pave the way for the widespread adoption and beneficial utilization of drone technology across various sectors.

##### **a) Regulatory and Legal Challenges**

Drones are required to navigate the complexities of airspace classification and operational requirements, adhering to guidelines set by authorities like the

Federal Aviation Administration (FAA), which delineate airspace into controlled and uncontrolled zones. Controlled airspace typically surrounds airports and sensitive locations, setting bounds beyond the legal flight ceilings for drones, whereas uncontrolled airspace is devoid of Air Traffic Control monitoring. The specifics of these classifications and their limitations are elaborated in (36). Concurrently, the deployment of drones instigates ethical and legal debates centered on privacy, surveillance, and data collection, necessitating the development of regulations and guidelines to mitigate these concerns, with a more detailed discussion on regulatory policies subsection 1.1.

Furthermore, the widespread use of drones has catalysed the creation of counter-drone technologies to address potential risks and threats, although deploying these technologies safely without interfering with legitimate drone operations poses significant challenges. Establishing a military-grade anti-drone system for civilian use is financially impractical due to regulatory, assembly, and operational cost barriers, as detailed in (37), which surveys anti-drone systems focusing on non-military applications and the rising incidents thereof. This includes the exploration of detection, identification, and neutralization technologies, and the proposition of a hypothetical adaptable defence system, also discussing drone-side safety schemes and future solutions for overcoming these challenges. Article (38) further explores the safety and security threats drones pose, presenting various countermeasure methods and technologies, including guidelines for adaptable and effective drone defence operations and highlighting the importance of neutralization technologies that avoid weapon use. It emphasizes developing countermeasures against unauthorized drone activities and potential security breaches, mentioning specific examples of anti-drone systems like the Blighter AUDS Anti-UAV Defence System and the MC-HORIZON D360 v3 Battle Proven Reactive Anti-Drone/Quadcopter/Small UAV Jamming System.

## **b) Technical and Operational Challenges**

Drones face significant energy constraints due to their limited battery life, which restricts extended flight durations and long-range capabilities. These

constraints necessitate careful consideration in drone operations, particularly in terms of energy efficiency for propulsion and communication. Various drone types exhibit different energy needs and limitations, affecting their flight duration, payload capacity, and performance. An exploration of drone energy consumption, including factors like drone weight, rotor size, battery capacity, and aerodynamics, is presented in (39), offering insights into the primary influencers of drone energy use: design, environmental conditions, dynamics, and operational practices. The study in (40) evaluates energy consumption models for delivery drones, emphasizing the need for accurate energy usage estimates, which can vary significantly under different conditions and can impact the efficiency and sustainability of drone delivery systems.

Onboard computational capabilities are another critical limitation for drones, influencing their ability to perform complex tasks and process data in real-time. The computational power of drones, which varies based on their design and intended use, is essential for tasks like object recognition and navigation. Research into onboard edge computing and energy-efficient algorithms aims to enhance these capabilities. The proposal of computational offloading schemes in UAV-Edge-Cloud environments, as discussed in (41), underscores the potential of cloud computing to extend drone functionalities through real-time data analysis, scalable storage, and reduced power consumption, thus broadening the scope of drone applications.

Adverse weather conditions present additional challenges to drone operations, impacting flight safety and operational reliability. The article (42) explores the implications of weather and climate change on drone-based wildlife surveys, advocating for climate-adaptive planning to ensure effective conservation efforts. Operating drones in dynamic environments, like urban areas, necessitates sophisticated navigation and obstacle avoidance techniques. Studies, including (43) and (44), delve into the complexities of urban drone operation, discussing the growth of drone use in cities and proposing methods to adapt drone paths in real-time to dynamic urban changes, highlighting the ongoing efforts to integrate drones safely and efficiently into various aspects of modern life.

### c) Safety and Security Challenges

Safety and security challenges in the realm of unmanned aerial vehicles (UAVs) present complex issues that require careful consideration and strategic solutions. These challenges encompass a range of factors, including regulatory compliance, technological limitations, and potential threats posed by malicious actors. Ensuring the safe operation of UAVs involves adherence to strict regulatory frameworks established by aviation authorities like the Federal Aviation Administration (FAA) to mitigate risks and uphold airspace integrity. Moreover, technical challenges such as energy constraints and onboard computational capabilities play a significant role in determining the effectiveness and reliability of UAV operations. Additionally, the proliferation of UAVs has led to the development of counter-drone technologies aimed at mitigating security risks posed by unauthorized drone activities. These technologies encompass detection, identification, and neutralization methods to safeguard critical infrastructure and public safety. Furthermore, dynamic environments present unique obstacles, necessitating advanced navigation and obstacle avoidance capabilities to ensure safe UAV operations in urban areas or crowded spaces. Addressing safety and security challenges requires collaborative efforts among regulators, industry stakeholders, and researchers to develop comprehensive strategies and innovative solutions that uphold safety standards while fostering continued innovation in the UAV industry (44), (45).

#### i. Risk of Collisions

Ensuring the safe integration of drones into the airspace system and minimizing the risk of collisions with other aircraft or obstacles presents a significant challenge. Various studies and reports have examined the collision risks associated with drones and their potential impact on aviation safety. For instance, in (44), the authors explored the complexities and approaches to collision avoidance in autonomous drones. They emphasized the importance of robust risk assessment and collision avoidance systems, highlighting their pivotal role in preventing accidents and mitigating damages. The article delves into both qualitative and quantitative methods for analysing risks and assessing safety in autonomous drone operations. These methodologies aid in evaluating

the likelihood and severity of collisions, facilitating the development of effective avoidance strategies. Additionally, the article discusses the utilization of machine learning and computer vision techniques to analyse the drone's surroundings and make instantaneous decisions to evade collisions. Such technologies empower drones to detect and respond to potential collision threats, thereby ensuring safe navigation. This underscores the broader significance and urgency of addressing collision risks within autonomous systems.

## **ii. Cybersecurity**

Securing drones against cyber threats, such as GPS spoofing and unauthorized system access, emerges as a critical imperative in safeguarding the integrity and reliability of drone operations. The discourse presented in (46) underscores the pressing need for robust cybersecurity protocols tailored to mitigate potential vulnerabilities inherent in drone connectivity. Once tethered to a network, drones become susceptible to an array of risks, ranging from nefarious hacking attempts to surreptitious data breaches. The article delineates the intricate landscape of challenges concerning the regulation and enforcement of drone security, emphasizing the pivotal role of standardized protocols and regulatory frameworks in addressing these complexities. Proposed strategies include rigorous authentication procedures for drone operators, the establishment of no-fly zones, and the deployment of geo-fencing mechanisms to curtail unauthorized drone activities. Through its exposition, the article sheds light on the multifaceted nature of threats and obstacles confronting drone security, thereby underscoring the imperative for comprehensive security architectures to fortify drones against physical assaults, cyber intrusions, and unauthorized data access.

## **iii. Safety Inspections and Maintenance**

Safety inspections and maintenance are vital components in ensuring the continued safe operation of drones. The regular assessment of drone components, including the airframe, propulsion system, and on-board electronics, helps identify potential issues or defects that could compromise flight safety. These inspections often involve visual checks, functional tests, and

diagnostics to detect any abnormalities or signs of wear and tear. Additionally, routine maintenance tasks such as cleaning, lubrication, and calibration help keep drones in optimal condition and minimize the risk of malfunctions during flight. Adhering to manufacturer recommendations and industry best practices for maintenance schedules and procedures is essential for upholding safety standards and prolonging the lifespan of drone equipment. Furthermore, incorporating pre-flight checklists and post-flight assessments as part of standard operating procedures ensures that drones undergo thorough scrutiny before and after each mission, reducing the likelihood of accidents or operational failures. By prioritizing safety inspections and maintenance protocols, drone operators can mitigate risks and enhance the overall reliability and safety of their aerial operations (46).

Eventually, While the proposed study aims to shed light on the challenges and considerations surrounding drone operations, it's essential to acknowledge some limitations. Firstly, the scope of the study may be limited by the available literature and research in the field, potentially overlooking emerging issues or recent developments. Additionally, the study may primarily focus on certain industries or applications of drone technology, neglecting others that could offer valuable insights. Furthermore, the analysis of regulatory, technical, and safety challenges may be influenced by subjective interpretations or biases, impacting the objectivity of the findings. Finally, the proposed study may face constraints in accessing comprehensive data or conducting empirical research due to factors such as resource limitations or restricted access to proprietary information. Recognizing these limitations is crucial for ensuring transparency and rigor in the research process and may guide future studies to address these gaps effectively.

## 5. CONCLUSION

- **Highlights:** This review emphasizes the crucial role of regulations and policies in governing UAV operations, ensuring safety, privacy, and responsible usage. The FAA's regulatory framework in the US serves as a model for maintaining airspace integrity. UAVs are widely adopted in civilian and military sectors due to their versatility, accessibility, and cost-effectiveness, offering benefits

such as aerial surveillance, real-time data acquisition, and risk reduction for personnel.

- **Research Contributions:** It underscores the importance of UAV regulations in guaranteeing safe operations across industries, highlighting the FAA's framework as a benchmark for UAV governance. The study also showcases the significant growth of UAV usage and its practical benefits, necessitating collaborative efforts to address regulatory, technical, and safety challenges.
- **Practical Advantages:** Collaborative efforts among stakeholders are vital for addressing regulatory, technical, and safety challenges in UAV operations. UAVs offer practical benefits like enhanced surveillance and real-time data acquisition, making them indispensable across industries. Their versatility, accessibility, and cost-effectiveness further highlight their importance. Effective regulations are essential for ensuring safety, privacy, and responsible usage while promoting innovation and growth in the UAV industry.
- **Future Research Suggestions:** Future research should evaluate existing UAV regulations' effectiveness in ensuring safety and fostering innovation while exploring advancements in UAV technology to overcome technical challenges. Focus should be on improving energy efficiency and onboard computational capabilities. Additionally, research strategies are needed to tackle safety and security challenges, including the development of robust counter-drone technologies and risk mitigation strategies for dynamic environments.

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## Removal of Copper, Cadmium, and Zinc using Activated carbon derived from Tea Residue

إزالة النحاس والكاموم والزنك باستخدام الكربون المنشط المشتق من بقايا الشاي

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**ABSTRACT**

This study aims to investigate the removal of heavy metal ions Copper (Cu<sup>+2</sup>), Zinc (Zn<sup>+2</sup>), and cadmium (Cd<sup>+2</sup>) from synthetic contaminated water using activated carbon derived from tea residue (TAC). The adsorption experiments were carried out using a tertiary component system. Batches experiments were carried out at pH (5-6), initial concentration (5 – 50 ppm), and adsorbent dosage (0.1-0.3mg/g). The equilibrium adsorption data were examined for two models: Langmuir and Freundlich isotherms. The results show that the experimental data are well-fitted by the Langmuir model. The maximum adsorption capacity (q<sub>max</sub>) was 42.19, 10.73, and 13.66 mg/g for Cu<sup>+2</sup>, Cd<sup>+2</sup>, and Zn<sup>+2</sup>, respectively. Also, the experimental data showed that (TAC) is preferentially adsorbs cations in the order: Cu<sup>+2</sup>> Zn<sup>+2</sup>> Cd<sup>+2</sup>. The kinetic study for the adsorption process shows that the pseudo-second-order model is more appropriate to represent the experimental data. Thermodynamic parameters such as enthalpy change  $\Delta H^\circ$ , entropy change  $\Delta S^\circ$ , and Gibbs free energy  $\Delta G^\circ$ , were determined and showed that the adsorption of Cu<sup>+2</sup>, Cd<sup>+2</sup>, and Zn<sup>+2</sup> is spontaneous and endothermic

**Keywords:** Adsorption, Tea residue, Active carbon, Multi metals, heavy metals

**الخلاصة**

تهدف هذه الدراسة إلى التحقق من إزالة أيونات المعادن الثقيلة النحاس (Cu<sup>+2</sup>)، الزنك (Zn<sup>+2</sup>)، والكاديوم (Cd<sup>+2</sup>) من المياه الملوثة الاصطناعية باستخدام الكربون المنشط المحضر من بقايا الشاي (TAC). تم إجراء تجارب الامتزاز باستخدام نظام المكون الثالث. تم إجراء التجارب على عند درجة الحموضة (5-6)، والتركيز المعادن الاولي (5-50 جزء في المليون)، والجرعة الممتزة (0.1-0.3 ملغم / جم). تم فحص بيانات الامتزاز التوازني لنموذجين: Langmuir و Freundlich. أظهرت النتائج أن البيانات التجريبية ملائمة بشكل جيد لنموذج Langmuir. وكانت قدرة الامتزاز القصوى (q<sub>max</sub>) 42.19، 10.73، و 13.66 ملغم/جم لـ Cu<sup>+2</sup>، Cd<sup>+2</sup>، و Zn<sup>+2</sup>، على التوالي. كما أظهرت البيانات التجريبية أن (TAC) يمتص الكاتيونات بشكل تفضيلي بالترتيب: Cu<sup>+2</sup> > Zn<sup>+2</sup> > Cd<sup>+2</sup>. أظهرت الدراسة الحركية لعملية الامتزاز أن نموذج الدرجة الثانية أكثر ملاءمة لتمثيل البيانات

التجريبية. تم تحديد المعاملات الديناميكية الحرارية مثل تغير المحتوى الحراري  $\Delta H^\circ$ ، وتغير الإنتروبيا  $\Delta S^\circ$ ، والطاقة الحرة لجيبس  $\Delta G^\circ$  وأظهرت أن امتزاز  $Cu^{+2}$ ، و  $Cd^{+2}$ ، و  $Zn^{+2}$  هو عملية تلقائية وماصة للحرارة.

الكلمات المفتاحية: الامتزاز، بقايا الشاي، الكربون النشط، المعادن المتعددة، المعادن الثقيلة

## INTRODUCTION

The presence of heavy metals in many water bodies has recently emerged as a significant concern (1). The issue of water contamination with heavy metals is a matter of global concern (2), (3). The substance's capacity to dissolve in water and its non-degradable properties make it a potential hazard to both human health and the biodiversity of plants and animals (4), (5). Prolonged exposure to heavy metals has been associated with significant risks in the human body as a result of their gradual build up and resistance to degradation (6), (7). Several compounds containing heavy metals exhibit high solubility in water, allowing them to rapidly enter the food chains of humans and animals and accumulate in the environment (8–10). Heavy metals such as copper,

nickel, zinc, lead, and cadmium are extensively utilized in diverse industrial sectors, encompassing electroplating, chemical manufacture, metallurgy, mining, and tannery (11), (12). The process of decontaminating wastewater streams in these sectors prior to their release into rivers or ponds is imperative in order to mitigate the potential health and environmental consequences associated with the direct or indirect ingestion of heavy metals (2). Various techniques have been employed to eliminate heavy metals from water, each employing a distinct mechanism that varies in terms of specifications and effectiveness. Various techniques have been employed in the field, including electrochemical treatment (13), membrane technology (14), chemical precipitation (15), solvent extraction (16), ion exchange (17), photocatalytic (18), and biosorption (19). Activated carbon is a sophisticated adsorption material derived from various organic compounds, specifically designed for water treatment purposes (20), (21).

Several adsorbents have been used such as activated carbon, graphene, and silica for water purification (22), (23). A wide range of inorganic and organic pollutants are removed from the aquatic environment and industrial wastewater using activated carbon as an efficient adsorbent due to high surface area, porosity structure, the presence of a broad range spectrum of the surface functional groups and its capability of pollutants distribution on the high internal surface (6), (24), (25).

Biosorption is widely used for waste pollutant treatments throughout the environmental world. Liquid–solid systems were conducted to concentrate specific components from aqueous solutions onto certain solid surface adsorbents (26). This principle can be utilized for removing metal ions and organic pollutants from wastewater (27).

Several comprehensive researches have been conducted to find out high capacity and low-cost adsorbents for metal ions removed from aqueous solution throughout the last ten years. Nonconventional and low-cost adsorbents and renewable precursors, palm fronds (4), date pits (28), corncobs (29), and animal bones (30) have been converted to activated carbons. Carbonization of Tea residue with the physio-chemical activation method has been used in this study for the preparation of activated carbon. It was concerned with the feasibility of using carbonization of tea residue with a physio-chemical activation method with  $H_2SO_4$  as a low-cost and readily available sorbent material for the removal of Copper (Cu), Zinc (Zn), and Cadmium (Cd) from aqueous solutions in batch mode.

## **Experimental Works**

### **Materials**

The tea residue was collected from tea used in homes. Copper (Cu), Cobalt (Co), and Cadmium (Cd) were used as adsorbate and supplied by Sigma-Aldrich, Germany. Sulfuric acid ( $H_2SO_4$ ), used as the activating agent, was purchased from Sigma-Aldrich, Germany.

### **Adsorbent Preparation**



The waste tea was subjected to a 2-hour boiling process using distilled water to eliminate water-soluble substances. Subsequently, it was rinsed with distilled water until the washing water became colourless. The decolorized waste tea was subjected to a drying process in a drying oven at a temperature of 110 °C for a duration of 10 hours, followed by grinding for 5 minutes. The remaining tea was filtered through a 300µm sieve and then placed in a desiccator for storage. Prior to activation, the tea leftovers undergo a carbonization process at a temperature of 400 °C for a duration of 1 hour. The waste tea is thoroughly combined with a 30% H<sub>2</sub>SO<sub>4</sub> solution in a 1:1 impregnation ratio (g waste tea /g H<sub>2</sub>SO<sub>4</sub>) at room temperature for a period of 12 hours. Next, the mixture underwent filtration. The raw material underwent carbonization in a furnace for 1 hour at a temperature of 470 °C using nitrogen. The flow rate of N<sub>2</sub> is 50 cm<sup>3</sup>/min. Once the activated carbon had cooled to ambient temperature, it was rinsed with DW until the pH reached seven. Subsequently, the carbons underwent a drying process at a temperature of 110 °C for a duration of 6 hours. The product, known as TAC, is stored in a desiccator for future utilization.

### **Characterization of Activated Carbon**

Various characterizations were performed to describe the adsorbent produced. Scanning electron microscopy (SEM) was used to analyse the surface morphologies. The functional groups on the surface of the adsorbent were studied using Fourier transform infrared spectroscopy in the range (4000 – 400 cm<sup>-1</sup>). The Brunauer-Emmett-Teller (BET) analysis determined the surface area and porous structure of activated carbon.

### **Preparation of metal concentrations**

For the experiment, synthetic wastewater containing the three metals was used. The metal solution was made using a stock solution containing 1000 mg/l of each of the three heavy metals (zinc, copper, and cadmium). For a tri-metal combination, 75 ml aliquots with a volume ratio of 1/3:1/3:1/3 for Cu, Cd, and Zn are being made.

### **Tri-metal Adsorption on TAC**

Batch studies were conducted to investigate the impact of pH, contact time, adsorbent dosage, and starting concentrations. Batch adsorption tests were conducted at room temperature using a 75 ml solution of heavy metals (Copper, Cadmium, and Zink). The parameters investigated in this study encompassed contact duration ranging from 0 to 180 minutes, pH levels ranging from 2 to 11, starting concentration ranging from 10 to 100 mg/L, and adsorbent dosage ranging from 0.1 to 1.2 g per 75 ml. In all runs, the agitation speed was fixed at 150 rpm. A 250 ml Erlenmeyer flask was utilized to introduce 75 ml of a heavy metal solution with a predetermined initial concentration. Subsequently, a predetermined quantity of TAC was introduced into the solution. After that, the adsorbent was removed from the aqueous solution using filter paper (Whatman). To determine the removal percentage of Tri-metal and adsorption capacity of activated carbon (TAC) was calculated using Eq. (1), and Eq. (2) (1,2).

$$R \% = \left[ \frac{C_0 - C_e}{C_0} \right] * 100\% \quad (1)$$

$$q_e = \frac{(C_0 - C_e)V}{m} \quad (2)$$

Where

$q_e$  represents the adsorbed quantity (mg/g)

R is the removal percentage;

$C_0$  &  $C_e$  are concentrations of metals at initial and equilibrium (mg/l) respectively.

m is the adsorbed quantity (g).

V is the sample volume (ml).

## Results and Discussion

### Characterization of Adsorbate

## FT-IR

The chemical structure of the carbon substance is revealed through infrared spectroscopy. Figure 3 shows the FTIR spectra of the synthetic carbons obtained by sulfuric acid activation. The slightly broad peak at  $3396\text{ cm}^{-1}$  is due either to moisture or to hydroxyl ( $-\text{OH}$ ) groups present in the sample. A broad transmittance band is visible in all spectra between  $3200$  and  $3600\text{ cm}^{-1}$ , with maxima at roughly  $3420$  to  $3440\text{ cm}^{-1}$ . The O-H stretching mode of the hydroxyl groups and the adsorbed water can be attributed to this band. All carbons' spectra have a faint, acute transmittance band between  $2921$  and  $2855\text{ cm}^{-1}$ , which decreases when carbons are exposed to  $\text{H}_2\text{SO}_4$  (3). The spectral bands shown in Figure 3 at wavenumbers  $885$ ,  $840$ , and  $775\text{ cm}^{-1}$  can be attributed to the out-of-plane deformation mode of the C-H bonds in different substituted benzene rings. The spectral feature observed at approximately  $1700\text{ cm}^{-1}$  is commonly attributed to the stretching vibrations of C-O bonds in ketones, aldehydes, lactones, or carboxyl groups. The activated carbons that were synthesized exhibit a prominent spectral feature in the range of  $1600$ - $1580\text{ cm}^{-1}$ , which can be attributed to the vibrations of carbon-carbon bonds inside aromatic rings. This assignment is supported by reference (4).

The Fourier Transform Infrared (FTIR) research conducted on activated carbon derived from sulfuric acid revealed a highly intricate composition characterized by the presence of several functional groups on its surface, as depicted in Figure 3. An analysis was conducted on the carboxylic group within the spectral range of  $3360.42\text{ cm}^{-1}$ , utilizing OH expansion. Continuous peaks at  $2359.64\text{ cm}^{-1}$ ,  $2320.14\text{ cm}^{-1}$ , and  $2111.33\text{ cm}^{-1}$  were observed to measure the presence of various groups containing Si-H and N=C groups on the surface of  $\text{H}_2\text{SO}_4$ -AC. The presence of carboxylic groups was indicated by the stretching of the C-O single bond and C=O double bond at  $1695.01\text{ cm}^{-1}$ . An additional miscellaneous group was detected at a wavenumber of  $1180\text{ cm}^{-1}$ , indicating the presence of a S=O double bonding stretch. Following the pyrolysis procedure of biomass, the lignin underwent a transformation into aromatic structures characterized by a carbon-hydrogen single bond. The presence of peaks at  $876.9\text{ cm}^{-1}$  and  $759.11\text{ cm}^{-1}$  provided empirical support for the aforementioned process (35).

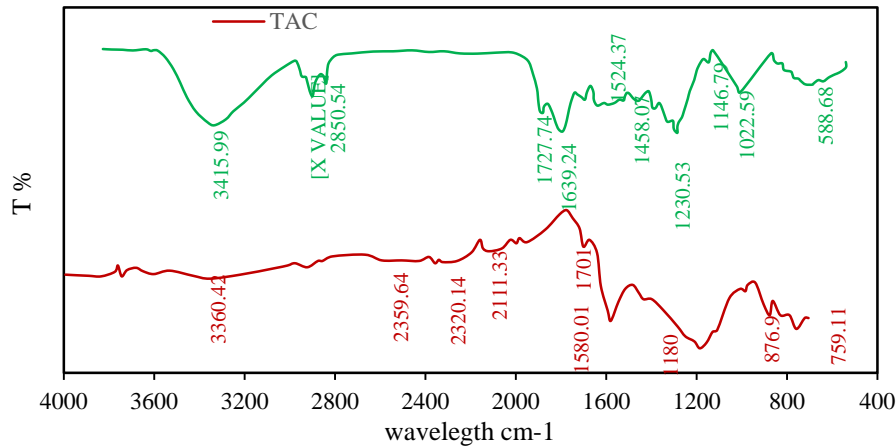


Figure 1: FTIR spectra of tea residue and activated carbon

## SEM

The surface morphology of both the tea residue and activated carbon was examined using SEM as shown in Figure 4. The activated carbon depressions exhibit internal structures characterized by the presence of cavities and cracks on their external surfaces. The presence of holes on carbon surfaces can be attributed to the evaporation of the activating agent, sulfuric acid, during the carbonization process. This evaporation leads to the creation of voids in the areas formerly occupied by the agent. (5). The  $H_2SO_4$  impregnation followed by a heat treatment in an inert environment affects the microstructure of activated carbon. These effects are connected to comparatively large mass losses. The image obtained from SEM in this study shows similar results as reported by Sikdar et.al. (6).

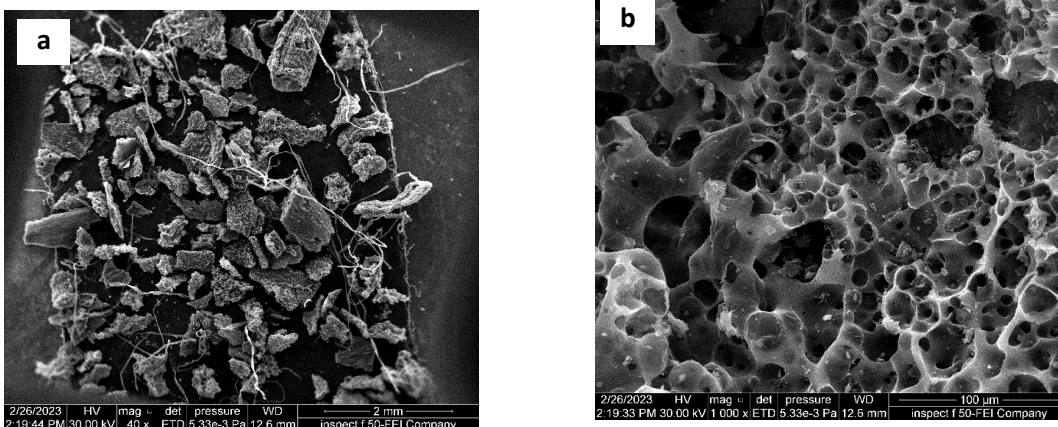


Figure 2: SEM image of (a) tea residue, (b) of TAC.

## Surface Area and Pore Structure

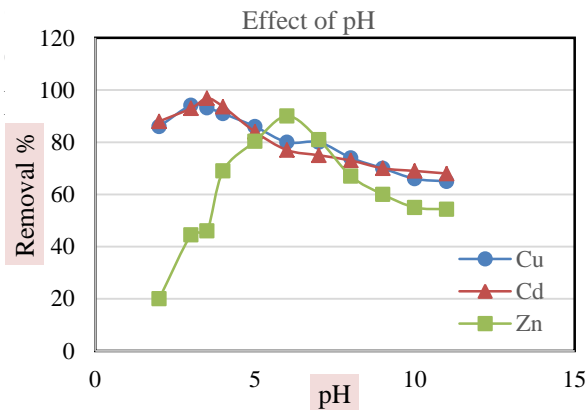
According to the research conducted by Brunauer-Emmett-Teller (BET), it was observed that the activated carbon derived from tea residue (TAC) exhibited a specific surface area of  $665 \text{ m}^2/\text{g}$  and an average pore volume of  $0.436 \text{ m}^3/\text{g}$ .

## Effect of Active Carbon Dosage

The dosage's impact was assessed within the range of 0.1–1.2 g/75 ml of a multi-metal solution for a duration of 60 minutes and at a rotational speed of 150 rpm. The starting pH of the solution was established as 6, while the initial concentration of all metal ions (Copper, Cadmium, and Zinc) was set at 30 ppm. Figure 3 displays the results. The findings suggest that the most effective dosage for Copper, Cadmium, and Zinc was determined to be 0.7g/75 ml, 0.8g/75 ml, and 1g/75 ml, respectively. The removal efficiency of metal ions exhibited a positive correlation with the dosage of the adsorbent. This phenomenon can be ascribed to an increase in the number of active sites present in the medium (38). Cherono et al. (39) observed comparable results in their assessment of the concurrent adsorption of heavy metals from water using discarded rubber tires. Constant adsorption was noted above and above the optimal dosage. This could be explained by the excessive concentration of metal ions on the adsorbent's attachment sites, which causes them to become oversaturated (7). The findings indicated that the elimination efficiency percentages for Copper, Cadmium, and Zinc were 94.2%, 96.85%, and 90.5%, respectively, when administered at the optimal dosage. Therefore, the operational dosage for the remaining batch trials was determined to be 0.8 g/L of the adsorbent dosage.

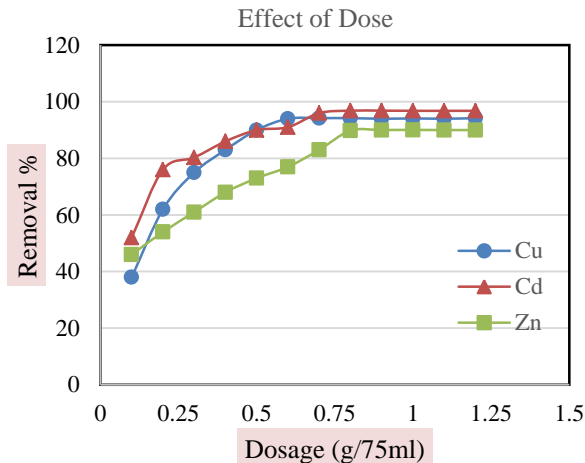
## Effect of pH solution

When removing heavy metals from an aqueous solution, the pH of the effluent is a crucial factor to consider (8). Figure 4 illustrates the impact of wastewater pH on the various TAC adsorptions of copper, cadmium, and zinc. The pH range of 2 to 11 was used to assess the effects of solution pH. After adding 0.8 g of adsorbent to 75 ml of multi-metal solution, the mixture was shaken for half an hour. The starting concentrations of zinc, copper, and cadmium were, respectively, 30 ppm, 35 ppm, and 35 ppm (9,10). This idea can also be used to



**Figure 4:** Effect of pH on adsorption of metal ions

ic potential increasing in a negative variation of the adsorption tests, the study on the information above.



**Figure 3:** Effect of Active carbon dosage on adsorption of metal ions

## Effect of contact time

In Figure 5, the influence of contact a duration on the removal of metal ions ( $\text{Cu}^{+2}$ ,  $\text{Cd}^{+2}$ , and  $\text{Zn}^{+2}$ ) from the TAC adsorbents is illustrated. The initial concentrations of these metal ions are 30 ppm, 35 ppm, and 35 ppm, respectively. The experimental procedure was conducted in a controlled environment, where the pH was maintained at a constant value of 6. The adsorbent dose used was 0.8 g/75 ml. The results of the experiment, as illustrated in Figure 5, demonstrate a positive association between the length of contact and the proportion of metal ion removal. Following this, there were no significant changes observed in the percentage of removal, indicating that the adsorption sites had become saturated due to intense competition among the heavy metals being studied. Gupta et al. (39) also observed a comparable trend, whereby the adsorption capacity of waste rubber tires reached a plateau within the initial 100 minutes of contact time. During this period, the adsorption efficiency of lead, copper, and zinc exhibited an increase. At the onset of the experiment, the efficiency of removing copper, cadmium, and zinc quickly reached equilibrium, with copper ions being removed in 60 minutes and cadmium and zinc metal ions being removed in 80 minutes. Subsequently, it exhibited a state of nearness constancy. The quick adsorption of metal ions is attributed to the early concentration gradient between the adsorbent in the solution and the initial availability of unoccupied active sites on the TAC. The gradual increase in adsorption and the subsequent attainment of equilibrium adsorption may be attributed to the restricted mass transfer of adsorbent molecules from the bulk liquid to the external surface of TAC (44).

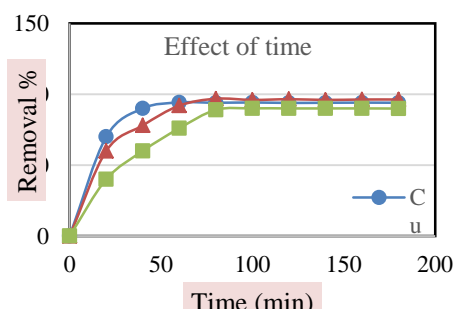
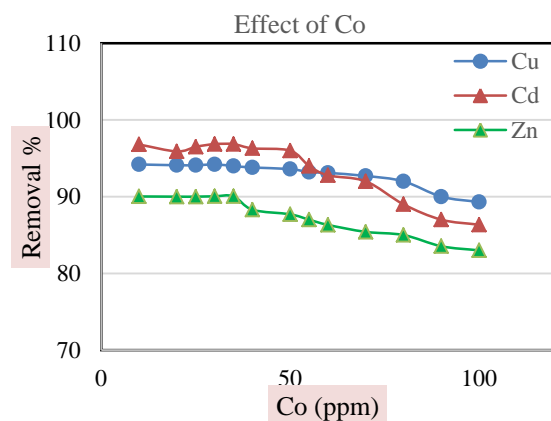


Figure 5: Effect of contact time on

### Effect of initial concentration of metals

By varying the starting concentration in the solution from 10 to 100 mg/L, the impact of the multi-metal concentration on its adsorption rate was ascertained. With an adsorbent weight of 0.8 g and 75 ml of multi-metal solution, the equilibrium concentration of heavy metals was determined. The starting pH of the solution was set to 6. Figure 6 demonstrates that when the initial metal ion concentration increased, the proportion of removed metal ions decreased. This is significant because the sorption sites of the adsorbent material get saturated

as the concentration rises. When compared to the accessible active sites on the waste tea active carbon adsorbent, the number of metal ions in the solution is smaller at lower metal ion concentrations. Higher metal ion concentrations reduce the amount of accessible active sites for metal ion adsorption, and the initial metal ion concentration determines the percentage of metal ions removed. The best removal rates for Cu, Cd, and Zn by TAC were 94.27% for zinc ions at 35 ppm, 96.85% for cadmium ions at 35 ppm, and 94.2% for copper ions at 30 ppm. This aligns with the outcomes found in (39).



**Figure 6:** Effect of initial concentration of TAC on adsorption of metal ions



## Adsorption isotherms

The adsorption isotherms were described using the Langmuir and Freundlich models, which are widely used because of their simplicity and adaptability to characterize the results of adsorption on activated carbon in a solution. Thus, these well-known two-parameter models were used to match the adsorption isotherm data. Figure 7 illustrates how two linearized isotherm models (Langmuir and Freundlich) are used to match the sorption data for  $\text{Cu}^{+2}$ ,  $\text{Cd}^{+2}$ , and  $\text{Zn}^{+2}$  by TAC. The mathematical expression of Langmuir is represented by Equation (3) (11).

$$q_e = \frac{K_L q_m C_e}{1 + K_L C_e} \quad (3)$$

The linearized form of Eq. (3) is given by Eq. (4)

$$\frac{1}{q_e} = \frac{1}{q_m} + \frac{1}{q_m K_L} \frac{1}{C_e} \quad (4)$$

Equation 3 can be used to evaluate the parameters  $K_L$  and  $q_m$ .

**Table I:** Parameters of Langmuir and Freundlich equations

	Freundlich			Langmuir		
	$K_F$	n	$R^2$	$K_L$ (L/mg)	$q_m$ (mg/g)	$R^2$
Cu	1.859	1.3	0.9736	0.042	42.19	0.9992
Cd	2.41	1.95	0.9084	0.3	10.73	0.9786
Zn	0.815	1.35	0.9836	0.053	13.66	0.9955

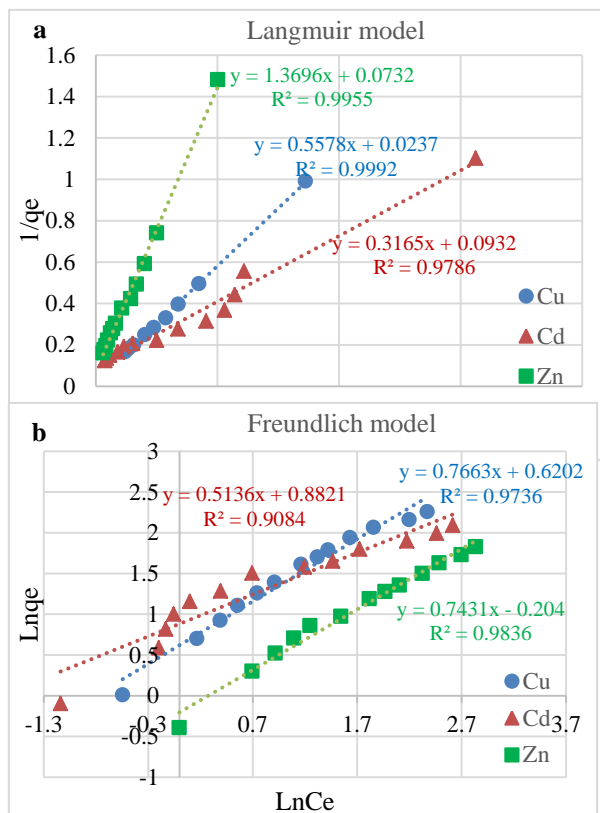
The Freundlich isotherm is represented by Eq. (5) (12).

$$q_e = K_F C_e^{\frac{1}{n}} \quad (5)$$

The Freundlich isotherm can be written in linear form as in Eq.(6).

$$\ln(q_e) = \ln(K_F) + \frac{1}{n} \ln(C_e) \quad (6)$$

Figure (7) represents the adsorption data for both isotherms: Langmuir and Freundlich.



**Figure 7:** Linear form of the (a) Langmuir and (b) Freundlich isotherm models for the sorption of  $\text{Cu}^{+2}$ ,  $\text{Cd}^{+2}$ ,  $\text{Zn}^{+2}$ .

Table 1 shows the parameters of both isotherms as well as the correlation coefficient  $R^2$ .

The Langmuir isotherm model (11) states that adsorption takes place at the homogenous sites of the adsorbents. This assumes that a monolayer of the metals is adsorbed onto the adsorbent surface (13). The adsorption type was identified as chemisorption by the  $q_m$  and  $K_L$ .

### Kinetics Adsorption

The kinetics of adsorption of tri-metal ions onto TAC were studied using two models: Pseudo-first-order and pseudo-second-order as shown by Eqs. (7) and (8), respectively

(14,15).

$$\left(\frac{dq_t}{dt}\right) = K_1 (q_e - q_t) \quad (7)$$

$$\frac{dq_t}{dt} = K_2 (q_e - q_t)^2 \quad (8)$$

Where

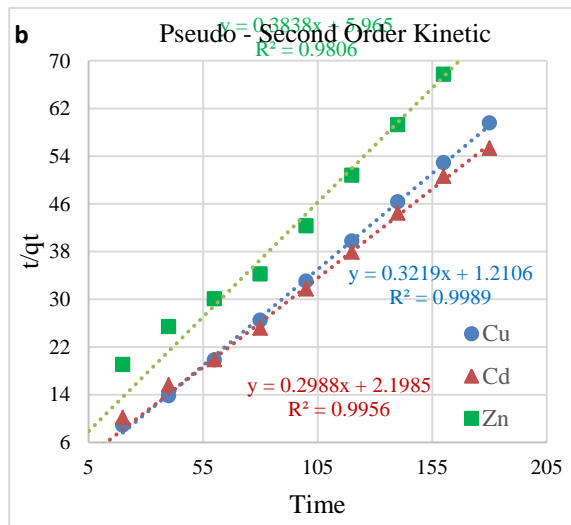
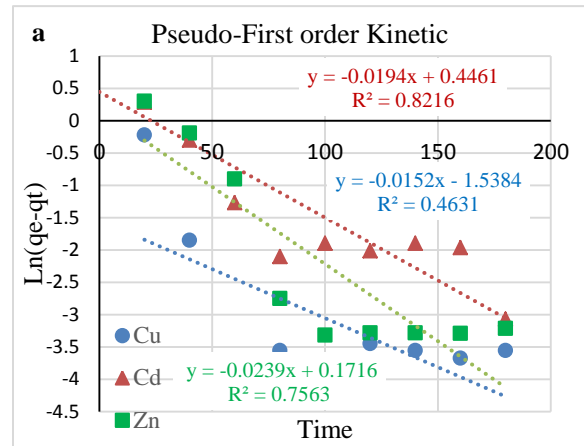
$q_t$  represent the adsorbed quantity of metal ions on the TAC at time  $t$ ,  $q_e$  is the adsorbed amount at equilibrium (mg/g).  $K_1$  and  $K_2$  are rate constants of both models.

The linear form of kinetics models is represented in Eqs. (9) and (10) (16).

$$\ln(q_e - q_t) = \ln q_e - K_1 t \quad (9)$$

$$\frac{t}{q_t} = \left(\frac{1}{K_2 q_e^2}\right) + \left(\frac{t}{q_e}\right) \quad (10)$$

The experimental adsorption data are graphically presented in Figure 10 using the pseudo-first-order and pseudo-second-order kinetics models.



**Figure 8:** Kinetics models for adsorption of Cu<sup>+2</sup>, Cd<sup>+2</sup>, and Zn<sup>+2</sup> onto TAC. (a) Pseudo-first-order, (b) Pseudo-second-order reaction model

With correlation coefficients  $R^2$  for the chosen metal ions being close to 1, Table 2 shows that sorption data fit was in line with the pseudo-second-order model.

### Study of Thermodynamics

The adsorption thermodynamic behaviour was studied through the values of Gibbs free energy change  $\Delta G^0$ , enthalpy change  $\Delta H^0$ , and entropy change  $\Delta S^0$ . Equations (11-14) were used to determine these parameters (17).

$$\Delta G^0 = -RT \ln(K_c) \quad (11)$$

The value of  $K_c$  was determined by Eq. (12).

$$K_c = \frac{q_e}{C_e} \quad (12)$$

Where  $q_e$  is the adsorbed amount at equilibrium.

The thermodynamic parameters are related to each other by Eq. (13) (18).

$$\Delta G^0 = \Delta H^0 - T \Delta S^0 \quad (13)$$

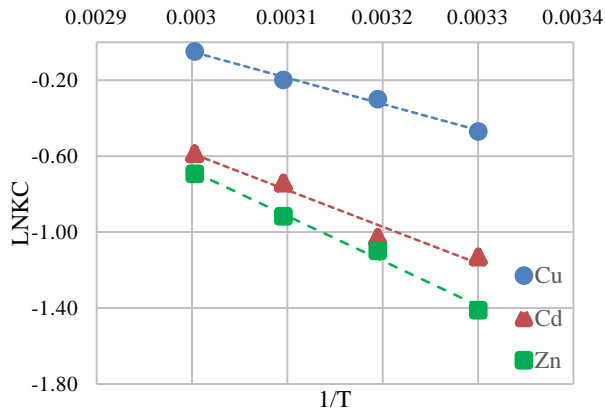
Substitution Eq. (13) in Eq. (11) gives

$$\ln K_c = \frac{\Delta S^0}{R} - \frac{\Delta H^0}{RT} \quad (14)$$

**Table II:** Kinetics parameters of pseudo-first-order and pseudo-second-order adsorption models

Heavy metal ions	Pseudo-first-order			Pseudo-second-order		
	$\ln(K_c)$	$K_1$ (min <sup>-1</sup> )	$\frac{1}{T}$ (mg/g)	$K_2$ (g/mg.min)	$q_e$ (mg/g)	$R^2$
Cu	0.0152	0.215	0.4631	0.09	3.11	0.9989
Cd	0.0194	1.56	0.8216	0.04	3.35	0.9956
Zn	0.0239	1.19	0.7563	0.02	2.61	0.9806

positive correlation between the value of  $K_c$  and temperature, indicating that when the temperature rises,  $K_c$  also increases. Table 6 presents the thermodynamic parameters  $\Delta G^\circ$ ,  $\Delta H^\circ$ , and  $\Delta S^\circ$  at various temperatures for the adsorption of Copper, Cadmium, and Zink onto TAC.



**Figure 9:**  $\ln K_c$  versus  $\frac{1}{T}$  for the adsorption of  $\text{Cu}^{+2}$ ,  $\text{Cd}^{+2}$ , and  $\text{Zn}^{+2}$  on TAC.

Negative values for  $\Delta G^\circ$  indicate the inherent spontaneity of the sorption process. The positive value of the enthalpy change ( $\Delta H^\circ$ ) indicates that the adsorption process can be categorized as physisorption and exhibits an endothermic nature. The favorability of the adsorption process can be enhanced by increasing the temperature. A positive sign is observed in the entropy change, indicating an increase in randomness at the interface between the

solid and liquid phases during the adsorption process of Copper, Cadmium, and Zinc (19).

**Table III:** Thermodynamic parameters of the adsorption process

Metal ions	$\Delta G^\circ$ (J/mol)				$\Delta S^\circ$ (kJ/mol K)	$\Delta H^\circ$ (kJ/mol)
	30 °C	40 °C	50 °C	60 °C		
Cu	-1.184	-0.781	-0.534	-0.135	0.034	11.454
Cd	-2.850	-2.679	-1.992	-1.627	0.043	16.055
Zn	-3.554	-2.859	-2.461	-1.919	0.053	19.63

## CONCLUSION

The utilization of tea residue-derived active carbon has been found to be a highly effective adsorbent in the removal of cations  $\text{Cu}^{+2}$ ,  $\text{Cd}^{+2}$ , and  $\text{Zn}^{+2}$  from contaminated water sources. An extensive inquiry was conducted to examine various factors affecting the elimination of heavy metals, including pH, adsorbent dosage, contact time, and beginning concentration. The average pore volume of the adsorbent is  $0.436 \text{ m}^3/\text{g}$ , while its specific surface area is  $665 \text{ m}^2/\text{g}$ . The highest percentage of metal ion elimination achieved for  $\text{Cu}^{+2}$ ,  $\text{Cd}^{+2}$ , and  $\text{Zn}^{+2}$  is 94.2%, 96.85%, and 95.27, respectively. The ideal working parameters consist of an adsorbent dosage of 0.8g/L, a pH range of 2-6, a contact time of 60-80 minutes, and an initial concentration of 30-35 ppm. The Langmuir isotherm is a reliable representation of the adsorption process. The experimental data can be well fitted using a pseudo-second-order kinetic model. The thermodynamic parameters, namely  $H^\circ$ ,  $S^\circ$ , and  $G^\circ$ , indicate that the adsorption process is both spontaneous and endothermic, supporting the stability of the system as adsorption progresses.

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## CONFLICT OF INTEREST

The authors of this paper declare that there is no conflict of interest in the submission of this paper.

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## Review of University Social Media Real-Time Sentiment Analysis System

مراجعة طرق تحليل المشاعر في الوقت الفعلي لوسائل التواصل الاجتماعي  
بالجامعة

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## ABSTRACT

Real-time sentiment analysis methods for university social media posts are examined in this paper. Universities have to track public sentiment on social media because it is important for communication and engagement. Real-time sentiment analysis systems collect, process, and analyse social media data to detect sentiment trends. The article reviews techniques, problems, and implications that assist academics, practitioners, and university administrators utilize sentiment analysis for informed decision-making and participation in the community. Real-time social media data enables universities to respond swiftly to trends, while sentiment analysis guides data-driven decisions for problem resolution and service enhancement. Effective crisis management minimizes reputation-threatening crises, improving community relations and communication techniques.

**Keywords:** Real-time sentiment analysis, university social media, decision-making, community participation, analytics systems.

## الخلاصة

يتم في هذه الورقة البحثية دراسة طرق تحليل المشاعر في الوقت الفعلي الى ردود الفعل على المنشورات في مواقع التواصل الاجتماعي الخاصة بالجامعات . يتعين على الجامعات أن تتتبع المشاعر العامة على وسائل التواصل الاجتماعي لأنها مهمة للتواصل والمشاركة. تعمل أنظمة تحليل المشاعر في الوقت الفعلي على جمع بيانات وسائل التواصل الاجتماعي ومعالجتها وتحليلها للكشف عن اتجاهات المشاعر. يستعرض المقال التقنيات والمشاكل والآثار التي تساعد الأكاديميين والممارسين ومديري الجامعات على استخدام تحليل المشاعر لاتخاذ قرارات صحيحة والمشاركة في المجتمع. تتيح بيانات الوسائط الاجتماعية في الوقت الفعلي للجامعات الاستجابة بسرعة للاتجاهات، في حين يوجه تحليل المشاعر القرارات المستندة إلى البيانات لحل المشكلات وتحسين الخدمة. تعمل الإدارة الفعالة للأزمات على تقليل الأزمات التي تهدد السمعة، وتحسين العلاقات المجتمعية وتقنيات الاتصال.



الكلمات المفتاحية: تحليل المشاعر في الوقت الحقيقي، وسائل التواصل الاجتماعي الجامعية، اتخاذ القرار، المشاركة المجتمعية، أنظمة التحليلات.

الكلمات المفتاحية: أنظمة الذكاء الاصطناعي، اضطراب طيف التوحد، تشخيص التوحد، التعلم العميق، تحسين المعالجة.

## INTRODUCTION

Universities use social media for real-time communication, knowledge sharing, and community participation. Monitoring university-related social media posts is essential for public perception, effect analysis, and strategic decision-making. Universities may continually acquire, process, and analyze social media data using real-time sentiment analysis algorithms to understand sentiment patterns. This paper covers the development, challenges, and applications of real-time sentiment analysis systems for university social media posts to help researchers, practitioners, and administrators use sentiment analysis for informed decision-making and community engagement[1,2,3].

This paper addresses an important topic in the field of sentiment analysis, specifically focusing on its applications in university social media posts. The authors demonstrate a clear understanding of the subject matter and present their findings logically and logically.

Sentiment analysis entails assessing the tone of a review, social media post, or customer evaluation. This analysis uses NLP and machine learning to identify sentiment as positive, negative, or neutral. the proposed method use data collection, processing, analysis, and visualization to extract insights from text data to enhance customer service, brand reputation, market research, and campaign performance. Businesses use sentiment analysis to get objective insights, improve goods and services based on consumer feedback, and evaluate massive amounts of text data at scale[4,5,6].

Social media sentiment analysis types:

- Polarity detection: Basic sentiment analysis identifies phrases as positive, negative, or neutral.
- Emotion classification: NLP sentiment analysis and machine learning algorithms categorize text into sophisticated emotional states, going beyond simple polarity.
- Aspect-based analysis: a detailed study of text context (words or phrases). Consider reviewing product reviews that emphasize pricing, design, or customer service.[7,8,9].

**Problem Statement:** The growing number of social media platforms has increased the complexity of monitoring university reputations and interacting with users. However, the enormous volume of social media data poses a significant difficulty for colleges in efficiently monitoring and analyzing public mood. Conventional approaches to sentiment analysis are sometimes time-consuming and might lack the flexibility needed to handle real-time data streams. Moreover, there is a limited availability of sentiment analysis systems that are specially designed for analyzing social media postings from universities. As a result, universities lack the necessary tools to effectively assess public opinion. To tackle these problems, it is necessary to create real-time sentiment analysis techniques that are capable of handling social media data from universities and offer useful information immediately.

The study discusses real-time sentiment evaluation for university social media posts, including methodology, issues, and findings. Assessing study gaps and future potential helps academics, practitioners, and university administrators employ sentiment analysis to improve decision-making and community involvement.

The outline of the paper is as follows: section 2: related work; section **3: methodology**; section **4: Challenges and Future Directions**; section 5: conclusions.

## LITERATURE REVIEW

The paper provides a detailed overview of related work in sentiment analysis on social networks, machine learning techniques for sentiment analysis, and real-time sentiment analysis.

**Evaluation of Naïve Bayes Classification in Arabic Short Text Classification.** This study analyses Arabic short text categorization using three Naïve Bayes classifiers, concentrating on thesis and dissertation titles. Preprocessing included punctuation and stop word removal and TF-IDF extracted features. The study employed three Naïve Bayes classifiers. The findings reveal interesting brief text categorization applications [10].

**Text Summarizing and Clustering Using Data Mining Techniques.** This paper presents an efficient text summarization method leveraging word association and data mining techniques, including the K-Means algorithm and TF-IDF. Critical material is extracted while eliminating document redundancy. Trials show that removing irrelevant terms and clustering related texts improves summarization ratios [11].

**Just-in-Time Sentiment Analysis for Streamed Data in Greek.** Spark-based Twitter sentiment analysis architecture is proposed in this work to manage the massive tweet volume for timely sentiment analysis. It effectively identifies Greek tweets and handles streaming tweets using Spark's machine-learning framework and modern queuing and in-memory data systems. The system also addresses big-data processing issues in sentiment analysis on social media networks like Twitter by reliably recognizing authentic account sentiments [12].

**A real-time big data sentiment analysis for Iraqi tweets using spark streaming.** The study uses Spark Streaming to create a real-time sentiment analysis model for Iraqi tweets. Machine learning research increasingly relies on social media data, notably Twitter. The suggested sentiment analysis system uses a lexicon-based algorithm for intake, processing, and display [13].

**A new big data approach for topic classification and sentiment analysis of Twitter data.** A Hybrid Lexicon-Naive Bayesian Classifier (HL-NBC) approach is proposed for Twitter sentiment analysis, a prominent real-time opinion source. The massive volume of data from Twitter hashtags makes manual processing difficult. Topic categorization filters irrelevant tweets in the suggested strategy. In contrast to Lexicon and Naïve Bayesian classifiers [14].

**Topic-level sentiment analysis of social media data using deep learning.** The research provides a deep learning-based topic-level sentiment analysis system for streaming social media. It employs online latent semantic indexing with regularization to find sentence-level themes and a long short-term memory network topic-level attention mechanism for sentiment analysis[15].

**Sentimental Analysis of COVID-19 Related Messages in Social Networks by Involving an N-Gram Stacked Autoencoder Integrated in an Ensemble Learning Scheme.** The study investigates COVID-19-related sentiments on Twitter, employing ensemble deep-learning techniques for enhanced prediction. It utilizes training data from Twitter posts and features extraction via an N-gram stacked autoencoder supervised learning algorithm. To classify and forecast, an ensemble fusion method using machine learning techniques including DT, SVM, RF, and K-nearest neighbour is used [16].

**A Spark-based Big Data analysis framework for real-time sentiment prediction on streaming data.** Real-time sentiment analysis is essential to big data processing to identify fraudulent data sources, according to the report. The framework combines sentiment analysis and fraudulent account identification using Apache Spark's Naïve Bayes models. The framework comprises sentiment prediction, Twitter data retrieval, bogus account identification, and real-time reporting [17].

**Real-time Twitter Sentiment Analysis for Moroccan Universities using Machine Learning and Big Data Technologies.** The paper provides a Moroccan public college Twitter sentiment prediction system

in real time. Instant prediction and offline sentiment analysis. French tweets concerning twelve Moroccan organizations were evaluated as 'positive', 'negative', or 'neutral' offline using six machine learning algorithms. Applying to live tweets. Twitter streaming API, Apache Kafka ingestion, Apache Spark sentiment analysis, Elasticsearch exploration, and Kibana visualization compose the real-time prediction pipeline [18].

**Real-time Sentiment Analysis on Social Network Using Meta-Model and Machine Learning Techniques.** This research presents a real-time social network sentiment analysis system that properly classifies user sentiment using a meta-model and machine learning. For better categorization, the system uses social media text and images. Superior accuracy, precision, recall, and F1-score compared to state-of-the-art approaches. The system can handle multimodal data in real-time, making it useful for social media monitoring and marketing analysis. Further study can remove constraints and enhance efficiency [19].

**Real-Time Sentiment Analysis of Social Media Content for Brand Improvement and Topic Tracking.** This study examines real-time social media sentiment analysis for brand enhancement and topic monitoring. Using natural language processing methods, it tries to construct a sentiment analysis system that is fast and accurate. It also uses topic modelling to detect trends and identify brand reputation concerns. The technology accurately analyzes sentiment and tracks hot issues on a big collection of tweets, providing useful information for brand enhancement and prompt business action [20].

**A Sentiment Analysis Model for Terrorist Attacks Reviews on Twitter.** This study examines Arabic short text classification using three Naïve Bayes classifiers, focusing on thesis and dissertation titles. Preprocessing included TF-IDF extraction, punctuation, and stopword removal. The study used three Naïve Bayes classifiers. The findings suggest intriguing brief text classification uses [21].

## METHODOLOGY

The methodology outlines how to build real-time university social media sentiment analysis tools. Table 1 addresses data collection, preprocessing, sentiment analysis, and real-time processing.

Title	Dataset	Sentiment Analysis Result	Real-time
[10]	The dataset was collected through scraping techniques using Python from online repositories	With 0.84 accuracy, the Complemented Naïve Bayes Classifier excelled in testing.	No
[11]	Collection of text documents	Eliminating unnecessary words improves summarization ratios.	No
[12]	A dataset of tweets composed in Greek obtained from Twitter	Random Forest classifier correctly identifies 87% of Twitter fake accounts, Decision Tree 85%, and Naive Bayes 75%	Yes (Real-time sentiment analysis)
[13]	Components tested using the Bassam Al-Rawi dataset	Real-time sentiment analysis model for Iraqi tweets utilizing Spark Streaming and DT and K-Means clustering.	Yes (Real-time sentiment analysis)
[14]	Six Twitter datasets from Flume were saved in Hadoop.	The proposed HL-NBC method gives an accuracy of up to 82%.	No
[15]	Streaming sentence topic identification dataset under hashtags #facebook, #bitcoin, and #ethereum	Averaged 0.879 for in-domain sentiment analysis and 0.846, 0.824, and 0.794 for Ethereum, Bitcoin, and Facebook datasets.	No
[13]	Twitter data collected from open-source available from the IEEE website filtered by COVID-related keywords	Achieved an accuracy of 87.75%, 4% to 10% greater than competing techniques	Yes (Real-time sentiment analysis)
[17]	HUMIR dataset comprising 65,000 instances extracted from "beyazperde.com" and "otelpuan.com"	Sentiment classification accuracies of 86.77% for offline mode and 80.93% for real-time mode	Yes (Real-time sentiment analysis)
[18]	French tweets list 12 Moroccan universities	The best test accuracy was 98% using a random forest classifier and TF-IDF.	Yes (Real-time sentiment analysis)
[19]	Social media post datasets from Twitter and Facebook	Had 0.85 accuracy and F1-score.	Yes (Real-time sentiment analysis)
[20]	Big data of brand and subject tweets	System accuracy was 83.6%	Yes (Real-time sentiment analysis)
[21]	Collected tweets for each terrorist incident	The model had 94.8% accuracy and 95.9% F1 score.	No

## CHALLENGES AND FUTURE DIRECTIONS

Real-time sentiment analysis can inform university social media posts, but data privacy, algorithmic bias, multi-modal analysis, and ethical problems must be addressed to assure accuracy, equality, and ethical use.

### 1.1.Data Privacy:

Data privacy: Real-time sentiment analysis analyzes massive social media data. Data privacy is important to protect users' data and comply with data protection laws like the GDPR.

### 1.1.Algorithmic bias:

Biased sentiment analysis algorithms may produce unjust results. Objective analysis requires addressing algorithm bias.

### 1.2.Multi-Modal Sentiment Analysis:

Some systems combine textual and visual social media data for multi-modal sentiment analysis to increase accuracy. Multi-modal sentiment analysis analyzes user sentiment across media.

### 1.1.Ethical Concerns:

Real-time sentiment analysis poses ethical problems about data use, algorithmic transparency, and effect. Following ethical guidelines decreases ethical risks.

## CONCLUSIONS

The university social media post-real-time sentiment analysis system evaluation emphasizes the need to use advanced approaches to monitor and evaluate sentiment trends in real-time. Various studies show that such systems require different datasets, machine learning methods, and big data technology. These solutions help improve brand perception, trend tracking, and social media engagement.

The paper also highlights the efficacy of Naive Bayes classifiers, deep learning models, and ensemble learning techniques in this research. Each technique improves sentiment analysis accuracy and dependability in its way. The evaluation stresses real-time sentiment monitoring for university social media posts. These technologies help institutions make educated decisions,

communicate with their audience, and improve their online presence by precisely recognizing sentiment patterns and tracking subjects of interest. More research and development are needed to improve real-time sentiment analysis systems for university social media posts.

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## THE STRUCTURAL DESIGN FOR STORING AND PROCESSING SMALL FILES ACROSS DISTRIBUTED SYSTEMS

التصميم الهيكلي لتخزين ومعالجة الملفات الصغيرة عبر الأنظمة الموزعة

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## ABSTRACT

The rapid growth of digital data has led to a rapid increase in the number of small files created and processed on distributed systems. Small files are commonly found in a variety of applications, including web servers, content management systems, and distributed file systems. However, traditional methods of storing and processing large files are not suitable for managing small files efficiently. This creates challenges related to file access times, storage loading, and system performance. In the current digital age, the number of small files being created and processed on distributed systems is increasing at an unprecedented rate. This increase in data poses a major challenge in terms of storage and processing efficiency. Traditional methods of file storage and processing are often inadequate to handle such a large volume of small files, leading to problems with response time, scalability, and reliability. This paper explores the architectural design considerations for efficiently storing and processing small files across distributed systems and presents a compelling solution to address this pressing problem.

**Keywords:** Data distribution; Data storage; Parallel processing; Small files.

## الخلاصة

أدى النمو السريع للبيانات الرقمية إلى زيادة سريعة في عدد الملفات الصغيرة التي تم إنشاؤها ومعالجتها على الأنظمة الموزعة. توجد الملفات الصغيرة بشكل شائع في مجموعة متنوعة من التطبيقات، بما في ذلك خوادم الويب وأنظمة إدارة المحتوى وأنظمة الملفات الموزعة. ومع ذلك، فإن الطرق التقليدية لتخزين ومعالجة الملفات الكبيرة ليست مناسبة لإدارة الملفات الصغيرة بكفاءة. يؤدي هذا إلى إنشاء تحديات تتعلق بأوقات الوصول إلى الملفات وتحميل التخزين وأداء النظام. في العصر الرقمي الحالي، تتزايد كمية الملفات الصغيرة التي يتم إنشاؤها ومعالجتها على الأنظمة الموزعة بمعدل غير مسبوق. وتشكل هذه الزيادة في البيانات تحدياً كبيراً من حيث كفاءة التخزين والمعالجة. غالباً ما تكون الأساليب التقليدية لتخزين الملفات ومعالجتها غير ملائمة للتعامل مع هذا الحجم الكبير من الملفات الصغيرة، مما يؤدي إلى المشاكل في زمن الاستجابة وقابلية التوسع والموثوقية. يستكشف هذا البحث

اعتبارات التصميم المعمار بتخزين الملفات الصغيرة ومعالجتها بكفاءة عبر الأنظمة الموزعة ويقدم حلاً مقنعاً لمعالجة هذه المشكلة الملحة.

**الكلمات المفتاحية:** توزيع البيانات، تخزين البيانات، المعالجة المتوازية، الملفات الصغيرة.

## INTRODUCTION

In the process of working on the information retrieval system "IT Specialist", the problem arose of storing and processing a large number of small files. Moreover, during storage, there should be the possibility of parallel processing of information on several computers that form a "cluster" (about the reasons for taking the word "cluster" in quotation marks - below). To simplify the work and increase the transparency of the system, as well as according to specific requirements (see below), a solution was developed - a distributed complex service similar to distributed file systems.

The rapid development of information and communications technology has led to an unprecedented acceleration in the generation of large and diverse sets of data [1]. This has led to the emergence of the importance and utility of big data in higher education. With the continuous increase in the number of images and videos being uploaded to the Internet, managing, storing and processing this huge flow of video content connected to the network represents an increasingly formidable challenge [2]. This challenge becomes particularly acute when storing and processing large numbers of small files [3]. In response, there is a critical need for efficient solutions that can seamlessly store, organize and categorize vast collections of networked video content while ensuring a seamless user experience [4].

An important aspect of this problem is the need to process information in parallel on multiple computers that form "clusters" during storage. Furthermore, the ever-increasing volume of data being generated requires specialized tools and technologies to manage and store it effectively and efficiently [5].

To meet this challenge, the IT specialist Information Retrieval System has developed a solution for reliable storage and fast processing of large numbers of small text files. The solution aims to meet specific requirements using a distributed data storage and processing system to simplify the work and increase the transparency of the system.

In the context of distributed systems, the architectural design for storing and processing small files plays a critical role in ensuring that data is managed smoothly and efficiently. This design must include elements that enable the system to process large numbers of small files while maintaining a high level of reliability, speed, and scalability [6].

Moreover, the development of distributed data storage and processing systems is necessary to meet the challenges posed by the rapid growth of data. These systems not only facilitate efficient data storage and retrieval but also improve the overall performance of the system by enabling parallel processing.

The importance of this architecture has implications for IT professionals' information retrieval systems and similar systems where efficient processing of small files is essential to the proper functioning of the underlying system. Implementing a robust architecture for storing and processing small files across distributed systems can improve data management, enhance user experience, and improve system performance [7, 8].

Managing, storing, and processing small files across distributed systems is a major challenge in the era of big data. To meet this challenge and manage large and diverse data sets effectively, it is necessary to develop and implement special architectural designs for handling small files [9, 10]. By leveraging distributed data storage and distributed data processing systems, institutions can overcome the complexities of managing small files and harness the potential of big data to benefit higher education and many other fields.

## **MATERIALS AND METHOD**

So, for data stored or processed



1. In the course of work, it was necessary to store and use a large number of small files (web pages and their text representations), each of which has a size of 50-100 kb, but their total number is huge - about a billion in the test database.
2. It is necessary to store a certain number of "medium" files in the project - 2-10 MB in size.
3. There are a certain number of large files in the system - 10-200 GB in size, some of them are continuously used.

## **PROBLEM**

1. First manifested in the backup procedures, the problem is mainly:
  - a) in significant, at the file system level, overhead for storing a large number of files;
  - b) in a significant time of reading the directory contents (moreover, there is no way to influence this operation - in each specific case it is approximately constant).
2. A significant amount of processed information required (at least occasionally) the need to process information on separate computers of a heterogeneous "cluster", each of which, conditionally, could fail (temporarily or permanently) at any time.

The word "cluster" in this case is used in quotation marks, because traditionally (architectures similar to MPI [11]) in a cluster, each computer is significant for the calculation procedure, and the failure or failure of even one computer involved leads to a crash of the entire calculation [12-14].

## **STORAGE REQUIREMENTS**

1. Data safety is more important than speed and response time.
2. A heterogeneous "cluster" with a high variability of components is formed by all available computers included in it. The computers included in it should potentially retain the possibility of their use by users.

3. The system stores a large number of small files, each of which may be required by each of the computers in the "cluster".
4. A number of processing programs are written in different programming languages.
5. "Cluster" is built from ordinary equipment operated by users. Therefore, failures, loss of individual files, unavailability of cluster nodes are the norm. This should not affect the functioning of the system.
6. As a rule, the following operations are most frequent: reading a small file, creating a small file, reading a linear fragment of a large file. Creation, recording, overwriting, appending, deleting are relatively rare operations, "creation" implies that at the time it is necessary to write to a file, its future volume is known [15-17].
7. Due to the specifics of the system being developed (a highly specialized search engine), after the initial processing is completed, the storage of almost all small files is of an archival nature (access to them is extremely rare and if necessary).
8. A situation of concurrent read and write access by many clients to one file is possible.  
It is required to execute these requests strictly sequentially [18].
9. Access to files is either read-only or write-only (plus sharing locks). There is no read/write access.
10. File storage should be hierarchical (using directories) in the global namespace.
11. Sometimes it is required to save a "snapshot" of a number of files (i.e. meta-information and contents of files) at the time of snapshot creation, the files or directories themselves can be changed or deleted later. Deleting a "snapshot" should entail deleting all information associated with that snapshot only.

12. A failure in the network, master server, storage server or client, which did not affect the stored data and metadata, should not affect the performance of the system as a whole, after eliminating the non-failures, work should continue from the interrupted place [19].

The requirements for a solution are reminiscent of the problems solved by some existing systems like Google FS [22] (solution closed), HDFS [23] (solution open but not satisfying requirements), DFS [24] (solution tied). to the Windows Server architecture and does not meet the requirements).

## **SOLUTION ARCHITECTURE**

Actually, the obvious, and perhaps the most efficient solution would be to put all the files in a database with transaction support [25]. Unfortunately, firstly, this catastrophically reduces the reliability of the entire system and significantly increases the requirements for speed and stability of equipment, and secondly, this does not in any way insure against failures on the media and file system - a certain pro- backup procedure, complicated by the size of the database [20].

In the process of solving the problems posed, first of all, an attempt was made to get rid of small files. Obviously, the solution is to put all the files in a file container and access its contents by the external index. The ZIP format was chosen as the container. During the initial processing of new small files, they are either served directly or placed in a separate ZIP container without compression. The lack of compression allows you to directly access any fragments of the ZIP container. At the end of the primary processing, the files from the ZIP container are compressed by a background stream with a higher compression ratio (maximum by default) and become "archived" data. All developed auxiliary procedures are absolutely transparent in the internal API and allow the use of ZIP files of any format and any compression level [21].

The second stage is to increase the size of the cluster on the file system. The maximum value of 64 kb was indicated (against the standard 4 kb). As a result, the size of the file allocation table was proportionally reduced by 16 times, the performance increased, and the consumption of RAM by the system also

decreased by about an order of magnitude. The following elements are highlighted in the storage system (Fig. 1).

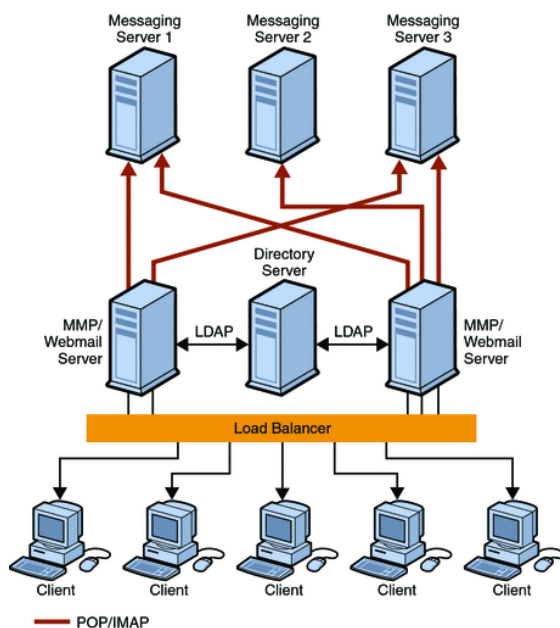


Fig. 1: The elements of the storage system.

Master server - stores meta-information about all files. In fact, it is a server application client for the MySQL DBMS. On the master server for each file, in addition to the usual meta-information, information is stored in how many copies each file should be stored. Storage servers - store the actual files [22].

For each file, there is a main storage server (designated as a master server), from which replication is carried out to other storage servers according to the number of required copies of each file (the number of replicas). Typically, three replicas are used. The master server contains a physical (manually set by the administrator) map of storage servers, which includes the physical location, organization of communication channels and network bandwidth (work is underway on procedures for automatically assessing the latter).

This minimizes the risks of damage and accessibility of stored files. A significant number of files, as mentioned earlier, are stored in ZIP archives. For clients, access to their content is transparently organized by storage servers.

The client interacts with the master server only to perform metadata related operations. All other operations are performed directly with the storage servers [23].

## **MASTER SERVER**

The system uses only one master server, which greatly simplifies the architecture. The load on the master server is relatively low, which allows:

- real-time control of availability and workload of slave storage servers. Collect relevant statistics;
- perform storage maintenance operations in the background – checking the integrity of individual files and container files, deleting files marked for deletion, deleting unnecessary file instances or restoring missing ones;
- organize, if necessary, "snapshots" of the file system of any complexity.

The master server database is replicated (meaning, by means of the MySQL DBMS itself) to the required number of replicas. The server application interacting with the clients is able to select and assign the appropriate available DBMS instance as the master.

One of the key parameters of the collected statistics is the reliability of the storage server, which consists of four simple assumptions: not used; b) the server that is least used by users globally in time is better than others - the assumption is based on empirical observation that, compared with other irresistible factors, usually only its users are to blame for the inoperability of an average computer system;

c) better than others is the server that was globally available more often in time - an assumption, almost directly related to the previous point, the probability that a rarely used computer system will fail while maintaining its mode of use is low; d) the server that is less used locally in time is better than others - again, a direct reference to the operation of the system by users.

According to these criteria, a conditional rating is formed, on the basis of which it is determined which available servers should be operated at this particular moment. "Snapshots" of the state of the file system are formed at the transaction level in the DBMS.

## **META INFORMATION**

Meta-information stored on the master server includes:

- file ID, its checksums and hash;
- file name, full path to it; - size;
- attributes of creation, last modification;
- sign of deletion (the file is not deleted immediately, only during maintenance);
- blocking status (optimistic blocking model is used);
- access attributes (the role-based model of access control is supported);
- number of stored copies;
- the main storage server for this file.

## **DATA STORAGE SERVER**

At start up, it collects information about all the files stored on it and transfers it to the master server, responds to direct requests via the API - for the actual return and saving of data.

A log of performed operations is maintained. If there is no load for a certain period of time, the data storage server starts the procedure for checking the number of file copies, first for those for which it is marked as the main storage server, then for all the others. If for some file the number of its copies has fallen below the minimum allowable, the duplication procedure is initiated [24].

If the number of copies exceeds the required number, a special notification is sent to the master server, according to which it starts deleting unused file instances from the least reliable, according to the current rating, computer systems.

CLIENT Most clients are assigned a location on a physical map stored on the master server (similar to a map of storage servers). For example, the procedure for reading a file by a specific client is as follows (the file name is known) [25].

The client connects to the master server and receives from it the names of storage servers and file identifiers, which should be contacted to obtain a file in descending order of priority: first - recommended - the closest, then - more remote, etc., according to the physical location and load of servers and network [26].

When generating this response, the master server takes into account the results of the last availability check of the storage servers [27].

## CONCLUSIONS

The developed solution covers the needs of the system for data processing both during regular operation and under emergency loads and approaches the theoretical limit of equipment use, taking into account the previously formulated limitations. The unique feature of the solution is its ability to efficiently process and store a large number of small files.

Storing and manipulating small files across distributed systems presents some major challenges. One major problem is the redundant metadata associated with small files, which leads to increased storage costs and decreased performance. Furthermore, managing small files increases latency during read and write operations, which can affect overall system responsiveness. Furthermore, scalability in traditional file systems is often limited when dealing with large numbers of small files, which hinders the system's ability to handle increasing data volumes.

An architectural design approach is essential to address the challenges associated with storing and processing small files across distributed systems. One effective solution is to use a hierarchical storage technique, where small files are grouped and organized based on their properties. This approach reduces redundant metadata and improves the efficiency of file access. Furthermore, the scalability and processing performance of small files can be improved by using a distributed file system with improved metadata management. Furthermore, the

use of In-memory caching can significantly reduce response time and improve overall system responsiveness.

In conclusion, the architecture for storing and processing small files across distributed systems is an important consideration in the era of big data. By addressing the challenges associated with managing small files through effective architectural design, organizations can increase the efficiency, scalability, and reliability of their distributed systems. Applying hierarchical storage techniques, improving metadata management, and using in-memory caching mechanisms are key components of a comprehensive solution to the small file storage and processing dilemma. By adopting these architectural design principles, organizations can effectively manage the growing number of small files and realize the full potential of distributed systems.

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# A review of IoT Technology in Agriculture: Applications and Future Direction and Challenges

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**Abstract**—A developing communication technology known as the Internet of Things (IoT) based agriculture is being increasingly used by farmers and businesspeople in the agricultural sector to carry out agricultural agro-chores on the farm to lower labor costs, improve monitoring, and increase productivity. This study is an attempt to provide a comprehensive foundation on the Internet of Things (IoT), as well as IoT in agriculture and system architecture. This paper is among the first to provide applications of IoT in agriculture including management systems (such as agricultural machinery, farm, and water), monitoring systems (such as disease fields, greenhouse. livestock, pest, and soil), control systems (such as farm, greenhouse, irrigation, and water quality), and unmanned machinery (such as autonomous machinery and unmanned aerial vehicle). This paper discusses the future direction and challenges for IoT in agriculture. This study has the potential to be useful for academics who are working on IoT and agriculture because it highlights areas that require additional development. Through the process of designing and developing any new approach for IoT in agriculture, this document has the potential to serve as a guide and reference.

**Index Terms**—*Agriculture-based IoT, IoT in Agriculture, Agriculture IoT Application, Agriculture IoT Approach, Agriculture IoT Review.*

## I. INTRODUCTION

The United Nations' Global Food and Agriculture Report [1], [2] stated that it was anticipated that the demand for food would increase by an additional 70 percent in order to satisfy the requirements of a population that is forecast to be 10.1 billion by the year 2050. Additionally, it has been discovered that roughly 58% of the population in India and approximately 26.7% of the global population are dependent on agriculture and agriculture for their means of subsistence for their livelihood [3]. According to the report on the economic survey of India for the fiscal year 2020–21, India's total food grain production in the fiscal year 2020 was registered at 296.65 million tons. Due to the high degree of dependence, agriculture is a crucial role in the improvement of higher yields, as well as improvements in quality and production. The volatility of food prices, the effects of climate change, and the accuracy of harvest projections are all important criteria that need to be addressed. There is a direct connection between these parameters and problems such as malnutrition and undernutrition [4], [5]. These parameters have a significant influence on the economy.

Anticipate that by the year 2050, the world's population of nine billion people will be confronted with the difficulty of feeding themselves. It is of the utmost importance to guarantee food security, implement environmentally responsible farming techniques, and effectively manage resources. Traditional farming methods, despite their longevity and dependability, are no longer able to satisfy the requirements of the global market. The ancient method of farming is being combined with the cutting-edge technology of the Internet of Things (IoT) to address this issue. The current technological revolution has led to this result, which is the result of the revolution.

A significant shift in agriculture has the potential to alter how we develop, manage, and safeguard our food resources. Agriculture 5.0 is the nomenclature given to this transformation. In the field of precision agriculture, this is a contemporary method that makes use of computers and electrical devices to create autonomous decision support systems. It makes use of technology such as artificial intelligence, robotics, and the Internet of things [6], [7]. To improve agricultural operations, IoT in agriculture makes use of data analytics, automation, and interconnected equipment. Monitoring the conditions of the soil in real-time, controlling irrigation systems remotely, keeping track of the health of livestock, and accurately predicting crop harvests are all possible applications of this technology. Currently, a large number of industrialized and developing nations, including China, India, the United States of America, and Israel, are making extensive use of agriculture that is based on the IoT in agriculture [8]. Numerous information technology companies, including Microsoft, Dell, Google, Watson, IBM, Jasper, Intel, HPE, CISCO, Hello Tractors, Farm 2050, and Qualcomm, are continuously working on developing IoT in agriculture solutions that would have a significant impact on the economy [9].

The remainder of this work is organized in the following manner. Section II introduces the background of this paper. Section III provides the applications of IoT in agriculture. Section IV shows the challenges in digital forensics. Section V discusses future direction and challenges. Lastly, the conclusion of this paper is provided in Section VI.

## II. BACKGROUND

## A. Review of IoT

The Internet of Things (IoT) is a network of networked gadgets that collect and share data [10], [11]. These devices range from smartwatches to refrigerators. The everyday experiences are being revolutionized as a result of this network's ability to cross the gap between the digital and the physical [12]. As a result of the symphony of information that is pouring through the Internet of Things (IoT), imagine houses that respond to your tastes, cities that optimize traffic flow, and industries that streamline operations. This rapidly developing technology has a great deal of potential, but it also raises concerns about privacy and safety. We must make sure that this interconnected future is developed responsibly as we navigate it [13].

## B. Review of IoT in Agriculture

There are many different industries that are being revolutionized by the Internet of Things (IoT), and agriculture is not an exception. Through the use of a network to connect sensors, devices, and equipment, the Internet of Things is resulting in the transformation of conventional farming practices into datadriven, precision agriculture. The following is a summary of its effects:

- **Increased Efficiency:** A focused approach to irrigation, fertilization, and pest management is made possible by sensors that monitor soil moisture, nutrient levels, and meteorological conditions. By doing so, waste is reduced, resource utilization is optimized, and yields are increased.
- **Improved Productivity:** When it comes to chores such as planting, weeding, and harvesting, automation through connected devices, such as drones for crop monitoring and robotic harvesters, can drastically cut down on human expenses and significantly boost efficiency.
- **Enhanced Decision Making:** Data collected in real time by sensors enables farmers to make educated decisions regarding their crops, thereby reducing the likelihood of losses and increasing the potential for profit.
- **Remote Monitoring and Management:** With the help of smartphones and tablets, farmers are able to remotely monitor their crops and even respond in real-time to any changes that may occur.
- **Precision Livestock Management:** Sensors monitor the health and behavior of animals, which has the potential to detect diseases at an earlier stage, increase animal welfare, and optimize feeding operations.

### C. System Architecture of IoT in Agriculture

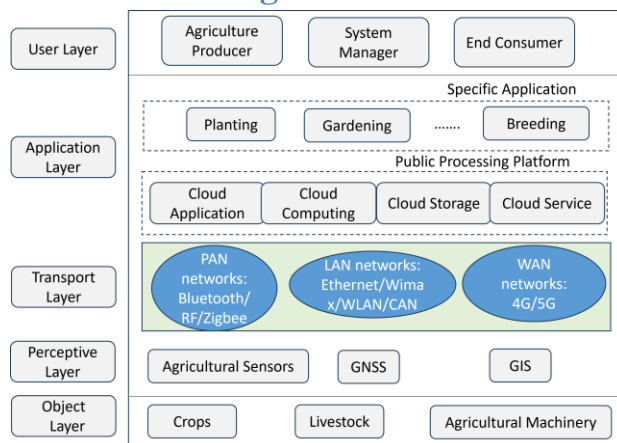


Fig. 1. System Model of IoT in Agriculture.

An agricultural IoT system's design and implementation are based on the system architecture. It is for this reason that academics from all over the world have studied architectural IoT extensively and come up with many proposed designs. The majority of academics agree that there are three distinct levels to the Internet of Things (IoT) architecture: the perception, transport, and application layers. There are two major issues with this overarching way of division: first, it doesn't take into account the unique traits and variations of users; and second, it doesn't describe the features and variations of IoT technology in certain industrial applications. In order to address this limitation, we propose a five-layer design for agricultural IoT systems: user, application, transport, perception, and object. According to [14], Figure 1 shows the function, composition, and logical relationship of each layer. Here are the procedures to follow in order to understand agricultural IoT architecture: (i) Generalise the many kinds of Internet of Things applications and use cases. (ii) Suggest the overarching criteria and guiding principles for the Internet of Things architecture. (iii) Describing the overall framework and functional structure, and further subdividing the IoT's core architecture

### III. APPLICATIONS OF IOT IN AGRICULTURE

## A. Management System

The following is an example of how the management system is used to numerous aspects in agriculture, including farms, energy, water, and agricultural machinery.

1) *Agricultural Machinery*: As part of the agricultural machinery service management system, the installation of remote monitoring terminals on large-scale intelligent agricultural machinery, as well as the development of accompanying mobile application and server software, were essential components [15].

2) *Farm*: Research by [16]–[18] suggests that farmers could benefit from internet of things (IoT)-based farm management information systems (FMISs) that would help them organise and make sense of all the data collected by sensors placed around their farms.

3) *Water*: The implementation of the multiintelligent control system (MICS) for the management of agricultural water resources was in response to the growing urgency of water shortages [19], [20].

## B. Monitoring Systems

Many agricultural research have focused on various aspects of monitoring, such as soil, livestock, illnesses, greenhouses, fields, and pests.

1) *Disease*: An early illness forecasting system for plants was developed using an Internet of Things (IoT) cognitive monitoring system [21], [22]. Automated crop disease recognition in the wild was proposed by [23] and implemented in the agricultural IoT using a multicontext fusion network (MCFN).

2) *Field*: Improved crop quality and yield can be achieved through the use of field monitoring in agriculture. One common use of the Internet of Things (IoT) in agriculture is field monitoring, which makes use of inexpensive sensors and networks. [24] suggested a smart field monitoring system for agriculture that tracks soil temperature and humidity.

3) *Greenhouse*: According to [25], the quality and productivity of plants in greenhouses are greatly influenced by environmental parameters including temperature and humidity.



4) *Livestock*: Poultry [26]–[28], cows, and other animal types have all had their data collected by agricultural monitoring systems.

5) *Pest*: In order to stop pests like the giant Oriental fruit fly (*Bactrocera dorsalis* (Hendel)) from coming back, an autonomous early warning system was suggested [29]. The overuse of chemical pesticides by farmers was mitigated by this system.

6) *Soil*: It is crucial to keep the soil in an ideal condition for crop growth since the soil environment influences crop growth in a direct manner. By keeping tabs on the soil, farmers can improve their methods and increase crop yields [30]. [31] developed an Internet of Things (IoT)-based smart soil monitoring system for agricultural output.

### C. Control Systems

The Internet of Things (IoT) is being utilised in the agricultural sector to regulate several resources, including greenhouse and farm environments, irrigation, and water quality [32]. Optimal growing conditions are maintained through the use of control systems in agriculture, allowing farms to produce high-quality crops.

1) *Farm*: The development of a control system that utilises Internet of Things technology in agricultural production was reported by [33]. in 2015. In the agricultural setting, the control system managed the actuators and collected data from autonomous sensor devices.

2) *Greenhouse*: Greenhouses have a significant impact on crop growing conditions, thus it's important to keep them in good shape to maximise crop quality and production. In their study, [29] used an Internet of Things (IoT) greenhouse to track environmental variables, determine the optimal temperature and relative humidity for plant growth, and design a control system to keep the greenhouse at those ideal values. 3) *Irrigation*: According to [34], irrigation systems that are connected to the internet of things help farmers make better use of water resources. There have been a plethora of studies done on irrigation systems that utilise the internet of things to provide the soil with the ideal amount of water it needs [35]. 4) *Water Quality*: [36] described the development of Internet of Things (IoT) smart systems that control water quality depending on pH to cleanse municipal wastewater and reuse it for agricultural applications.

## D. Unmanned Machinery

1) *Autonomous Machinery*: Since the concept of precision agriculture arose in the 1980s, utilising many modern sensor systems, autonomous agricultural machinery has been in development. International pioneers in agricultural machinery have created a tractor that uses GPS autoguidance technology to cut down on labour needs and increase productivity [37].

2) *Unmanned Aerial Vehicle*: Unmanned aerial vehicles (UAVs) powered by the Internet of Things (IoT) have helped elevate precision agriculture beyond conventional farming methods [38]. The agriculture industry is anticipated to benefit from the advanced technology that UAVs bring by way of data-driven strategies and plans that are based on real-time processing.

Figure 2 shows the four main areas of application for the Internet of Things (IoT) in agriculture, as described by [39], [40]: (a) management systems, (b) monitoring systems, (c) control systems, and (d) unmanned machinery.

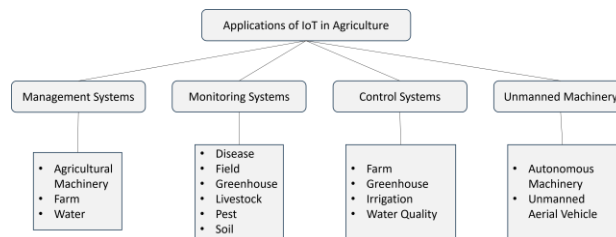


Fig. 2. Applications of IoT in Agriculture.

## IV. CHALLENGES IN DIGITAL FORENSICS

The identification of digital evidence, as well as its preservation, investigation, analysis, and presentation, are all aspects of digital forensics, which is a methodical and scientifically proven technique [41]. The technique of investigating digital devices with the aim of unearthing evidence is known as digital forensics. An assortment of digital gadgets, such as laptops, cell phones, personal digital assistants (PDAs), palmtops, hard drives, gaming systems, audio devices, digital cameras, and devices based on the Internet of Things (IoT), are among the examples that are investigated. Internet of Things (IoT) gadgets are at the top of the list of digital devices because they are an easy target for criminal activities [42], [43]. Law enforcement authorities understand that

modern life comprises a separate set of technologies. A sensor, gateway, network, the internet, and the cloud are all components that are included in the agriculture in IoT, which is a subset of the Internet of Things (IoT). It inherits essentially identical issues in Digital Forensics (DF) to those present in the Internet of Things (IoT). The purpose of this research is to examine a variety of DF concerns and issues in the agriculture in IoT sphere by reviewing different studies.

There are a few forensic frameworks that have been recognized and developed in the past to facilitate the process of gathering and analyzing evidence that is associated with the Internet of Things (IoT). A framework that is utilized for the gateway of the smart home is a framework that is known as the Forensic Edge Management System (FEMS) framework [44]. The dynamic nature of the Internet of Things environments, including elasticity, virtualization, volatility, multitenancy, and multijurisdiction, is addressed by Almolhis et al. [45]. There have been numerous scholars who have proposed an Internet of Things forensics model. In this review article, concerns and challenges from the field of Internet of Things (IoT) forensics have been discussed, along with a comparative study of the various approaches. A holistic forensic model for the Internet of Things was presented by Sadineni et al. [46], which was based on ISO/IEC 27043. There are three components that form the foundation of this model: forensic preparedness, initialization, and investigation (including proactive, incident, and reactive). It is possible to construct a variety of Internet of Things applications using this comprehensive framework, which is recommended by this model. Saleh et al. [47] addressed the primary difficulties that arise from the heterogeneity of IoT infrastructures, which include the complexity and ambiguity of forensics in the Internet of Things (IoT). Several Internet of Things (IoT) forensic models and frameworks have been examined by them. These models and frameworks cover a variety of IoT applications and phases of development. Through the utilization of the meta-modeling technique, the authors suggested a standard Internet of Things (IoT) forensic model that they referred to as the Investigation Process Model (IPM). The CIPM that has been proposed is comprised of four standard investigation processes, which are the preparation, collection, analysis, and report operations. For the purpose of

categorizing the interconnection between devices, Kim et al. [48] presented an Internet of devices forensic model. In order to meet the issues of Internet of Things forensics, such as the preservation of digital provenance, inspection, and analysis, this assists in identifying every interconnected thing of Internet of Things nodes on a network forensics framework that is enabled by blockchain technology. The task that was recommended was supposed to be carried out with the intention of utilizing the genetic fuzzy expert system for examination and analysis. Using hyper ledger fabric and private-permissioned blockchain, the authors' primary concern was to ensure that the chain of custody and privacy integrity were preserved in order to accomplish the goal of achieving integrity. In their study, Sadineni et al. [49] highlighted the difficulties associated with disclosing and comparing significant artifacts from network packets in order to reconstruct attack scenarios during the period of forensic Internet of Things.

In order to investigate network-level assaults in an Internet of Things context, they suggested a novel provenance-based forensic model called ProvNet-IoT. This model was developed in response to said problem. In an article that is quite similar to this one [50], Sadineni and colleagues introduced ProvLinkIoT, which is a unique provenance-based paradigm for the collecting of evidence and forensic analysis in Internet of Things networks. The efficiency of their proposed approach was demonstrated through the use of a case study that was carried out on 6TiSCH networks. Specifically, Liu et al. [51] raised concern that holistic forensics of the Internet of Things (IoT) could not be beneficial in all applications of the IoT, and that there is a requirement for a forensic framework that is tailored to each aspect of the IoT application. To determine the origin of evidence, they provided a digital forensics model that addresses Internet of Things devices, networks, and cloud storage. When it comes to digital forensics, it is necessary to design a specialized model for a certain kind of Internet of Things application. The Internet of Things environment does not make use of a uniform architecture or file format because of the wide variety of sensors, storage, and SBCs that are available. Specifically for agriculture in IoT, we developed a Digital Forensics Model (DFM) to fill this void. The DFM consists of five stages: the first stage is identification, followed by collection,

examination, analysis, and finally presentation. Below, we will go into further depth about each of these stages. The application of these forensic phases is carried out asynchronously on each layer of agriculture in the Internet of Things architecture, which is structured in chronological order.

## V. FUTURE DIRECTION AND CHALLENGES

The deployment of IoT applications is fraught with numerous unanswered questions and difficulties. This section has covered some of the difficulties found in the literature.

- **Security:** There are varying degrees of security concern with agricultural systems that rely on the internet of things (IoT). Data loss and other on-field parameters are only a few of the problems users have as a result of inadequate security. Potential physical threats to Internet of Things (IoT) devices in agricultural settings include attacks by animals and predators as well as changes to physical addresses.
- **Lack Knowledge of Technology:** The biggest problem for farmers in rural areas is their lack of knowledge about technology. Since the majority of farmers in underdeveloped nations lack formal education, this is a prevalent issue there.
- **Reliability:** Internet of Things (IoT) devices used in agriculture are often left exposed to the elements, which can lead to malfunctions in communication and even the degradation of the sensors themselves.
- **Scalability:** Because there are so many Internet of Things (IoT) devices and sensors used in farming, a smart IoT management system is needed to track and manage each node individually.
- **Localization:** When deploying devices or sensors, there are a lot of things to think about. Without deploying more devices with unnecessary configuration, these devices should be able to support and function for the rest of the world.
- **Accuracy and Stability:** The current standard for the Internet of Things architecture calls for a separation of responsibilities into three distinct layers: perception, transport, and application. When it comes to the structure of the Internet of Things (IoT), there is a dearth of research and discussion compared to that of a single layer. As a result, the reliability of data transmitted by IoT devices is compromised, leading to delays in data sharing, transmission safety risks, inaccurate placement, and other issues.

- Many Sensors: The wide variety of sensors, each with its own unique set of communication protocols and interfaces, necessitates a plethora of software and hardware components and makes future expansion a daunting prospect. At the heart of the Internet of Things (IoT), there is a lack of research and implementation of embedded gateway middleware, and the majority of these efforts are still in their early phases.
- Research Technologies: There is a dearth of research on comprehensive application systems in the field of agricultural IoT monitoring and perception, with most studies concentrating on data collecting and processing on a single unit. The optimisation of a small number of technologies has received the majority of the attention in the study and implementation of IoT in intelligent agricultural machines.
- WAN issues: Data transmission in the agricultural IoT is dependent on fast wireless WAN. It is not feasible to provide high-speed data transmission in rural agricultural areas due to the weak wireless communication signal. Thus, the only way to guarantee the system's real-time performance is to increase the data coding efficiency.

## VI. CONCLUSION

This paper has reviewed IoT technology in agriculture. The Internet of Things (IoT) is flourishing in the agricultural sector, creating a web of interconnected devices that are the driving force behind the transformation of conventional farming methods into data-driven precision farming. Even though there are still obstacles to overcome, such as cost, connectivity, and data security, the potential benefits are enormous. There are four main applications called management systems, monitoring systems, control systems, and unmanned machinery for IoT in agriculture. To successfully track culprits and provide support to law enforcement agencies, it is vital to have a digital forensic model or framework to trace IoT technology in agriculture. The potential damage that can be caused by an agriculture in IoT system that has been hacked or is insecure has also been explored by a few researchers.

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## Cytokine storm in COVID-19 patients at Salahuddin proviance

### عاصفة الساييتوكين في لدى مرضى كوفيد-١٩ في محافظة صلاح الدين

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## ABSTRACT

In the late of December 2019, In Wuhan, China, a new virus known as COVID-19 (coronavirus disease 2019) was identified. Iraq learned of its first COVID-19 patient on February 24, 2020. A student who went there from Iran. This condition is brought on by the zoonotic virus known as SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus 2). There are many biomarkers might possibly elevate in COVID-19 patients, but there are currently no early biochemical markers utilized in clinical settings to estimate COVID-19 severity. The SRS-CoV-2 coronavirus is the cause of the most recent pandemic, COVID-19. The goal of the study was to identify patient groups with COVID-19 and healthy controls using a two biomarkers. Biochemical profiles of 60 patients with SARS CoV-2 RNA positive testing at salahuddin province was suffering from respiratory distress syndrome and 30 healthy controls were gathered and examined. All biomarkers were subjected to two-dimensional automated hierarchy clustering, and control groups were tested. This findings show that COVID-19 patients have higher levels of inflammatory cytokines, especially IL-6 and TNF-alpha, This findings aid in understanding the reaction of COVID-19 and cytokine storm which represent the main cause of organ dysfunction in severe coronavirus infections or death. .

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Key words: COVID-19, IL-6, TNF-alpha, Cytokine storm.

## الخلاصة

في أواخر ديسمبر ٢٠١٩، تم التعرف على فيروس جديد يُعرف باسم كوفيد-١٩ (مرض فيروس كورونا ٢٠١٩) في مدينة ووهان الصينية. تم التعرف عليها في العراق بأول مريض بفيروس كورونا في ٢٤ فبراير ٢٠٢٠ من طالب إيراني. يحدث هذا المرض بسبب فيروس حيواني المنشأ يُعرف باسم سارسكوف ٢ (متلازمة الجهاز التنفسي الحادة الوخيمة فيروس كورونا ٢). هناك العديد من المؤشرات الحيوية التي من المحتمل أن ترتفع لدى مرضى كوفيد-١٩، ولكن لا توجد حاليًا علامات كيميائية حيوية مبكرة تُستخدم في القياسات السريرية لتقدير مدى خطورة كوفيد-١٩ وعلاقته

بهذه المؤشرات. إن فيروس كورونا SRS-CoV-2 هو السبب المسؤول عن المرض وهو ما يعرف بكوفيد-١٩. الهدف من هذه البحث هو دراسة مجموعات المرضى المصابين بكوفيد-١٩ ومجموعة السيطرة باستخدام اثنين من المؤشرات الحيوية. كان مستوى تركيز المواد الكيميائية الحيوية لـ ٦٠ مريضاً مصابين بفيروس SARS CoV-2 RNA في محافظة صلاح الدين يعانون من متلازمة الضائقة التنفسية وتم جمع وفحص ٣٠ من الأصحاء كمجموعة سيطرة. تم تحليل المؤشرات الحيوية بشكل مجموعتين، وتم اختبار مجموعات السيطرة وتظهر هذه النتائج أن مرضى كوفيد-١٩ لديهم مستويات أعلى من السيتوكينات الالتهابية، وخاصة IL-6 و TNF-alpha، وتساعد هذه النتائج في فهم تفاعل السيتوكينات الالتهابية مع مرض كوفيد-١٩ وعاصفة السيتوكين التي تمثل السبب الرئيسي لفشل الأعضاء في حالات العدوى الشديدة بفيروس كورونا أو الوفاة.

الكلمات المفتاحية: كوفيد-١٩، انترلوكين\_٦، عامل نخر الورم الفا، عاصفة السيتوكين.

## INTRODUCTION

The World Health Organization (WHO) proclaimed COVID-19 to be a pandemic in March 2020. 1 Since then, 216 countries and regions have reported cases of COVID-19, and as of February 2013, 502,906 deaths had been confirmed in those cases. Clinical traits of SARS-COVID-2, SARS-COVID-1, and MERS-COVID are similar. despite the fact that the patients may have moderate infection similar to influenza 2. The reason why some people develop serious illnesses and others don't is still a mystery. Comorbidities and laboratory markers have been considered for risk categorization. There is growing evidence that in critically sick patients, hyperinflammation is linked to hyperferritinemia, C-reactive protein (CRP) and D-dimer this might considerate that the pathophysiology of COVID-19 disease may be significantly influenced by a phenomena cytokine storm<sup>3,4</sup>. In the event of a pandemic, the tested biomarkers that indicate COVID-19 pathology are very necessary particularly in the case of respiratory or artificial support preparation. 5 a pro-inflammatory cytokine, encourages the development of neutrophils, cytotoxic T-lymphocytes,

and natural killer cells 6 When cells are stimulated by IL-1 or tumor necrosis factor (TNF)-a, or when toll-like receptors (TLR)-4 are activated, IL-6 production release are induced 7

Tumor Necrosis Factor-alpha regard as pro-inflammatory chemical substances which regulate cell proliferation and cell death. It is located on chromosome 6p21.33 inside the HLA III region.8 Macrophages are one of the main sources of TNF-a. It is mostly produced by active macrophages and monocytes, numerous cells, including T and B cells, osteoblasts, smooth muscle cells, endothelium, epithelial, and tumor cells, can also release it. 8 This study aimed to evaluate the IL-6 and TNF alpha levels in COVID-19 patients and to have an insight if there is a connection between the IL-6 and TNF-alpha with inflammatory biomarkers in COVID-19 patients.

## MATERIALS AND METHOD

This study, are of a case control, was conducted in august 2022. Five milliliters of whole blood then we obtained a 1ml of serum were taken from each of the sixty (60) COVID-19 patients cases and the thirty (30) healthy controls. The study included all patients who were over the age of 18 and had a positive Nasopharyngeal swab-RT-PCR result who had been hospitalized to COVID-19 and admitted to different local hospitals , an ELISA test (Mindray, China) to detect concentration of cytokines (IL-6, TNF- $\alpha$ ).

## RESULTS

This study had includes 60 individuals infected with coronavirus ,and 30 healthy control According to the descriptive statistics, the average disease duration for COVID-19 patients was 7-14 days, with a maximum disease duration of 20 days. After this period, the symptoms started to fade and the patients were discharged from the hospital.

IL-6 and TNF - $\alpha$  Table 1 and fig ,1,2 displays mean of each category. It can be shown that high mean levels of IL-6 concentration (p 0.01) and TNF-  $\alpha$  (p 0.01) between the research groups. Patients with severe levels of IL-6 were 58.71 $\pm$ 39.52 pg/ml and 10.45 $\pm$ 10.95 pg/ml for healthy controls. Patients of

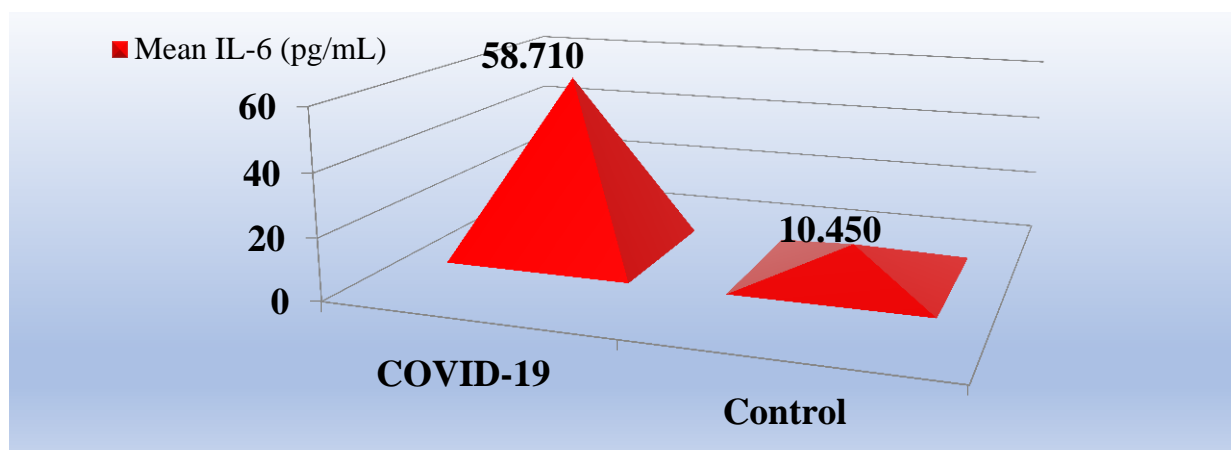


severe COVID-19 had levels of  $126.35 \pm 70.70$  pg/ml of TNF- $\alpha$ , whereas  $73.14 \pm 13.48$  pg/ml for control group.

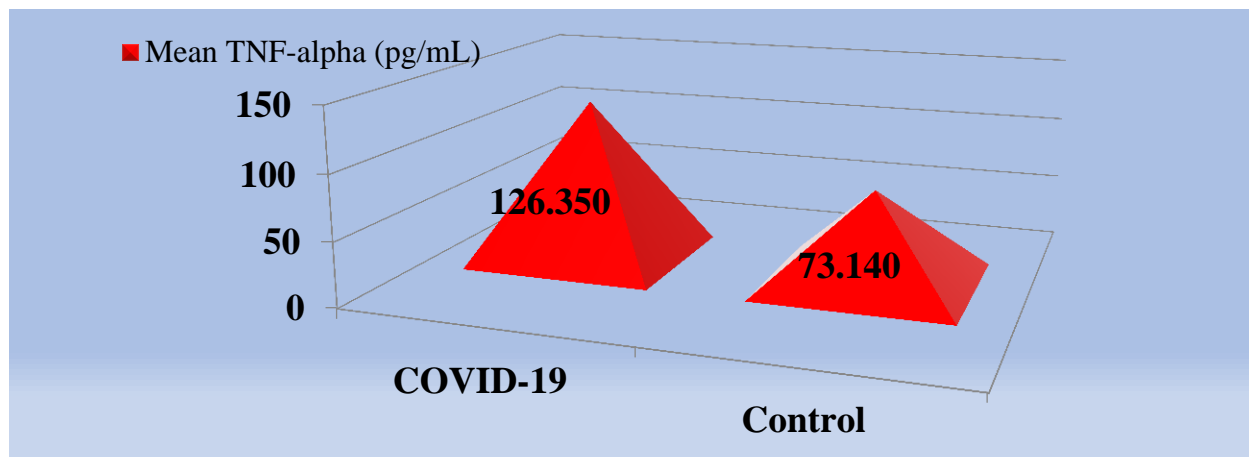
**Table 1: Descriptive Statistics of IL-6 and TNF- $\alpha$ , in patients with COVID-19.**

IL-6 (pg/mL)		COVID-19 patients	Control	P value
Mean $\pm$ SD (Range)		$39 \pm 58$	$10.45 \pm 10.95$ (0.797-53.6)	* $\langle, \langle \langle \langle$
TNF- $\alpha$ (pg/mL)				
Mean $\pm$ SD (Range)		$70 \pm 126$	$73.14 \pm 13.476$ (38.48-110.4)	* $\langle, \langle \langle \langle$

**^Significant difference among more than two independent means using ANOVA-test at 0.05 level.**



**Figure 1: IL-6 frequency in the two groups**



**Figure 2: TNF- $\alpha$  frequency in the two group**

## DISCUSSION

to explain the high levels of cytokine production that are responsible for inducing immunopathological reactions during infectious processes, the term "cytokine storm" was developed. Among the inflammatory mediators released by immune cells, the cytokines IFN-gamma, IFN- $\alpha$ , IL-1, IL-6, TNF- $\alpha$ , and TGF are highlighted, and altered levels are associated with different clinical features either metabolically triggered as a result of an infection<sup>10,11</sup> What is the relationship between COVID-19, cytokines, inflammation, and spices? Accordingly, this investigation assessed the levels of TNF- $\alpha$  and IL-6.

High levels may be associated with to production of inflammatory cytokines in acute COVID-19 individuals. Although cytokines fight microbes, an immune system overreaction can harm lung tissue. Inflammatory cytokines and tissue damage lead to its production in COVID19 patients<sup>12</sup>. As our understanding of COVID-19, the authors found that the frequency of thrombotic episodes and the use of decreasing mortality with heparin. The scientists In autopsy reports, there

are several thromboembolic occurrences, both clinical cases and histopathological series. based upon We might state that these and coagulation indicators COVID-19 is Prothrombotic disease. As stated by Scientists discovered platelet abnormalities, altered blood flow, and vascular endothelium abnormalities. malfunction that resulted in numerous different thrombosis within COVID-19.12

The current study comparable to the study involved of 2377 patients adults were hospitalized with COVID-19 who had D-dimers more than 2000 ng /mL, which regarded as a risk factor . hematological agglutination incidence of 37.8%, renal injury for about 58.3% , and death for about 47%. (the critical disease being regarded as death, mechanical ventilation, or stay in intensive care).15 The study of 29 randomized studies which represented 4328 patients with COVID-19 found that severe patients had higher average of cytokines concentrations .13 well known study discovered that patients infected with COVID-19 who had elevated thrombosis biomarkers at the beginning of their infection were at high risk of developing the sickness and dying. 12. in this study had observably higher levels of IL-6 (P 0.001). The conclusions of Liu's inquiry were approved by his coworkers in 2020.14

Other researchers found that 67.9% of patients had higher IL-6 levels upon admission. The percentage of patients in the severe category who had elevated IL-6 levels was significantly higher (P 0.001). 14. and that similar to our study. Additionally, the Coomes et al study from 2020 discovered that individuals with COVID-19 had noticeably higher IL-6 levels, which were connected to worse clinical outcomes, based on the comparability of data between investigations. The severe group had considerably higher blood levels of IL-6 than the non-severe group , In studies describing the immunological features of severe cases of COVID-19, significant levels of circulating cytokines especially IL-6 as well as high concentrations of various inflammatory indicators as complete blood count values have been documented 15.

TNF- $\alpha$  was strongly correlated with the presence of coronavirus . This finding might point to a particular cytokine profile that was present at this stage of coronavirus infection. According to the study by Costella-Ruiz et al. 2020,

the patients with elevated level of Interleukin-6 and TNF- $\alpha$  was associated with the severe and harm immune response that contributed at coronavirus infection rate. Additionally, even in severely ill COVID-19 patients who were hospitalized, IL-6 and TNF- $\alpha$  a normal range were found. Similarly, data on the use of anti-TNF-  $\alpha$  are indicative of a treatment use in patients infected with coronavirus . as a Compared to other immune-suppressing medications, collected informations of patients who are uptaking anti-TNF  $\alpha$  medications suggest a lower ratio for coronavirus bad health or even and death 16. Clinical severity, lung fibrosis, and mortality in COVID-19 patients are predicted by proinflammatory cytokines.

## CONCLUSION

The spread of the COVID-19 disease is driving up the cost of healthcare globally. This study is imply that early assessed the concentration of IL-6 and TNF-  $\alpha$  is a reliable indicator of severe illness in COVID-19 patients. The results of the current investigation could help clinicians and healthcare professionals in identifying COVID-19 patients who may be seriously ill or in need of immediate attention.

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وزارة التعليم العالي والبحث العلمي  
كلية المصطفى الجامعة

## البحوث المشاركة في المؤتمر (المحور الطبي)

ملاحظة: جميع البحوث خاضعة للاستلال الالكتروني





## Association between Gestational Diabetes Mellitus and Physical Activity Level among A Sample of Pregnant Women Attending PHC Centers in Baghdad City

العلاقة بين داء سكري الحمل ومستوى النشاط البدني لدى عينة من النساء الحوامل المترددات على مراكز الرعاية الصحية الأولية في مدينة بغداد

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## ABSTRACT

Gestational diabetes was rarely seen. However, more women are starting to observe this phenomenon in the last few years. The study aims to identify the association between gestational diabetes and physical activity level among women attending PHC centers in Baghdad City. A case-control study including 98 cases and 98 controls in primary healthcare facilities was done. Cases and control groups were selected for study using a multi-stage sample technique using body anthropometry and direct interviews. The data collection continued from 14 August to 14 November 2023. The results of the study indicate that women who have a low level of education, such as illiterate, and who read and write (OR= 23.947 (95% C.I=2.906-197.374, and, OR= 3.684 (95% C.I 1.664-8.159 respectively) have an increased risk of developing gestational diabetes compared to women who have a high level of education. As for other demographic variables such as age groups, occupational status, crowding index, and SES, there is no significant association with GDM (P value >0.05). Also, the results indicate morbid obesity and obesity increase the risk of developing gestational diabetes compared to normal weight (odd ratio; 8.486, and 4.190, respectively). Furthermore, UMAC and weight values also show significant differences between the two groups, with p-values of 0.009 and 0.0001, respectively. Furthermore, the results reveal that higher IPAQ scores are associated with a lower prevalence of GDM. Low IPAQ scores were associated with 92.9% of GDM, compared with 86.7% in the control group. Moreover, regarding women with GDM, the mean±SD (228.2±252.3) was significantly lower than the control group (464.8±958.8). These results indicate the association between higher BMI categories, advancing maternal age, low socio-economic status, living in urban regions and women with low physical activity before and during pregnancy are strongly associated with increased risk of GDM.

**Keywords:** Gestational diabetes; physical activity level; association; primary health care centers; Baghdad city.

معلومات المادة	خلاصة
تاريخ المادة: تلقى العشرين فبراير ٢٠٢٣ قبلت	ونادرا ما شوهد سكري الحمل. ومع ذلك، بدأ المزيد من النساء في ملاحظة هذه الظاهرة في السنوات القليلة الماضية. تهدف الدراسة إلى التعرف على العلاقة بين سكري الحمل ومستوى النشاط البدني لدى النساء المترددات على مراكز الرعاية الصحية الأولية في مدينة بغداد. تم إجراء دراسة الحالات والشواهد بما في ذلك ٩٨ حالة و ٩٨ مجموعة مراقبة في مرافق الرعاية الصحية الأولية. تم اختيار الحالات والمجموعات الضابطة للدراسة باستخدام تقنية عينة متعددة المراحل باستخدام القياسات البشرية للجسم والمقابلات المباشرة. استمر جمع البيانات في الفترة من ١٤ أغسطس إلى ١٤ نوفمبر ٢٠٢٣. وتشير نتائج الدراسة إلى أن النساء ذوات المستوى التعليمي المنخفض، مثل الأميات، واللواتي يقرأن ويكتبن (نسبة الأرجحية = ٢٣,٩٤٧ (فاصل الثقة ٩٥% = ٢,٩٠٦-١٩٧,٣٧٤، ونسبة الأرجحية = ٣,٦٨٤ (٩٥% CI ١,١٥٩-١,٦٦٤ على التوالي) لديهم خطر متزايد للإصابة بسكري الحمل مقارنة بالنساء اللاتي لديهن مستوى تعليمي عالٍ. أما بالنسبة للمتغيرات الديموغرافية الأخرى مثل الفئات العمرية، والحالة المهنية، ومؤشر الازدحام، و SES، لا يوجد ارتباط كبير مع GDM (قيمة >0,٠٥P). كما تشير النتائج

<p>إلى أن السمّة المرضية والسمّة تزيد من خطر الإصابة بسكري الحمل مقارنة بالوزن الطبيعي (نسبة الغريب؛ ٨,٤٨٦، ٤,١٩٠، على التوالي). تُظهر قيم UMAC وقيم الوزن أيضًا اختلافات كبيرة بين المجموعتين، حيث تبلغ القيم <math>p &lt; 0,0001</math> و <math>0,009</math> على التوالي. علاوة على ذلك، تكشف النتائج أن درجات IPAQ الأعلى ترتبط بانخفاض معدل انتشار GDM. ارتبطت درجات IPAQ المنخفضة بنسبة ٩٢,٩% من GDM، مقارنة مع ٨٦,٧% في المجموعة الضابطة. علاوة على ذلك، فيما يتعلق بالنساء المصابات بـ GDM، كان متوسط <math>DS \pm (228,2 \pm 252,3)</math> أقل بكثير من المجموعة الضابطة <math>(8,464 \pm 958,8)</math>. تشير هذه النتائج إلى أن الارتباط بين فئات مؤشر كتلة الجسم الأعلى، وتقدم عمر الأم، وانخفاض الوضع الاجتماعي والاقتصادي، والعيش في المناطق الحضرية، والنساء ذوات النشاط البدني المنخفض قبل وأثناء الحمل يرتبطان بقوة بزيادة خطر الإصابة بـ GDM.</p> <p>الكلمات المفتاحية: سكري الحمل؛ مستوى النشاط البدني منظمة؛ مراكز الرعاية الصحية الأولية؛ مدينة بغداد.</p>	<p>العشرين أبريل ٢٠٢٤ النشر XX يونيو ٢٠٢٤</p>
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## INTRODUCTION

Gestational diabetes mellitus (GDM)[1] is an intolerance to carbohydrates that manifests as variable-severity hyperglycemia and starts or is first seen during pregnancy [2]. Carbohydrate, lipid, and amino acid metabolisms are all significantly altered during a healthy pregnancy [3]. Globally, the overall incidence of GDM is between 2 and 32%, and it affects a total of 18.4 million live births. [4]. linked to the rise in pregnant women's obesity and overweight frequency. The risk ratio (RR) for gestational diabetes mellitus is increased by 2-3 and 5–6 fold in overweight and obese women compared to normal-weight women, respectively [5]. Even in pregnant women with GDM, exercise and physical activity are supported and encouraged. Pregnancy benefits from moderate exercise include a decreased risk of developing GDM, a lower probability of macrosomia baby, a decreased risk of hypertension disorders, and a decreased risk of premature births without an increase in restriction of fetal growth. [6]. Increased physical activity during pregnancy is one of the most favoured treatments for gestational diabetes mellitus (GDM), which is frequently recommended. It is normal to observe that GDM is typically controlled through glycemic control [7]. For women who have already experienced gestational diabetes during a previous pregnancy, it is especially important to maintain a healthy weight, eat nutritious foods, and engage in regular physical activity and sports before becoming pregnant in order to avoid developing gestational diabetes. [8]. There isn't currently a systematic plan in place to avoid GDM. The similarity between the pathophysiology and risk factors of GDM and T2DM is thought to make it likely that interventions that are successful in avoiding T2DM are likely to be successful in treating GDM.

These include gaining weight during pregnancy, changes in obesity rates, physical activity levels, and eating habits. As with T2DM, identifying population determinants is crucial to lowering rising GDM rates. [9].

### Nomenclature & Symbols

GDM	Gestational diabetes mellitus	SPSS	Statistical Packages for Social Sciences
WHO	World Health Organization	SES	Socioeconomic Status
PA	Physical activity	SD	Standard Deviation

## 1.1 Aim of the Study

The study aims to identify the association between gestational diabetes and physical activity levels among women attending PHC centres in Baghdad city.

The purpose statement should clearly emphasize how the work relates to the advancement of the field. If the manuscript describes a new method or concept, indicate why it is preferable to already known methods.

## MATERIALS AND METHOD

### 2.1 Study design

A case-control study Included 196 pregnant women (98 cases and 98 age-matched control). The data collection continued from 14 August to 14 November 2023.

### 2.2 Setting of the Study

The study was carried out in Baghdad city by two health directorates; the first, al-rusafa health directorate, and the second, al-karkh health directorate, were involved. Five days a week, from 9 am to 1 pm, healthcare facilities were visited as part of the study. The maternity and child care units at primary health care centers in Baghdad City were where the cases and control data were collected.

### 2.3. Sampling technique

The total number of Baghdad health directorates in Baghdad city was 2 (al-rusafa and al-karkh), 5 health sectors were randomly selected from each, 50% of health care centres were picked from each sector, and primary health care centres were labelled and chosen from a list. The study selected case and control by interviewing pregnant women in maternal and child care units and measuring their height, weight, and mid-upper arm circumferences.

## 2.4. Method of data collection

Data were obtained from pregnant women using a systematic questionnaire filled out by the researcher and asked in plain Arabic. The questionnaire collected English-language pregnant data. The researcher uses specific techniques to assess the pregnant woman's anthropometrics. Data was collected five days a week from 9 am to 1 pm at primary health care centres. Interviews lasted 15-20 minutes. Information was kept private.

## 2.5. Statistical Analysis

The questionnaire collected data, which was copied to code sheets, inputted into the personal computer, and analysed using SPSS-28. Simple frequency, percentage, mean, standard deviation, and range measurements were used. Qualitative data was analysed using the Pearson Chi-square test ( $X^2$ -test) to determine the significance of percentage differences. Statistical significance was considered when P-value was 0.05 or below. The data's type determined the statistical tests after the Kolmogorov-Smirnov normalcy test assessed variable distribution. An independent sample test was used to compare group means for normally distributed variables. Assuming a normal distribution, One-way ANOVA with the LSD post-hoc test was used to compare mean values between groups.

## Results

### 3.1. Socio-demographic Characteristics

Table 1 represents the distribution of women with Gestational Diabetes Mellitus (GDM) and control group according to Socio-demographic characteristics. The results of this study indicate that Women who live in urban areas are more at risk of developing gestational diabetes than those who live in rural areas ( $P = 0.023$ ,  $OR = 2.038$ ). While women who have a low level of education, such as illiterate, and who read and write ( $OR = 23.947$  (95% C.I.=2.906-197.374, and,  $OR = 3.684$  (95% C.I 1.664-8.159 respectively) have an increased risk of developing gestational diabetes compared to women who have a high level of education. As for other demographic variables such as age groups, occupational status, crowding index, and SES, there is no significant association with GDM ( $P$ . value  $>0.05$ ).

Table 1. Distribution of women with Gestational Diabetes Mellitus (GDM) and control group according to Socio-demographic characteristics

Variables	Groups				P value	OR (95%CI)	
	GDM N=98		Control N=98				
	No.	%	No.	%			
Age (years)	<20years	3	3.1	2	2.0	R	-
	20---24	6	6.1	8	8.2	0.513	NS
	25---29	24	24.5	21	21.4	0.777	NS
	30---34	28	28.6	40	40.8	0.420	NS
	≥35years	37	37.8	27	27.6	0.924	NS
	Mean± SD (Range)	33.20±7.032 (18-47)		31.34±5.631 (18-46)			
Residence	Rural	39	39.8	24		<b>0.023</b>	2.038(1.104-3.762)
	Urban	59	60.2	74	75.5	R	-
Educational level	Illiterate	13	13.3	1	1.0	<b>0.003</b>	23.947 (2.906-197.374)
	Read & write	36	36.7	18	18.4	<b>0.001</b>	3.684 (1.664-8.159)
	Intermediate	10	10.2	24	24.5	0.575	0.768 (0.304-1.936)
	Secondary	20	20.4	20	20.4	0.151	1.842 (0.800-4.243)
	College & higher	19	19.4	35	35.7	R	-
Occupational status	High professional & managerial jobs (doctor, engineer, professor, large employer, director, land owner)	19	19.4	10	10.2	R	NS
	Lower professionals, skilled & semiskilled workers (teacher, cleric, owners of small business, military, policemen)	14	14.3	13	13.3	0.065	NS
	Unskilled workers (laborer, farmer, casual worker, unemployed & retired)	65	66.3	75	76.5	0.100	NS
Crowding Index	Less crowded (<3.0)	80	81.6	84	85.7	0.962	NS
	Average (3-4.9)	16	16.3	12	12.2	0.788	NS
	Overcrowded (=>5.0)	2	2.0	2	2.0	R	-
SES for single data	Low (0-59)	38	38.8	27	27.6	0.589	NS
	Middle (60-80)	30	30.6	45	45.9	0.124	NS
	High (81-100)	30	30.6	26	26.5	R	-

R= reference; NS= non-significant; Bold font highlight the significant results

Table .2 shows the distribution of women with GDM and the control group according to body mass index. The results of this study indicate that morbid obesity and obesity increase the risk of developing gestational diabetes compared to normal weight (odd ratio; 8.486, and 4.190, respectively). Furthermore, UMAC (mid-upper arm circumference) and weight values also show significant differences between the two groups, with p values of 0.009 and 0.0001, respectively.

Table 2. Distribution of women with Gestational Diabetes Mellitus (GDM) and control group according to BMI

BMI	GDM		Control		P value	OR (95%CI)
	No	%	No	%		
<b>BMI (Kg/m2) Underweight (&lt;18.5)</b>	-	-	-	-	-	-
Normal (18.5-24.9)	7	7.1	22	22.4	R	-
Overweight (25-29.9)	36	36.7	45	45.9	0.059	2.514(0.966-6.546)
Obese (30-34.9)	28	28.6	21	21.4	<b>0.006*</b>	<b>4.190(1.509-11.639)</b>
Morbid obese (=>35)	27	27.6	10	10.2	<b>0.0001*</b>	<b>8.486(2.774-25.954)</b>
BMI (Kg/m2); Mean±SD (Range)	31.4081±5.247 (19.98-46.25)		28.6027±4.581 (18.51-39.30)		<b>0.0001#</b>	
UMAC (cm); Mean±SD (Range)	31.439±5.046 (21.0-44.0)		29.571±4.926 (21.0-45.0)		<b>0.009#</b>	
Height (cm); Mean±SD (Range)	161.98±6.575 (149-173)		160.99±5.723 (146-172)		0.262	
Weight (Kg); Mean±SD (Range)	82.364±14.106 (45.0-120.0)		74.267±13.311 (46.0-115.0)		<b>0.0001#</b>	

\*Percentage differences are significant using Pearson Chi-square test ( $\chi^2$ -test) at 0.05 level. R= reference; bold type indicates significant findings.

#Students-t-test at 0.05 shows significant difference between independent means.

### 3.2. International Physical Activity Questionnaire assessing physical activity (IPAQ)

Table 3 shows how International Physical Activity Questionnaire results relate to Gestational Diabetes Mellitus and a control group. For Vigorous Physical Activities (VIGOROUS), GDM prevalence differs across groups with varying activity levels (P = 0.0001). Zero days of strenuous physical exercise was associated with a much higher GDM prevalence. For Vigorous Physical Activities (V-Hours), zero hours is associated with greater GDM prevalence (P = 0.001). Vigorous Physical Activities (V-Minutes) are not significantly

different across groups ( $P = 0.420$ ). Moderate Physical Activities (MODERATE) had a significant effect on GDM prevalence ( $P = 0.016$ ), with those who reported seven days of moderate exercise having the greatest prevalence. For Moderate Physical Activities (M-Hours), zero hours is associated with greater GDM prevalence ( $P = 0.029$ ). For Moderate Physical Activities (M-Minutes), zero minutes is associated with the greatest GDM incidence ( $P = 0.015$ ). Walking days ( $P = 0.009$ ) and hours ( $P = 0.002$ ) significantly affect GDM prevalence. Zero days and zero hours of walking are associated with the greatest GDM prevalence. Finally, for Sitting (S-Hours), GDM prevalence is significantly different ( $P = 0.061$ ) depending on daily sitting hours, with the greatest incidence among those who recorded four hours.

Table 3. the association between GDM, and control group according to the International Physical Activity Questionnaire (IPAQ)

(IPAQ)	GDM		Control		P value	
	No	%	No	%		
	0	28	28.6	59	60.2	<b>0.0001</b>
During the last 7 days, how many days did you do VIGOROUS physical activities like heavy lifting, digging, aerobics, or fast bicycling (days per week)	1	14	14.3	18	18.4	
	2	23	23.5	7	7.1	
	3	14	14.3	6	6.1	
	4	1	1.0	3	3.1	
	5	14	14.3	3	3.1	
	=>6	4	4.1	2	2.0	
	0	31	31.6	62	63.3	<b>0.001</b>
	1	16	16.3	14	14.3	
	2	25	25.5	11	11.2	
V-Hours	3	16	16.3	5	5.1	
	4	6	6.1	5	5.1	
	5	2	2.0	0	.0	
	=>6	2	2.0	1	1.0	
	0	89	90.8	92	93.9	0.420
	30	9	9.2	6	6.1	
V-Minutes	Mean ±SD (Range)	146.0±273.3 (16-1200)		150.4±270.8 (16-1680)		
During the last 7 days, how many days did you do MODERATE physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis (Do not include walking)	0	-	-	3	3.1	<b>0.016</b>
	3	-	-	2	2.0	
	4	-	-	1	1.0	
	5	-	-	3	3.1	
	6	2	2.0	8	8.2	
	7	96	98.0	81	82.7	
	0	-	-	5	5.1	
	1	-	-	3	3.1	
	2	12	12.2	8	8.2	
	3	13	13.3	16	16.3	
	4	11	11.2	13	13.3	
M-Hours	5	22	22.4	22	22.4	
	6	24	24.5	15	15.3	
	7	2	2.0	9	9.2	
	8	11	11.2	5	5.1	
	9	3	3.1	1	1.0	
	10	-	-	1	1.0	



	0	98	100.0	88	89.8	<b>0.015</b>
	20	-	-	1	1.0	
	30	-	-	8	8.2	
	45	-	-	1	1.0	
M-Minutes	Mean ±SD (Range)	133.0±52.4 (28-252)		261.6±697.0 (12-5400)		
	0	10	10.2	11	11.2	<b>0.009</b>
	1	22	22.4	39	39.8	
	2	17	17.3	23	23.5	
During the last 7 days, how many days did you WALKING for at least 10 minutes at a time	3	14	14.3	10	10.2	
	4	5	5.1	3	3.1	
	5	25	25.5	6	6.1	
	6	1	1.0	2	2.0	
	7	4	4.1	4	4.1	
	0	24	24.5	35	35.7	<b>0.002</b>
	1	42	42.9	19	19.4	
	2	16	16.3	22	22.4	
W-Hours	3	11	11.2	21	21.4	
	4	5	5.1	1	1.0	
	5	-	-	-	-	
	0	75	76.5	67	68.4	0.076
	20	-	-	6	6.1	
	25	23	23.5	23	23.5	
	30	-	-	1	1.0	
W-Minutes	40	-	-	1	1.0	
	45	75	76.5	67	68.4	
	Mean ±SD (Range)	103.0±217.0 (3-1980)		103.6±266.1 (3-2970)		
During the last 7 days, how much time did you spend SITTING on a week day	2	9	9.2	11	11.2	0.061
	3	11	11.2	14	14.3	
	4	34	34.7	22	22.4	
	5	26	26.5	16	16.3	
S-Hours	6	8	8.2	18	18.4	
	7	4	4.1	3	3.1	
	8	4	4.1	4	4.1	
	9	0	.0	5	5.1	
	10	1	1.0	4	4.1	
	12	1	1.0	1	1.0	

SD= standard deviation; Bold font highlight the significant results

Table 4. and Figure 1. analyze GDM risk variables based on the IPAQ SCORE, which measures physical activity. The results reveal that higher IPAQ scores are associated with a lower prevalence of GDM. Low IPAQ scores were associated with 92.9% of GDM, compared with 86.7% in the control group. Moreover, regarding women with GDM, the mean±SD (228.2±252.3) was significantly lower than that of the control group (464.8±958.8).

Table 4. the assessment of risk factors for GDM according to the overall assessment of IPAQ SCORE

IPAQ SCORE	GDM		Control		P value
	No	%	No	%	
Low (0---600)	91	92.9	85	86.7	0.095
Moderate (601 - 1500V/ 3000T)	6	6.1	6	6.1	
High (>1500V / >3000T)	1	1.0	7	7.1	
Mean $\pm$ SD (Range)	228.2 $\pm$ 252.3 (65-1501)		464.8 $\pm$ 958.8 (13-5409)		0.040 <sup>#</sup>

#Students-t-test at 0.05 shows significant difference between independent means.

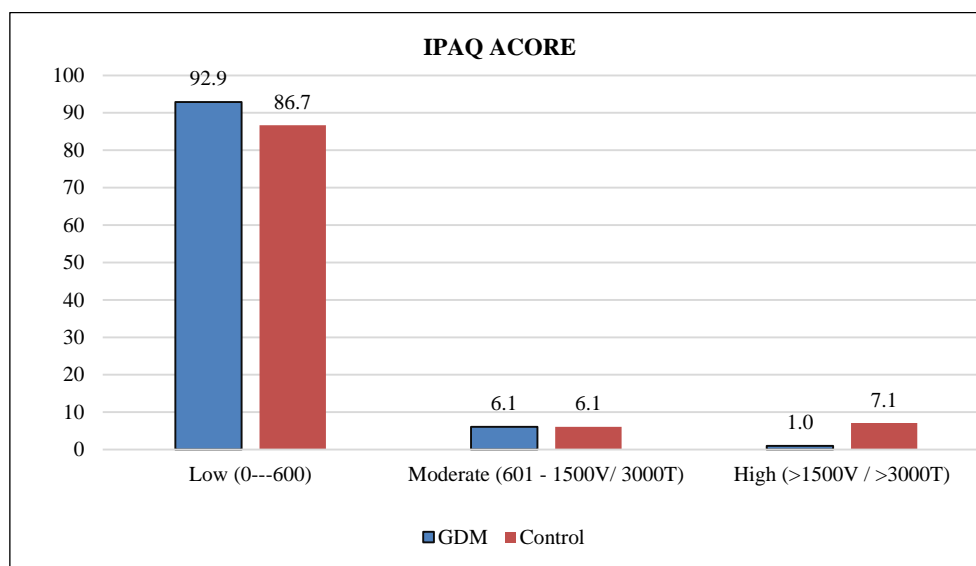


Figure 1. Illustrates distribution of GDM and control groups according to the overall assessment of IPAQ SCORE

## DISCUSSION

This study shows Gestational Diabetes Mellitus (GDM) risk does not change by age. This shows that this study's matching approach did not discover substantial age-related GDM risk differences. Researchers may compare cases and controls more reliably by matching them to share key traits.

The present study shows that rural locations had double the risk of GDM as urban areas ( $P = 0.023$ ,  $OR = 2.038$ ). This countered [3], who reported that urban areas had a higher GDM risk than rural ones (PRR: 1.69, 95% CI 1.67-1.72). Study outcomes might vary

by area and time. Many variables impact the risk of gestational diabetes mellitus (GDM) by location and time.

This study found that women with less formal education are more likely to acquire gestational diabetes mellitus (GDM). This study supports the expanding body of data showing that education shapes health outcomes like GDM risk. These findings confirmed [4], who found that more education lowered GDM risk (relative risk ratio = 0.93; 95% confidence range = 0.86 to 0.99). GDM was more likely in women with lower education, with an OR of 2.47 (CI 1.45-4.22) and a PV of 0.001. A Palestine and Gaza study [5] found that women with lower education had a greater incidence of GDM. Education reflects socioeconomic factors including information, healthcare, and health literacy. Lower-educated women may struggle to receive prenatal care and understand healthy pregnancy habits like nutrition and exercise. Thus, they may have a higher GDM risk.

Also, the results reveal that occupational status, home crowding, and socioeconomic position all had p-values above 0.05, demonstrating that GDM prevalence is constant across these groups. These results are inconsistent with the study findings in Beijing, China conducted by [6] which found a significant difference in the number of women with GDM when comparing women who worked in other types of jobs with housewives (OR = 1.69, p = 0.032). These disparities between the two studies underscore the potential influence of regional, cultural, or contextual factors on the relationship between occupational status and GDM.

When examining household crowding and socioeconomic status, all p-values consistently surpass the threshold for statistical significance ( $P > 0.05$  in all cases). This indicates that there are no statistically meaningful differences in the prevalence of GDM within these categories. These results are inconsistent with the other studies in Pakistan, and Saudi Arabia done by [7][8] respectively which found that low socio-economic status is associated with an increased risk of GDM. Those studies suggested that low socioeconomic status was linked to a heightened risk of GDM. The discrepancy between these results underscores the importance of recognizing that regional and population-specific factors may contribute to differing outcomes in the relationship between socioeconomic status and GDM risk.

**In this study, the morbidly obese group stands out with the highest prevalence of GDM at 27.6%. The odds ratio (OR) values further underscore this pattern, revealing that women categorized as obese and**

morbidly obese are associated with significantly elevated risks of developing GDM, with odds ratios of 4.190 and 8.486, respectively. These findings emphasize a strong correlation between higher BMI and an increased likelihood of GDM occurrence. These findings are in agreement with the study in Palestine Gaza, done by [9] reported that strong association between maternal weight, obesity and the development of GDM at (OR 1.15; 95% C.I 1.10–1.20). A research conducted [10] in Portuguese indicated that the risk of developing gestational diabetes is two times higher for pregnant women who are obese. These findings coincided with that finding. Obesity and gestational diabetes mellitus are commonly seen together as co-morbid disorders. Obesity and excessive weight gain during pregnancy may both increase the likelihood of developing GDM. because fat serves as an endocrine organ and has a reciprocal relationship with diabetes. Being obese or overweight, particularly in the first few months of pregnancy, is one of the most important risk factors for developing GDM. GDM is more likely to occur in pregnant women whose body mass index (BMI) was high before they became pregnant. Obesity can lead to insulin resistance, where the body's cells do not respond effectively to insulin, increasing blood sugar levels. This insulin resistance can be exacerbated during pregnancy, leading to GDM [11]. Furthermore, Adipose tissue (fat) is known to produce hormones and cytokines. Excessive fat can disrupt the balance of these hormones, contributing to insulin resistance and inflammation, both of which are risk factors for GDM [12].

The results reveal that the UMAC (Upper Mid-Arm Circumference) and weight values display notable disparities between the two groups, signified by p-values of 0.009 and 0.0001, respectively, underscoring their link to GDM risk. Conversely, height did not reveal any significant distinctions between the groups. These results emphasize the robust correlation between a higher BMI, UMAC measurement, and overall weight with the onset of GDM. In summary, the study highlights that both UMAC and weight significantly contribute to the risk of developing GDM, while height does not show a similar association. These results are consistent with the study findings conducted in Ghana done by [13] reported that mothers with higher MUAC, BMI, and maternal weight were at more risk to develop gestational diabetes than the control set.

The results show that higher IPAQ scores reduce GDM prevalence. Compared to 86.7% in the control group, low IPAQ scores were related with 92.9% of GDM. For women with GDM, the mean±SD (228.2±252.3) was substantially lower than the control group (464.8±958.8). According to a study in Iran [14],

women who reported low total physical activity on the pregnancy physical activity questionnaire during early pregnancy had a significantly higher risk of gestational diabetes mellitus (OR = 4.12, 95% CI (2.28 - 7.43), P = 0.001). Hispanic women with high moderate-intensity activity during pregnancy had a 50% lower risk of impaired glucose tolerance than those in the lowest quartile [15]. PA-induced fat loss and muscle gain may improve glucose tolerance and insulin sensitivity. Physically active people, especially obese ones with lots of adipose tissue, may also remove glucose [16].

A study found that women with GDM were less likely to participate in vigorous physical activity, and the difference was statistically significant for those who reported strenuous exercise (one days per week and one V-Hours). More women with GDM were sedentary or less active than the control group. Regular physical exercise improves blood glucose control, which may emphasize its value in GDM therapy. These results agreed with the previous study findings done by [18], Which reported that nearly half of pregnant women tested were sedentary, and none were energetic. Higher risks of gestational diabetes mellitus were linked to sedentary lifestyle (odds ratio=1.8, 95% confidence interval = 1.1–2.9).

This study demonstrated substantial differences in 10-minute walk frequency between GDM and control groups. More GDM patients walked less than controls. This implies walking may lower GDM risk. These findings support [19], which found that walking at different stages during pregnancy reduces gestational diabetes risk.

Women who are pregnant tend to be less active and more sedentary. Unless it is contraindicated, the American College of Obstetricians and Gynaecologists (ACOG) recommends that pregnant women participate in physical activity for at least thirty minutes on most days of the week, providing that the intensity of the exercise is moderate [20].

## CONCLUSION

According to the study, mothers with low levels of job experience, mothers have a family history of diabetes, are obese or overweight, live in urban areas, practice limited physical activity, and have low socioeconomic status are all significantly correlated with an increased risk of gestational diabetes.

## Recommendations

All pregnant women, especially those who are at high risk for gestational diabetes, should be encouraged to regularly check their blood sugar levels throughout pregnancy and after delivery. Healthcare professionals should emphasize the potential hazards of GDM and suggest prevention measures, ensuring that high-risk women regularly get their blood sugar tested, and emphasizing the significance of non-communicable disease health education.

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I want to express thanks to everyone who assisted me in completing this task.

## CONFLICT OF INTEREST

Authors must provide a statement describing all potential sources of bias (if any) that may constitute conflicts of interest. If there is no conflict of interest to declare, the authors can state "The authors declare no conflict of interest".

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## Knowledge for Mothers Awareness of Healthy Food for Children Under Five Years in Al-Diwaniya Governorate

معارف وعي الأمهات بالغذاء الصحي للأطفال أقل من خمس سنوات في محافظة الديوانية

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## ABSTRACT

Child health is a state of perfect height and weight with respect to chronicle age, and physiological, psychological and highbrow progress and the absence of any disease symptom. Poor and unstable nutrition is a problem for growth and headway, and it could lead to many health difficulties. The World Health Organization (WHO) advises delaying supplemental feeding until when the infant is six months old because, up until then, nursing alone is sufficient to provide all of the baby's nutritional needs. Given that proper nutrition, capable of delivering sufficient nutritional quantity and quality, is required to support the growth and overall development in its maximum potential, complementary feeding is recognized as a significant physiological milestone in the life of the baby.

**Objective;** was to determine the nutritional knowledge level of mothers with children aged less than five years on Al-Diwaniya government. **Subject and Methods;** cross-sectional study was carried out at children Hospital, Al-Diwaniya /Iraq from 1 January 2023 to 30 March 2023. The **results** showed good knowledge of mothers that pointing to healthy nutrition for their child. Children's diets but that this influence decreases as children grow older. also, mothers who have children less than five years have a high level of awareness of home management. **Discussion:** about attitude of women of this study have showing frequency of can you give your child health food. And there was 96 women have said yes and that meaning a lot of women have had to give their baby child a healthy food under five years.

**Conclusion:** study concluded that mothers who married and have bachelor especially moderate ages have good awareness about healthy food through their attitudes and practice that indicates they have enough information may help them in feeding their children.

**Keywords:** Knowledge, Healthy Food, Mothers, Children under Five Years

## الخلاصة

صحة الطفل هي حالة الطول والوزن المثاليين بالنسبة للعمر الزمني والتقدم الفسيولوجي والنفسي والثقافي وعدم ظهور أي أعراض مرضية. تعتبر التغذية السيئة وغير المستقرة مشكلة للنمو والتقدم، وقد تؤدي إلى العديد من الصعوبات الصحية. تنصح منظمة الصحة العالمية (WHO) بتأخير التغذية التكميلية حتى يبلغ الرضيع ستة أشهر من العمر، لأن الرضاعة وحدها كافية حتى ذلك الحين لتوفير جميع احتياجات الطفل الغذائية. ونظرًا لأن التغذية السليمة، القادرة على توفير كمية ونوعية غذائية كافية، مطلوبة لدعم النمو والتطور الشامل بأقصى إمكاناته، فإن التغذية التكميلية تعتبر معلمًا فسيولوجيًا مهمًا في حياة الطفل.

كان الهدف تحديد مستوى المعرفة الغذائية للأمهات اللواتي لديهن أطفال تقل أعمارهم عن خمس سنوات في محافظة الديوانية. تم إجراء دراسة مقطعية للموضوع والطرق في مستشفى الأطفال في الديوانية / العراق في الفترة من ١ كانون الثاني (يناير) ٢٠٢٣ إلى ٣٠ آذار (مارس) ٢٠٢٣. وأظهرت النتائج معرفة جيدة للأمهات بالإشارة إلى التغذية الصحية لأطفالهن. النظام الغذائي للأطفال ولكن هذا التأثير يتناقض مع تقدم الأطفال في السن. كما أن الأمهات اللاتي لديهن أطفال أقل من خمس سنوات يتمتعن بمستوى عالٍ من الوعي بإدارة المنزل. المناقشة: حول موقف النساء في هذه الدراسة، تم توضيح مدى تكرار هل يمكنك إعطاء طفلك طعامًا صحيًا. وقد أجابت ٩٦ امرأة بنعم، وهذا يعني أن الكثير من النساء اضطررن إلى إعطاء أطفالهن طعامًا صحيًا أقل من خمس سنوات.

الاستنتاج: خلصت الدراسة إلى أن الأمهات المتزوجات العازبات وخاصة الأعمار المتوسطة لديهن وعي جيد بالغذاء الصحي من خلال مواقفهم وممارساتهم مما يدل على أن لديهم معلومات كافية قد تساعد في تغذية أطفالهم.

الكلمات المفتاحية: المعرفة ، الغذاء الصحي ، الأمهات ، الأطفال أقل من خمس سنوات

## INTRODUCTION

Children are future of society and mothers are promoter of that future. First and notable, health, safety, and nutrition for the young child are written on behalf of young children everywhere. Parental knowledge and a commitment to their children's welfare are the foundation of a strong, healthy family. Comprehending appropriate nourishment is a crucial component of this challenge. Ultimately, healthy eating choices nourish our bodies and minds throughout our lives. A healthy diet can even help prevent or decrease a number of chronic health issues. Nutrients are organic & in organic complexes contained in food"(1). There are six main classes of nutrients those are mainly carbohydrates, fats, minerals, protein, vitamins, and water. These nutrient courses can be categorized as either macronutrients (needed in relatively large amounts) or micronutrients (needed in smaller quantities). The macronutrients comprise carbohydrates, fats, protein, and water (2) Malnutrition continues to be a substantial risk factor for death among children under 5years old, in both advanced and rising countries, many youngsters of weaning age are unable to grow well due to poor nutrition and disease. Poor weight gain or, in more severe cases, weight loss can be seen on the growth chart as a result. A major social determinant of the health of children has been discovered as the mother's educational position. (4). The World Health Organization (WHO) advises delaying supplemental feeding until when the infant is six months old because, up until then, nursing alone is sufficient to provide all of the baby's nutritional needs. Given that proper nutrition, capable of delivering sufficient nutritional quantity and quality, is required to support the growth and overall development in its maximum potential, complementary feeding is recognized as a significant physiological milestone in the life of the baby According to the WHO report, it was assessed that 165 million children had stunted growth, 101million were underweight while 52million children were malnutrition, Africa backed to 56million stunted children and 13.4million were wasted (5).

Mother's knowledge is essential, as the child's care is mostly the concern of the mother." As a result, mother's knowledge about the childcare has an

inordinate influence on the nature and quality of care that is accessible to the child (6) due to lack of study until now.

**Aim of the study:** is to find knowledge, attitude and practice for mothers that their children under five years about healthy food.

## MATERIALS AND METHOD

**Study Design:** A cross-sectional study.

**Duration of the study and sample size:** The data was collected between 1 January 2023 to 30 March 2023. was (100) one hundred women.

**Place:** This study was conducted in Al-Dewania teaching Hospital

**Data Collection Tool:** Data were obtained by direct interview with the women and her baby by using detailed self- reporting questionnaire.

**Statistical Analysis:** The data have been analyzed and organized statistically by (One sample t-test and chi-square).

The data have been analyzed and organized statistically by (One sample t-test and chi-square) according to the aim of the current study (To determine the awareness and characteristics of the mothers of malnourished children under 5years old on Al-Diwaniya). Or (To determine the knowledge of mothers of healthy food for children aged less than five years on Al-Diwaniya).

## RESULTS

Table (I): distribution of mothers according to socio-demographic characteristics

Socio-demographic characteristics		Freque ncy	Pe rcent
Marital Status	Married	69	69.0
	Divorced	15	15.0
	Widower	16	16.0
Health	Primary	7	7.0

<b>Education Level</b>	Secondary	25	25.0
	Preparatory	27	27.0
	Bachelor	31	31.0
	High Education	6	6.0
	Illiterate	4	4.0
<b>Age group</b>	Less Than 24	23	23.0
	25-34	52	52.0
	35-44	16	16.0
	More Than 45	9	9.0

The table shows high percentages in married women 69% with bachelor 31% from 25-34 ages.

Table (II): distribution of mothers according their knowledge about food

<b>Knowledge</b>	<b>Yes</b>		<b>No</b>		<b>I don't know</b>	
	<b>No</b>	<b>%</b>	<b>No</b>	<b>%</b>		
<b>about healthy food</b>	50	50.0	45	45.0	5	5.0
<b>about malnutrition</b>	53	53.0	45	45.0	2	2.0
<b>about canned food</b>	13	13.0	84	84.0	3	3.0

This table reveals high percentages in knowledge about malnutrition 53% and healthy food 50%.

Table (III): distribution of woman's attitude about healthy food

<b>Attitude</b>		<b>No.</b>	<b>Percent</b>
<b>can you give your child health food</b>	Agree	90	90.0
	Disagree	4	4.0
	Don't sure	6	6.0
<b>listen to seminars when take the child</b>	Agree	34	34.0
	Disagree	60	60.0

<b>for immunization</b>	Don't sure	6	6.0
<b>do you think poster and seminars give the information about food</b>	Agree	77	77.0
	Disagree	20	20.0
	Don't sure	3	3.0
<b>age to give egg</b>	less 2years	8	8.0
	More than 2years	32	32.0
	2-3	36	36.0
	3-4	24	24.0
<b>Is vegetable important</b>	Agree	83	83.0
	Disagree	10	10.0
	Don't sure	7	7.0

This table shows high percentage in giving babies healthy food 90% who think that posters are important for information about food 77%, eating eggs between 2-3 years 36% and they agree with importance of vegetable 83%.

Table (IV): distribution of women's practice of mothers for healthy food

<b>Practice</b>	<b>No.</b>	<b>Present</b>
<b>Age for Give Milk</b>	less than 1 year	99
	more than 1 year	1
<b>Meal for Child</b>	3	11
	4	41
	more	48
<b>Is The Milk Important</b>	Yes	99
	No	1
<b>Type of Meat</b>	White	28
	Red	72
<b>Age to Give Egg</b>	less 2	8
	more2	32
	2-3	36
	3-4	24
<b>Is the Egg Important</b>	yes	74
	no	26
<b>Drink Enough Water</b>	Yes	76
	No	7
	don't know	17
<b>Is Healthy to</b>	yes	11

<b>Drink Artificial Drink</b>	no	89	89.0
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This table shows higher percentage was the importance of giving milk 99% and refused giving artificial drink 89%, many meals 48%, red meat 72% and importance of eggs 74%.

## DISCUSSION

The objective of this study was to fix the knowledge of mother about nutrition and malnutrition among the children under five years who living in Al-Diwaniya city in Iraq. As for in table (I), showed have frequency of marital status. 69 married 15 divorced and 16 widowers from the total. These results are different to study in United States in 1999 that showed who received all highly frequency (50) in widowers and then married (7). As evident, the knowledge regarding nutrition among the women on her baby children of reproductive age who were visiting a children Hospital, Al-Diwaniya in the south of Iraq was found to be little different to that of the women in a United States such as in the study (8). The results hint towards insufficient knowledge of the nutrition among the women of reproductive age even if they were attending and were receiving regular antenatal checkups at a children Hospital (9).

In our study have showed a similar to a study in Egypt found that mothers with higher education having a lower risk of stunting in their children (10). On health education level. meaning a lot of the people in study have finished the bachelor. This making an idea about their people have some true tips for knowledge about healthy food such as showing in the table (II) 51 yes and 49 no from the total. But there are a lot of the people in this study have no idea about knowledge about canned food in addition, the people say yes in the have more than the people saying no where they have knowledge about malnutrition (11) Where have showing frequency of knowledge about malnutrition.

In the table (III) talked about attitude of women of this study have showing frequency of can you give your child health food. And there was 96 women have said yes and. that meaning a lot of women have had to give their



baby child a healthy food under five years. There was a little information about attitude of mother for nutrition and malnutrition for children less than five years. (12) The item of do you think poster and seminars give the information about food. And there was 77 women have said yes that is reveals that health education plays active rules and gave good results (13).

Table (IV) reveals the practice of women with their babies, high percentages were in women agree to give eggs between 2-3 ages (36%), refuse giving artificial drinks 89% and drinking enough water 76% (14). **CONCLUSION**

From the outcome of the study, it is concluded that mothers who married and have bachelor especially moderate ages have good awareness about healthy food through their attitudes and practice that indicates they have enough information may help them in feeding their children.

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## CONFLICT OF INTEREST

The authors declare no conflict of interest.

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## Risk factors of psoriasis among patients attending a Baghdad teaching hospital in medical city between age groups (6 \_18) years

عوامل خطر للإصابة بالصدفية لدى المرضى المترددين على مستشفى بغداد التعليمي في مدينة الطب بين الفئات العمرية (٦ \_ ١٨) سنة

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## ABSTRACT

An approximately 200-300 words abstract must accompany the submitted manuscript. The abstract should briefly summarize the problem or purpose of the research, the theoretical or experimental method(s) used, the principal findings, and the conclusions of the study.

**Keywords: Psoriasis , Risk , factors , Baghdad.**

### الخلاصة

الرجاء كتابة الخلاصة باللغة العربية و كما مذكورة في خلاصة اللغة الانكليزية مع مراعاة استخدام ترجمة صحيحة و ليست ترجمة Google .  
الكلمات المفتاحية : الصدفية ، خطر ، عوامل ، بغداد

## INTRODUCTION

Psoriasis is an enduring autoimmune disorder distinguished by clusters of atypical epidermal growths . [1] Usually, these skin areas are scaly, dry, itchy, and red. [2] The patches may seem purple on individuals with deeper skin tones. [3] The severity of psoriasis varies, ranging from tiny, localised spots to full body covering. [2] There are five major categories of illness. Usually, plaque psoriasis manifests as red areas covered with white scales. [4]

The backs of the forearms, shins, navel region, and scalp are the body parts most often impacted. Lesions in guttate psoriasis have a drop form [4]. [1] Pustular psoriasis appears as tiny, non-contagious blisters filled with pus. [5] Red areas in skin creases are caused by inverse psoriasis. [1] The rash may extend to other areas of the body, leading to erythrodermic psoriasis, which can evolve from other forms of the condition. [4] Psoriasis often manifests itself on the nails, namely the fingernails and toenails, in most cases. [4]

This might include variations in nail colour or pits in the nails. [4] Environmental factors may affect the inherited condition known as psoriasis. However, it is uncertain how these genes work together. The bulk of the

identified genes are associated with the immune system, namely the major histocompatibility complex (MHC) and T cells. [2] Psoriasis isn't contagious. [4] The immune system responding to skin cells is the fundamental process. The signs and symptoms are usually used to make the diagnosis [4]. [4] Psoriasis cannot be cured, although there are therapies that may help manage the symptoms. [4]

Psoriasis is statistically associated with an elevated risk of developing lymph nodes, cardiovascular disease, psoriatic arthritis, and depression. [4] It is estimated that 2–4% of the population of the western globe suffers from psoriasis. [6] A multifactorial interplay of genetic and environmental elements is hypothesised to account for the variations in psoriasis incidence that occur with respect to age, region, and ethnicity. [6] The most typical onset age is between fifteen and twenty-five years old, while it may happen at any age. Diagnosed before the age of twenty, around a third of psoriasis patients report. [7] Psoriasis has an equal impact on both sexes. [8] Approximately 6.7 million Americans are afflicted with psoriasis, which is more prevalent among adults. [9].

## MATERIALS AND METHOD

**The study design:** Cross-sectional study.

**Setting:** Data collection is carried out via direct interviews with cases using a questionnaire designed specifically for this research. The data were acquired from the Dermatology and Venereology Centre in Baghdad's Medical City. The questionnaire encompasses various factors including gender, age, family history, other immunological diseases, location of symptom appearance, shape of symptoms, itching, redness, types of psoriasis, impact of food, impact of drugs, impact of environmental factors, impact of psychological status, impact of chemical substances, and effectiveness of treatment.

**Duration of the study:** The data collection from 1<sup>st</sup> September- 2023 to 2<sup>nd</sup> January- 2024  
**Sample of the study:** Sample type: All sample patient have Psoriasis reported in Dermatology and Venereology center in Medical city in Baghdad and Sample size: 150 cases of psoriasis.

**Statistical analysis:** The SAS (2012) statistical analysis system programme was used to examine the impact of various kinds of variables on research parameters. The P-value test was used to examine the significance between percentages in this investigationspecial precautions in sufficient detail so that those repeating the experiments can take appropriate safety measures. Published procedures should be cited, but not described, except for substantial modifications. Ethical clearance must be obtained for any study involving animal or human subjects.

## RESULTS

**Table (1) Distribution of gender and age sample study according to study sample**

Gender	Frequency	Percent
Female	80	53.3
Male	70	46.7
Total	150	100.0
Age	Frequency	Percent
6-12 years	54	36.0
12-15 years	31	20.7
15-18 years	65	43.3
Total	150	100.0

This table shows that the higher percentage of cases in gender was (53.3%) in female group.

And the higher percentage of cases in age was (43.3%) in age group (15-18) years

**Table (2) Distribution of symptoms appear according to cases**

Symptoms appear	Frequency	Percent
all of body	51	34.0
Specific place of the body	99	66.0
Total	150	100.0

This table shows that the higher percentage of cases who have symptoms was (66%) in cases who have specific place of the body.

**Table (3) Distribution of shape of the symptoms according to cases**

Shape of the symptoms	Frequency	Percent
Granular	25	16.7
Peel	125	83.3
Total	150	100.0

This table shows that the higher percentage of shape of the symptoms was (83.3%) in cases who have peel.

**(Table 4) Relationship of family history according to gender**

Family history	gender		Total	P -value
	female	male		
Yes	40	46	86	$\chi^2 = 8.333$ <b>P=0.038</b> <b>(S)</b>
	26.7%	30.7%	57.3%	
No	40	24	64	
	26.7%	16.0%	42.7%	
Total	80	70	150	
	53.3%	46.7%	100.0%	

This table shows that the higher percentage of family history according gender was (30.7%) in males who have family history. The association statistically was found to be significant.

**(Table 5) Relationship of shape of the symptoms according to age group**

Shape of the symptoms	Age			Total	P -value
	6-12 years	12-15 years	15-18 years		



Granular	4	6	15	25	$\chi^2= 0.541$ <b>P=0.067</b> <b>(NS)</b>
	2.7%	4.0%	10.0%	16.7%	
Peel	50	25	50	125	
	33.3%	16.7%	33.3%	83.3%	
Total	54	31	65	150	
	36.0%	20.7%	43.3%	100.0%	

This table shows that the higher percentage of shape of the symptoms according to age was (33.3%) in (6\_12) years who have peel symptoms. The association statistically was found to be no significant

**(Table 6) Relationship of other immune disease according to type of psoriasis**

Other immun e disease	Type of psoriasis					Total	P – value
	Guttat e	Plaque	Nail	Genita l	Scalp		
Yes	1	3	4	1	4	13	$\chi^2=$ <b>12.307</b> <b>P=0.026</b> <b>(S)</b>
	0.7%	2.0%	2.7%	0.7%	2.7%	8.7%	
No	24	66	9	5	33	137	
	16.0%	44.0%	6.0%	3.3%	22.0%	91.3%	
<b>Total</b>	25	69	13	6	37	150	

	16.7%	46.0%	8.7%	4.0%	24.7%	100.0%	
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The table shows that the higher percentage of other immune disease according to type of psoriasis was (44.0%) in cases who have no plaque psoriasis. The association statistically was found to be significant

**Table 7) Relationship of psyche effect according to type of psoriasis**

Psycho effect	Type .psoriasis					Total	P – value
	Guttate	Plaque	Nail	Genital	Scalp		
Yes	18	56	9	6	26	115	$\chi^2=4.157$ P=0.385 (NS)
	12.0%	37.3%	6.0%	4.0%	17.3%	76.7%	
No	7	13	4	0	11	35	
	4.7%	8.7%	2.7%	0.0%	7.3%	23.3%	
Total	25	69	13	6	37	150	
	16.7%	46.0%	8.7%	4.0%	24.7%	100.0%	

The table shows that the higher percentage of psycho effect according to type of psoriasis was (37.3%) in cases who have plaque psoriasis. The association statistically was found to be non\_significant.

**(Table 8) Relationship of environment effect according to type of psoriasis**

Environme	Type .psoriasis	Total	P –
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nt effect	Guttat e	Plaqu e	Nail	Genit al	Scalp		value
Yes	16	56	12	4	17	105	$\chi^2=$ <b>18.274</b>  <b>P=0.00</b> <b>0</b>  <b>(HS)</b>
	10.7%	37.3%	8.0 %	2.7%	11.3 %	70.0%	
No	9	13	1	2	20	45	
	6.0%	8.7%	0.7 %	1.3%	13.3 %	30.0%	
Total	25	69	13	6	37	150	
	16.7%	46.0%	8.7 %	4.0%	24.7 %	100.0 %	

The table shows that the higher percentage of environment effect according to type of psoriasis was (37.3%) in cases who have plaque psoriasis. The association statistically was found to be high significant.

(Table 9) Relationship of Eating specific food according to type of psoriasis

Eating .food	Type psoriasis					Total	p- value
	Guttat e	Plaque	Nail	Genita l	Scalp		
Yes	20	47	9	5	15	96	$\chi^2=$ <b>13.572</b>  <b>P=0.010</b>  <b>(S)</b>
	13.3%	31.3%	6.0%	3.3%	10.0%	64.0%	
No	5	22	4	1	22	54	
	3.3%	14.7%	2.7%	0.7%	14.7%	36.0%	

Total	25	69	13	6	37	150	
	16.7%	46.0%	8.7%	4.0%	24.7%	100.0%	

The table shows that the higher percentage of eating specific food according to type of psoriasis was (31.3%) in cases who have plaque psoriasis. The association statistically was found to be significant.

(Table 10) Relationship of chemical effect according to type of psoriasis

Chemical effect	Type psoriasis					Total	p-value
	Guttate	Plaque	Nail	Genital	Scalp		
Yes	17	47	10	5	20	99	$\chi^2=3.930$ P=0.402 (NS)
	11.3%	31.3%	6.7%	3.3%	13.3%	66.0%	
No	8	22	3	1	17	51	
	5.3%	14.7%	2.0%	0.7%	11.3%	34.0%	
Total	25	69	13	6	37	150	
	16.7%	46.0%	8.7%	4.0%	24.7%	100.0%	

The table shows that the higher percentage of chemical effect according to type of psoriasis was (31.3%) in cases who have plaque psoriasis. The association statistically was found to be non\_significant

(Table 11) Relationship of effect drug according to type of psoriasis

Effect Drug	Type psoriasis					Total	
	Guttate	Plaque	Nail	Genital	Scalp		
Yes	9	6	1	1	11	28	$\chi^2=$ <b>13.496</b> <b>P=0.000</b> <b>(HS)</b>
	6.0%	4.0%	0.7%	0.7%	7.3%	18.7%	
No	16	63	12	5	26	122	
	10.7%	42.0%	8.0%	3.3%	17.3%	81.3%	
Total	25	69	13	6	37	150	
	16.7%	46.0%	8.7%	4.0%	24.7%	100.0%	

The table shows that the higher percentage of drug effect according to type of psoriasis was (42.0%) in cases who have no plaque psoriasis. The association statistically was found to be high significant.

## DISCUSSION

Etiology of psoriasis is still inconclusive due to its complexity . The findings of our research suggest that the larger proportion of psoriasis was among age groups (15-18) years (43.3%). These results correspond with another study that demonstrated the first peak between the ages of 15 and 20 years and a second one happening at 55-60 years [10].

also our study shows higher percentage of psoriasis among the females more than males with (53.3%) that's not agree with the same study that says psoriasis prevalence is estimated to be equal in males and females[11].

According to the Japanese Dermatological study, the presence of a family history had no effect on the severity of psoriasis or the proportion of patients with

comorbidities. Our study found that patients with a family history had a higher percentage (57.3%). [12] In our study shows the most cases have plaque psoriasis and the percentage was and mechanics of the disease and this is appear in our study in high percentage (81.3%) of cases who the treatment not effective to eliminate the disease. This finding is consistent with the findings of the "Clear about Psoriasis" worldwide research, which included 31 nations (both Western and non-Western) and found that 57% of moderate-to-severe psoriasis patients assessed did not obtain clear/almost clear skin on current therapy[20]. This confirms previous results that the majority of psoriasis patients globally are undertreated.

## CONCLUSION

Many factors may associate with psoriasis and there are variation in the effect. These factors which include : Gender which Higher percentage in females than the males, The age group (15\_18) years is more effected, Family history, Other immunological disease and Environmental factors, Specific foods, Chemicals and Specific drugs: There is high significant associated with type of psoriasis.

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## CONFLICT OF INTEREST

“The authors declare no conflict of interest”.

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## **The Effect of Psychosocial Competencies-Based Educational Program on Youth's Health Behavior**

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## المستخلص

**الهدف:** تحديد تأثير البرنامج التنقيفي النفسي الاجتماعي على سلوكيات اليافعين الصحية في جامعات بغداد.

**المنهجية:** تم اعتماد دراسة شبه تجريبية في تحليل البيانات وتطبيق نهج ما قبل الاختبار وبعد الاختبار للمجموعة الاختبارية والمجموعة الضابطة. وقد أجريت

الدراسة في جامعتين في بغداد، الأول في الرصافة والثاني في الكرخ. في مدينة بغداد للمدة من ٥ تشرين الأول ٢٠٢٣ ولغاية ١٥ من نيسان ٢٠٢٣. ولتحقيق أهداف الدراسة، اختيرت عينة غرضية غير احتمالية مكونة من (٦٠) شاباً وشابة تتراوح أعمارهم ما بين ١٥-٢٤ سنة، قسمت العينة على مجموعتين متساويتين، المجموعة الاختبارية والمجموعة الضابطة، وجمعت البيانات الخاصة بالدراسة من خلال استخدام استبانة مصممة لغرض جمع المعلومات تكونت من جزئين تضمنت معارفهم وصفاتهم الديموغرافية. وقد تم بناؤها وتصميمها من قبل الباحث لأغراض الدراسة الحالية. تم تحقيق ثبات أدوات القياس من خلال استخدام معامل ارتباط بيرسون والذي كانت نتيجته (٠,٩٢) لمعارفهم. أما مصداقية أدوات القياس فقد تحققت من خلال عرضها على مجموعة من الخبراء لغرض مراجعتها وتقويم درجة مصداقيتها. تم تحليل بيانات الدراسة باستخدام الإحصاء الوصفي ( التوزيع التكراري والنسبة المئوية) والإحصاء الاستنتاجي الذي شمل الوسط الحسابي، معامل ارتباط بيرسون، الأختبار التائي.

**النتائج:** أشارت نتائج الدراسة الى أن المجموعة الاختبارية من الشباب استفادت من تنفيذ البرنامج التنقيفي الصحي حيث تحسنت وتطورت معارفهم ووعيهم ومهاراتهم بشكل كاف.

**التوصيات:** أوصت الدراسة على إمكانية تنفيذ مثل هكذا برنامج على شكل دروس للشباب في المدارس والجامعات ومراكز الشباب لبرامج التنقيف النفسي الاجتماعي وبضرورة فتح مراكز استشارية في كل من وزارة الصحة والشباب لتقديم الخدمات لهذه الفئة المهمة في المجتمع، فضلاً عن ذلك يمكن إعماده من وثائق برامج التنقيف النفسي الاجتماعي في العراق.

**Abstract**

**Objective(s):** determining the effectiveness of psychosocial competencies-based educational program on young's health behavior.

**Methodology:** "A quasi-experimental study in data analysis and the application of pre-post tests approach for the study and the control groups. The study was carried out in two university in Al-Rusafa and Al-Karkh in Baghdad City from 5<sup>th</sup> of October 2022 to 15<sup>th</sup> of April 2023. To achieve the objectives of the study, a non-probability (purposive) sample of (60) youth (males and females) their ages between 15-24 years were selected. The sample is divided equally into study and control groups. A questionnaire format was used for data collection which consisted of (2) two parts, including their knowledge, and demographic characteristics. Instrument validity was determined through content validity, by a panel of experts. Reliability of the instrument was determined through the use of Pearson correlation coefficient for the test-retest approach, which is (0.92) for their knowledge. Analysis of data was performed through the use of descriptive statistics (frequency, percentage and mean) and inferential statistics (paired t-test, Mann-Whitney test and Chi-square)

**Results:** Results of the study indicate that there are significant comparative differences between youths knowledge of psychosocial competencies-based towards health promotive behavior in the study and control groups through the pre-test and post-test. While there are no comparative differences between youth's knowledge of psychosocial competency in the study groups related to their age and gender through the pre-test and post-test, also there are no comparative differences too related to their socio-economic status through pre-test and post-test.

**conclusions:** The study concludes that the program is successful and can be suggested as an effective means to increase youth's knowledge of psychosocial competencies towards health promotive behavior.

**Recommendation:** The study recommended that such a program can be implemented in form of sessions for youth in school and youth's centers to increase their awareness. Furthermore, it may be suggested as a document of psychosocial competencies-based programs in Iraq.

**Key words:** Psychosocial Competencies-Based Educational Program, Youth, Health Behavior

### **Introduction:**

Youth is a challenging transitional period for many young people. They go through many changes in physical, cognitive, emotional and social development of their life. During these developmental changes young people believe that they are unable to communicate what they want with their parents, teachers and adults and often find themselves in the middle of conflicts and arguments. These situations lead to unnecessary stress, anger issues and low self esteem resulting in, low academic performances, and disruptive behavior in school and at home. In order to cope with the crucial stages of youth development, early intervention of psychosocial competencies programs are carried out with basic skill building activities; participative interactions of role plays, group work, team building exercises, discussions, voicing out opinions and presentations, to actively engage young people in their self development process<sup>1</sup>.

The current life styles of youth, habits and behavior are crucial for the health and disease patterns that will be observed in the future. Knowledge of the significant rapid physical, mental, and social changes occurring during this critical stage of life help youth to absorb and adapt to these changes and enables them to avoid becoming victims of many serious diseases. Urgent need bridge the gap in the knowledge of youth, their parents and other concerned partners<sup>2</sup>. Throughout the growth years, youth are exposed to a variety of influences, some are internal (the process of biological, sexual, maturation and psychosocial development) and others are external. Familial sources include family structure and cohesion, parental characteristics, parent-child communication and the influence of siblings. Migration of the parent or parents, especially the absence of the father (which is not uncommon in the Eastern Mediterranean region) may have negative influence on growing of youth, family problems between the parents, the worst of which is divorce, will influence the psyche of adolescents. Information gleaned from the behavior of maids and servants may lead youth astray. The extra familial environment has a great influence on the youth. This environment includes the neighborhood, the school, the peer group, and the community at large and last but not least, the health system in and outside school. The cultural and religious norms in the family and community have far-reaching effects on the upbringing of the youth. Central to all of these is the institution of marriage, which can be entered into the age of 18 or later<sup>3</sup>.

Young people live within a community and cultural setting which influence their behavior. It provides them with the opportunity of exploring the norms, beliefs and practices within their immediate environs with the view point to challenging the negative ones and reinforcing the positive ones. Youth are made to understand the link between certain community practices of high risk behavior in relation to their health<sup>4</sup>. Psychosocial competencies enable individuals to translate knowledge, attitudes and values into actual abilities "What to do and how to do it". psychosocial competencies are abilities that enable individuals to behave in healthy ways , given the desire to do so and given the scope of opportunity to do so. " how to do" abilities are not the only factors that affect behavior, there are many factors that relate to the motivation and ability to behave in positive ways to prevent health problems. These factors include such things as social support, cultural and environmental factors<sup>5</sup>.

### **Methodology:**

**Study Design:** A quasi experimental design with the application of pre and post approach for the study and control group, which extends from 5<sup>th</sup> of October 2023 to 15<sup>th</sup> of April 2023, in order to determining the effectiveness of the psychosocial competencies-based educational program on youth's health behavior

**Study Sample** A systematic selected sample of (60) youth have been recruited from Baghdad city. They were divided into two groups of (30) youth for the study group exposed to the educational program and (30) were considered as a control group without being exposed to the education program. The sample of the study were selected with respect to the youth's age and gender distribution. The youth's socioeconomic status is measured through the following indicators: parents education and parents occupation , type of family , properties and crowding Index .Each item was graded with score ranging from (0-25).the groups were selected according to specific criteria, youth who live in Baghdad city ,youth who do not participate in any education program related to the issue of psychosocial competencies ,and youth who is student and single.

**The Study Instruments:** Educational program of psychosocial competencies-based is constructed as a result of assessment for youth's need. The investigator has arranged the components of the program in sessions and learning objectives through review of literature and related studies. The educational program of psychosocial competencies has been modified throughout the reviews of the relevant programs which are applied in other countries in order to increase the youth's awareness about psychosocial effects. The educational program of the psychosocial competencies is implemented through (13) sessions related to the major domains of psychosocial competencies at each of selected youth centers.

each session is designed and scheduled for 60-90 minutes. Almost all of sessions are presented at youth centers. It was carried out as a pre and post-tests approach for the study and control groups during the period from 19<sup>th</sup> July 2023 through 19<sup>th</sup> September/ 2023. Sessions included:

1- psychosocial competencies

2-Health behaviors (Value of good health, Dietary habits, Fitness for life, Social Skills, Management of stress, Anger and other emotions, Attitude toward violence, Substance abuse, Sexual health, Aids, Reproductive health, Life transitions, Environmental health)

**Data collection:** the investigators collected data by questionnaire and semi-structured interview technique used with youths', after taking the initial consent of each adolescent to participate in the study. The process started from 1<sup>st</sup> of February until the 15<sup>th</sup> of April 2023. An approximately (20-25) minutes spends with each sick adolescent to complete the interview and filling of the questionnaire format.

**Data Analyses:** Data of the present study are analyzed by using and application of the descriptive statistical data analysis which is appropriate statistical approaches are used in order to assess and analyze the results of the study. The descriptive and inferential statistical data analysis approaches were used in order to analyze the study data.

The mean of score calculated according to the following equation:

- **Mean of Score:**  $MS = \frac{f_1 \times S_1}{n} + \frac{f_2 \times S_2}{n} + \frac{f_3 \times S_3}{n}$  ,      f = Frequency, S = score, n = Sample size

A mean of score of < 1.5 was considered low, (1.5-2.5) was considered moderate and >2.5 was considered high.

## Results:

**Table(1):** shows the distribution of the two samples(Study and Control) according to their demographical characteristics variable's (Gender ,and Age (Per years), through their different groups.

	Groups	Control		Study		CS P-value
		Freq.	Percent	Freq.	Percent	

Gender	Male	15	50	15	50	FEPT
	Female	15	50	15	50	P=1.000 NS
Age Groups	15 - 19	10	33.3	9	30	FEPT
	20 - 24	20	66.7	21	70	P=1.000 NS

NS: Non Sig. at  $p > 0.05$

The results had been indicated that there were a non-significant differences at  $P > 0.05$  for the observed frequency's distributions at the two samples.

**Table (2):** Participants' socioeconomic status (Study and Control)

	Groups	Control		Study		CS
		Freq.	Percent	Freq.	Percent	P-value
Socio - Economic status	Low	11	36.7	11	36.7	$\chi^2 = 0.432$
	Moderate	10	33.3	12	40	P=0.806
	High	9	30	7	23.3	NS

NS: Non-Significant at  $P > 0.05$

The results had been reported that there was a non-significant differences at ( $P > 0.05$ ) for the observed frequency's distributions at the two samples, which indicated that they were corresponding proportionally /or whether the two independent samples are seems to be drawn from the same population.

**Table (3):** Relationship between youth's psychosocial competencies toward Health Behavior and gender

CS	Total	Improvement		Freq. & Percents	Gender
		Yes	Non		
FEPT	15	10	5	Freq.	Male

P=0.341	100%	67%	33%	% Gender	
NS	50%	46%	63%	% Improvement	
	15	12	3	Freq.	
	100%	80%	20%	% Gender	Female
CC=0.149	50%	55%	38%	% Improvement	
P=0.409	30	22	8	Freq.	
NS	100%	73%	27%	% Gender	Total
	100%	100%	100%	% Improvement	

**Table (4):** Relationship between youth's psychosocial competencies toward Health Behavior and Age groups

CS P-value	Total	Improvement		Freq. & Percents	Age Groups
		Yes	Non		
FEPT P=0.453	9	6	3	Freq.	15 - 19
	100%	67%	33%	% Age Groups	
	30%	27%	38%	% Improvement	
NS	21	16	5	Freq.	20 - 24
	100%	76%	24%	% Age Groups	
	70%	73%	63%	% Improvement	
CC=0.098	30	22	8	Freq.	Total
	100%	73%	27%	% Age Groups	
	100%	100%	100%	% Improvement	

**Table (5):** Relationship between youth's psychosocial competencies toward Health Behavior and Socioeconomic status



CS P-value	Total	Improvement		Freq. & Percents	Socio - Economic status
		Yes	Non		
$\chi^2= 1.156$ P=0.561 NS	11	7	4	Freq.	Low
	100%	63.6%	36.4%	% Socioeconomic Status	
	36.7%	31.8%	50.0%	% Improvement	
NS	12	10	2	Freq.	Moderate
	100%	83.3%	16.7%	% Soci -Economic Status	
	40%	45.5%	25.0%	% Improvement	
CC=0.193 P=0.561 NS	7	5	2	Freq.	High
	100%	71.4%	28.6%	% Soci -Economic Status	
	23.3%	22.7%	25.0%	% Improvement	
NS	30	22	8	Freq.	Total
	100%	73.3%	26.7%	% Socioeconomic Status	
	100%	100%	100%	% Improvement	

To predicting the relationship between youth's psychosocial competencies toward Health Behavior and their demographical characteristics of (Gender, Age groups, and Socioeconomic status) and due to overall assessments of improvements groups of the suggested program ,association through the contingency coefficient of the contingency tables had been constructed in tables (3 ), (4), and (5) which were illustrated and testing the effectiveness distribution between the different levels of the predicted variables and the two categories of an overall responding assessment which were reported (Improvement – No Improvement) at the cutoff point (0.50) for the Global Mean of Score of the two periods (Pre & Post) through their improvement.

The results has reported that the improvement of the study sample had no relationship with their Gender, Age groups, and socio-economic status in the overall assessments and that concluded that the studied program can be amend for all individuals of the population of the youth's population whatever a differences with their demographical characteristics factors would be.

**Discussion:**

Throughout the course of the present study, and as it has been shown that the percentage of youths in study and control group concerning gender were equally distributed to match the design of the study. Regarding their ages, two-thirds of sample (66.6%); (70%) respectively in control and study groups were between (22 – 24) years old. Regarding socio –economic status the present study indicated that one third (36.7%) of control group were low level, while (40%) in study group were moderate level. Regarding the relationship between youth's psychosocial competencies and gender, age, and socio-economic status, the results had been reported that there was a non-significant difference for the observed frequency's distributions at the two samples, which indicated that they were corresponding proportionally.

These results are supported by studies that reports the following factors (clinical preventive health services, health status indicators, health risk behaviors, and health behaviors) have been found to be not significantly associated with sex, race/ethnicity, age category, and educational attainment, and identify that there are independent associations of each demographic characteristic with behavior and health outcomes, among young adults aged 18 to 24 years<sup>6</sup>.

While a study showed a positive changes after the implementation of his programme. These findings indicated that the youth in the intervention group were significantly more likely to pursue a healthier lifestyle and to have greater health literacy than those in the control group, regardless of socio-economic status<sup>7</sup>.

Concerning the relationship between youth's psychosocial competencies toward Health Behavior and (gender, age, and socio-economic status), demonstrated that exposure to the educational program resulted in a significant improvement in the four key curriculum areas, attitude toward oneself, communication, problem solving, and career planning. So, the Socio-demographic characteristics such as gender, parental occupation and school affiliation level were found to be associated with pupil's behaviors study schools had higher scores than control schools for 'personal health and psychosocial competencies<sup>8</sup>. Moreover, the most fundamental causes of health disparities are socioeconomic disparities<sup>9</sup>. Socioeconomic status has traditionally been defined by education, income, and occupation. Each component provides different resources, displays different relationships to various health outcomes, and would be addressed by different policies.

Education was recognized as a having a major role to play in future sustainability, while studies in countries including India, China, Sri Lanka, and Kenya illustrate how education leads to economic growth<sup>10</sup>. Regardless of educational level, physically or mentally unhealthy days differed by selected demographic characteristics, health care access, behaviors risky to health, and health conditions<sup>11</sup>.

The school contributes to the social equalization of the health of youth but creates at the same time new disparities, with probably long-lasting consequences. The factors determining the school climate have to be studied more in depth. gender, social class, ethnicity, and school climate as independent variables revealed the disappearance of social gradients by 15 years of age and the emergence of new inequalities related mainly to gender and school climate<sup>12</sup>

Results of the data analysis indicated that there was a significant difference between the study and control groups, this depicts the fact that youths' psychosocial competencies and all sub domains in the study group were good improved as a results of their exposure to the educational program. This result is supported by (Zahran, et al., 2007) (MacKillop, et al., 2006) (Barners, et al., 2008) they revealed in their studies that health was improved in study group after exposure to the educational program<sup>11,13,14</sup>.

One of the methods by which promotion of child health can lead to prevention of illness is by the protection of psychosocial competencies education for psychosocial competence. The program was designed by WHO about the importance of psychosocial competencies education in order to improve individual psychosocial competence, given that most people in this world have average intelligence although they may differ vastly and widely in their self-image<sup>5</sup>.

### **Recommendations:**

1. Suggesting the educational program for psychosocial competencies in youth's centers governmental and non- governmental organizations in order to increase the knowledge of psychosocial competencies among population as well as preventing unhealthy behavior.
2. Establishing counseling centers in both the ministry of youth and the ministry of health to present information services for this population toward health behavior.
3. Educational program should be designed and constructed for youth through which educational sessions can provide critical information concerning factors that influence youth's behavior.

4. Collaborative work can be issued between the ministry of health, the ministry of higher education, and the ministry of education to provide services for this segment of population.

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## ISIS Restricted Al-Anbar Healthcare Services

داعش قيدت خدمات الرعاية الصحية في الأنبار

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**ABSTRACT**

ISIS conquered Iraq and Syria between 2014 and 2018. This report described how ISIS has harmed Al-Anbar healthcare services, personnel, and drugs. It is a retrospective research that was compiled from annual Iraqi health reports. It focuses on healthcare services in Al-Anbar from 2007 to 2017. The factors covered include hospitals in Al-Anbar, basic healthcare facilities, healthcare services, physicians, pharmacists, laboratory personnel, paramedics, and nurses. Excel 2016 was used to examine the data. An estimate of 50 to 95% of the buildings and facilities in the healthcare industry were damaged. The medications were insufficient. Information about healthcare personnel was lacking in the reports from 2015 and 2016. Following the conflict with ISIS, some migrant healthcare workers returned. There were severe shortages of personnel, medications, and healthcare services during the ISIS conflict. The civilian suffering in Al-Anbar was evident and pervasive.

**Keywords:** Influence, ISIS war, Iraqi, Healthcare, Services.

**الخلاصة**

اجتاح تنظيم داعش العراق وسوريا بين عامي ٢٠١٤ و ٢٠١٨. يصف هذا التقرير كيف أضر تنظيم داعش بالخدمات الصحية والموظفين والأدوية في محافظة الأنبار. وهذا التقرير عبارة عن دراسة بأثر رجعي تم تجميعها من التقارير الصحية السنوية في العراق، مع التركيز على الخدمات الصحية في محافظة الأنبار من عام ٢٠٠٧ إلى عام ٢٠١٧. وقد غطت المستشفيات ومرافق الرعاية الصحية الأولية والخدمات الصحية والأطباء والصيادلة وموظفي المختبرات والمسعفين والممرضين في محافظة الأنبار. استُخدم برنامج Excel 2016 لمسح البيانات. تضرر ٥٠-٩٥% من المباني والمرافق في القطاع الصحي. كانت الأدوية شحيحة؛ وكانت التقارير المنشورة في عامي ٢٠١٥ و ٢٠١٦ تفتقر إلى معلومات عن الكوادر الطبية؛ عاد بعض العاملين الطبيين المهاجرين بعد النزاع مع داعش؛ كان هناك نقص حاد في الكوادر والأدوية والخدمات الطبية خلال النزاع مع داعش؛ وكان عدد العاملين في المجال الطبي في الأنبار منخفضاً. كانت معاناة المدنيين في الأنبار واضحة ومتعددة.



الكلمات المفتاحية: تأثير، حرب داعش، العراقية، الرعاية الصحية، الخدمات.

## INTRODUCTION

ISIS signifies an Islamic state that emerged in Syria and Iraq between 2014 and 2018. It goes by several aliases, such as AL Qaida militia. The extremist leaders had full or partial control over the cities and towns of Al-Anbar. <sup>(1)</sup> Members of ISIS took control of all governmental structures and medical facilities. Facilities were either taken to other ISIS areas or used by ISIS for their own purposes. Members of ISIS imposed their laws on civilians by force. <sup>(2)</sup>

The radicals harm the medical facilities they infiltrate. These institutions as well as numerous homes and businesses owned by civilians were destroyed by ISIS bombs. <sup>(3)</sup>

Those who opposed ISIS either killed, wounded, or abducted people. Random acts of warfare, such as explosions over Al-Anbar, concealed bombs, and street fights, occurred. <sup>(4)</sup>

Both Iraqi nationals and medical personnel in the Islamic State depart from Al-Anbar. The radicals engaged in severe combat with the immigration of healthcare workers. <sup>(5)</sup>

Healthcare professionals migrate outside as a result of these conflicts in any way they can. The primary causes of migration are force conflicts, threats, and inadequate security. <sup>(6)</sup>

The "Iraqi Academic Scientific Journals" website contains 447 articles written in Arabic and/or English that discuss the rise of ISIS, the war, the conflict, the effects it had on the people of Iraq, and its consequences for both the country and the region. <sup>(7)</sup>

The goal is to demonstrate how Al-Anbar Healthcare's personnel, supplies, and services have gotten worse due to ISIS and the ISIS war.

## MATERIALS AND METHOD

This report is retrospective, utilizing data gathered from Iraq's annual health reports. It concerns the medical care provided in Al-Anbar between 2007 and 2018. Al-Anbar hospitals, primary healthcare facilities, healthcare services, physicians, pharmacists, laboratory personnel, paramedics, and nurses are among the variables that are included. Excel 2016 was used for the data analysis.

## RESULTS

The number of all Al Anbar healthcare staffs (in all specializations) was drastically reduced.

Between 50 and 95 % of Al-Anbar hospitals' and primary healthcare facilities' buildings were destroyed.

Regarding the medical facilities, equipment, and machinery, nothing was known during that period. Institutions and healthcare facilities have suffered damage as a result of ISIS warfare. The medical facilities had burned due to explosions or arson.

Table 1. the numbers and types of hospitals and primary healthcare centres in Al-Anbar government between 2007-2017 according to Iraqi ministry of healthcare reports.

Year	Private hospital s	Government hospitals		Total	primary health centres		Total
		Non-teachin g hospital s	Teachin g hospital s		Managed by paramedic al staff	Manage d by doctors	
٢٠٠٧	١	٩	٢	١٢	٨٠	٤٣	١٢٣
٢٠٠٨	١	٩	٢	١٢	٧٨	٥٠	١٢٨

٨							
٢٠٠ ٩	٢	٩	٢	١٣	٧٧	٥٨	١٣٥
٢٠١ ٠	٢	٩	٢	١٣	٩٠	٦٤	١٥٤
٢٠١ ١	٢	٩	٢	١٣	٩٥	٦٦	١٦١
٢٠١ ٢	٢	٩	٢	١٣	٩٥	٦٦	١٦١
٢٠١ ٣	٣	٩	٣	١٥	١١٦	٥٣	١٦٩
٢٠١ ٤	٣	٩	٣	١٥	١٠٠	٧٦	١٧٦
201 5 *	٣ *	١٠ *	٢ *	١٥ *	١١٦ *	٥٢ *	١٦٨ *
٢٠١ ٦ *	٣ *	٨ *	٤ *	١٥ *	١٢٠ *	٥٦ *	176 *
٢٠١ ٧	٣	٩	٣	١٥	١٢٣	٦٢	١٨٥

\* 50-95 % of the buildings of these hospitals and primary healthcare centres were destroyed.

Table 2. that shows the numbers and types of the healthcare staff in Al-Anbar government (2007-2017) according to the Iraqi ministry of healthcare reports.

	Doctors			Pharmacists		Lab. Staff	Staff	
	Spec ialist	Non- Special ist	Associ ate From higher educat ed	Speci alist	Non- special ist		Parame dical	Nurs ing

٢٠٠٧	١٤٥	٦٢٠	؟	٤	٣٦	١٣٢	٦٤٩	١٤٣٨
٢٠٠٨	١٦١	٤٣٥	٢١	٥	٧٩	١١٢	١٥٢٩	١٧٧٠
٢٠٠٩	٢٥٤	٦٧٦	٢٩	١٠	١٩٣	٣٠٣	١٣٨٢	١٦٥٩
٢٠١٠	٢٦١	٦٦٢	٣٠	٨	٢٠٩	٣١٠	١٣٩٣	١٦٩١
٢٠١١	٢٩٦	٨٤٠	٢٧	٦	٢٩٨	٣١٧	١٧١١	١٨٦٦
٢٠١٢	٣١٠	٧٥٢	٢٧	١٦	٢٨٦	٤٦١	١٨٢٣	٢٢٦١
٢٠١٣	٣٠١	٧٢٢	٢٧	١٧	٣٣٨	٥٠١	١٨٦٨	٢٢١٥
٢٠١٤	٣٠٣	٧٢٠	٢٧	١٧	٣٣٨	٥٠١	١٨٦٨	٢٢١٥
٢٠١٥	؟	؟	؟	؟	؟	؟	؟	؟
٢٠١٦	؟	؟	؟	؟	؟	؟	؟	؟
٢٠١٧	٣٣٨	٦٩٥	٢٢	١٣	٣٨٧	٥٨٢	٢٣٧٥	٢٢٣٩

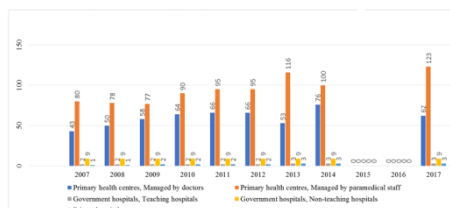


Fig.1. the numbers and types of hospitals and primary healthcare centres in Al-Anbar government between 2007-2017 according to Iraqi ministry of health reports.

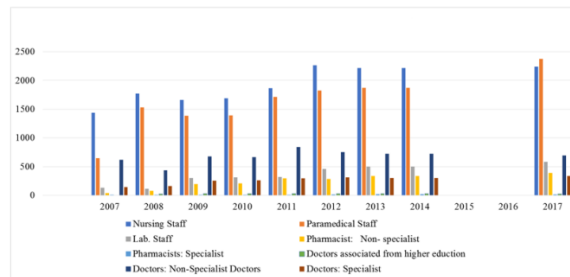


Fig.2. the numbers and types of the healthcare staff in Al-Anbar government (2007-2017) according to the Iraqi ministry of health reports.

## DISCUSSION

About Al-Anbar hospitals:

### 1.a: Small local hospitals:

Al-Anbar' smaincities and deserts were home to nine small- to medium-sized hospitals. Because of inadequate security, these hospitals, which have fifty beds, are nearly invariably closed. Between 50 and 95 percent of these hospitals' institutions had collapsed. These hospitals resumed operations in 2017 after making changes to their caravans.

### 1.b: Private hospitals:

Two Al-Ramadi private hospitals that closed in 2003 due to fighting before that year. There was another private hospital close to Fallujah in 2009. The worst security was the reason behind the opening of a new private hospital in al-Ramadi after that. Following an ISIS attack in 2013, the second private hospital in Al-Ramadi was closed for two months. These hospitals underwent reconstruction and reopened in 2017.

### 1.c: Teaching hospitals:

The government of Al-Anbar operated two sizable teaching hospitals. (Maternity and pediatric Al-Ramadi Teaching Hospital and Al-Ramadi Teaching Hospital). Academic and healthcare improvements in medicine and surgery are encouraging. Prior to 2003, they operated effectively. Al-Fallujah

Teaching Hospital for Pediatrics and Maternity opened its doors in 2013. The Japanese fund overseen by the World Health Organization carried out the reconstruction.

Al-Fallujah Teaching Hospital for Maternity and Pediatrics was impacted by ISIS warfare in 2015. This hospital underwent reconstruction in 2016, and medical personnel was brought back. Another teaching hospital, Al-Fallujah Teaching Hospital, was established in 2016 following the withdrawal of ISIS. Al-Fallujah Teaching Hospital for Maternity and Pediatrics was impacted by ISIS warfare in 2015.

This hospital underwent reconstruction in 2016, and medical personnel was brought back. Another major teaching hospital, Al-Fallujah Teaching Hospital, opened its doors in 2016 following the withdrawal of ISIS. These hospitals underwent reconstruction in 2017 and reopened.

About Al-Anbar primary healthcare centres:

2.a: primary healthcare centres managed by doctors:

These primary healthcare facilities are the principal healthcare facilities or the main sectors. They dispersed throughout each town and city. The majority of these primary healthcare facilities were run by female physicians or dentists. There were

fifty primary healthcare facilities in 2008. Early in 2014, the Al-Anbar Health Directorate expanded to 76 centers. In 2015–16, there were 52–56 primary healthcare centers that remained open. Six healthcare facilities reopened for business in 2017. <sup>(8)</sup>

Following ISIS's withdrawal, WHO assistance was used to rebuild the remaining primary healthcare facilities. Between 50 and 95 percent of primary healthcare centers' buildings were destroyed.

2.b: Primary healthcare centres had managed by paramedical staff.

Six healthcare facilities reopened for business in 2017. There were 78 of these primary healthcare facilities in Al-Anbar towns in 2008. The quantity of

these centers is doubled by the Health Directorate. They continued to grow at an inconsistent rate, reaching 116 centers at the beginning of 2013. Their number is dropping to 100 centers at the start of 2014 as a result of the ISIS sanctions. The Al-Anbar Health Directorate established makeshift primary healthcare facilities in 2015–16. The WHO had provided support to these centers. <sup>(9)</sup>

The Al-Qaida militia sanction had placed restrictions on the rural healthcare centers. 50–95% of the facilities were destroyed, just like the other primary healthcare facilities. <sup>(10)</sup>

There are more paramedic-run primary healthcare facilities than medical doctors. This increase might have resulted from 2008's shortage of general practitioners. due to lax security conditions, leading the physicians to migrate outside of official borders. Due to their superior medical experiences, paramedics oversee primary healthcare facilities.

About Al-Anbar healthcare staff

### 3.a: Al-Anbar Specialized physicians:

Compared to 2008, the number of specialist physicians had doubled to 310 in 2011. In the 2014 report, there were 303 specialists; however, data was missing for all but 2015–16. These ongoing increases demonstrate the great aspiration to obtain medical certifications. Certain experts were murdered, maimed, or denigrated by the extremists of ISIS. A few of them made threats to pay taxes or give money. A large number of professionals quit their jobs, left hospitals, and immigrated to Iraq or the Gulf States. They increased to 338 specialists in 2017. due to the withdrawal of ISIS and increased security. <sup>(11)</sup>

### 3.b Al-Anbar non-specialized physicians:

2008 saw a rise in the number of non-specialized physicians due to security concerns. They frequently quit their jobs, turn down offers of employment, or move outside of Al-Anbar. <sup>(12)</sup>

There was an increase in non-specialized physicians between 2009 and 2014. because of the transient security improvements. particularly in the larger

towns and cities. However, they weren't fond of the outlying primary healthcare facilities. Their number dropped to 695 in 2017. This decline is a result of their ongoing employment at alternative healthcare facilities.

### 3.c: Associate specialists From Iraqi ministry of higher education:

There was an increase in associate specialists to thirty professionals between 2008 and 2010. Temporary security improvements occurred, and some professional immigrants returned. Several of them obtained advanced degrees from foreign scholarships. There were 27 Associates professionals between 2011 and 2014, which is fewer than in 2010. It might list the deceased, retired experts. In search of stable security, some of them moved to the Gulf States. <sup>(13)</sup>

### 3.d: specialist Pharmacists:

In 2008, there were only five pharmacists who were specialists. This low figure indicates that pharmacists at the time were not interested in pursuing advanced academic degrees. Maybe because of the terror of extremists. From 2008 to 2010, the number of specialty pharmacists increased steadily. The growing interest in pursuing higher education has led them to look for academic positions at the University of Al-Anbar. However, in 2011 they dwindled to just six. <sup>(14)</sup>

This marked decline contrasts with the overall decline of physicians. This decline might indicate that extremists are posing a threat to specialty pharmacists. Midway through 2014, their numbers had tripled. Like the doctors of the immigrants, specialty pharmacists returned to the government of Al-Anbar. Maybe as a result of the brief security enhancements. By 2017, they numbered just thirteen. Maybe because of the inadequate security.

### 3.e: Non-specialist Pharmacists:

In 2011, the total count of non-specialist pharmacists climbed to 298. In 2012, there were 286 non-specialist pharmacists due to a lack of confidence. The fighting of ISIS was not an avalanche. However, ISIS launched a number of radicalized assaults prior to its arrival in Al-Anbar. Many fear the glow of extremists and lax security. Due to Al-Anbar need, the number of non-



specialist pharmacists increased to 338 in 2013 and 2014. They grew to 387 in number in 2017. The specialty pharmacists oppose this increase. The urgent need of the Al-Anbar Health Directorate could be the reason.

### 3.f: laboratory staff:

In 2007, there were 132 laboratory employees; by 2008, that number had dropped to 112. There were 303 lab employees in 2009. Over the ensuing years, their number will steadily and consistently rise. The years 2015 and 2016 had missing data. Another raise to 582 laboratory staff members occurred in 2017. This increase signifies the urgent need of the Al-Anbar Health Directorate. <sup>(15)</sup>

### 3.g: Paramedical staff:

The number of paramedics increased to 649 in 2007 and to 1529 in 2008. In 2009, their number fell to 1382, but in 2010, it soared to 1393. From 2011 to 2013, their population increased significantly and steadily, reaching 1868. There was missing data for the years 2015 and 2016. There were additional raises to 2375 in 2017. This is due to the urgent need of the Al-Anbar Health Directorate. <sup>(16)</sup>

### 3.h: nursing staff:

In 2008, there were 1770 nurses. However, in 2009, there were only 1659 nurses. This decline is a result of some nurses leaving Al-Anbar to live elsewhere because of the lax security. Then, as time went on, the number of nurses rose, reaching 22,15 in 2014. due to the brief security gains prior to the ISIS conflict. There were additional raises to 2239 in 2017. The Al-Anbar Health Directorate's urgent need is the reason for this increase. <sup>(17)</sup>

### About Al-Anbar pharmaceutical industry and drugs:

1.a: Al-Anbar healthcare facilities (healthcare instruments, machines, institutions and furniture):

The medical facilities suffered losses as a result of ISIS warfare. Because of the extensive damage, reconstruction is both challenging and impossible. <sup>(18)</sup>

People's homes, marketplaces, farms, and government estates all experienced fires. Healthcare facilities that were not damaged were sabotaged. Following ISIS's withdrawal, there was deliberate theft and sabotage of government institutions.

#### 1.b: Al-Anbar pharmaceutical industry:

Samarra is home to a sizable pharmaceutical industry in Iraq. The oldest pharmaceutical sector in Iraq is the Samara drug industry. Drug production in Samara was stopped during the conflict with ISIS. Ninety percent of the pharmaceutical products available in Al-Anbar are imported from other nations.<sup>(19)</sup>

Drug abuse was a problem during the ISIS conflict. Perhaps as a result of drugs being unavailable in Al-Anbar during the ISIS conflict. The challenges of distributing drugs to the afflicted populations in cities under ISIS control.

## CONCLUSION

There were severe shortages of medical personnel, supplies, and medications during the conflict. The governmental and private healthcare facilities drastically diminished during ISIS war.

## ACKNOWLEDGMENTS

Thanks to ALLAH, my god.

## CONFLICT OF INTEREST

The author declares no conflict of interest.

## ABBREVIATIONS

ISIS: Islamic State in Iraq and Syria.

WHO: World Health Organization.

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## **Women's Knowledge of Health Practices during the Postpartum Period**

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### *Abstract*

During the postpartum period, women experience significant physical, familial, and psychological changes that require adequate knowledge of appropriate health practices. This knowledge is crucial for maintaining the health of the mother, child, and family. To assess this knowledge, a descriptive study was conducted among 50 women at Al-Hayat Private Hospital in Al-Qadmus city. Participants were randomly selected, and data was collected using a researcher-developed questionnaire. The results revealed that the majority of women possessed a high level of overall knowledge about postpartum health practices, particularly in relation to nutrition, physical activity, breastfeeding, and family planning. The study recommends enhancing women's knowledge further by providing updated information on these practices. Additionally, future research with a larger sample size is warranted to generalize the findings.

### **Introduction**

According to the World Health Organization (WHO), maternal mortality rates remain unacceptably high, with approximately 830 women dying every day due to pregnancy and childbirth complications worldwide. In 2015, an estimated 303,000 women died during pregnancy and childbirth, with the vast majority of these deaths occurring in low-resource countries. Most of these deaths could have been prevented with timely and appropriate healthcare, particularly in the immediate postpartum and postnatal periods.

The postpartum period, traditionally defined as the time during and immediately after childbirth, has now been extended to include the weeks following birth, during which the woman's reproductive tract and body return to their pre-pregnancy state. This period, which can last up to six weeks, poses significant health, social, and psychological challenges for women. Their personal needs often take a backseat to the demands of the newborn, spouse, and other family members. Illnesses during this period can range from mild to life-threatening. There is a common misconception that safe motherhood is achieved simply by delivering a healthy baby, with no possibility of complications afterward. However, it is well-established that the postpartum



period is equally important and risky as the pregnancy and childbirth period itself.

During the postpartum period, women should prioritize certain health practices to promote their physical and emotional well-being. Early postpartum movement and activity, within limits to avoid excessive strain, can prevent blood clots, improve circulation, and accelerate recovery. Exclusive breastfeeding for as long as possible offers both physical and psychological benefits for both the mother and the child. Additionally, maintaining a healthy and balanced diet is crucial to replenish nutrients depleted through breastfeeding and other activities. Proper birth spacing using effective family planning methods suitable for the woman's condition can help prevent complications by ensuring adequate time for the body to recover between pregnancies. By adhering to these practices, women can significantly reduce their risk of postpartum complications, which affect approximately 40% of mothers and can have serious consequences for both themselves and their babies.

Several researchers have investigated health practices during the postpartum period and the importance of knowledge for women's health and the well-being of their children. A study in Iran (Mirzaii et al., 2015) found that participating mothers had a moderate level of knowledge about postpartum healthcare practices. However, studies in Eritrea (Beraki et al., 2020) and Ethiopia (Mekonnen et al., 2021) revealed that the majority of mothers had low levels of knowledge about postpartum health practices and family planning methods. In contrast, a study in Egypt (Alkalash et al., 2022) indicated that more than half of the mothers had a good level of knowledge about postpartum health practices.

Women in the postpartum period require comprehensive knowledge and information to make timely and informed decisions for preventing and treating any postnatal complications. Increased knowledge plays a crucial role in adopting positive attitudes toward these practices. Nurses are considered the most effective healthcare team members in providing pregnant women with this knowledge and supervising the implementation of these options optimally

through the relationships built between nurses and pregnant and postpartum women benefiting from the healthcare provided. To further enhance this role effectively, it is necessary to assess women's knowledge about health practices during the postpartum period.

### **Study Objective and Importance**

**Study Objective:** To evaluate women's knowledge regarding health practices during the postpartum period.

**Study Question:** What is the level of women's knowledge about health practices during the postpartum period?

### **Importance of the Study:**

This study focuses on women in the postpartum period, who require considerable care and attention due to the prevalence of serious health and psychological problems they may face during this stage. The increasing needs of the newborn, the family, and the mother's own health expose them to a multitude of changes, highlighting the necessity for comprehensive knowledge about appropriate nutrition, physical activity, breastfeeding, sexual health, and family planning.

Given the vital role of nurses in providing professional nursing care to women during this stage of their lives, it is important for them to assess women's knowledge about health practices during the postpartum period. This assessment can help identify deficiencies and address them through awareness-raising sessions, health education programs, and training initiatives aimed at continuously improving and enhancing these practices.

Additionally, this study represents a valuable scientific contribution to the local and Arab library for comparison and reference, as there is a scarcity of nursing studies in Syria on the subject of the study

### **Materials and Methods** □

**Study Design:** This study followed a descriptive approach

**Study Location and Time:** Data were collected at Al-Hayat Hospital in Al-Qadmus city, between April 6, 2023, and May 25, 2023.

**Study Sample:** A sample of 50 postpartum women was selected using an appropriate sampling method. They were required to be sensory intact, capable of communication, and free from any chronic illness.

**Study Instruments:** The researcher developed a questionnaire after reviewing relevant research on the research topic to collect data from the study sample. The final tool consisted of two parts.

**Part One:** Demographic data sheet including age, education, occupation, place of residence, and number of children.

**Part Two:** Questionnaire to assess the knowledge of the study sample regarding health practices during the postpartum period.

This part included four axes as follows: Nutrition axis comprising 13 items. Movement and activity axis comprising 10 items. Breastfeeding axis comprising 10 items. Family planning axis comprising 8 items.

Each item was answered with either "Yes" or "No," with "Yes" assigned a value of (1) and "No" assigned a value of (0). To determine the level of knowledge, the percentage of correct answers was calculated. Mothers' knowledge levels were categorized as follows: Good knowledge level (percentage of correct answers  $\geq 75\%$ ), moderate knowledge level (percentage of correct answers 50% to 74%), and poor knowledge level (percentage of correct answers  $<50\%$ ).

## Methodology

- Obtaining the necessary official approval to conduct the research
- Developing the research tool after reviewing relevant references and studies.
- Ensuring the credibility of the research tool through presentation to three experts in the field, resulting in no modifications being made.

- Conducting a pilot study on 5 mothers to assess the clarity and applicability of the tool, achieving a Cronbach's alpha reliability coefficient of 0.79, indicating high and appropriate reliability for conducting the research.
- Obtaining verbal consent from women to participate in the study after explaining its purpose, importance, and ensuring the confidentiality of information and the right to withdraw from the study.
- Administering the questionnaire to the study sample personally and allowing them 10-20 minutes to answer the questions, with the researcher present nearby to address any inquiries.
- Encoding, transcribing, and statistically analyzing the data using SPSS v25 software and presenting it in appropriate tables. Descriptive statistical methods such as percentages (%) and frequency (N) were utilized.

## Results

Table 1: Distribution of Women in the Study According to Their Personal Information

variables		*n = 50	
		f	%
Age (year)	<20 y	٧	١٤
	20 – 30 y	٢٦	٥٢
	> 30 y	١٧	٣٤
qalification	Illiterate	1	2
	Reads and writes	2	4
	Primary education	14	28
	Secondary	18	36
	University and abov	15	30
Work	Yes	٢٧	٥٤
	No	٢٣	٤٦
Place of recedancy	Rural	٣٢	٦٤
	Urban	١٨	٣٦
Number of children	One	١٢	٢٤
	Two	١٥	٣٠
	More than tow	٢٣	٤٦

\* n: number of the sample. F. frequecy

Table 1 shows the distribution of women in the study according to their personal information, revealing that approximately half of them (52%) were in their second decade of life. The highest proportion of them (36%) had a secondary education, and more than half of them (54%) were employed in a profession or job. Around two-thirds (64%) resided in rural areas, and less than half of them (46%) had more than two children

Table (2): Distribution of Women in the Study According to the Percentage of Their Answers to Nutrition Axis Statements.

<b>Nutrition</b>	<b>correct</b>		<b>wrong</b>	
	f	%	f	%
1. It is important to distribute and repeat meals without sticking to three heavy meals.	49	98	1	2
2. It is important to avoid fast food and include all the nutritional components in meals.	50	100	0	0
3. It is preferable to avoid beverages containing high levels of caffeine.	47	94	3	6
4. Foods that cause gas buildup should be excluded from the diet.	50	100	0	0
5. It is advisable to avoid fried foods and fast food.	49	98	1	2
6. Avoid consuming spicy foods.	47	94	3	6
7. It is essential to consume a variety of foods rich in vitamin C, such as cauliflower and oranges.	48	96	2	4
8. It is important to consume fluids immediately after childbirth, especially warm ones like anise and fenugreek.	48	96	2	4
9. Proteins are crucial for the recovery process after childbirth.	45	90	5	10
10. Increase consumption of fiber-rich foods.	47	94	3	6
11. The best types of food are those rich in proteins, vitamins, fibers, moderate in carbohydrates, and low in fats.	47	94	3	6
12. It is important to increase fluid intake to at least 1.5 liters per day.	48	96	2	4
13. Increasing dairy consumption is necessary to compensate for calcium loss.	48	96	2	4

Table 2 illustrates the distribution of women in the study according to the percentages of their answers to statements in the nutrition axis. It shows that all women, 100%, acknowledged the importance of avoiding processed meals and including all food components in their meals. Moreover, they recognized the

necessity of excluding foods causing gas accumulation from their diet. Translate to English (academic).

Table (3): Distribution of Women in the Study According to the Percentage of Their Answers to Statements in the Movement and Activity Axis.

<b>Movement and activity</b>	<b>correct</b>		<b>wrong</b>	
	f	%	f	%
1. It is possible to start exercising within a few days after giving birth.	32	64	18	36
2. Walking is a suitable start for all women during the postpartum period.	49	98	1	2
3. Gradual movement and exercises should begin after childbirth.	47	94	3	6
4. It is advisable to avoid abdominal and stomach muscle exercises in the short period after childbirth.	44	88	6	12
5. It is important to start pelvic floor muscle exercises as soon as the woman feels capable of performing them.	39	78	11	22
6. Excessive movement can affect the recovery process after childbirth.	41	82	9	18
7. Exercising for 30 minutes, 5 days a week, helps speed up the recovery process.	44	88	6	12
8. Appropriate exercises reduce postpartum depression symptoms.	49	98	1	2
9. Exercising along with a proper diet helps in losing the weight gained during pregnancy.	50	100	0	0
10. It is advised to refrain from engaging in resistance exercises such as squats and running for a period of no less than 1	45	90	5	10

Table (3) illustrates the distribution of women in the study according to the percentages of their answers to statements in the Movement and Activity Axis. It shows that all women, 100%, acknowledged that exercises, alongside a proper diet, aid in losing the weight gained during pregnancy. Furthermore, 98% recognized that walking represents a suitable beginning for all women during the postpartum period, and that appropriate exercises reduce symptoms of postpartum depression.

Table (4) displays the distribution of women in the study according to the percentages of their answers to statements in the Breastfeeding Axis.

<b>Breastfeeding</b>	<b>correct</b>		<b>wrong</b>	
	f	%	f	%
1. Initiating breastfeeding within the first hour after birth is essential.	42	84	8	16
2. Ensure breast cleanliness before breastfeeding.	50	100	0	0
3. When starting breastfeeding, it is important to place the hands under the baby's head at a 45-degree angle and ensure that the baby is breathing normally.	48	96	2	4
4. It is necessary to burp the baby after feeding to allow them to release gas.	50	100	0	0
5. Breastfeeding helps the uterus to return to its normal size after childbirth and reduces bleeding during the postpartum period.	48	96	2	4
6. It is important to get an adequate amount of rest and consume sufficient fluids as they play a crucial role in milk production.	44	88	6	12
7. During the postpartum period, it is important to avoid taking certain medications while breastfeeding.	49	98	1	2
8. To reduce breast congestion, you can gently express a small amount of milk when feeling breast heaviness.	47	94	3	6
9. To prevent breast engorgement, it is possible to breastfeed the baby from both breasts each time.	48	96	2	4
10. To reduce breast congestion, they can be massaged in a circular motion.	46	92	4	8

Table (4) illustrates the distribution of women in the study according to the percentages of their answers to statements in the Breastfeeding Axis. It shows that all women, 100%, recognized the importance of ensuring breast cleanliness before breastfeeding, and that it is necessary to burp the baby after breastfeeding so they can expel any trapped air.

Table (5) presents the distribution of women in the study according to the percentages of their answers to statements in the Family Planning Axis.

<b>Family Planning</b>	<b>correct</b>		<b>wrong</b>	
	f	%	f	%
1. Contraceptive methods can be used after 6 weeks postpartum while breastfeeding.	44	88	6	12
2. The spiral can be used as a contraceptive method after childbirth.	34	68	16	32

3. It is preferable to use a condom to prevent pregnancy during the postpartum period.	35	70	15	30
4. It is very important to keep a distance between loads for a period of at least 3 years.	49	98	1	2
5. It is preferable to avoid using hormonal contraceptives during the postpartum period while breastfeeding.	46	92	4	8
6. Unplanned pregnancy can occur shortly after childbirth.	48	96	2	4
7. Some birth control methods may be effective, but they should not be used without consulting a doctor.	48	96	2	4
8. Relying on natural breastfeeding as a method of contraception during the postpartum period is not advisable.	43	86	7	14

Table (5) illustrates the distribution of women in the study according to the percentages of their answers to statements in the Family Planning Axis. It indicates that the majority of women, 98%, recognized the importance of spacing pregnancies for at least 3 years. Additionally, 96% acknowledged the possibility of unplanned pregnancies shortly after childbirth, and that while some contraceptive methods may be effective, they should not be used without consulting a doctor.

Table (6) presents the distribution of women in the study according to their levels of knowledge regarding health practices during the postpartum period.

Knowledge axis	levels of knowledge					
	High		Moderate		Low	
	f	%	f	%	f	%
1.Nutrition	47	94	3	6	0	0
2.Movement and activity	39	78	10	20	1	2
3.Breastfeeding	48	96	2	4	0	0
4.Family Planning	45	90	5	10	0	0



<b>Total</b>	49	98	1	2	0	0
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Table (6) illustrates the distribution of women in the study according to their levels of knowledge regarding health practices during the postpartum period. It revealed that the majority of women, 98%, had a high overall level of knowledge. Furthermore, 96% of them had a high level of knowledge in the breastfeeding axis, 94% in the nutrition axis, 90% in the family planning axis, and 78% in the movement and activity axis.

### Discussion

The results of the current study showed that most women during the postpartum period had a high level of knowledge about nutrition. All of them knew that they should avoid fast food and include all food components in their meals, and that foods causing gas should be excluded from the diet. This result could be attributed to the experience gained by women due to work and repeated childbirth. The demographic information showed that the majority of them had more than one child and had completed secondary education, indicating experience and cultural awareness of vital information related to nutrition during the postpartum period.

This result is consistent with a study by Darling et al. (2014) in India, which found that the majority of mothers in the study had a high level of knowledge regarding nutrition during breastfeeding in the postpartum period [14]. However, it does not align with a study by Liu et al. (2009) in China, which found that the level of maternal knowledge about general dietary behaviors during the postpartum period, such as fruit and vegetable consumption, soy and soy product consumption, and nutritional and health knowledge, was low [15]. It also does not align with a study by Mirzaii et al. (2015) in Iran, which showed that the majority of women in the study had moderate knowledge about postpartum care [3].

The results of the current study also showed that most women during the postpartum period had a high level of knowledge about movement and activity. All of them knew that exercise, along with diet, helps in losing the weight gained during pregnancy. This result could be attributed to the fact that the

majority of women were employed, lived in rural areas, and had good educational levels, reflecting good knowledge about the importance of movement and activity in managing family, household, and work responsibilities, which women are committed to, and its positive impact on their health, helping them avoid gaining excess weight and maintaining a weight that helps them manage their affairs.

The results of the current study also showed that most women during the postpartum period had a high level of knowledge about breastfeeding. All of them knew that ensuring the cleanliness of the breasts before breastfeeding is necessary. This is likely due to the fact that the majority of women had more than one child, indicating good experience that makes their knowledge about breastfeeding and breast care during the postpartum period good. This result aligns with a study by Darling et al. (2014) in India, which stated that the majority of mothers in the study had high levels of knowledge regarding breast cleanliness before breastfeeding [14]. However, it does not align with a study by Mirzaii et al. (2015) in Iran, which showed that most women were not aware that washing the nipples with water and soap before breastfeeding is necessary [3].

The results of the current study also showed that most women during the postpartum period had a high level of knowledge about family planning. Most of them knew that it is very important to space pregnancies for at least three years. This is likely due to the good cultural level of the majority of women and their being workers, which motivates them to space pregnancies. They are aware of the positive effects of spacing pregnancies on their health, the health of their children, and their work.

This result aligns with a study by Alkalash et al. (2022) in Egypt, which showed that more than half of the women in the study had good knowledge about health practices related to the postpartum period [12]. However, it does not align with a study by Mirzaii et al. (2015) in Iran, which showed that the majority of women in the study had moderate knowledge about family planning methods [3]. It also does not align with a study by Beraki et al. (2020) in Eritrea, which found that the vast majority of mothers in the study had a low level of knowledge about health practices related to the postpartum period [10].

The results of the current study showed that most women, 98%, had a high level of knowledge about health practices during the postpartum period overall. This is likely due to the fact that the majority of women were in their twenties and had relatively high educational levels. This indicates both enthusiasm and cultural factors that converge to make women aware of postpartum health care practices. Additionally, the majority of women were mothers, indicating experience in pregnancy, childbirth, and the postpartum period. This experience, combined with their good education and appropriate age, contributes to their high level of knowledge.

### Conclusions

- Most women had a high level of knowledge about nutrition during the postpartum period.
- Most women had a high level of knowledge about movement and activity during the postpartum period.
- Most women had a high level of knowledge about breastfeeding during the postpartum period.
- Most women had a high level of knowledge about family planning during the postpartum period.
- Most women had a high overall level of knowledge about health practices during the postpartum period.

### Recommendations

1. Enhance women's knowledge about health practices during the postpartum period by placing brochures and illustrative images in women's rooms depicting periodic updates in health practices during the postpartum period.
2. It is necessary to conduct a study on women's attitudes and actual practice of health practices during the postpartum period.
3. Repeat the study on a larger sample size to ensure the generalizability of its results.

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