

المؤتمر الملمى الدولى الثالث عشر للملوم الصرفة والتطبيقية والتكنولوجية

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PREFACE

The XIII. International Scientific Congress of Pure, Applied and Technological Sciences "Minar CONGRESS", was organized by Igdir University, in collaboration with Rimar Academy. The primary objective of this event was to compile and disseminate valuable scientific knowledge and make a meaningful contribution to the future.

Remarkably, a substantial number of researchers, both from local and international backgrounds, demonstrated their interest in this conference. The scientific committee meticulously reviewed the submissions and ultimately accepted a select group of individuals, totaling **34** applicants, **28** of them were accepted by the scientific committee.

The core of this conference was the presentation of **19** complete research papers, while the remaining articles and research findings are set to be featured in forthcoming issues of the MINAR Journal.

I would like to extend my sincere appreciation to all the contributors and scholars who played an essential role in making this conference a resounding success. Your dedication and valuable contributions are deeply respected and acknowledged.

> Editor-in-Chief Prof. Dr. Ghuson H. MOHAMMED



الهيئة الاستشارية

Consultative Committee





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Effect of Hookah Smoking On Liver Function and Immune Parameters

Wurood Ali Hathal¹ Frial Gemeel Abd² Anmar M. K. Al-Maamori³ Mustafa Abdulrahman Al-Kinani⁴

Abstract

The use of hookahs has increased among students in universities, and due to the presence of many harmful effects of smoking on individual health, the study aimed to study some immune parameters and liver functions in student smokers of regular, classic, or electronic hookahs. Blood samples were collected from 50 smokers (25 regular shisha and 25 electronic) whose ages ranged between (16-40) years in Babil Governorate. 25 non-smokers and even those not accompanying smokers were chosen as a control group. Sick people were excluded from the study for the period from October. 2023 to January 2024.

The immunoglobulin's IgG ,IgM IgA and complement components C3 and C4 were measured using the single radial immunodiffusion method. The results showed a lower concentration of IgG and IgM in smokers (1397.16 \pm 256.61 and 106.60 \pm 56.64), respectively, compared to control non-smokers (2374.0 \pm 1116.340 and 146.77 \pm 94.97), respectively. The concentration of complement components was also non-significantly lower in smokers compared to the control. Liver functions were studied by estimating the concentration of the Glutamic Pyruvic Transaminase (GPT) and Glutamic Oxalacetic Transaminase (GOT), and the results also showed a significant decrease in their concentration. Total protein and liver enzymes were also compared between classic and electronic hookahs, as electronic hookahs had a significant impact on liver function.

Keyword : Smoking , Immunoglobulin's, Complement Components, Liver Functions.



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Introduction

More than 300 million persons use smokeless tobacco (ST) orally or through their noses (National Cancer Institute, 2014). ST can be chewed or dipped like betel quid, or it can be finely chopped or powdered snuff. With over 220 million ST users in India, 28 million in Bangladesh, and 11 million in Myanmar, much of South and Southeast Asia has extremely high ST usage rates. In 2009–10, ST use was more common than cigarette smoking in India for both men (33% vs. 24%) and women (18% vs. 3%). WHO (2019) and the National Cancer Institute (2014) Furthermore, there is evidence that while the prevalence of ST consumption is increasing in India, the prevalence of cigarette smoking is starting to decline (Sinha et al., 2015; Misra et al., 2016).

According to the National Cancer Institute (2014), the prevalence among teenagers is higher than 10% in certain African nations, such as Namibia and Congo. Approximately eight million people use ST in the US, primarily in southern and midwestern states (National Cancer Institute, 2014) (Israel et al., 2014). In Europe, ST use is comparatively rare, with the exception of Norway (Lund and Lindbak, 2007) (about 16% of males and 1% of women) and Sweden (21% of men and 4% of women) (Leon et al., 2016).

Several inflammatory cytokines and chemokines were considerably reduced in smokers' whole blood samples after a 7-hour challenge with E. coli. In contrast to controls, smokers' blood samples produced considerably higher levels of PGE2 and a number of cytokines/chemokines when stimulated with HSV-1. Red blood cell composition, hematocrit, hemoglobin levels, MCV, MCH, MCHC, Pct, and RDW were all higher among smokers, which is associated with reduced lung function. Increases in granulocytes and monocytes also contributed to a notable increase in total leukocytes. Furthermore, smokers exhibited increased Tregs and fewer NK cells compared to controls, indicating that smoking may lessen the body's capacity to eradicate early-stage cancer cells. Importantly, smokers varied greatly from person to person; for many of the parameters evaluated, some smokers had values that were considerably different from those of controls, while others had normal levels (Elisia et al., 2020). the aim of this study to measurements of immunological parameters such immunoglobulin's, complement components, Liver functions.

Materials and methods

In the Babil Governorate, blood samples were taken from 50 smokers, 25 of whom were regular shisha users and 25 of whom were electronic users. The smokers' ages ranged from 16

to 40. A control group of twenty-five nonsmokers, including those who did not accompany smokers, was selected. From October 2023 to January 2024, research participants who were ill were not allowed to participate.

A unique one-time syringe was used to take five milliliters of blood from the humeral vein. The extracted blood was put in tubes with a gel that aids in serum separation. After five minutes of centrifuging the blood at a power of 4500, the serum was separated using a Pasteur pipette and stored in Eppendrof tubes at 5 °C for freezing. Using the radial immune diffusion method (Easy RID/Italy), which uses a plate with 12 wells for the quantitative determination of human plasma proteins in serum and plasma, the concentration of immunoglobulins (IgG, IgM) and complement levels (C3, C4) were estimated. The total protein concentration was estimated in accordance with the kit procedure (Colorimetric total protein kit/France) to detect total protein. Assessing liver function.

Glutamic Pyruvic Transaminase (GPT) and Glutamic Oxalacetic Transaminase (GOT), two liver enzymes, were tested using the protocol developed by DiaSys Diagnostic Systems GmbH, the manufacturer.

Statistical analysis

SPSS software (version 23 SPSS) was used to perform the T test for statistical presentation and analysis of the current study. It was deemed statistically significant when the value was less than 0.05.

The results

The concentrations of immunoglobulins and complement component C3 and C4 were estimated for 3 days according the kits

In table (1) the concentration of Immunoglobulin's and complement were no significant different between first, between patients and healthy groups at P value more than 0.05. Concentration of IgG ,C4 were decreased (1790.16 ± 495.34 , 29.53 ± 11.88) respectively in electronic hookah smoking compared with control groups (2346.95 ± 1120.31 , 31.200 ± 0.000)(no smoking) While IgM and C3 concentrations were increased(182.23 ± 104.71 , 29.53 ± 11.88 i)n hookah smoker compared with control (94.60 ± 92.75 , 125.63 ± 115.57) respectively.

Parameters	Patients / M±SD	Control	P -value
IgG	1790.16 ± 495.34	2346.95 ± 1120.31	0.2
IgM	182.23 ± 104.71	94.60 ± 92.75	0.58
C3	212.50 ± 78.19	125.63 ± 115.57	0.43
C4	29.53 ± 11.88	31.200 ± 0.000	0.12

Table 1: Concentrations of IgG ,IgM ,C3 and C4 in smokers (electron hookah) and control

In table (2) the concentration of Immunoglobulin's IgG and IgM were no significant decreased in patients compared healthy groups at $P \le 0.05$. except C4 .

Table 2: Concentrations of IgG ,IgM ,C3 and C4 in smokers (classic hookah) and control

	M±	SD	
Parameters			P -value
	Patients	Control	
IgG	1940.77 ± 303.74	2346.95 ± 1120.31	0.17
IgM	106.60 ± 56.64	146.77 ± 94.97	0.23
C3	128.10 ± 90.66	125.63 ± 115.57	0.66
C4	39.51 ± 7.34	31.20 ± 0.00	0.02**

In table (3) the concentration of GOT ,GPT and total protein were no significant different between patients and healthy groups at $P \le 0.05$.

Table 3: Concentration of GOT , GPT and total protein between patients (electron smokers) and control

	M±	SD	
Parameters	Patients	Control	P -value
GOT	6.83 ±2.07	3.57 ± 1.68	0.73
GPT	8.80 ± 1.55	6.17 ± 3.66	0.18
Total protein	9.38 ± 1.43	6.69 ± 1.21	0.74

In table (4) the concentration of GPT and total protein were no significant increased in patients compared with healthy groups at P ≤ 0.05 . but only GOT was significant different between patients with normal smoking and healthy (no smoking) at p ≤ 0.05

Table 4: Concentration of GOT , GPT and total protein between patients and control in normal
smoking

Parameters	M±	SD	P -value
	Patients	Control	
GOT	13.17 ± 9.42	3.57 ± 1.68	0.03**
GPT	10.27 ± 6.18	6.17 ± 3.66	0.2
Total protein	9.38 ± 4.20	6.69 ± 1.21	0.06

In table (5) the concentration of IgA was significantly increased in smokers than healthy (no smoking) at $p \le 0.05$

Table 5:	concentration of	IgA in	patients	smoking an	d control
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Parameter	M±SD		P -value
	Patients	Control	
IgA	103.100 ± 29.716	33.400 ± 22.69	0.007**

The comparison between electric and classical hookah smoking on IgG ,IgM . and C4 were no significantly increased in electric compare with classic while concentration of C3 were increased significantly compare with classic as table 6

Table 6:	the comparison	between electric and	d classical hookah smok	ing
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Parameters	M±S	M ± SD	
	Electronic smoking	Classic smoking	
IgG	1638.054 ± 428.890	1682.878 ± 457.446	0.8
IgM	182.225 ± 96.940	106.60 ± 50.658	0.1
C3	190.72 ± 73.183	118.54 ± 73.520	0.02*
C4	92.52 ± 10.99	36.70 ± 6.35	0.2
Total protein	9.37 ± 1.43	9.37 ± 4.20	1

Discussion

Many inflammatory diseases have a pathogenic mechanism that involves extreme complement activation. Inflammation of the lungs and respiratory disorders such as pneumonia, asthma, and smoke-induced damage are likely caused by complement activation products (Rawal, 2006). According to Chaudry et al. (2009), there are approximately 25 million smokers in Pakistan, with men making up the majority of smokers due to the 4:1 male to female ratio.

The present study found no significant difference in IgG and IgM concentrations, in contrast to a study (Tarbiah et al., 2019) that found that serum IgG levels were significantly lower in smokers than in non-smokers (P < 0.0001) and serum IgM levels were significantly higher in smokers than in non-smokers (P < 0.0001). Nonetheless, this study corroborated Tarbiah et al.'s (2019) findings that smoking had no discernible effect on IgM serum levels.

According to Azizi et al. (2017) and Arason et al. (2010), smoking-induced decreases in Ig levels could be plausibly classified as a type of moderate secondary immunodeficiency. Similarly, smoking may cause immunodeficiency, including decreased Ig levels, which leads to insufficient control of infectious agents and, ultimately, the development of autoimmunity (Qiu et al., 2017). This could account for the correlations found between smoking and autoimmune disorders (Perricone et al., 2016). This model presents a plausible relationship between smoking and infections, two environmental factors known to be associated with autoimmune diseases (Perricone et al., 2016; rcolini and Miller, 2009).

According to Barnes (2016), cigarette smoke is the main risk factor for COPD and is also connected to autoimmune diseases. According to multiple studies, about 25% of COPD patients had total serum IgG levels below the lower limit of normal, which is comparable to our findings in smokers without COPD (Leitao Filho et al., 2017). A higher frequency of exacerbations and hospitalizations (mostly from respiratory tract infections) is associated with deficiencies in IgG1 and/or IgG2 subtypes in patients (Leitao Filho et al., 2018).

According to Sanai and Hussain's (2011) research, there is no discernible difference in the levels of C3 protein between smokers and non-smokers in this study. indicated the smokers' serum C3 levels were 102.63 ± 14.69 . The control group of nonsmokers had serum C3 values of 76.68 ± 7.41 . Comparing smokers to controls, it was found that their C3 was 33.84% greater. Contrary to previous research, the current investigation revealed a substantial difference between smokers and nonsmokers (Sanai and Hussain, 2011). uncovered that smokers had a 45.28% greater C4 content than the controls. Because the p value was greater than 0.05, the

independent T test revealed that although the smoker participants had higher mean serum levels of C3 and C4, the difference was not statistically significant.

There is no discernible difference in concentrations between smokers and non-smokers, according to the results of the current study on the effects of smoking on liver function tests like GOT and GPT. This study is different from one by Abdul-Razaq & Ahmed (2013), who discovered that the serum levels of alkaline phosphatase (ALP), alanine transaminase (GPT), and aspartate aminotransferase (GOT) were statistically significantly higher in heavy smokers. Jabbar and Abdul-Hassan (2017) also discovered that heavy cigarette smoking was significantly associated with higher levels of glutamate pyruvate transaminase, or GPT (44-54) mg/dl (P < 0.0001) and glutamic-oxaloacetic transaminase, or GOT (23–48) mg/dl.

This study contradicts both the findings of the study by Abdul-Razaq and Ahmed [Abdul-Razaq and Ahmed, 2013] and the study by LATEEF et al. (2024), Results revealed that smokers had a considerably lower total serum protein level (5.833±0.255) than non-smokers (6.139±0.535). The concentration of total protein did not significantly change between smokers and non-smokers, according to the current study. Serum levels of albumin, globulin, and total protein were considerably lower in the heavy and moderate smoker groups than in the nonsmoking group, the study found. No statistically significant changes were seen between the smoker and non-smoking groups when comparing their serum A/G ratios. Smoking may impair the liver's function and activity. These types of effects depend on the dosage of exposure. Based on the comparison of electric and classic hookahs, the majority of proteins were higher in the former.

This is in line with another study (Rezk-Hanna et al., 2022) that found that using an ehookah to vape was more likely to generate an immediate rise in carotid-femoral PWV than using a combustible hookah. When vaping with an e-hookah, there were acute elevations in the proinflammatory markers hsCRP, fibrinogen, and TNFa, which were associated with increases in carotid-femoral PWV; however, smoking a hookah did not cause any alterations. These results suggest that, although being promoted as "safe," e-hookah vaping has negative effects on the vasculature that are, at least in part, brought on by inflammation. Alterations in CO and nicotine synthesis are probably the cause of acute elevations in proinflammatory markers.

Conclusion

Smokers' serum levels of complement components and immune globulins decreased as a result of hookah smoking. Due to the considerable drop in enzyme concentrations among smokers, hookah had a major impact on liver function.

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The Role of Iron Overload and Ferritin Levels in the Prevalence of *Klebsiella pneumoniae* Among Beta-Thalassemia Iraqi Patients

Bassam Shaker Mahmood ¹ Anwer Jaber Faisal ² Allaa Hatim Thanoon ³ Baraa Ahmed Saeed ⁴

Abstract

Background and Aim: The study investigates the relationship between the frequency of *Klebsiella pneumoniae* infections in individuals with Beta-thalassemia and iron excess, as determined by ferritin levels. Beta-thalassemia often results in iron overload, a prevalent concern intensified by regular blood transfusions, leading to increased ferritin levels. This study analyses how these characteristics contribute to vulnerability to *K. pneumoniae* infections, a notable source of illness in the Iraqi patient population.

Methods: Seventy blood samples from thalassaemia patients of various genders and ages were donated for this study. Thermo Scientific chemical analysers analyzed human ferritin (FE). Vitek 2 Compact and traditional microbiology recognized *K. pneumoniae*.

Results: The findings showed that in the 70 Thalassaemia patients' group, both men and women donated blood samples. Of the samples examined, 39 (55.7%) were positive for *K. pneumoniae*. The serum ferritin levels of 58 people were 1000–3000 ng/ml. *K. pneumoniae* infections in Beta-thalassemia patients were linked to higher ferritin levels.

Conclusion: Due to blood transfusions, beta-thalassemia patients with iron overload are at risk of bacterial infections, notably *K. pneumoniae*. The high rate of positive bacterial infection tests in Iraqi thalassaemia patients and their elevated ferritin levels demonstrate the importance of managing iron overload and monitoring ferritin levels to reduce infection risk.

Keywords: Thalassemia, Klebsiella Pneumonia, Iron, Ferritin.



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Introduction

Genetically, beta-thalassemia causes haemoglobin to produce fewer beta-globin chains than usual. Beta-thalassemia mutations are more common in Asian, Mediterranean, and Middle Eastern people [1]. Over 200 beta-globin gene mutations cause thalassaemia and has many physical and genetic characteristics. Beta-thalassemia mutations vary widely by area. Mediterranean, Middle Eastern, Southeast, and Central Asian regions have the highest incidence. Beta thalassaemia affects almost 68,000 newborns. About 80-90 million people, or 1.5% of the global population, have this illness [2].

Iron-containing ferritin is essential to humans. It's essential for cell and body iron balance. It is also an acute-phase reactant in inflammatory responses and promotes cancer and infection [3].Serum ferritin (SF) prevents iron deficiency and excess. Since the body cannot remove iron, serum ferritin (SF) is an excellent way to monitor iron levels after treatment. Four. In healthy adults, SF concentrations typically range from 12 to 300 μ g/L for men and 12 to 150 μ g/L for women [4]. When SF levels exceed 1000 μ g/L, the body overloads with iron, leading to organ damage, cardiac and liver issues, and increased mortality. It is important to consider the risks to healthy individuals when assessing the effects of elevated SF levels in β -thalassemia [5]. Bacterial infection is a leading cause of death in thalassemia patients, with over 10% of infections being severe. Blood transfusions are the leading cause of infection [6].

The state of iron excess has been linked to the presence of microorganisms such as *Yersinia enterocolitica*, Klebsiella spp., *Escherichia coli*, *Streptococcus pneumonia*, *Pseudomonas aeruginosa*, and *Listeria monocytogenes*. A prior investigation demonstrated that the removal of the spleen increased the susceptibility of individuals with thalassemia and sickle cell disease to severe infections, primarily caused by Gram-negative germs [7].

The primary objective of this study is to examine the correlation between excessive iron accumulation, as shown by ferritin levels, and the frequency of *Klebsiella pneumoniae* infections in individuals with beta-thalassemia in Iraq.

Material and method

Patient data

A total of 70 blood samples were taken from patients of all ages and genders who had been diagnosed with Thalassemia. The individual has received a verified medical diagnosis of Thalassemia Major, with no presence of any other medical conditions or use of medications. The samples were obtained from the Thalassemia centers at Ebn-Albalidy Hospital and Al-Karama Hospital in Baghdad.

Blood collection

Aseptically, 10 mL of blood specimens were obtained via venipuncture and transferred into a sterile, non-additive tube. The tube was thereafter subjected to centrifugation at a speed of 3,000 revolutions per minute for an average of 15 minutes. Serum samples were then obtained using an automated pipette. The specimen was preserved at a temperature of -20 degrees Celsius until it was needed for future use [8].

Measurement of Human FE (Ferritin) by Chemistry Analyzers

The method depends on microparticle-enhanced immunoturbidimetry utilizing a chemical analyzer manufactured by Thermo Scientific. The serum received treatment with microparticles that were coated with rabbit antibodies that specifically target human Ferritin. The increase in absorbance caused by the formation of immunocomplexes is quantified at a wavelength of 700 nm. The change in absorbance is directly proportional to the amount of antigen (Ferritin) in the solution.

Klebsiella pneumonia isolation and identification

The blood sample was inoculated onto selective and differential medium, such as MacConkey agar or Blood agar. The plates were incubated at 35-37°C for 18-24 hours. Any gram-negative bacteria with mucoid growth on MacConkey agar were subjected to an IMViC test and automated biochemical identification utilizing the Vitek 2 compact system for further identification.

Results

The objective of this study was to find out the frequency and potential causes of bacterial infections in individuals with B-thalassemia. This study was conducted on a group of 70 thalassemia patients at Thalassemia centers located at Ebn-Albalidy Hospital and Al-Karama Hospital in Baghdad. Table (1) shows that 47 individuals (67.1%) were females, and 23 individuals (32.8%) were males. The average age of the group was 22 years.

Table 1: Disruption of B-thalassemia condition among genders

Variables	Number of samples	Percentage %
Female	47	67.1%
Male	23	32.8%

Ferritin levels in the blood serum

The average serum ferritin level was 2567.52 (SD 1649.1) ng/ml. Out of the total number of patients, only 12 individuals, accounting for 17.1% of the sample, exhibited a serum ferritin level below 1000 ng/ml. Out of the total number of patients, 37 individuals (52.8%) had a serum ferritin level ranging from 1000 to 2500 ng/ml. On the other hand, 30% of the patients (21 individuals) had values beyond 2500 ng/ml, Figure (1). The serum ferritin level rises in correlation with both the patient's age and the frequency of blood transfusion.



Figure 1: Distribution of serum ferritin concentrations among patients

Klebsiella pneumonia isolation and identification

A total of seventy blood samples were taken, from which 39 out of 70 (55.7%) probable colonies of *Klebsiella pneumonia* were identified, Figure (2). All 39 blood samples exhibited colonies with a pink color, appearing wet and mucoid on the surface of MacConkey agar. On blood agar, the isolated bacteria formed huge gray colonies that lacked hemolytic properties. Among the 39 isolated *Klebsiella pneumonia*, only 4 samples exhibited positive hypermucoviscosity features, as previously described [9]. Table (2) displays the IMViC results obtained from the analysis of bacterial isolates. Using the VITEK 2 Compact System GN cards,

the blood sample of a patient with B-thalassemia has been confirmed to be contaminated with Klebsiella pneumonia.

Indole	Methyl red	Voges-Proskauer	Citrate test
-	-	+	+

Table 2: IMViC result for Klebsiella pneumonia



Figure 2: Distribution of Klebsiella Pneumonia

Discussion

Thalassaemia is the most prevalent single-gene disorder worldwide [10]. Infections are the second most frequent cause of mortality in individuals with thalassemia major. Medical professionals who are responsible for treating patients with thalassemia are well-informed about this potential danger and understand the significance of any measures that can reduce it [11]. In this study, women are more susceptible to thalassemia, as shown in Table (1), disparities in reported instances among genders may stem from variations in healthcare accessibility, awareness levels, or reporting methodologies rather than an actual disparity in the disease's prevalence [12]. Although prevalence reports may vary, beta-thalassemia does not intrinsically exhibit a gender bias. The perception of a gender disparity could be shaped by regional, societal, or reporting variables rather than a biological distinction [2].

Figure (1) shows that 52.8% of individuals had a serum ferritin level between 1000 and 2500 ng/ml. On the other hand, 30% of the patients had values exceeding 2500 ng/ml, which aligns with the findings of a study conducted by [13]. A similar study conducted In Duhok showed a similar result, patients with Beta-Thalassemia Major (TM) have significantly elevated

ferritin levels compared to those with Beta-Thalassemia Minor (Tm) and healthy controls [14]. An additional investigation from Asia, done in Pakistan, indicated that 85.4% of individuals with Beta Thalassaemia Major displayed markedly elevated serum ferritin levels, averaging 4442 ± 2882 ng/ml. Notably, 44.4% of patients had serum ferritin levels between 1000 and 2500 ng/ml, whilst 43.05% demonstrated levels beyond 2500 ng/ml, indicating severe iron overload. The findings highlight the critical need for enhanced management of chelation therapy to avert issues associated with excessive iron accumulation, especially in those over the age of 11[15].

Iron overload is a consistent and significant complication in thalassemia, with serum ferritin concentration serving as an accurate indicator of body iron stores [16]. Iron-induced cardiomyopathy is the leading cause of death in people with thalassemia, especially in those who receive chronic red-cell transfusions [17]. An excessive accumulation of iron mainly causes cardiac dysfunction and heart failure in this population. The presence of excessive iron in severe thalassemia is a result of heightened absorption in the gastrointestinal tract and regular transfusion of red blood cells [18]. The ferritin test is a straightforward and non-invasive method used to detect excess iron levels and the negative effects it might have on the body [19].

Figure (2) shows that among the 70 blood samples suffering from B- thalassemia, 39 cases were found to be infected with *K. pneumonia*. A study conducted by Wanachiwanawin revealed that Klebsiella species were responsible for 25% of all severe infections in thalassemia patients in Thailand. Additional significant causative pathogens comprised *E. coli* (accounting for 26% of infections), Salmonella species (contributing to 15% of infections), and *S. pneumoniae* (responsible for 13% of infections)[20].

Klebsiella infections provide a significant risk of death and illness in individuals with thalassemia major, and even more so in those with HbE/b-thal. Occasionally, reports in literature document the high rates of mortality and morbidity associated with these infections [21]. A comprehensive analysis of 160 patients in retrospective research revealed a prevalence rate of 7.5%. The clinical manifestations of this condition encompassed sinusitis, cerebral infection, meningitis, septicemia, and pyogenic abscesses affecting the liver, lung, and kidney. The mortality rate was 16%, and 25% of patients experienced permanent neurological sequelae. The apparent factors that increase the likelihood of a condition include iron excess and liver dysfunction [22].

The relationship between iron load and susceptibility to infection has not been definitively proven in clinical research. It is evident, however, that a range of microorganisms exhibit increased pathogenicity when there is an excess of iron [23]. The most well-documented connection between bacterial infection, iron, and iron chelators is related to *Y. enterocolitica*. Several additional organisms, including Klebsiella species, *E. coli, S. pneumoniae, P. aeruginosa, L. pneumophila*, and *L. monocytogenes*, have demonstrated heightened virulence when exposed to an abundance of iron. In contrast, persons with thalassemia and iron overload have reduced phagocytic effectiveness when evaluated in vitro, as compared to individuals without thalassemia [24].

A study was undertaken to ascertain the risk factors associated with Klebsiella infection in individuals diagnosed with thalassemia major. Only the univariate analysis revealed the significance of a high ferritin level and abnormal liver function. Previous research has established that an excessive amount of iron in the body is a key risk factor for Klebsiella infection in individuals with thalassemia major [25]. Iron was determined to be important for the proliferation of several bacteria, including Klebsiella species, based on clinical trials [26, 27].

Multiple in vivo observations suggest that individuals with iron excess, whether due to genetic hemochromatosis or transfusions as in thalassemia, are more prone to experiencing more frequent or severe infections. Evidence has shown that iron excess exacerbates Mucormycosis in people who have undergone bone marrow transplantation [28].

Overall, the study revealed that Klebsiella infection is a significant complication in Iraqi patients with thalassemia major, with high rates of incidence, mortality, and morbidity. When there is suspicion of a Klebsiella infection, it is crucial to promptly start treatment, which should involve a judicious selection of antibiotics and early surgical intervention due to the unfavorable prognosis associated with this type of infection. Additional research should be conducted to examine the fundamental factors that contribute to increased susceptibility.

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Monitoring the Stages of Growth for Wheat and Barley Using Field, Laboratory Measurements and Satellite Images

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Abstract

Wheat and barley growth stages can be monitored using a variety of techniques including field and laboratory measurements and satellite imagery. Satellite imagery has the ability to monitor large areas on a regular and periodic basis, making it an effective way to monitor wheat and barley growth. Field and laboratory data help provide detailed and accurate information. Wheat and barley growth can be monitored using different indices such as Normalized Difference Vegetation Index (NDVI)

In this research the spectral response of wheat and barley crops was monitored during three stages of growth. The relationship between chlorophyll and spectral signal have found in Latifia fields for the agricultural season 2017 - 2018 through some spectral evidence were studied (Spectral Signature, Chlorophyll Index and NDVI) depending on field and laboratory measurements using ENVI 5.6 and GIS 10.8 programs with Landsat and Sentinel satellite image for the same area to monitor crop growth. The first agriculture date 11/11 for the wheat field achieved the highest value of chlorophyll 29.1 in the elongation phase which correspond to the lowest reflective value of the spectral signature and the lowest value of the NDVI, While the second and third phases achieved lower chlorophyll values against higher values of reflective and NDVI.

The barley harvest recorded a slightly different spectral behavior from that of wheat due to its earlier planting date.

Keywords: Spectroradiometer, Spectral Signature, Chlorophyll Facto.



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Introduction

The vegetation covers the largest part of the Earth's surface. The role of plants in regulating the global temperature and absorption of carbon dioxide and other important functions make them a kind of land cover of great importance and benefit (Hadi, F.A., Ahmad, W.A., Mahmood, F.H., 2019). The wheat and barley crops are also among the most important crops in Iraq in terms of quantity and value food. Therefore, is studied through remote sensing technology as an attempt to monitor and distinguish between them, and remote sensing technology can take advantage of the distinctive way in which plants reflect the fallen electromagnetic energy and obtain information about these plants (Kadhim, 2014).

Remote sensing technology has contributed to agricultural studies, such as monitoring plant diseases, early detection of these diseases, observing many of the stresses that plants are exposed to, such as the breakdown of chlorophyll and lack of nutrients, and distinguishing between stressed crops and healthy ones, through examine the spectral behavior of the plant under different conditions (Eitel J, U, H; Long D, S; Gess ler, P, E; Hurt E, R;, 2008).

Wheat and barley are considered the first and fourth cereal crops in the world in terms of their cultivated area. Wheat and barley play an increasingly essential part in human and animal feed due to the world's expanding population and the serious effects of climate change on food security worldwide (S K AAI-Hummadi, N S Nuaimy, A L Ubaidy, 2024). Consequently, it becomes necessary to ensure the quality of food. Modern ground, air, and satellite technologies and computers have been used to process contemporary data so that we can literally measure and synchronize Earth and its natural resources on a global basis (Rawnak A. Abdulwahab, Laith A. Al-Ani, Auday H. Shaban, 2024).

The Chlorophyll Factor in Remote Sensing

Chlorophyll is the protein responsible for using solar energy and support the photosynthesis process, so it has an important effect on the quantity of reflected energy. In addition to the chlorophyll dye, there is a dye of carotene and anthocyanins, all of which are found in the top layer of leaves. Most of the visible electromagnetic spectrum is absorbed due to the presence of these dyes and is absorbed in the blue and red bands (Eitel J, U, H; Long D, S; Gess ler, P, E; Hurt E, R;, 2008).

Chlorophyll begins to break down in a plant that exposed to stress, regardless of the cause of the stress, and this affects the cellular structure of the leaves and, consequently, the plant's reflection of infrared rays, even before the chlorophyll is completely lost. Therefore, the plant remains green and does not show signs of stress despite the breakdown of chlorophyll (Iyad Al-Khaled, Youssef Tamr and Iman Al-Hamar, 2017).

Remote sensing provides us with data in the near-infrared range that is not visible to the naked eye. Most vegetation indices take the difference in reflectance between the visible light range and the near-infrared range into account. However, chlorophyll has a distinctive absorption in the infrared range, which is often chosen instead of using the visible light range and complementary this information with data in the visible spectrum. The data helps to identify stressed plants before the symptoms appear, such as thirst, disease, or nutrient deficiency (Raymond et,al., 2013) (Al-Khaled and others, 2017).

The Relationship Between Chlorophyll and The Spectral Signature

Spectral Signature is the product of energy reflected from the top of plants. However, when the plants are denser in the field, the fingerprint is specific to plants (Daughtry C, Walthall C, Kim M, De Colstoun EB, McMurtrey III J., 2000).

The spectral fingerprint is inversely proportional to chlorophyll, due to the higher darkness of the plant green color, the greater the absorption and the less reflectivity. In other words, the spectral fingerprint curve is lower in more advanced phases of plant life until maturity begins to increase and achieve its maximum potential (Zhu Y, Zhou D, Yao X, Tian Y, Cao W., 2007).

The figure below shows the spectral signatures of three similar plants appear in the phenotypic properties but difference in the concentration of chlorophyll only. The red, yellow and green lines are produced from plants with low, medium and high chlorophyll concentrations, respectively. The higher the concentration of chlorophyll, the greater the absorption capacity in the field of infrared radiation, and this results in less reflection (Abdul Wahab, R.A., Nassir, S.T., Hadi, F.A., 2019). In addition, the area with more absorption has increasing width. This causes the red edge to shift toward longer waves (near infrared) and its slope becomes less acute. Most vegetation indices take into consideration the variation in reflectance between the near-infrared and visible light spectrums. In contrast chlorophyll is primarily exists in plants and has a distinct absorption in the infrared range, so it is may chose instead of using the entire visible light range (Rawnak A. Abdulwahab, Laith A. Al-Ani, Auday H. Shaban, 2024).



Figure 1: The effect of the chlorophyll concentration on the spectral profile

Normalized Difference Vegetation Index:

Normalized Difference Vegetation Index (NDVI) is a non-linear mathematical transformation based on the relationship between spectral data stored in red and infrared spectral bands in order to assess plant health density as equation (1):

$$NDVI = (NIR-RED) / (NIR + RED) \dots (1)$$

Studies refers to reversely relation between the vegetation density and reflectivity of the red spectral band and directly relation with near infrared spectral band.

NDVI used as well to identify the effects of climate changes on plants, estimate the green biomass, calculate of the amount of the crop, and a lot of applications (S K AAl-Hummadi, N S Nuaimy, A L Ubaidy, 2024).

Despite that, the NDVI has some drawbacks. Climatic conditions and light clouds can affect the calculation of the index when using satellite data. In addition to that, the low vegetation thrones may affect to spectral signal recording which could be bare land, plant waste or different plant (Ayad Abdullah Khalaf Al-Dulaimi, 2015)

The Study Area

The study area is located in Latifiyah, which was named after the Latifiyah River, which is a connected with the Mahmoudiya District as shown in figure 2, located 35 km south of Baghdad at 33.03333 ° Northing, 44.166667 ° Easting, with a population of about 80 thousand people, according to the 2015 census, the area of the Latifiya region (484 km²), which is equivalent to 193222 acres (Mushtaq A Majed and Hameed M.Abduljabbar, 2022).



Figure 2: The study area

Methodology

• The Field Parts:

In this research, two wheat fields of the Barcelona type were visited, each of them of area (40) dunums, as well as barley field have been visited, its area is (10) dunums. The visits were done in certain dates depending on the plant's growth stages which defines as: elongation of the spike stage for stage-1, expelling wheat ears stage for stage-2 and filling the wheat grain stage for stage-3. Each visit contains the following records:

1- GPS coordinates for one point for each field,

2- The plant spectral signature with Analytical Spectral Devices (ASD) incorporated (Inc) Spectroradiometer as shown in figure 3

3- plant samples from each field in order to sign spectral signature in laboratory part of the device.,

4- Detemine the Chlorophyll ratio in plant leaves utilizing Chlorophyll Meter type 502-SPAD (shown in figure 4). The Chlorophyll device measures the electromagnetic spectrum of light at two specific wavelengths are (650 nm) and (940 nm) which belonged to red and infrared spectrum respectively (Marguerite Olivier, and Marc Frankinet, June 2011).



Figure 3: The Spectroradiometer





• The Laboratory Part:

1- download six satellite scenes for GPS field coordinates represented the three stages of the study area of Sentinel-2 satellite with a spatial accuracy of 10m and Landsat-8 satellite with a spatial accuracy of 30m,

2- using the Spectral Library Viewer in the ENVI 5.6 program to draw the spectral signature for each stage,

3- Calculate NDVI for each stage.

4- Compare the behavior of the spectral signature which refers to the reflectivity of with the percentage of chlorophyll.

5- Compare the NDVI values with the spectral signature reflectivity values for each stage in all three fields.

Results and Discussion

V. V. coordinatos	Wheat Field-1 at	Wheat Field-1 at	Barley field -2 at	
A, I coordinates	2/12	2/12	11/1	
Easting	44°23.575	44°24.179	44°26.387	
Northing	33°00.035	32°59.917	32°58.685	

Table 1: GPS and sparkling values for all stages.

Table 2: Spectral fingerprint curves for all stages of growth



Table 3: The highest reflectance values of spectral signature

Fields with agriculture date		Stages of plant growth			
		Elongation	Kick out the spikes	The pill is full	
Wheat	Field (1) 2/12	0.86	0.88	1	
	Field (2) 11/11	0.92	0.9	0.96	
Barley	11/1	0.92	0.86	0.94	

		Stages of plant growth		
Fields w	ith agriculture date			
		Elongation	Kick out the spikes	The pill is full
	Field (1) 2/12	29.10	28.50	24.30
Wheat				
	Field (2) 11/11	26.30	27.10	25.8
			31.6	
Barley	11/1	26.6		26.8
			Fresh fertilization	

Table 4: Chlorophyll rates in SPAD for all stages of growth

Table 5: Range of NDVI values for three fields depending on Landsat-8 satellite

		Stages of plant growth			
Fields wi	ith agriculture date				
		Elongation	Kick out the spikes	The pill is full	
	Field (1) 2/12	0.3 - 0.4	0.4 - 0.48	0.45 - 0.5	
Wheat					
	Field (2) 11/11	0.2 - 0.3	0.4 - 0.5	0.44 - 0.54	
Barley	11/1	0.23 - 0.3	0.36 - 0.43	0.41 - 0.46	

Table 6: Range of NDVI values for three fields depending on Sentinel-2 satellite

		Stages of plant growth		
Fields with agriculture date				
		Elongation	Kick out the spikes	The pill is full
	Field (1) 2/12	0.5 -0.76	0.7-0.78	0.46-0.55
Wheat				
	Field (2) 11/11	0.3-0.5	0.7-0.78	0.5-0.54
Barley	11/1	0.4-0.67	0.63-0.72	0.41-0.5


Figure 5: NDVI values for the first field visit, using pictures of Sentinel 2 satellite



Figure 6: NDVI values for the second field visit, using pictures of Sentinel 2



Figure 7: NDVI values for the third field visit, using pictures of Sentinel 2



Figure 9: NDVI values for the second field visit, using pictures of Landsat 8

Figure 8: NDVI values for the first field visit, using pictures of Landsat 8



Figure 10: NDVI values for the third field visit, using pictures of

: NDVI values for the first field Figure 6:

1- The results of Table (3) showed that the highest reflective values of the spectral imprint of the wheat fields and both dates in the stage of filling the pill amounted to (1 and 0.89) respectively, and this explains the inverse relationship between the chlorophyll and reflection ratios, where the level of reflection rises as the plant progresses toward aging and the chlorophyll appears by fracturing, the plant became less green towards ripening (Raymond et al. 2013). Barley gave the highest value of the spectral fingerprint in the elongation stage and the lowest value in the expulsion phase of the spikes was (0.87 and 0.83) respectively due to the nitrogen fertilizer (urea) during field visits.

2- The results of Table (4) showed that the highest percentage of chlorophyll recorded in the first field of the late date of cultivation in the elongation stage (the stage of maximum vegetative growth) was 29.10. The second field for the early date recorded the highest percentage of chlorophyll in the expulsion phase of the spikes (the stage of maximum vegetative growth) of 27.10. This is explained by the difference in the dates of cultivation, as the early date 11/11 was the optimal date for wheat cultivation in central and southern Iraq due to the favorable climatic conditions of cultivation and crop growth, which led to giving a long vegetative growth period and became facets in the expulsion phase of the spike (Sarhan, 2011). The barley yield took behavior similar to the wheat behavior of the early date due to the approximate date of planting, as the highest percentage of chlorophyll was recorded in the expulsion phase of the seeds reached 31.6 and it was a very high value compared to the percentages of chlorophyll for the elongation and full stages of the grain, and this is explained by the nitrogen fertilization in the field at the mentioned date because nitrogen is an element It is essential in building the amino acids that make up the chlorophyll protein, which led to making vegetative growth in aspects in addition to the darkness and concentration of the green color at that stage (Al-Muzaffar and Salman, 1984).

3- The values of the NDVI for the fields showed the lowest value in the elongation stage. As for the two stages of flushing of the spikes and the fullness of the grain, they showed a slight variation due to the change of the vegetative factor of the two phases as shown in Tables 5 and 6.

4- There is an inverse correlation between the spectral reflectance and NDVI values on the one hand and the chlorophyll values on the other as obvious in tables 3-6.

Recommendations

1- To delve deeper into studying the spectral footprint and distinguishing the wheat and barley plants, we must rely on the Hyperspectral Image, because it gives a reflexive curve graphic for each pixel.

2- Taking field readings continuously and simultaneously with the satellite image gives more accurate results.

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Correlation Between Thyroid Hormone Therapy and Improved Gallstone in Iraqi Patients

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Abstract

BACKGROUND: The association between cholesterol gallstone disease and thyroid hormone abnormalities has been widely categorized. Numerous investigations have demonstrated a crucial connection between gallstone disease and thyroid issues. These studies show that cholesterol gallstone disease is linked to both hyperthyroidism and hypothyroidism. Because thyroid hormones significantly impact cholesterol synthesis, bile function and content, and gallbladder motility, there is a correlation between thyroid hormone abnormalities and cholesterol gallstone disease.

OBJECTIVE: This study aims to determine the association between thyroid hormone therapy and improved gallstone in Iraqi patients.

METHODS: This study included 100 patients, aged 20 to 55, admitted to Baghdad Teaching Hospital/Medical City-Baghdad, Iraq, between October 2023 and September 2024 (50 with hypothyroidism and 50 with hyperthyroidism). Gallstones on ultrasonography indicated a positive cholelithiasis in the eligible people. Anthropometric and clinical characteristics were assessed for each participant. TSH, T4 and T3, IL 6, IL 7, and IL 8 levels in patients and control groups are measured before and after therapy.

RESULTS: The study was comprised of 100 gallstone patients. A more significant proportion of patients were found to be over 40, with a prevalence of female patients. The group with a greater-than-normal BMI had a higher number of cholelithiasis patients. The group with a greater-than-normal BMI also had a more significant number of patients with both hypothyroidism and cholelithiasis. The majority of patients with symptoms reported right hypochondriac discomfort. Gallstones were observed to disappear in patients with hypothyroidism or hyperthyroidism when they received thyroid treatment without the need for laparoscopic surgery, with the return of thyroid hormones and interleukins to normal levels.

CONCLUSION: This study concludes that there is an association between cholelithiasis and thyroid disorder. Thyroid examinations and treatment could be a portion of the diagnostic of gallstones and improve executive. Thus, early detection of thyroid dysfunction will reduce surgical/anesthetic complications. Also, the high levels of cytokine in bile can be detected precisely in the primary level of the disease, especially in unconscious or elderly patients.

Keywords: Hypothyroidism, Hyperthyroidism, Cholelithiasis, Interleukins, Thyroid Disorders, Gallstone.



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Introduction

cholelithiasis is a prevalent disorder. The accumulation of bile salts in the gallbladder cavity is typically the result of abnormal lipid and bile salt levels. The most prevalent biliary tree illness in India and Western nations is gallstones. Gallstone-induced biliary blockages of the cystic duct cause acute cholecystitis, an inflammation of the gallbladder. An immediate inflammatory reaction is triggered by this blockage, which also raises intraluminal pressure inside the gallbladder [1]. Therefore, high-risk individuals might benefit from a more precise early identification of acute cholecystitis as an additional signal for prompt diagnosis. In Western nations, between 10% and 12% of persons suffer from gallstones [1,2]. Oversaturation of bile with cholesterol is the most common beginning phase for developing cholesterol stones. The question of whether thyroid and hormone disorders might cause gallbladder illnesses has been up for dispute for a long time. There are several possible reasons for the potential association between gallstone disorders and hypothyroidism. It is commonly known that the thyroid gland's hormones affect cholesterol metabolism [3].

Bile becomes supersaturated with cholesterol due to elevated blood cholesterol levels in hypothyroidism, which hinders filling, reduces contractibility, and extends the amount of time bile may remain in the gallbladder and pass through it [4-6]. These conditions aid in the retention of cholesterol crystals, allowing them sufficient time to develop, expand, and mature into gallstones [4]. The pathogenesis of cholelithiasis, a common gastrointestinal condition, is yet unclear. According to recent clinical observational studies, there may be a connection between thyroid function and cholelithiasis. According to several compelling research, cholelithiasis development is positively correlated with elevated cholesterol (6). Additionally, a favorable correlation exists between blood FT4 levels and LDL-C and total triglycerides (TG) (7). It was also shown that the causal effects of thyroid function on cholelithiasis may be mediated by characteristics of lipid metabolism. Sphincter relaxation is directly facilitated by thyroxine (T4). Thyroid hormones, particularly triiodothyronine (T3) and thyroxine (T4), and gallstone development have been the subject of recent studies. People with hypothyroidism have blood cholesterol levels higher than those of euthyroid individuals, and almost 90% of patients with hypothyroidism exhibit high cholesterol [8].

Small protein mediators called cytokines have roles in immunomodulation, metabolism, and inflammation [9]. Hepatocytes and the biliary epithelium generate them, as do monocytes, lymphocytes, fibroblasts, and endothelial cells [10]. Proinflammatory cytokines and other

secreted inflammatory substances are important mediators of the altered processes linked to hepatobiliary illness [11,12].

Materials and methods

1. Study design:

In our study, 100 cases and 50 controls were enrolled in single-center observational research—all patients over 18 years old who visited the surgical department. The 100 patients (50 with hypothyroidism and 50 with hyperthyroidism) had clinical characteristics indicative of cholelithiasis. Ultrasonography (USG) verified this. Fifty male and female participants who had USG/laparotomy for various reasons made up the control group. The study was conducted for one year (October 2023 – September 2024).

2. Inclusion and exclusion criteria :

The patient had a clinical examination after a thorough history of the presenting disease, as well as a personal and family history, was obtained. Random sampling was used to choose patients who showed signs of cholelithiasis on radiological examinations. The patient with symptoms and indicators of thyroid dysfunction and biliary lithiasis was thoroughly questioned, and a biochemical analysis was performed. Exclusion criteria included diabetes mellitus, pregnant women, those with a Thyroid replacement or a history of thyroid dysfunction treatment, and those using medications that alter thyroid hormone levels, such as fenofibrate, estrogen therapy, or oral Contraceptive Pills (OCP).

a. Biochemical investigations :

Following stringent aseptic procedures, venous blood samples were obtained, and serum was separated and subjected to Chemiluminescence Immunoassay analysis for TSH, T3, and T4. Based on the patient's medical histories and TFT values, they were divided into two groups: 1. Hypothyroid, which is characterized by signs of TSH-related hypothyroidism levels exceeding 5 mIU/ml and TT3/TT4 below the standard limit, and 2: Hyperthyroid, which is characterized by signs of TSH-related below 0.38 mIU/ml.

b. Statistical analysis :

Descriptive statistics like mean, standard deviation, and range were calculated to evaluate the data statistically once it was gathered. The study group's mean values and the control group's

mean values were compared using the unpaired sample student t-test to see if there was a significant difference. A social science statistical program called SPSS v26 was used.

Results

1. Association between thyroid status with Age and Gender :

Fewer patients in our study were between 18 and 40, and more patients were over 40. However, the investigation revealed that the frequency was higher in female and male patients, as shown in Tables 1 and 2.

Age	Percentage	P value
18-40 Years	35	0.5
>40 Years	65	0.001
Total	100	-

Table 1: Distribution of the patients in accordance with age group

Table 2: Distribution of the patients in accordance with gender group

Gender	Percentage
Male patients	30%
Female patients	70%
Total	100%

2. Correlation between thyroid status and BMI:

Cases with hypothyroidism were more likely to be obese, according to the BMI sharing of cholelithiasis patients. In our research, the largest group of patients—35—were classified as borderline obese if their BMI was between 25.5-29.9 kg/m². Thirteen patients were classified as overweight based on their BMI, which ranged from 23.0 to 25.3 kg/m². Two patients had normal BMIs, ranging from 18.5-22.9 kg/m². Nineteen of the individuals in the hyperthyroid patients had a BMI of around 18 kg/m². The BMI of 23 subjects ranged from 19.0 to 22.0 kg/m². The BMI of eight subjects ranged from 23.0 to 25.9 kg/m².

3. Cholelithiasis patients according to the thyroid status:

TFT results in cases of hypothyroidism. The p-value was not statistically significant, even though the mean values of T3 and T4 were lower in cases than in controls. On the other hand, Table 3 shows that the mean TSH value was statistically significant and higher in cases than in controls.

	Patients	Control	P value
TSH(mIU/ml)	5.01±2.45	2.50±1.39	0.001
T4 (mg/dl)	6.5±3.6	10.5 ± 4.50	0.06
T3 (ng/dl)	101.6±29.7	117.3 ±36.3	0.06

Table 3: TFT values in cases with hypothyroidism

The TFT values in patients with hyperthyroidism. The p-value was not statistically significant, even though the mean values of T3 and T4 were higher in cases than in controls. Conversely, the patients and the controls had a statistically significant difference in the mean TSH value. Within two to six months, most patients who received hormonal therapies had their gallstones disappear, and their hormone levels returned to normal, as seen in Tables 4 and 5.

Table 4: TFT values in patients with hyperthyroidism before treatments

	Patients	Control	P value
TSH(mIU/ml)	5.01±2.45	2.50±1.39	0.001
T4 (mg/dl)	13.6±3.6	10.5 ± 4.50	0.02
T3 (ng/dl)	124.3±4.7	117.3 ±36.3	0.05

Table 5: Gallstones dissolved	l in patients with	Thyroid dysfunction	after treatments
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Thyroid dysfunction	Percentage
Hypothyroidism patients	37(74%)
Hyperthyroidism patients	30(60%)

Blood samples from healthy persons and patients with acute cholecystitis were obtained and purified to examine the biliary proinflammatory cytokine profile. Clinical signs of acute cholecystitis were fever, abdominal discomfort in the right upper quadrant, and an abdominal computed tomography or confirming ultrasonography. In order to investigate proinflammatory cytokines like IL-6, IL-7, and IL-8 as well as early inflammatory cytokines in patients with acute cholecystitis, samples were collected and analyzed. The mean biliary IL-6, IL-7, and IL-8 levels were higher in the acute cholecystitis group it about 30.2, 13.9, and 66.7 pg/ml, respectively. These levels were higher than those in the control group, which had 2.3, 3.5, and 8.3 pg/ml, respectively. Our study showed that all patients' interleukin levels reverted to normal **following therapy. According to Table 6**

	Mean ± SD		
Parameters	Patients	Control	p-Value
	n=100)((n=50)	
IL-6 (pg/mL)	30.2±2.45	2.30±0.2	0.0001
IL-7 (pg/mL)	13.90±1.6	3.5 ± 0.1	0.01
IL-8 (pg/mL)	66.7±4.7	8.3 ±0.3	0.005

Table 6: Cytokines levels of participants in the study

Discussion

According to our findings, the observational analyses have mainly demonstrated a relationship between cholelithiasis and thyroid function. Most patients who had thyroid hormone treatment recovered from gallstones, and within two to six months, their interleukin levels returned to normal. In addition to individual genetic and environmental variables, the size and quantity of gallstones cause the variation in time. Gallstones are thought to affect fertile, overweight forty women [13, 14]. Gallstone disease affects women more frequently than men [13-16]. As a result, we have divided the case and control groups in this study equally between males and females.

A greater incidence of gallstone disease was seen in both sexes beyond 40. This is agree with previous study [17], which revealed that 60% of patients had gallstones when they first appeared 41 years later. According to Singh et al. [18], 75% of his cases included people over

41, and 60% involved those over 50. This indicates that growing older is a risk factor for gallstones[19]. The study showed that the prevalence of cholelithiasis was high in males aged \geq 65 years, at over 30%, and in women aged \geq 65 years, at 55%. This high incidence is consistent with our study's findings. Additional investigations also found serum lipids, a high body mass index, and advanced age to be significant independent risk factors for cholelithiasis [20]. According to previous data [21,22], a high BMI may have a role in developing gallstone disease. In earlier studies, BMI was frequently employed to determine the risk of gallstone development because of the link between obesity and gallstones. Gallstone formation may be influenced by the ratio of total body fat to the distribution of body fat.

In both male and female patients, obesity that primarily affects the abdomen is linked to several metabolic disorders, including the formation of gallstones. The high incidence of gallstones is thought to be caused by a higher BMI, the most prevalent primary risk factor that can be avoided. Similar to our findings, studies by Hayat et al. and Alexander et al. reported elevated cholesterol levels [23, 24]. Several experts have hypothesized that some forms of mental stress may increase blood cholesterol, increasing the risk of gallstone formation [25].

Increased serum thyrotropin (TSH) levels were statistically significant and independent of cholelithiasis, and the occurrence of common bile duct stones was significantly correlated with pre-existing hypothyroidism, according to previous study [26]. The present findings are also in line with research that indicates women are more vulnerable to thyroid issues and cholelithiasis [27]. Additionally, a Chinese researcher has shown that gallstone development may be facilitated by thyroid disorders, including both hyperthyroidism and hypothyroidism, via a variety of mechanisms [28]. Cholelithiasis can have several causes since thyroid hormones influence bile production, biliary secretion, gallbladder motility, and cholesterol balance. The basic causes of thyroid function and cholelithiasis are unclear [29]. It has been demonstrated that thyroid hormones affect enterohepatic circulation and detoxification [30–32]. The current findings showed that individuals with gallstones had considerably more significant levels of IL-6, IL-7, and IL-8—particularly IL-6 and IL-8—than healthy persons. Inflammatory cytokine levels are elevated in hypothyroidism patients, according to several investigations [33-35].

Levothyroxine treatment considerably reduced but did not normalize TNF- α , IL-6, and CRP levels in hypothyroid patients compared to healthy controls, according to Tayde et al. [36]. Levothyroxine therapy also changed the inflammatory profile of hypothyroid individuals by raising anti-inflammatory cytokines and lowering pro-inflammatory cytokines, according to another research [37]. Radványi et al. [38] showed that TSH activated the pro-inflammatory

cytokine IL-6 in preadipocytes via the cAMP protein kinase A signaling pathway. Monlar [39] demonstrated that TSH induced the production of TNF- α by myeloid cells. Additionally, a number of in vitro studies have shown that TSH can affect the release of cytokines in a variety of cell types [38–40].

However, more comprehensive epidemiological or metagenomic studies are needed to further explain the apparent correlation between the risk of hypothyroidism in people with specific inflammatory cytokines. Our study looked at the potential association between thyroid disorders and three inflammatory cytokines and found several strong correlations. We also need to investigate whether these cytokines may be used as medications to stop hypothyroidism or hyperthyroidism.

Conclusion

According to the study's findings, thyroid disorders and cholelithiasis are related. Thyroid exams and treatments may be necessary to diagnose gallstones and enhance executive function. Therefore, early identification of thyroid dysfunction will result in fewer surgical and anesthetic problems. Additionally, particularly in unconscious or old patients, the elevated cytokine levels in bile can be precisely identified at the main level of the illness.

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Effect of Silver Nanoparticles on Dermatophytes Isolated from Palms Of Hands & Feet

Khetam Ibrahim Mohammed ¹ Taif Muthhar Muslim ²

Abstract

The dermatophytosis skin infection is caused by filamentous fungi and can caused by some of types of yeasts. The prevalence of these common mycoses is about 20% of the population. These fungi have demonstrated strong resistance to some of the drugs used to treat them in the past few years, it has been noted. Nanoparticles, whether silver nanoparticles or gold nanoparticles, and other types of nanoparticles show great effectiveness against human pathogens, whether bacterial or fungal, They have the ability to change The cell membrane's structure until it causes its death. The purpose of this research is to test effectiveness of nanoparticles (Ag nanoparticles) against the fungi that cause skin infections in patients. This has been demonstrated by their high effectiveness against the Trichophyton fungus, as here in this research their effectiveness was studied on fungi isolated from the feet and the hands. Which were diagnosed according to agricultural and microscopic features. The effectiveness of the silver nanoparticles solution was tested at concentrations of 2%, 4%, and 8% against the diagnosed Trichophyton fungus isolated from the skin infected with the fungus. It was found to have a high effectiveness for the silver nanoparticles , especially at the concentration of 8%, which is the highest concentration used against this pathogen compared to the commercial antifungal.

Keywords: Dermatophytes, Trichophyton, Nanoparticles, Silver Nanoparticles.



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Introduction

Keratinophilic, filamentous fungus are the source of the skin infection known as dermatophytosis. Around 20% of the population is affected by these common mycoses, which are very common, Dermatophytes infections typically manifest as different types of superficial cutaneous mycoses, yet they incredibly rarely develop invasive infections when they invade the deep dermis, Depending on an individual's immunity, fungi—the majority of which are opportunistic—cause a variety of diseases in humans. These fungi have the potential to infect Skin appendages like hair and nails . Dermatophytes can spread directly by contact with other people (anthropophilic species), animals (zoophilic species), and soil (geophilic species), in addition to indirectly through fomites. It is simple to identify Infections by dermatophytes using the history, physical examination, or Microscopy of potassium hydroxide.Sometimes A Wood's lamp analysis, examining fungi in the lab after they have grown on petri dishes , or a study of histology are necessary for the diagnostic. [1,2,5,18].

Keratinases and other enzymes secreted by the fungus enable the Dermatophyte to penetrate the stratum corneum farther. Keratinocyte growth and Mannan from the *Trichophyton rubrum* cell wall might both be inhibited by a lipophilic toxin connected to it. *Epidermophyton, Microsporum*, and *Trichophyton* are the three genera that include the dermatophytosis etiologic agents, or the ringworm. [1,3,4]

Dermatophytes can only grow on the surface of the skin, nails, and hair because they need keratin to do so. These fungi do not therefore infect mucosal surfaces. Infections with a "tinea" are referred to as dermatophytoses. They are also given names based on the affected bodily part. The most prevalent pathogens in skin infections are the species of *Microsporum*, *Trichophyton, and Epidermophyton*. Less frequently, nondermatophyte fungi such *Malassezia furfur* in tinea and Candida species cause superficial skin infections **.**[5]

Approximately 20–25% of people on this world are affected by dermatophytosis, which is thought to be second-most prevalent skin condition in grownups and the third most frequent skin condition in children under the age of 12. It causes Thirty percent of all fungal infections of the skin. [6,7] In rare cases, the infection may spread to deeper layers of the skin and other organs in immunocompromised hosts, leading to invasive dermatophytosis.[8].It has long been understood that silver and its compounds work well as antibacterial agents and due to recent developments in research, nano-Ag has drawn particular attention as antibacterial agent, Numerous studies have demonstrated the effectiveness of nano-Ag against skin-related fungal

infections.[9,10]. Numerous studies have shown the impact of gold and AgNPs on human Keratinocyte and fungal infections on the skin. [11].

The analysis of the colony's microscopic morphology (size and form of macroconidia and microconidia, spirals, nodular parts, and pectinate branches) and surface and reverse side pigmentation, topography, texture, and growth rate) are standard procedures for dermatophyte species identification [12]. Strain identification is sometimes challenging because morphological and physiological traits can regularly alter. In fact, external factors such temperature variation, medium, and chemotherapy can easily influence the phenotypic features [13].

Materials and Procedures

The Materials

Nanoparticles of silver, commercial antifungal, dimethyl sulfoxide solution (DMSO).

Isolation of the fungi

Specimens were obtained from the nails of patients infected with skin fungi in these places. The samples were obtained in a sterile manner, and transferred to the laboratory for incubation and test. .[21,22]

Making ketocanazole solution

An airtight tube containing 5 ml of 100% Dimethylesulphoxide (DMSO) was filled with 50 mg of antifungal. The mixture was then quickly shaken using a Vortex, and the solution was calculated to have a concentration of 10,000 μ g/ml.(in the role of a negative control)

How to prepare a concentration of nanoparticles?

Sterile distilled water was used to create the different quantities of silver nanoparticles, which were then heated to 50 °C. In 100 milliliters distilled water, 2, 4, and 8 milligrams of silver nanoparticles were dissolved to create the concentrations of 2%, 4%, and 8%, respectively.

Looking for silver nanoparticles' antimicrobial qualities

Employing the method of poisoned food:[24]

In order to measure the colony growth rate on solid media, SDA medium was poured One milliliter of every concentration (2%, 4% & 8%) of Solution of Ag-Nps in Petri plates at a

temperature of 50 °C. The medium was then homogenized with a circular motion . Following the preceding step of hardening the medium, the inoculum was transferred from fresh isolates using a 5 millimeter diameter cork borer and put in the center of the dish with three replicates of each concentration for each isolate.

Following a four-day incubation period at 37 °C, measurements were made on the dishes. Two control plates, one positive and one negative used to compare the diameter of the colony. (To create an antifungal dish, add one milliliter of anti-fungal solution to dish, then add the Sabroaud Dextrose Agar medium then wait for it to set before inoculating with a cork with a five millimeter diameter hole and transferring a portion of the fungal growth.

Result and discussion

Isolation & Identification

21 samples were examined and cultured, and the doctor had suspicions about the pathogen causing them. 4 samples appeared positive by culture on Sabroaud Dextrose Agarmedium and were diagnosed as Trichophyton fungus, as will be discussed later.

Gender	Total samples	Positive samples	%
Male	9	3	33.33
Female	12	1	8 33
T CIMUIC	12	Ĩ	0.00
Total	21	4	19.04
Calculated X ²	2.08		
Calculated P		0.149*	

Table 1: positive samples according to the gender of patients

* No significant difference (P>0.05)

Table No. 1 here shows the positive samples in relation to gender. There are no clear significant differences according to gender. From this, we would like to point out that gender has nothing to do with fungi that cause skin diseases, and that there is no relationship here between them. Regarding age, we also found that there are no significant differences between the different ages, as there is no relationship between infection with skin fungi and the different ages studied. As shown in Table 2.

Age interval	Total samples	Positive samples	%
11-30	9	3	33.33
31-50	4	0	0
51-70	8	1	12.5
Total	21	4	19.04
Calculated X2	2.35		
Calculated P		0.308*	

Table 2: positive samples according to the age of patients

* No significant difference (P>0.05)

Using the identification keys, *Trichophyton* spp. were recognized based on microscopic and agricultural characteristics. Fig1(A , B) .[14,18,]. Standard methods for identifying dermatophyte species include examining the colony under a microscope (shape and size of macroconidia and microconidia, spirals, nodular parts, and pectinate branches) and examining its morphology (topography, appearance, rate of development, and pigmentation of the surface and reverse sides). [12,19,23]





Figure (1-A): Trichophyton after 5 days on culture 37 C

Figure (1-B): Trichophyton under microscope 40x

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Antifungal activity

Table 3 displays A summary of the silver nanoparticles solution's antifungal reaction is provided.

Concentrations	Mean ±SD
Nano 2%	50.33±1.72a
Nano 4%	29.58±3.55b
Nano 8%	17.75±3.51c
Antifungal drug	5.16±0.24d
Calculated P	< 0. 0001
L S D (P <0.05)	2.17

Table 3: Ag-NPs activity against the radial growth (Trichophyton spp.)

Any two means with different letters indicate a considerable difference. P<0.05

The solution of silver nanoparticles had a very noticeable influence on Trichophyton development; the largest effect was recorded at a concentration of 8%, in table 3 The difference in the letters shows a large difference between the different concentrations, as the highest growth diameter was at the lowest concentration of 2%, which was (50.33mm). As for the highest concentration of silver Nanoparticales, it showed growth at a rate of (17.75mm).

Ag-Nps have a strong affinity for the membranes of fungi, which allows them to attach to enter and pass through them. Once inside the cell, Ag-Nps alter the fungus's core structurally that result in a low molecular weight site, which in turn causes cell lysis. Lastly, Ag-Nps kills the cell by binding to the respiratory chain. Fungal cells' Ag-Nps generate silver ions, which increase antifungal action. Numerous investigations have demonstrated that nano-Ag possesses antibacterial capabilities [15, 16, 17]. According to Kim and others in 2008 [10,11] dermatophytes, which result in superficial fungal infections, can be inhibited in their proliferation by Nano-Ag. Additional investigators also saw a discernible impact on the pathogenic fungus. [10]

The morphological alterations of the developing mycelium frequently accompany the decrease in the tested strain's growth rate caused by the effects of treatments Fig (2) .The

fungus development on the plate led us to conclude this. Fig-2 shows up a reduction in spore production, as well as alterations to the colony's color, morphology, and development in comparison to the control treatment Additionally, it clearly altered the morphology of fungal colonies' appearance. Radhakrishnan et al. observed that the genus Candida underwent







- a- Positive Control Without any additi
- b- Negative Control (ketocanazole antifung:
- c- 8% of Ag-NPs



d-4% of Ag-NPs d- 2% of Ag-NPs

Figure 2: In comparison to the positive and negative control plates, it illustrates how the *Trichoph* fungus is affected by different concentration of silver nanoparticles.

morphological alterations following treatment with silver nanoparticles [20]

Conclusion

In this research, after collecting specimens from people infected with skin fungi, we focused on treating the fungus that causes the disease. After diagnosing Trichophyton, we focused on treating it with nanoparticles, as most researchers believe that there is a strong effect of silver nanoparticles on all pathogens when used in certain concentrations, and in fact it has been shown to be very effective and becomes This effectiveness is greater when concentration increases Additionally, it clearly altered the morphology of fungal colonies' appearance. We anticipate using these experiments in vivo in subsequent studies.

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Using Fuzzy Logic to Measure the Smartness of Smart Cities

Shahla Hazim Ahmed Kharofa¹

Abstract

Smart cities are cities that use the latest communication and information technologies to improve the services they provide, thus contributing to the effective management of resources.

The Internet of Things is one of the main pillars of smart cities, and is responsible for generating a huge amount of data. With such huge amounts of data, it is difficult to determine which procedures are most accurate and efficient. Through the use of artificial intelligence, big data analysis becomes possible to reach the optimal decision that will positively affect the construction and development of these cities.

In this research, fuzzy logic was used to measure the smartness of smart cities, using rules that were built based on smart city elements, which include (smart people, smart transportation, smart environment, Smart Economy and smart living).

Keywords: Artificial Intelligence, Fuzzy Logic, Rules in Fuzzy Logic, Smart Cities, Elements of Smart Cities.



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Introduction

There has been a lot of global interest in transforming into smart cities or digital cities, and the name varies according to their goals [1]. They are known as cities that invest in innovative digital solutions with the aim of achieving well-being and distinguished life services for citizens and visitors, and seek to provide an environmentally friendly digital environment that stimulates learning and creativity, contributing to providing a sustainable environment that enhances feelings of happiness and health [2]. The components of smart cities are mainly based on serving people and responding to their changing economic, cultural and social conditions. So the importance of smart cities lies in improving the standard of life, saving time, effort and costs, improving methods of benefiting from the infrastructure and services provided, and saving costs and resources [3].

Artificial intelligence is one of the most important topics in the modern era in all aspects of life, not only changing the business world but also fundamentally and significantly changing our cities and changing the methods we work and live [4].

Artificial intelligence aims to develop lifestyles for humans, and it is the same for smart cities by obtaining huge amounts of data and information and analyzing them very quickly to make more beneficial decisions with the aim of improving the lifestyles of the residents of these cities in various aspects of life, and researchers hope that technological progress will reduce Congestion, pollution and accidents in the cities of the future [5]. In fact, artificial intelligence and intelligence techniques will manage and develop the life, and will change the shape of these cities in proportion to the development taking place in various fields of life [3].

In the past ten years, international and Arab interest in the term smart city has emerged, in response to the residents' need to take advantage of all modern smart technology technologies [6].

The term smart cities can be defined, which are cities that work to achieve goals for their residents from an environmentally friendly digital environment that stimulates learning and creativity. It is the city that provide a convenient place to live. Smart technology and data analytics are its most prominent and important features, and it defends its role in improving services and saving costs [5]. The basic idea of the smart city is to develop methods that contribute to development the society, thus, to enhancement the life of citizens. A smart city is an integration of technological development, information and human development to generate economic development and improve well-being and quality of life [7].

1. Basic Elements of Smart Cities:

Smart cities are based on a set of basic elements, as show in Fig. 1: [8]

- 1. Smart People: are people and citizens who have a high level of cultural awareness and social
- 2. Smart Transportation: is the process of transferring information and data through the use of advanced intelligent transportation systems
- 3. Smart Environment: sustainable resource management and environmental protection from pollution
- 4. Smart Economy: It is the total competitiveness of the city that depends on the innovative method in business, research and development expenditures, job creation, productivity and market flexibility the work and economic role of the city in the local and global market.
- 5. Smart Living: Improving the lives of citizens by providing them with the best community service [8-10].



Figure 1: Smart Cities Elements

The main factors for creating a smart city is to develop a good and effective strategy, and a smart budget that ensures the building of the smart city vision, and by implementing it correctly, smart cities can transform the city, develop its economy and heritage, and enhance its resilience and sustainability and relying on artificial intelligence, smart technologies, digitization, building a smart workforce, and open data, as well as exchanging communication and knowledge between smart city residents in order to drive innovation and engaging companies, startups, university students and the public to develop ideas, insights and feedback to create the most cost-effective smart city [11]. The process of building a smart city is an advanced and complex step and the method forward and the future [12].

2. Characteristics to be available in a smart city:

- Providing communication services to the widest extent
- Emphasis on effective education and training

> Achieving a balance in the distribution of digital services, to ensure that everyone benefits from these technologies

Achieving broad economic development

➢ Promoting creativity in various sectors, and establishing economic groups to finance development [9] [12].

The Research Methodology

In this research, fuzzy logic was used to determine the average of smart cities:

a. Fuzzy logic:

Fuzzy logic is a system that uses fuzzy data to produce real and meaningful results [13]. Its strength lies in building reliable rules, which is one of the methods of artificial intelligence that is widely used in many fields such as decision making on a specific issue, medical field (assisting in the diagnosis of diseases), environment, traffic light management, and robots [1].

b. Rules in Fuzzy Logic:

In this research, use the following rules in fuzzy logic to determine average elements of smart cities:

Rule 1: If [(average smart people) ≤ 1 and (average smart people) > 0.86] and [(average smart transportation) ≤ 1 and (average smart transportation) > 0.86] and [(average smart environment) ≤ 1 and (average smart environment) > 0.86] and [(average smart economy) ≤ 1 and (average smart economy) > 0.86] and [(average smart life) ≤ 1 and (average smart economy) > 0.86] and [(average smart life) ≤ 1 and (average smart cities extremely high

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Rule 2: If [(average smart people) ≤ 0.86 and (average smart people) > 0.72] and [(average smart transportation) ≤ 0.86 and (average smart transportation) > 0.72] and [(average smart environment) ≤ 0.86 and (average smart environment) > 0.72] and [(average smart economy) ≤ 0.86 and (average smart economy) > 0.72] and [(average smart life) ≤ 0.86 and (average smart economy) > 0.72] and [(average smart life) ≤ 0.86 and (average smart cities very high

Rule 3: If [(average smart people) ≤ 0.72 and (average smart people) > 0.58] and [(average smart transportation) ≤ 0.72 and (average smart transportation) > 0.58] and [(average smart environment) ≤ 0.72 and (average smart environment) > 0.58] and [(average smart economy) ≤ 0.72 and (average smart economy) > 0.58] and [(average smart life) ≤ 0.72 and (average smart economy) > 0.58] and [(average smart life) ≤ 0.72 and (average smart economy) > 0.58] and [(average smart life) ≤ 0.72 and (average smart economy) > 0.58] and [(average smart life) ≤ 0.72 and (average smart economy) > 0.58] and [(average smart life) ≤ 0.72 and (average smart economy) > 0.58] and [(average smart life) ≤ 0.72 and (average smart economy) > 0.58] and [(average smart life) ≤ 0.72 and (average smart economy) > 0.58] and [(average smart life) ≤ 0.72 and (average smart economy) > 0.58] and [(average smart life) ≤ 0.72 and (average smart economy) > 0.58] and [(average smart life) < 0.58] Then average smart economy > 0.58] and [(average smart life) < 0.58] and [(average smart economy) > 0.58] and [(average smart life) < 0.58] Then average smart economy > 0.58] and [(average smart life) < 0.58] and [(average smart economy) > 0.58] and [(average smart life) < 0.58] and [(average smart economy) > 0.58] and [(average smart e

Rule 4: If [(average smart people) ≤ 0.58 and (average smart people) > 0.44] and [(average smart transportation) ≤ 0.58 and (average smart transportation) > 0.44] and [(average smart environment) ≤ 0.58 and (average smart environment) > 0.44] and [(average smart economy) ≤ 0.58 and (average smart economy) > 0.44] and [(average smart life) ≤ 0.58 and (average smart economy) > 0.44] and [(average smart life) ≤ 0.58 and (average smart cities normal

Rule 5: If [(average smart people) ≤ 0.44 and (average smart people) > 0.3] and [(average smart transportation) ≤ 0.44 and (average smart transportation) > 0.3] and [(average smart environment) ≤ 0.44 and (average smart environment) > 0.3] and [(average smart economy) ≤ 0.44 and (average smart economy) > 0.3] and [(average smart life) ≤ 0.44 and (average smart economy) > 0.3] and [(average smart life) ≤ 0.44 and (average smart cities low

Rule 6: If [(average smart people) ≤ 0.3 and (average smart people) > 0.16] and [(average smart transportation) ≤ 0.3 and (average smart transportation) > 0.16] and [(average smart environment) ≤ 0.3 and (average smart environment) > 0.16] and [(average smart economy) ≤ 0.3 and (average smart economy) > 0.16] and [(average smart life) ≤ 0.3 and (average smart economy) > 0.16] and [(average smart life) ≤ 0.3 and (average smart cities very low

Rule 7: If [(average smart people) ≤ 0.16 and (average smart people) ≥ 0] and [(average smart transportation) ≤ 0.16 and (average smart transportation) ≥ 0] and [(average smart environment) ≤ 0.16 and (average smart environment) ≥ 0] and [(average smart economy) ≤ 0.16 and (average smart economy) ≥ 0] and [(average smart life) ≤ 0.16 and (average smart economy) ≥ 0] and [(average smart life) ≤ 0.16 and (average smart cities extremely low

Result

In this research, seven rules were built in fuzzy logic to determine the status of any city and measure the rate of smart in it, depending on the basic elements of smart cities, as shown in Fig. 2



Figure 2: Results of Rules in Fuzzy Logic

This work were divided into seven rules, all elements of smart cities must be fulfilled as they are an interdependent unit. And that any defect in any of the elements of smart cities will affect the other elements.

Conclusion and Discussion

Through this research, the following conclusions were reached:

Smart cities include cities that use smart elements and are associated with technological development, it's keen to provide all data and information and to use modern means and applications that prepare radical and smart solutions to various problems in all aspects of life by using artificial intelligence and benefiting from its many advantages

> Smart cities have made a qualitative leap represented by the linking and merging between information and communication technology and the use of advanced physical devices. The main goal of smart cities is to provide a suitable and comfortable life and environment for citizens. All this is achieved through technology associated with artificial intelligence

> A wide interest has been noticed recently in artificial intelligence technologies and their multiple uses in different areas of life. Through the use of fuzzy logic in the research, a set of rules was built, which depended on the elements of smart cities represented by Smart People, Smart Transportation, Smart Environment, Smart Economy and Smart Living. The rate of smart cities was measured through these rules. As the closer all the elements of the smart city are to one value, the more it meets the criteria of the smart city, in the event that these elements are in the middle of the values, i.e. close to 0.5, the city is normal, and in the event that the elements are close to zero, this city is poor, meaning that it lacks any of the smart elements

 \succ The research aims to give an explanation of the concept of smart cities and its basic elements, which must all be achieved to form a modern and developed smart city

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Conflicts of Interest:

The author declare that no conflicts of interest exists for this research.

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Assessing Vitamin B12 and Iron Levels in Helicobacter Pylori-Infected Individuals and Researching the Function of Interleukin-10 In Infection.

Sundus Jassim Mohammad Aljbory ¹ Dunia Kamal salim ² Bushra Ali.Kadhim ³

Abstract

Given their capacity to pierce the stomach's mucous membranes and infect 50% of the global population, Helicobacter pylori bacteria are regarded as extremely pathogenic pathogens that are resistant to antibiotics. This study's objectives were to measure the iron and vitamin B12 levels in those who had this type of illness and to ascertain the extent to which the infection impacted the interleukin IL10 levels, which are highly connected with the immunological status of the patients. A case-control strategy was employed in this study, which involved randomly selecting participants from hospitals in Salah al-Din and the surrounding area. 60 male and 70 female patients with gastroenteritis symptoms who were visitors to Tikrit Teaching Hospital and Baiji General Hospital and ranging in age from 15 to 60 made up the study samples. 50 Uninfected cases. patients as a group under control. The research was carried out from September 2023 to April 2024. According to the findings, 49.3% of the patients were male and 50.7% were female. women, with little distinction between the sexes .Additionally, the results showed that serum iron levels in cases were much lower than in controls. The vitamin B12 level was much lower in the cases than in the controls, according to the results of the ELISA device's analysis of serum samples from patients with and without Helicobacter pylori. Interleukin 10 levels were higher in the patients than in the control group, suggesting that the immune system can lessen inflammation. Interleukin 10 helps counteract inflammatory symptoms brought on by bacteria by generating pro-inflammatory cytokines such as interleukin 6.

Keywords: Helicobacter Pylori, Iron Levels, Vitamin B12, Interleukin 10, Gastroenteritis, Immune Response.



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Introduction

The Helicobacter Pylori bacteria known as the gateway is one of the most widespread bacterial species, which affects 70% to 90% of the population of developing countries (HOOI, 2017), which is a negative bacterium for a spiral generous dye of multiple strings. The bacterium colonizes the epithelial cells of the stomach mucosa and produces ureais, which stimulates the decomposition of urea to Ammonia, and raises the acidity of the stomach. The gatellasty bacterium is one of the most widespread pathogens in the world. Because of the inflammation caused by bacteria, cytokin secretion, generation of interactive oxygen, mitochondria (HU, 2017) . Infection of the gap bacterium in general is acquired during childhood and usually continues for life until it is recovered using antibiotics. Chronic gap infection increases the risk Infection with digestive system, such as gastritis, stomach and duodenal ulcers and lymphoma -associated lymphoma tumor, and systemic diseases outside the digestive system, such as the lack of immune platelets and anemia caused by iron deficiency (Crowe,2019).

In addition, chronic inflammation caused by a long -term infection leads to changes in the mucous membrane in the stomach and the development of stomach cancer calamities such as atrophic gastritis and intestinal weaving. In 1994, the World Health Organization announced that it was a first -class carcinogen for human beings and this classification was confirmed in 2012 (Zhang, 2017)). The world, the gap bacterium infection stimulates the responses of the auxiliary T cells 1 (Th1) and auxiliary T -cells 17 (TH17), and the complications of the infection of the goupe lent anemia and it is known that the IDA anemia (IDA) is the most type Anemia, where most of the anemia in the deficiency in developing countries live. Between 2% and 5% of adult men and women in the developed world suffer from iron deficiency anemia during menopause, with the most prevalent cause being blood loss from the digestive tract. According to Kumar (2015), 15% of cases have unwarranted iron deficiency anemia. After H. pylori was eradicated, a patient with iron deficiency anemia showed improvements in blood parameters, establishing the first connection between the two conditions in 1991 (Demerdash et al, 2018).,(Alblehi et al, 2021).

Children and teenagers are less prone than adults to suffer from the negative effects of Helicobacter pylori infections, which can range from mild or asymptomatic gastritis to severe peptic ulcers (Kisa et al., 2022). If therapy is not received, H. pylori may persist indefinitely. (Malfertheiner, 2023)

Helicobacter pylori bacteria are thought to cause a decrease in vitamin B12 levels, and this may be due to The bacteria's altered absorption results in a deficit. According to one study, Helicobacter pylori is a distinct risk factor for abnormally low blood bilirubin, particularly in adults over 60 (Kadhim et al.2018).

Mania, psychosis, and dementia symptoms can also be brought on by a vitamin B12 shortage. Among other issues, women's poor immunity, infertility, and blood circulation disruption.

Cobalamin, another name for vitamin B12, is a water-soluble vitamin that is essential to all bodily cell metabolism. Because it aids in the production of DNA and the metabolism of amino and fatty acids, it is necessary for all living things. Because it plays a part in myelin formation and blood circulation, as well as the development of red blood cells in the bone marrow, it is thought to be crucial for the proper operation of the nervous system and the brain. Vitamin B12 is an essential nutrient as humans are unable to produce it and it is necessary for life. (Green, 2017)

B12The only vitamin that people need to get from animal-based foods or supplements is the largest and most chemically complicated of all the vitamins. Vitamin B12 can only be synthesized by certain bacteria and archaea.Meat, shellfish, liver, fish, poultry, eggs, and dairy products all naturally contain it. Pregnant women, small children, and the elderly are more affected by vitamin B12 insufficiency, which is more prevalent in middle- and low-developed nations. Malabsorption, which results from the loss of an intrinsic factor in the stomach that must bind to a vitamin B12 food source for absorption to take place, is the most frequent cause of vitamin B12 insufficiency in developed nations. Age-related decreases in stomach acid production are the second main cause, as exposure to acid causes the vitamin that is bound to protein to be released. For the same reason, those who use antacids for a long time.(Maruvada,2020).

are more vulnerable. A blood condition known as pernicious anemia or neuropathy of the extremities are two symptoms of deficiency (Mubaraki, 2022). Helicobacter pylori infection is closely related to chronic gastritis of the lower stomach, which diminishes the production of gastric acid and pepsin and is thus associated with malabsorption of dietary vitamin B12. A person with Helicobacter pylori may not get enough vitamin B12. Furthermore, because it prevents the stomach from absorbing vitamin B12, it has been connected to stomach ulcers and can lead to vitamin B12 insufficiency. (Sharma *et al*, 2022) The anti-inflammatory cytokine IL-10 controls the activation and activity of both innate and adaptive immune cells. IL-10 secretion in response to H. pylori infection has been documented in both acute and chronic

stages of the illness. During the acute phase, Tregs produce IL-10 to counteract the extensive pro-inflammatory reaction that Th1/Th17 cells have activated. According to Moyat and Velin (2014), the chronic stage is characterized by a shift in polarization from the pro-inflammatory type 1 to the anti-inflammatory type 2 responses due to DCs' production of IL-10, which encourages H. pylori persistence in the stomach environment (Kumar et al., 2021). have demonstrated increased IL-10 production in cultured biopsies from patients infected with H. pylori. Additionally, it was claimed that following an H. pylori infection, a reduction in IL-10 production exacerbated the degree of stomach inflammation and increased the risk of developing gastric cancer (Aziz et al., 2022). Furthermore, Leon et al. (2002) observed that IL-10 (-/-) knockout mice developed hyperplastic gastritis rapidly, suggesting that IL-10 is important in lowering the inflammatory response to H.pylori.

IL-10 can protect host tissue from damage because of its well-known ability to suppress a range of immunological responses, including as T-cell activation, the generation of inflammatory cytokines, and antigen presentation (Sharifinejad, 2022).

Materials and methods

This study, which employed a case-control design, involved randomly chosen participants from Saladin Governorate's main hospitals. 130 instances, 60 male and 70 female patients with Helicobacter pylori infections, ages 15 to 60, who were referred to the governorate's public hospitals for medical care, made up the study population. Furthermore, fifty people who appeared to be in good health were utilized from the same age-matched demographic as the baseline comparisons' control group. The study was carried out between September 2023 and April 2024 at Tikrit Teaching Hospital and Baiji General Hospital, the two biggest public hospitals in the Saladin Governorate.. individuals on immunosuppressive medications, chemotherapy, steroids, or H. pylori eradication therapy were excluded, as were pregnant individuals. as well as those who complain who are younger than 15 and older than 60. infection with Helicobacter pylori

Collecting and testing samples

All of the stool samples were collected in containers and sent to the lab in less than an hour. Each patient (cases and controls) had around 5 ml of venous blood extracted and put in a serum tube so that serum iron could be measured using a DiaSys reagent kit.9(. Using an enzyme immunoassay (Immulite/Immulite 1000) using a device(respons 910 DIaSys Diagnostic Company) that is competitive and solid-phase chemiluminescen, the quantity of vitamin B12 in the serum was quantitatively assessed.10 The color chromatographic
immunoassay was used to identify H. pylori. A ready-made commercial kit from Milenia that employs the enzyme linked immunosorbent assay (ELISA) method was used to evaluate the levels of IL10 using immunological test reagent kits(Abcam company) (CerTest H. pylor). The findings were read at 450 nm.

Statistical analysis

Software called the Statistical Package for the Social Sciences (SPSS) was used to tabulate, encode, and statistically analyze the data. Statistical significance was defined as p-values <0.05 for means compared using the dependent-samples t-test.

Variable	Case n (%)	Control n (%)	Chi-square	p-	value ^a				
Gender									
Male	60 46.15)	25 (50)	0.3638	().546				
Female	70 (53.85)	25 (50							
	Age (years)								
15–24	23 (17.69)	10 (20)							
25–34	45(34.62)	15(30)	139.46		0.05				
35 -44 45-54 54-60	37(28.46) 20(15.38) 5(3.85)	13(26) 8(16) 4(8)							
Place of residency									
City		85(65.4)	30(60)	132.08	0.05				
Villag	ge	45 (34.6)	20(40)						

Table 1: Sociodemographic traits of the research participants.

The gender distribution of the case and control groups is shown in Table 1, together with the socioeconomic and demographic characteristics of the research population. Male and female differences are not statistically significant. The results of our study differed from the study (22), where females were more susceptible to infection with Helicobacter pylori, while other studies reported an increased rate of infection with Helicobacter bacteria in males than in

females(Klein et al.,1994 ;Böhmer et al.,1997). The increase in cases in the ages 25-34 and 35-44 was 34.62% and 28.46%, respectively. The results also showed that the least The ages of infection according to the study population are From 450-54 and 54-60, there was a significant increase in Helicobacter pylori infection between the countryside and the city. An increase in disease cases was noted in the city compared to the village. The reason for this may be due to the weak immune status in the city compared to the village.

Biochemical and immunological parameters

When comparing patient samples with the control group, the average levels of vitamin B12 were 264.5 and 377.3 for patients and controls, respectively, which indicates that there are significant differences between patients and healthy people with regard to vitamin B12,The results of our study agreed with (Sudai& Granot,2003)which demonstrated the association of low levels of vitamin B12 in the serum of people infected with Helicobacter pylori. The reason for this is a change in the intestinal environment, which weakens the body's ability to absorb it, as shown in the table. No. 2: Lower iron values in the serum of patients compared to healthy people In healthy people, the values were 70.5 and 81.3 for healthy people and patients, The results of our study were consistent with(Bille& Mabeku,2022)cases, as infection with Helicobacter bacteria was associated with a decrease in iron levels and an increase in anemia. respectively. As for interleukin 10, it was shown through our study that this factor was higher in patients compared to healthy people These results agreed with, (Rizzuti et al.,2015) as it is one of the cytokines that help increase the immune response, which helps in the healing process.

Variables	Case	Control	t value	<i>p</i> -value ^a
Vitamin B ₁₂ (pg/mL)	264.5 ± 176.6	377.3 ± 90.53	2.460	0.015
Iron (µg/dL)	70.5 ± 20.268	81.3 ± 20.733	4.122	0.0001
IL10(μg/dL)	5.10±1.078389	1.87 ± 718455	-18.937	0.0001

Table 2: The various study groups' serum levels of iron, vitamin B12, and IL10.

Low: less than 174 pg/mL; normal: between 174 and 878 pg/mL; high: greater than 878 pg/mL.

In women, serum iron levels are low <23 μ g/dL, normal 23–134 μ g/dL, and high >134 μ g/dL. In men, serum iron levels are low <35 μ g/dL, normal 35–168 μ g/dL, and high >168 μ g/dL. The means \pm standard deviation (SD) are used to express values.



Figure (1). The level of sensitivity and correlation between Helicobacter pylori infection and study factors

Figure 1 suggests that the high incidence of Helicobacter pylori infection is inversely correlated with both vitamin B12 and iron, whereas interleukin 10 is directly correlated with the severity of illness.

Correlations

		IL10	B12	IRON
IL10	Pearson Correlation	1	138	082
	Sig. (2-tailed)		.118	.353
B12	Pearson Correlation	138	1	.097
DIZ	Sig. (2-tailed)	.118		.275
IRO	Pearson Correlation	082	.097	1
Ν	Sig. (2-tailed)	.353	.275	

Table 3: Correlations between factors studied in a patient group

Table 4:	Correlations	between	variables	in tl	he healthy	group	(control)
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IL10	Pearson Correlation	1	.170	219
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	Sig. (2-tailed)		.242	.130
B12	Pearson Correlation	.170	1	021
	Sig. (2-tailed)	.242		.886
IRON	Pearson Correlation	219	021	1
	Sig. (2-tailed)	.130	.886	

Tables 3 and 4 explain the correlation factors between the elements of the study, as it is clear that the intensity of the correlation between the percentage of vitamin B12 and iron in the serum, while there was no relationship between the previous two factors and interleukin 10.¹

Discussion

Helicobacter pylori bacteria is considered one of the health problems resulting from suffering due to suffering from treatment, in addition to its association with pernicious anemia. Many studies have reported that it has even surpassed the main infection of cancer. It has been classified, according to the International Organization of Fellows, as a carcinogenic agent. The current study indicated that there were no significant differences. It indicates that the sex factor in February is related to Helicobacter pylori bacteria, while the age factor was

The residential area has a clear impact on the distribution of the spread of infection

Since an excess of Helicobacter pylori in the stomach causes hypochlorhydria, the data indicated that Helicobacter pylori infection significantly affects the absorption of vitamin B12. Consequently, the majority of patients may experience malabsorption of vitamin B12 due to a lack of this crucial component.

According to earlier research, Helicobacter pylori is associated with anemia brought on by an iron deficit in the body. This condition is brought on by a malfunction in the mucous membrane's ability to function, which lowers iron absorption and increases the body's loss of iron.

The spread of Helicobacter pylori is more common in developing nations than in industrialized ones, and its mode of transmission is yet unknown.

Vitamin B12 levels are much lower in cases than in controls, indicating a link between H. pylori and vitamin B12 insufficiency; patients are 4.2 times more likely to have low vitamin B12 levels than healthy individuals. Vitamin B12 deficiency was observed in 28% of the H.

pylori-positive group and 11% of the H. pylori-negative group, respectively. These findings corroborate previous studies that demonstrated a statistically significant relationship between serum vitamin B12 levels and H. pylori infection . precise mechanisms underlying vitamin B12 malabsorption caused by an H. pylori infection are unknown, the following are some possible explanations:

The IL10 gene encodes the anti-inflammatory cytokine interleukin 10 (IL-10), sometimes referred to as human cytokine synthesis inhibitory factor (CSIF). A receptor complex consisting of two IL-10 receptor-1 and two IL-10 receptor-2 proteins signals IL-10. Consequently, the functional receptor consists of four IL-10 receptor molecules. The cytoplasmic tails of IL-10 receptors 1 and 2 are phosphorylated by JAK1 and Tyk2, respectively, upon IL-10 binding, which initiates STAT3 signaling. IL-10 is a cytokine that has a variety of tropic effects on immunoregulation and inflammation. It inhibits Th1 cytokines, MHC class II antigens, and costimulatory molecules on macrophages. Furthermore, it enhances B cell survival, proliferation, and antibody production. The JAK-STAT signaling system is regulated by IL-10, which can also prevent NF-κB.activation.

IL-10 was first discovered in 1991 and was demonstrated to suppress cytokine release, antigen presentation, and CD4+ T cell activation. According to more studies, IL-10 mainly stops lipopolysaccharide (LPS) and bacterial products from inducing the pro-inflammatory cytokines TNFα.

At the site of an allergic reaction, mast cells also release IL-10, which lessens their inflammatory effect, according to a mouse study. (Gunasekera, 2020).

The study found that interleukin 10 levels were higher in Helicobacter pylori-infected people than in healthy people.

Conclusions

Helicobacter pylori appears to be one of the most common factors causing low levels of iron and vitamin B12, which contributes to people suffering from severe anemia, which threatens the individual's general health. The spread of the infection in the body also contributes to high levels of interleukin 10, which is a major indicator of the body's ability to heal itself, as it is one of the factors that contribute to fighting the inflammation resulting from the infection. Actually, a decrease in iron and vitamin B12 can be considered indicators of the possibility of infection with Helicobacter pylori, . Which draws attention to thinking that infection with Helicobacter pylori bacteria is one of the causes of this deficiency and the main cause of gastroenteritis and one of the main causes of pernicious anemia.

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Inference On Genetic Variation and Enzymatic Behavior of Callus in Two Sunflower Cultivars Induced by Ultraviolet Radiation

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Abstract

The experiment was conducted in the Central Plant Tissue Culture Laboratory at the College of Agricultural Engineering Sciences, University of Baghdad, during the period 2021–2023. The study aimed to identify the optimal UV doses for enhancing callus induction and enzymatic activity, which serve as indicators of the plant's tolerance to abiotic stress. Callus from two sunflower cultivars, Agmar and Shamoos, was used to induce genetic variation through UV-C radiation (wavelength < 280 nm) for exposure durations of 0, 10, 20, and 30 minutes. The lethal dose (LD50) was determined to be 20 minutes. The hypocotyls of the two sunflower cultivars were cultured on MS medium containing 1 mg L⁻¹ 2,4-D and 0.5 mg L⁻¹ BA to induce callus formation. Two primers, OPA-5 and OPB-13, were used. The primers revealed differences in the number of bands after electrophoresis. The first primer, under the influence of UV-C radiation, produced seven bands for the Aqmar sunflower cultivar at a 10minute dose, eight bands at a 20-minute dose, and five bands at a 30-minute dose. For the Shamoos cultivar, the primer produced eight bands at 10 and 30 minutes, while the 20minute dose resulted in five bands. The second primer for the Agmar cultivar produced six and seven bands at 20 and 30 minutes, respectively, while no bands appeared at the 10minute dose. For the Shamoos cultivar, the primer generated nine bands at the 10-minute dose and seven and six bands at the 20- and 30-minute doses, respectively. Enzymes SOD, POD, and CAT were extracted, with the 10-minute dose showing the highest values for all enzymes: 3.28, 3.36, and 3.54, respectively.

Keywords: Inference, Enzymatic Behavior, Ultraviolet Radiation, Callus.



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Introduction

Sunflower is one of the primary industrial crops due to its oil, which is among the healthiest and most nutritious vegetable oils. It is rich in unsaturated fatty acids and contains various vitamins that prevent oxidation, making it one of the most widely consumed vegetable oils globally. Climate changes affecting arid and semi-arid regions, including Iraq, have led to the loss of vast agricultural areas annually, resulting in reduced productivity of field crops (Bilgen *et al.*, 2018).

Global food production relies heavily on the expansion of cultivating high-yield cultivars. The development of these cultivars fundamentally depends on traditional breeding methods and biotechnological techniques that focus on generating genetic variation, which serves as the starting point for any plant breeding and improvement program, including for oil crops. Advances in plant tissue culture and biotechnology have significantly supported plant breeding and improvement programs. Researchers have combined their efforts to study cellular plant concepts, focusing on the growth, development, and metabolic processes of plant cells, as well as plant breeding and improvement (Anis and Ahmad, 2016; Al-Temimi *et al.*, 2016). One of the common breeding methods is mutation breeding. However, since natural mutations are rare and cannot be reliably utilized as the main component of a plant breeding program, induced mutations have become essential (Al-Khayri *et al.*, 2015; Al-Ogaidi *et al.*, 2019).

The use of physical mutagens plays a significant role in the potential production and improvement of promising new cultivars. Studies have indicated the feasibility of using UV-C radiation as a physical mutagen (Hasoon, 2014). One of the initial steps in plant breeding programs aimed at enhancing productivity and genetic quality of crops involves inducing mutations in seeds using either physical or chemical mutagens (Al-Shammari *et al.*, 2015). Some chemical mutagens have been employed to stimulate the embryos of seeds from two alfalfa cultivars to induce genetic variation for tolerance to abiotic stress (Hamza *et al.*, 2017). The induction of mutations using UV-C radiation for crop quality improvement can result in significant genetic variation, providing greater opportunities for selection (Al-Shugeairy *et al.*, 2021). The impact of drought stress on the expression of the *dhn1* gene in sorghum showed variation in gene replication among genetic lines (Abed *et al.*, 2018). Furthermore, traits are influenced by dominant genes, which contribute to achieving higher yields in maize (Hadi *et al.*, 2023; Rania and Sudad, 2019).

It is essential to determine the optimal dose that induces the most significant variations, as the appropriate mutagen dose greatly influences the success of mutation formation. This is also affected by the levels of oxygen and water molecules in the material to be irradiated (Herison *et al.*, 2008). Wedean *et al.* (2022) found that the higher the water and oxygen molecule content in the irradiated material, the greater the formation of free radicals, leading to desirable mutations. One of the criteria used to evaluate plant response to UV-C radiation is the increased activity of oxidative enzymes such as SOD, POD, and CAT, which also serve as indicators of plant tolerance to drought stress (Maharani *et al.*, 2015; Suliartini *et al.*, 2015; Al-Taei *et al.*, 2020). Radiation sensitivity levels vary depending on species, cultivars, plant organs, and physiological conditions (Aisyah *et al.*, 2009). Various studies have been conducted to identify plants responsive to UV-C radiation by several researchers, such as rice and sunflower (Hasnawi *et al.*, 2017; Al-Taei, 2019; Najm, & Hamza ,2023). found in her study on the effect of UV radiation on drought tolerance in three sunflower cultivars that low doses of UV radiation stimulated the plants to resist drought stress. This study aimed to identify the optimal UV doses for enhancing callus induction and enzymatic activity, which serve as indicators of the plant's tolerance to abiotic stress.

Materials and Methods

1. Seed Preparation:

Sunflower seeds from two cultivars were washed with water and detergent for 2 minutes to remove dirt and surface impurities. The seeds were then sterilized using a 3% sodium hypochlorite (NaOCl) solution for 20 minutes. Following sterilization, the seeds were rinsed three times with sterile distilled water, each rinse lasting 5 minutes, to eliminate any residual disinfectant that could affect germination.

2. Seed Germination and UV-C Exposure:

The sterilized seeds were placed in sterile containers containing 10 mL of sterile distilled water and incubated in complete darkness. After 48 hours, once germination had begun, the seeds were exposed to UV-C radiation at doses of 0, 10, 20, and 30 minutes to determine the lethal dose (LD50) and the optimal dose for inducing callus growth. The induced callus was later used for studies under various abiotic stresses, such as drought and salinity.

3. Callus Induction:

The hypocotyl segments of germinated sunflower seeds treated with UV-C radiation were cultured on MS medium (Murashige and Skoog, 1962) supplemented with 1 mg L⁻¹ 2,4-D and 0.5 mg L⁻¹ BA. The cultures were maintained for six weeks in complete darkness at a temperature of 25 ± 2 °C (Al-Taie *et al.*, 2020).

4. Division and Analysis of Callus:

After inducing callus and obtaining actively growing cells, the callus was divided into two parts:

- 1. The first part was genetically tested using the PCR-RAPD technique.
- 2. The second part was used to evaluate proline content and enzymatic activity.

5. DNA Extraction and Purification:

Genomic DNA was extracted and purified from the callus cells of each UV-C dose treatment using the Wizard® Genomic DNA Purification Kit (Promega, USA), following the manufacturer's protocol. The concentration and purity of DNA were determined using a Nanodrop spectrophotometer. A volume of 3 μ L from each UV-C treatment was analyzed. Optical density (O.D.) was measured at wavelengths of 260 nm and 280 nm. The purified DNA was stored at –20 °C (Maniatis *et al.*, 1982).

6. Primer Sequence:

The primers listed in Table 1 were used for the amplification of DNA samples. The primers were synthesized by Bioneer (Korea) in a lyophilized powder form and dissolved in sterile distilled water to achieve a final concentration of 10 pmol/µL (Ismail *et al.*, 2022).

Primer Name	Sequence $(5 \longrightarrow 3^{\circ})$	Annealing temp. (°C)
OPA-05	AGGGGTCTTG	38
OPB-13	TTCCCCCGCT	

Table 1: Sequence of the Primer Used in This Study

Thermal Cycling Steps

Each 25 μ L PCR mixture contained the components listed in **Table** (2). DNA amplification was performed using a thermal cycler (MultiGene Optimax-USA). A reaction tube without DNA was included in each run to check for cross-contamination of the PCR components.

Item	Volume			
Nuclease free water	3.5 µl			
Master mix (2x)	12.5 µl			
Primer (10 pmol/ µl)	4 µl			
Total volume	20 µl			
Then added genomic DNA5 μ l (100ng/ μ l) + mix 23 μ l = 25 μ l				

 Table 2: Components of the Master Mix

Polymerase Chain Reaction (PCR)

The quantity and size of amplified DNA fragments from the PCR reaction were determined using agarose gel electrophoresis. A DNA Ladder (250–10,000 bp) from Promega was used. A total of 4 μ L of amplified DNA was loaded onto a 1% agarose gel and electrophoresed for one hour at 60 volts. The agarose gel was stained with ethidium bromide and visualized under UV light at 320 nm. Images were captured using a gel imaging system. The size of the PCR products was estimated by comparison with the DNA Ladder (Hanum *et al.*, 2020).

7. Proline Content Determination:

The proline content in the growing callus was measured by taking 250 mg of fresh callus and placing it in a porcelain crucible. A total of 5 mL of 3% sulfosalicylic acid was added. After separating the liquid mixture, the optical density was measured at a wavelength of 520 nm using a spectrophotometer. These readings were compared with a standard curve of pure proline (Figure 1) (Bates *et al.*, 1973).

8. Enzymatic Activity Estimation in Sunflower Callus Cultivars

9. Enzyme Activity Determination:

• **SOD** Activity: The activity of superoxide dismutase (SOD) was determined using the method of Fridorich and Beyer (1987).

• **CAT Activity**: Catalase (CAT) activity was measured using a spectrophotometer as per the method described by Aebi (1984).

• **POD Activity**: Peroxidase (POD) activity was assessed according to the method of Nezih (1985).



Figure 1: Standard curve of proline

Results and Discussion

The results revealed no significant differences between the two sunflower cultivars, Aqmar and Shamoos, in terms of fresh callus weight (mg) (Table 3), despite variations in their values. However, significant differences were observed among the UV-C radiation doses. The 10-minute UV-C dose resulted in the highest fresh callus weight, reaching 214.8 mg, compared to the other doses and the control. In contrast, the 30-minute UV-C dose produced the lowest fresh callus weight, measuring 155.8 mg.

The results indicated significant interaction effects between the two sunflower cultivars and UV-C radiation doses, showing notable differences. The 10-minute UV-C dose combined with the Aqmar cultivar yielded the highest average fresh callus weight of 215.3 mg, surpassing other interactions and the control. Conversely, the 30-minute UV-C dose combined with the Shamoos cultivar resulted in the lowest average fresh callus weight of 154 mg. The balance between cytokinins and auxins is essential for callus induction. Cytokinins, in appropriate concentrations alongside auxins, act as a key to initiate cell division. Adenine, a component of cytokinins, is particularly crucial for influencing cell division. However, an excessive concentration of either auxins or cytokinins disrupts this hormonal balance, negatively affecting the response rate due to increased ethylene production, which inhibits growth (Devlin and Witham, 1998). Several researchers have emphasized the importance of incubating cultures in complete darkness to prevent the oxidation of light-sensitive auxins by activating the AA oxidase enzyme. Darkness also suppresses phenolic compounds through reduced activity of oxidative enzymes that are light-activated. Furthermore, darkness leads to thinner and more delicate cell walls, increasing their permeability and facilitating the uptake of nutrients essential for growth (Grayg Compton, 2000).

	UV-C R				
Cultivars					Average
	0	10	20	30	
Aqmar	198.0	215.3	190.7	157.7	190.4
Shamoos	190.0	214.3	187.7	154.0	186.5
LSD 0.05	9.11				N.S
Average	194.0	214.8	189.2	155.8	
LSD _{0.05}	6.44		·	·	

Table 3: Fresh callus weight (mg) of two sunflower cultivars under the influence of UV-C radiation

Dry Callus Weight

Table (4) shows no significant differences between the two sunflower cultivars in terms of dry callus weight (mg), despite variations in the values. However, significant differences were observed among the UV-C radiation doses. The 10-minute UV-C dose resulted in the highest dry callus weight of 22.85 mg, compared to other doses and the control. Conversely, the 30-minute UV-C dose produced the lowest dry callus weight, measuring 13.93 mg.

Significant interaction in the dry callus weight between the two sunflower cultivars and UV-C radiation doses. The 10-minute UV-C dose combined with the Shamoos cultivar resulted in the highest average dry callus weight, reaching 23.60 mg, significantly outperformed all other doses and the control, except for the Aqmar cultivar at the same dose. In contrast, the 30-minute UV-C dose combined with the Aqmar cultivar produced the lowest average dry callus weight, measuring 13.10 mg. The increase in dry callus weight observed with the 10-minute dose, compared to the 20- and 30-minute doses and the control, can be attributed to the differential effect of this dose on the growth and development of callus tissue cells. Higher doses negatively impacted the average callus weight due to direct harmful effects on cell chromosomes, disrupting mitotic division (*mitosis*), which subsequently affected plant development and regeneration. Hence, the optimal dose is essential for producing lines that are tolerant to salinity and drought (Najm and Ibraheem, 2023).

The reduction in fresh and dry callus weights under high radiation doses is attributed to radiation sensitivity, which measures the susceptibility of irradiated parts to radiation. Radiation effects can be direct or indirect. Direct effects target the cell nucleus, particularly DNA, where sufficient energy can break bonds, causing single- or double-strand breaks, altering the genetic code, and leading to cell death (Al-Husseini, 2016). Indirect effects result from radiation interacting with water in the cell, producing free radicals like reactive oxygen species (ROS) and hydrogen peroxide, which form toxic compounds that damage cells. Increased levels of *HO* and lipid hydroperoxide have been linked to plasma membrane oxidation and destruction (Kovacs and Kereszles, 2002). Furthermore, the inhibitory effects of high UV doses are influenced by cellular and external conditions, including growth stage and cell size. Cells with smaller nuclei exhibit lower sensitivity to radiation, while those with larger nuclei experience greater chromosomal aberrations and damage (Ibrahim *et al.*, 1990).

Cultivars	τ	Average			
	0	10	20	30	
Aqmar	17.93	22.10	20.23	13.10	18.34
Shamoos	18.43	23.60	18.03	14.77	18.71
LSD 0.05		N.S			
Average	18.18	22.85	19.13	13.93	
LSD0.05					

Table 4: Dry callus weight (mg) of two sunflower cultivars under the influence of UV-C radiation

Proline Amino Acid (µg g⁻¹)

The results show no significant differences between the two sunflower cultivars in terms of proline amino acid activity ($\mu g g^{-1}$), despite variations in values (Table 5). However, significant differences were observed among the UV-C radiation doses. The 10-minute UV-C dose resulted in the highest proline activity, reaching 3.41 $\mu g g^{-1}$, compared to other doses and the control. Conversely, the 30-minute UV-C dose produced the lowest average proline activity, measuring 0.69 $\mu g g^{-1}$.

Significant interaction in proline activity was observed between the two sunflower cultivars and UV-C radiation doses. The 10-minute UV-C dose combined with the Aqmar cultivar resulted in the highest average proline activity of 3.72 μ g g⁻¹, significantly outperforming all other doses and the control, except for the Shamoos cultivar at the same dose. In contrast, the 30-minute UV-C dose combined with the Shamoos cultivar resulted in the lowest average proline activity of 0.55 μ g g⁻¹.

Cultivars	τ	Average				
	0	10	20	30		
Aqmar	0.85	3.72	1.91	0.83	1.83	
Shamoos	1.13	3.10	1.46	0.55	1.56	
LSD 0.05		0.68				
Average	0.99	3.41	1.69	0.69		
LSD0.05						

Table 5: Proline Amino Acid (µg g⁻¹) of two sunflower cultivars under the influence of UV-C radiation

SOD Enzyme Activity (µg g⁻¹)

Table (6) shows no significant differences between the two sunflower cultivars in terms of SOD enzyme activity ($\mu g g^{-1}$), despite variations in values. However, significant differences were observed among the UV-C radiation doses. The 10-minute UV-C dose resulted in the highest SOD enzyme activity, reaching 3.28 $\mu g g^{-1}$, compared to other doses and the control. Conversely, the 30-minute UV-C dose produced the lowest average SOD enzyme activity, measuring 0.75 $\mu g g^{-1}$.

Significant interaction was observed between the two sunflower cultivars and UV-C radiation doses. The 10-minute UV-C dose combined with the Shamoos cultivar resulted in the highest average SOD enzyme activity, reaching 3.43 μ g g⁻¹, significantly surpassing all other doses and the control, except for the Aqmar cultivar at the same dose. Conversely, the 30-minute UV-C dose combined with the Shamoos cultivar resulted in the lowest average SOD enzyme activity, measuring 0.74 μ g g⁻¹. Plants possess various defense mechanisms to mitigate the harmful effects of unfavorable conditions, with enzymatic antioxidants being among the

most effective. SOD is a key component of these defense enzymes (Hanacek *et al.*, 2002). The mentioned enzymes typically remain at minimal levels under normal growth conditions but gradually increase as stress levels rise. This increase is linked to the generation of free radicals, including hydrogen peroxide (H_2O_2), hydroxyl radicals, and superoxide radicals, which are likely responsible for cell damage under drought stress. Drought stress leads to the production of high levels of free radicals, causing damage to cellular membranes. The increased activity of the SOD enzyme may be attributed to elevated levels of free radicals, as the enzyme's primary role is to scavenge free oxygen radicals. The increase in SOD levels could be explained by the possibility that water stress stimulates the genes responsible for producing this enzyme, such as *sod4* and *soda* (Sofo *et al.*, 2015).

Table 6: SOD enzyme Activity (μg g⁻¹) of two sunflower cultivars under the influence of UV-C Radiation

	UV-C Radiation Doses (minutes)						
Cultivars		Average					
	0	10	20	30			
Aqmar	0.40	3.12	1.32	0.80	1.40		
Shamoos	0.88	3.43	1.07	0.74	1.53		
LSD 0.05		N.S					
Average	0.64	3.28	1.20	0.75			
LSD0.05							

POD Enzyme Activity (µg g⁻¹)

Results show no significant differences between the two sunflower cultivars in terms of POD enzyme activity ($\mu g g^{-1}$), despite variations in values (Table 7). However, significant differences were observed among the UV-C radiation doses. The 10-minute UV-C dose resulted in the highest POD enzyme activity, reaching 3.36 $\mu g g^{-1}$, compared to other doses and the control. Conversely, the 30-minute UV-C dose produced the lowest average POD enzyme activity, measuring 0.87 $\mu g g^{-1}$.

The results also indicated significant interaction effects between the two sunflower cultivars and UV-C radiation doses on POD enzyme activity ($\mu g g^{-1}$). The 10-minute UV-C dose combined with the Shamoos cultivar resulted in the highest average POD enzyme activity,

reaching 3.38 μ g g⁻¹, significantly outperforming all other doses and the control, except for the Aqmar cultivar at the same dose. Conversely, the 30-minute UV-C dose combined with the Aqmar cultivar resulted in the lowest average POD enzyme activity, measuring 0.85 μ g g⁻¹.

Table 7: POD enzyme Activity ($\mu g g^{-1}$) of two sunflower cultivars under the influence	of UV-C
Radiation	

	UV-C Radiation Doses (minutes)				
Cultivars				Average	
	0	10	20	30	
Aqmar	0.93	3.33	1.53	0.85	1.66
Shamoos	0.88	3.38	1.58	0.88	1.68
LSD 0.05		1.	12		N.S
Average	0.91	3.36	1.56	0.87	
LSD0.05		0.	79		

CAT Enzyme Activity (µg g⁻¹)

Results show no significant differences between the two sunflower cultivars in terms of CAT enzyme activity ($\mu g g^{-1}$), despite variations in values (Table 8). However, significant differences were observed among the UV-C radiation doses. The 10-minute UV-C dose resulted in the highest CAT enzyme activity, reaching 3.54 $\mu g g^{-1}$, compared to other doses and the control. Conversely, the 30-minute UV-C dose produced the lowest average CAT enzyme activity, measuring 0.56 $\mu g g^{-1}$.

The results also indicated significant interaction effects between the two sunflower cultivars and UV-C radiation doses on CAT enzyme activity (μ g g⁻¹). The 10-minute UV-C dose combined with the Shamoos cultivar resulted in the highest average CAT enzyme activity, reaching 3.64 μ g g⁻¹, significantly outperforming all other doses and the control, except for the Aqmar cultivar at the same dose. Conversely, the 30-minute UV-C dose combined with the Aqmar cultivar produced the lowest average CAT enzyme activity, measuring 0.54 μ g g⁻¹. Reactive oxygen species (ROS) are byproducts of aerobic metabolism, and their production is exacerbated under stress conditions by disrupting the electron transport system and oxidizing metabolic activities occurring in chloroplasts, mitochondria, and microbodies. Under non-stressful conditions, ROS are efficiently neutralized by enzymatic and non-enzymatic

antioxidants. However, during drought, ROS production exceeds the capacity of antioxidant systems to eliminate them, leading to oxidative stress (Ajithkumar and Panneerselva, 2014). Catalase (CAT) isoforms, which are iron porphyrin enzymes, act as an efficient ROS scavenging system to prevent oxidative damage caused by stress (Sofo *et al.*, 2015).

Table 8: CAT enzyme Activity (µg g ⁻¹) of two sunflower cultivars under the influence of UV-C
Radiation

	UV-C Radiation Doses (minutes)				
Cultivars					Average
	0	10	20	30	-
Aqmar	0.52	3.43	2.04	0.54	1.63
Shamoos	0.85	3.64	1.89	0.58	1.74
LSD 0.05		0.	90		N.S
Average	0.69	3.54	1.96	0.56	
LSD0.05		0.	64		

Table (9) and Figure (2) illustrate the effect of UV-C radiation on the callus of two sunflower cultivars, showing the number of bands, fluorescence intensity, and estimated molecular weight (bp) using the random primer OPA-05 after agarose gel electrophoresis. For the Aqmar cultivar, differences in the number of bands and molecular weights were observed across the doses. The control treatment produced eight bands with molecular weights ranging from 410 to 1300 bp, with the first, third, and fifth bands exhibiting strong fluorescence. The 10-minute UV-C dose resulted in seven bands with molecular weights ranging from 415 to 1100 bp, with the first, third, and fifth bands showing strong fluorescence. The 20-minute UV-C dose produced eight bands with molecular weights of 420 to 1110 bp, with the same bands (first, third, and fifth) displaying strong fluorescence. In contrast, the 30-minute UV-C dose yielded five bands with molecular weights of 415 to 780 bp, with the third and fourth bands exhibiting strong fluorescence.

For the Shamoos cultivar using the same primer, the 10-minute UV-C dose produced eight bands with molecular weights ranging from 425 to 1320 bp. The first, third, fourth, fifth,

and eighth bands exhibited strong fluorescence. The 20-minute UV-C dose resulted in five bands with molecular weights ranging from 430 to 750 bp, with the third band showing strong fluorescence. The 30-minute UV-C dose produced eight bands with molecular weights ranging from 470 to 1300 bp, with the first, third, fourth, and fifth bands displaying strong fluorescence.

Table 9: Effect of UV-C radiation at different doses showing the number of bands, fluorescence intensity, and molecular weight (bp) for primer OPA-05 in the Aqmar and Shamoos sunflower cultivars

Cultivars	UV-C Radiation Doses / Minutes	Number of Bands	Fluorescence Intensity	Molecular Weight (bp)
	/ 0Minute	8	_*_**_*_**_* *_*	-520-490-410 -820-760-610 1300-1200-1100
Aqmar	/ 10Minute	7	_*_**_*_**_* *	-520-490-415 -820-760-610 1100
	/ 20Minute	8	_*_**_*_**_**_** *_*	-530-495-420 -825-775-615 1110
	/ 30Minute	5	*_**_**_*_*	-530-500-415 780-620
	/ 10Minute	8	_**_**_**_* **_*_*	-540-498-425 -1150-790-620 1320
Shamoos	/ 20Minute	5	*_*_**_*	-560-510-430 750-670
	/ 30Minute	8	_**_**_**_* *_*_*	-590-510-470 -1100-790-610 1300-1200



Figure 2: M = DNA Ladder 250–10000 bp, Primer OPA-05 (OPA-05/38°C)

- 1 = 0 (Control) for both cultivars
- 2 = 10 minutes of UV-C radiation for Aqmar cultivar
- 3 = 20 minutes of UV-C radiation for Aqmar cultivar
- 4 = 30 minutes of UV-C radiation for Aqmar cultivar

5 = 10 minutes of UV-C radiation for Shamoos cultivar

- 6 = 20 minutes of UV-C radiation for Shamoos cultivar
- 7 = 30 minutes of UV-C radiation for Shamoos cultivar.

Table (10) and Figure (3) illustrate the effect of UV-C radiation on the callus of two sunflower cultivars, showing the number of bands, fluorescence intensity, and estimated molecular weight (bp) using the random primer OPB-13 after agarose gel electrophoresis.

For the Aqmar cultivar, variations in the number of bands and molecular weights were observed across the doses. The control treatment produced eight bands with molecular weights ranging from 370 to 1100 bp, with the third band exhibiting strong fluorescence. The 10-minute UV-C dose showed no primer association. The 20-minute UV-C dose resulted in six bands with molecular weights ranging from 375 to 971 bp, with the third band showing strong fluorescence. The 30-minute UV-C dose produced seven bands with molecular weights ranging from 377 to 980 bp, with the third band exhibiting strong fluorescence.

For the Shamoos cultivar using the same primer, the 10-minute UV-C dose produced nine bands with molecular weights ranging from 350 to 1200 bp, with the third band exhibiting strong fluorescence. The 20-minute UV-C dose resulted in seven bands with molecular weights ranging from 390 to 975 bp, with the third band showing strong fluorescence. The 30-minute UV-C dose produced six bands with molecular weights ranging from 395 to 975 bp, with the third band also exhibiting strong fluorescence. Khan *et al.* (2023) suggested that the disappearance of bands in some treatments might be due to the inability of the primer to bind to its complementary sequence, resulting from mutations such as deletions, additions, or rearrangements of nucleotides caused by UV-C irradiation.

Khalifa Noufal *et al.* (2015) confirmed in their study on a group of rice cultivars the effect of ultraviolet radiation on DNA by altering the sequence of nitrogenous bases. This occurs through the formation of pyrimidine dimers, where covalent bonds are created between cytosine and thymine bases. The presence of multiple bands when using specific primers can be attributed to several factors, including an increase in DNA concentration, polymerase enzyme activity, or the concentration of magnesium ions (Mg^{2+}) , primers, or the primer binding temperature. An increase in binding temperature may result in the loss of many binding sites, while a decrease below the required threshold can lead to the appearance of non-specific bands that do not represent actual genomic sites.

Table 10: Effect of UV-C radiation at different doses showing the number of bands, fluorescence intensity, and molecular weight (bp) for primer OPB-13 in the Aqmar and Shamoos sunflower cultivars

Cultivars	UV-C Radiation Doses / Minutes	Number of Bands	Fluorescence Intensity	Molecular Weight (bp)
	/ 0Minute	8	_*_*_*_*_**_* *	-511-450-370 -825-760-675 1100-895
Aqmar	/ 10Minute	None	-	
	/ 20Minute	6	*_*_****_*	375-470-513- 831-875-971
	/ 30Minute	7	*_*_*_*_**_*	377-471-513- 711-835-875- 980
GI	/ 10Minute	9	_*_*_*_**_*_*_* *_*	350-390-521- 717 790-810-950- 1100-1200
Shamoos	/ 20Minute	7	*_*_*_*_**_*	390-420-519- 711-810-860- 975
	/ 30Minute	6	*_*_**_**_*	



Figure 3: M = DNA Ladder 250–10000 bp, Primer OPB-13 (OPA-13/38°C)

- 1 = 0 (Control) for both cultivars
- 2 = 10 minutes of UV-C radiation for Aqmar cultivar
- 3 = 20 minutes of UV-C radiation for Aqmar cultivar
- 4 = 30 minutes of UV-C radiation for Aqmar cultivar
- 5 = 10 minutes of UV-C radiation for Shamoos cultivar
- 6 = 20 minutes of UV-C radiation for Shamoos cultivar
- 7 = 30 minutes of UV-C radiation for Shamoos cultivar.

Conclusions

Increasing doses of UV-C radiation reduced callus growth and induction while enhancing the activity of enzymes that serve as indicators of plant tolerance to abiotic stresses. Additionally, the lethal dose (LD50) was determined.

Recommendations

It is recommended to study other sunflower cultivars and apply different doses of UV-C radiation, subjecting them to abiotic stresses to develop plants that are tolerant to drought and salinity.

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Effect of Vit.D3 on Serotonin Hormone Level Between Urban and Rural Populations

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Abstract

Background: The Vitamin D3 is considered one of the most important vitamins in the human body, it is a steroidal derivative and action mechanism is same as hormone action, as it has its own receptor. The most important of Vitamin D3 benefits is that it act to gene regulation. On the other hand, the sources of vitamin D3 are divided into endogenous and exogenous. Serotonin is a protein neurotransmitter and is considered as hormone that is synthesized within the human body in various organs such as the brain, digestive system, and other via amino acid tryptophan through multiple steps. One of the most important benefits of serotonin in the human body is transmitting nervous signals, regulating the psychological condition and others.

Material and methods: This study included the collection of two groups, the first group were urban population and the second group were rural population . Individuals were included in the study after obtaining their consent, and all chronic diseases were also excluded. A serum sample was obtained in order to measure some biomarker levels in it (vitamin D3 and serotonin levels) by a various laboratory techniques . On the other hand, the focus was on whether or not there was a state of depression among all individuals in both groups .

Results: After comparing the two groups showed the following:

Significant decrease in the level of vitamin D3 and serotonin for urban populations compared with rural populations . On the other hand, it has been shown that there are increasing cases of depression among urban populations compared to rural populations . It was inferred that there are significant clinical differences between the two groups by means of the statistical value P-value .

Conclusion: This study concluded to show the difference in the level of vitamin D3 between rural and urban populations, and the consequences of the existence of this difference and its effect on the level of the neurotransmitter serotonin, because serotonin directly affects the psychological condition of humans . This findings our help reduce cases of psychological disorders such as depression by raising the level of vitamin D3.

Keywords: Vitamin D3, Serotonin, Depression.



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Introduction

Vitamin D3 (vit.D3) is one of the most common vitamins important for the human body and is classified among the fat-soluble vitamins because it is derived from steroidal compounds and is chemically symbolized by (1,24,25(OH)3cholecalciferol) [1]. The vit.D3 has several names depending on its metabolic stages therefore called cholecalciferol or calcitriol. It has two main sources of production in the body [2], which are : -Endogenous , occur through a metabolic pathway for using subcutaneous 7-dehydroxycholesterol as a precursor and converting it within the metabolic pathway under the influence of sunlight into vit.D3[3].

- Exogenous, obtain through food, such as milk, eggs, nuts and etc. [4].

Both sources provide the body with 1,25(OH)2cholecalciferol (un-active form) which is transformed into the 1,24,25(OH)3cholecalciferol (active form) through several metabolic steps that occur in the liver and kidneys by specific enzymes [5]. See Figure 1.



Figure 1: Endogenous and exogenous pathway of vitamin D3 synthesis[5].

The vit.D3 is work according to a mechanism similar to that of the endocrine glands, as it depends on its specific receptor exist on the target cell membranes by vit.D3 to gain its special effectiveness. Accordingly, vit.D3 has several functions and activities in the human body is most important in regulating mood, regulating metabolism, contributing to strengthening bones and etc. [6].

Serotonin is a chemical compound that acts as a hormonal neurotransmitter synthesized by tryptophan as its precursor and is chemically called 5-hydroxytryptamine [7]. Serotonin is synthesized from tryptophan which enters the body through foods such as meat, eggs, milk derivatives, nuts and etc., see figure 2. The hormone serotonin act to transmit nerve signals across the nerves and across the brain barrier therefore, its loss in the body causes mood disturbances, which is why it is called the happiness hormone [8].



Figure 2 The serotonin synthesis steps [9]

The hormone serotonin has multiple functions, the most important of which is regulating bowel movement, reducing psychological disorders, regulating nausea and vomiting for the patient in pathological conditions and others [10]. Also, there are other important roles for the serotonin such as help to regulate the wake and sleep, blood clotting regulation and support function of sexual . On other hand, there are many studies confirm the important role of serotonin in regulation of psychological condition and treatment it's disorders [11].

The clinical significant of serotonin divide into high and low level of serotonin .The high level serotonin can cause serotonin syndrome that caused many signs and symptoms such as mild manifestations (diarrhea and shivering) and sever manifestations (seizures and muscle rigidity and fever), this syndrome can cause death if not treated. But, the low level serotonin can cause many of psychological disorders such as depression and anxiety [12].

Our current study aims to know the effect of vit.D3 on the serotonin hormone and the psychological disorders that accompany it, and what are the differences according to these biomarkers between rural and urban populations.

Materials and Methods

Study design

This study depended on the difference between rural and urban populations groups according to the vitamin D3 level in blood, serotonin level in blood and depression condition among this populations. The present study involved selection of 2 groups that classified to first group included 37 individuals from rural and second group included 37 individuals from urban. Both groups were enrolled males and females and age 20-50 years for all individuals with excluded any chronic disease such as diabetes, blood pressure, thyroid disorders and others.

Collection of samples

The all individuals samples were collected from the patients were attended to Al-Madain General Hospital - Baghdad from 2/4 to1/6/2024. All study's individuals were fully the special questionnaire then draw blood sample after their approval. The blood samples collected with gel tube then immediately separation by centrifuge to obtain serum samples for all study's individuals to measurement of vitamin D3 and serotonin levels.

kits, tools and apparatus

See table 1.

kits , tools and apparatus	Company /country	
vitamin D3 kit (LOT : VESHB09E) [13]	Boditech Med Inc. compant / Korea	
Serotonin kit (LOT : ab133053 Serotonin ELISA kit) [14]	Abcam /UK	
Gel tube	Wafi / China	
Micropipette	Dragon-lab / China	
Refrigerator	SONY / Japan	
Ichroma	Boditech Med Inc. company / Korea	
Elisa Reader	PARA medicaly / Italy	
Centrifuge	Hettich / Germany	

Table 1 : kits , tools and apparatus

Statistic analysis

To the statistical analysis at this study used the T-test method (mean \pm standard deviation (SD)) for quantity measurements and Chi-square method for qualities measurements at statistic analysis for obtain the different value after compare of groups.

Results

The study's result included a comparison between rural and urban populations groups according to the vitamin D3 level in blood, serotonin level in blood and depression condition among this populations. This study was show decrease of vitamin D3 and serotonin levels in urban populations group when compared with rural populations group, that appear the significant different of P-value by t-test statistic method for 2 bio-parameter, table 2 and figure 3. On other hand, this study show increase of depression condition in urban populations group when compared with rural populations in urban populations group by the significant different of P-value by t-test statistic method for 2 bio-parameter and populations group when compared with rural populations group are test statistic method.

Table 2: Comparison of serum vitamin D3 and serotonin levels between rural and urban populations groups by t-test method

Variable (ng/ml)	Urban populations group (No. =37)	Rural populations group (No. =37)	P-value
Serum serotonin level	77.2 + 1.14	113.3 + 0.89	< 0.05*
Serum vitamin D3 level	21.7 + 2.16	37.5 +1.83	< 0.05*





 Table 3: Comparison of depression condition percent between rural and urban populations

 groups by Chi-square test method

Variable	Urban populations group (No. =37)	Rural populations group (No. =37)	P-value
Depression condition percent	Yes / 23 individuals 63 % No / 14 individuals	Yes / 12 individuals 27 % No / 25 individuals	< 0.05*
	37 %	73 %	





Discussion

This study is of great importance in the human's life due to contain the import information's because it refer to important matters in human health, as it is concerned with the role of vitamin D3 and its effects on human mood through its effect on the synthesis of the neurotransmitter called serotonin (the happiness hormone).

Vitamin D3 is considered an important steroid compound in human life because it has many functions in the human body, as it has two sources, endogenous and exogenous sources [15]. The endogenous source produces vitamin D3 by converting the subcutaneous 7dehydrocholesterol compound into vitamin D3 under the influence of sunlight through many steps. While the exogenous source comes from food or nutritional supplements, where it is converted into the active form of vitamin D3 through metabolic steps in the human body. Vitamin D3 has many and multiple functions, and the most important of these functions is regulating the genes that produce important protein substances, and this happens through a special bio-mechanism, which is at briefly, vitamin D3 hormone regulated transcription occurs both by gene activation and repression [2]. On handling of vitamin D3 hormone to the vitamin D3 receptor (VDR), the VDR heterodimerizes with the retinoid X receptor (RXR), and triggers the VDR to recognize vitamin D responsive element (VDRE) in DNA sequences of vitamin D3 regulated genes. it has been demonstrated that the VDRE sequence alone can determine whether the CDR-RXR heterodimer activates or represses transcription, possibly by inducing a conformational change that favors recruitment of either co-activators or corepressors . multiple-regulatory VDR can be present in proximal and distal regions of gene and have been shown to represent more than one way to modulate gene transcription in different tissues[16], see the figure 5.



Figure 5 : Vitamin D3 action mechanism [17]

Among the most important genes affected by vitamin D3 are the genes that produce the happiness hormone(serotonin) .

Serotonin is a protein neurotransmitter that is manufactured in various parts of the body, such as the intestines, the brain, and others. Serotonin plays an important role in the body as it

is involved in the process of transmitting nerve impulses between cells, which is why it is involved in many processes in the body[18] . The mechanism of serotonin's action is summarized as follows :

At rest, serotonin is stored within the vesicles of presynaptic neurons. When stimulated by nerve impulses, serotonin is released as a neurotransmitter into the synapse, reversibly binding to the postsynaptic receptor to induce a nerve impulse on the postsynaptic neuron .Therefore, serotonin has different roles in the human body, and the most important role is regulating a person's mood and psychological state [19].

In this study, the important role of the vitamin D3 level in the process of producing serotonin and regulating of humans mood. This study proved that people who life in urban have lower levels of vitamin D3 compared to people who live in the rural. This difference is due to the level of vitamin D3 to the nature of life in the rural. It is known that rural residents usually have a healthy diet that depends largely on milk products such as fresh milk, cheese, butter, etc., while urban residents do not eat such fresh food. This fresh food and milk products are rich in vitamin D3. This is why we noticed in our study a high level of vitamin D3 when rural residents are more than urban residents.

On the other hand, we also noticed in this study that the level of serotonin in urban residents is lower than in rural residents, as the reason here is due to the low level of vitamin D3 in urban residents. Therefore, this study proved the role of vitamin D3 in regulating serotonin production and thus regulating a person's mood and psychological state[20].

Vitamin D3 can regulation of serotonin production through effect on enzymatic steps to serotonin synthetic and regulation it . Brain serotonin is synthesized from tryptophan by tryptophan hydroxylase (TPH), which is transcriptionally activated by vitamin D3 after the RXR heterodimerise with VDR in present vitamin D3[21]. Since the vitamin D3 activates the transcription of the enzyme responsible (called TPH) to serotonin-synthesizing in the brain at a VDRE because the TPH gene has 2 distal activating VDRE sequences that are associated with transcriptional activation. Thus, TPH is likely to be transcriptionally activated by vitamin D3, after the TPH activation triggered the serotonin synthesis steps to serotonin production[22]

This study results are confirm the vitamin D3 role in serotonin synthesis and relieve depression condition, and agree with (Kaneko I, Sabir MS and et al 2015) that demonstrated

same results to explain effect of vitamin D3 deficiency on psychological disorder conditions like depression through effect on serotonin production in the human body [23].

Our current study highlight on the health differences between rural and urban population in terms of measuring vitamin D3 and serotonin levels, along with assessing the psychological state in terms of depression. Such studies open up horizons for research and finding other relationships with other vitamins and hormones, For example can find a relationship and impact of rural lifestyle on thyroid hormones, vitamin K or other parameters compared to urban residents.

Conclusion

Concluded this study results to show the role of vitamin D3 to regulation of serotonin synthesis through effect of VDRE on TPH enzyme gene activation that responsible to convert of tryptophan into serotonin via serial steps .Also , this study explain the different of vitamin D3 level between urban and rural populations and effect it on psychological condition for them.

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Authors' contributions

All authors contributed to sample collection, practices steps, data analysis, drafting, and revising of the paper and agreed to be responsible for all the aspects of this work.

Conflict of Interest

There are no conflicts of interest in this study.

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Pre-Treatment of Green Grap Seeds to Remove the Cationic Dye from Aqueous Solution

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Abstract

This study examines green grape seeds, a byproduct of juice production, to determine their potential as a P-GGS adsorbent and its efficacy in eliminating cationic methylene blue from aqueous solutions. The investigation of the P-GGS adsorbent was performed using scanning electron microscopy (SEM) and (FTIR) spectroscopy, X-ray diffraction (XRD) analysis, and Energy-dispersive X-ray spectroscopy (EDX). The results demonstrated a high ability of P-GGS to adsorb MB dye (44.55 mg/g) under the following conditions: pH = 6.0, starting dye concentration = 50 ppm, contact time = 90 minutes, P-GGS dose = 0.3 g / 50 mL, and temperature = 50 °C. Equilibrium data on MB adsorption has been obtained using isothermal Freundlich and Langmuir models. The experimental results aligned with the Langmuir model (R^2 = 0.968). The adsorption kinetics were followed to the Elovich model (R^2 = 0.937). Thermodynamic The study found that the reaction was both endothermic and spontaneous, as shown by the negative Gibbs free energy (Δ G°). The P-GGS adsorbent may be an effective means of removing cationic dyes from aqueous solutions.

Keywords: Green grape seeds (P-GGS), Adsorbent, Cationic dye removal, Methylene blue



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Introduction



There is an increasing global demand for pure water due to its scarcity as a natural resource. Achieving the Sustainable Development Goals of the UN depends on this [1]. Many different industries utilize synthetic dyes extensively; in particular, the textile and dyestuff industries are significant water users and polluters, releasing noticeable amounts of dyes into their effluents [2]. In addition to its application in paint, apparel, printing, dyeing, and various chemical industries [3]. Dyes from residual effluents can have the potential to seriously harm aquatic environments both toxicologically and aesthetically [4]. Synthetic dyes take a long time to break down and are carcinogenic, because synthetic dyes contain the azo group (-N=N-), they are potentially polluting, hazardous to life, and non-biodegradable [5]. Therefore, even at low dye concentrations the color is visible, wastewaters from the dye production and application sectors pose a threat to the environment. Methylene blue (MB) can irritate the skin, eyes, stomach, diarrhea, and induce mental disorders, among other side effects [6]. MB is among the numerous cationic dyes that are most commonly utilized in the textile field, is thought to be extremely hazardous and possibly even cancerous. Furthermore, the complex molecular makeup of this pollutant. It also contains aromatic and aliphatic functional groups, which makes it stable and resistant to biodegradation. [7,8]. Various techniques have been employed to remove colors from wastewater, including adsorption [9], advanced oxidation processes [10], coagulation/flocculation [11], electrochemical processes, and photocatalysis [12, 13]. Because of its simplicity design, ease of use, and affordability, adsorption is regarded as a high-quality treatment method. Additionally, that has the ability to employ a broad range of artificial and natural materials as adsorbents [14,15]. Over the past decade, a number of non-conventional, low-cost adsorbent [16]. A variety of adsorbents, including carbon nanotubes, clay minerals,

and activated carbon zeolites [17]. However, Adsorbents are essential to the process of adsorption, and a variety of materials have been employed in this regard. To achieve high adsorption capacity and improved adsorption conditions, however, new materials had to be discovered or the traditional ones had to be modified [18]. Because agricultural waste contains a large amount of cellulose and lignocellulose, they have been suggested as an inexpensive alternative to adsorbents [19]. Agricultural waste is categorized as wastes from crop and processing activities. The most prevalent wastes in the food and agricultural industries include cereals, seeds, fruits, vegetables, herbage, and pasture. These materials have a great deal of promise as adsorbents that may clean up contaminated effluents [20,21]. furthermore, agricultural wastes are abundant and renewable. Because agricultural wastes are typically utilized without or with minimal processing (washing, drying, and grinding), they are superior to other adsorbents because they lower manufacturing costs by employing an inexpensive raw material and avoiding energy expenses involved with heat treatment [22,23]. Various agriculture waste The usage of adsorbents such as, including orange peel [24], sugarcane bagasse [25], wheat husk [26], walnut shells [26]. However, agricultural waste is considered a very important raw material because it is a renewable source and a low-cost material [27].

A rising number of studies has been conducted in the past few years on the use of grape waste as a biomaterial for water filtration. In fact, grape waste performed remarkably well in eliminating heavy metals [28] and pharmaceutical dyes from aquatic solutions [29]. Numerous plant chemicals, such as flavonoids, melatonin, and antioxidants, are plentiful in grape seed extract and may offer health advantages. In fact, it's believed that byproducts or waste, including grape skins and seeds, account for about 25% of the weight of grapes used in the wine industry. Additionally, oil, lignin, cellulose, and hemicellulose are all present in grape seeds. Each of these substances has a number of functional groups which can act as biosorption sites. These data lead us to conclude that grape seeds may be a readily available, reasonably priced, and effective material for use as a biosorbent in aqueous systems to remove dyes [30,31].

In this context, this study focused on the possibility of using green grape seeds which are the remains of grape seed extraction during winemaking processes or grape juice production after pre-treatment, to produce a low-cost, locally available adsorbent (P-GGS), and evaluating as an absorbent material for removal MB dye from the medium. aqueous using the adsorption process. Due to their ease of design and low cost, the effect of different process parameters has been studied in batch adsorption experiments. In addition, the treated adsorbent material was characterized and in order to identify the type of adsorption of methylene blue dye on the adsorbent material's surface, the adsorption mechanism was further investigated using isotherm, kinetic, and thermodynamic studies.

1. Material and Methods 1.1. Material:

Applied reagents including MB ($C_{16}H_{18}ClN_3S$, M. wt, 319.9 g/mol, Fluka, 99.6%), HCl and NaOH from (Merck, Germany). The solutions' pH was adjusted using NaOH (0.01 N) and HCl (0.01N). Deionized water (D.W) was used to dissolve the chemical solutions. A Centrifuge, digital pH meter and Germany).

1.2. Preparation of adsorbent (P-GGS):

The P-GGS adsorbent was prepared from collecting green grape seeds from local juice factories in Mosul, Iraq. The seeds were isolated and washed multiple times. with tap water, then washed with distilled water at least three times. After that, they were dried for a week under the sun, then ground in an industrial mill and sieved through a 230 nm size sieve to produce tiny particles that appeared powder. A 1000 mm beaker of distilled water was filled with 5 grams of the adsorbent material. To get rid of any dust, oil and colored materials that were adhered to it, it was boiling to 90 °C for 3 hours. After decantation of water, it was left to soak in hydrochloric acid HCl (0.1 N) for over the night. It was then repeatedly cleaned with distilled water. Up to the neutralization of the PH. Following that, it is dried at 80 °C for an entire day in the oven, and it is then stored in a drying container (desiccator) for later use.

1.3. Preparation of adsorbate (MB):

To create a stock solution with a concentration of 500 ppm MB, 0.125 g of (MB)dye was dissolved in 250 ml of deionized water in a volumetric bottle. This solution might be used to create different concentrations in the future. These are measured at λ max 663 wavelength.

1.4. the point zero charge of P-GGS adsorbent:

Solid addition methods were employed to ascertain the P-GGS point of zero charge (PH_{PZC}). It has been split up into many 100 ml beakers containing 0.4 g of KNO₃. the Solutions of HCl and NaOH (0.1 N) was added to change the pH (pH_i) values from 1 to 10, each beaker was received 0.4 g of P-GGS, and the beakers were sealed tightly then, the solutions were

shaken for 24 hours, the(pH_f) value of solutions was determined after completing the shaking period. The pH was plotted to calculate pHpzc [32].

1.5. Characterization techniques for adsorbent (P-GGS) :

It included an X-ray diffraction analysis (Philips, Netherlands, PW1730) At a wavelength of 0.15406 nm, Cu K \pm 1 radiation was analyzed to yield XRD patterns. (FESEM/EDX) (Tescan, Czech, MIRA III) was used to analyze the surface morphology of P-GGS both prior to and after the adsorption treatment. Using an FTIR spectrometer (1800, Sgimadzu, Japan), Fourier transform infrared spectroscopy (FT-IR) was conducted in the 400–4000 cm⁻¹ range.

1.6. Batch adsorption process:

The adsorbent of P-GGS made from grape seeds was used in this laboratory batch experiment to adsorption MB in aqueous medium. The variables, pH (2 - 10), dose (0.05 - 0.6 g/L), concentration of MB dye (10 to 80 mg/L), temperature from (20-50) °C and contact time (15 to 120 minutes), to asses P-GGS adsorbent effectiveness were chosen batch tests for the adsorption process it. round flasks with a working capacity of 50 mL and a total volume of 250 mL were used for all adsorption process. Furthermore, there was a 250-rpm shaking rate. The dye solutions' starting pH was adjusted using either NaOH or HCl (0.01 N). Centrifugation was used to separate P-GGS after the adsorption phase, with a speed of 2500 rpm for 10 minutes. Ultimately. The remaining concentration of the dye is found by measuring the absorbance at 663 nm., which is its maximum wavelength (λ max = 663 nm). Equation (1, 2) [33].

$$q_e = \frac{(C_o - C_e)}{W} \times V$$
 [1]

%Removal effciency

$$= \frac{(C_o - C_e)}{C_o} \times 100$$
 [2]

the amount of of mass the

where qe is adsorbate per adsorbent (mg/g), V is the volume of solution (L), and W is the weight of the adsorbent (g). C_o and C_e are the initial and final MB dye concentrations (mg/L), respectively.

1.7. Adsorption Isotherm:

After calculating the amount of remove MB dye absorbed on the adsorbent using equation (1).

Finding a suitable model to be utilized in the design process requires analyzing the data from the adsorption equations using several equation models. The most important nonlinear adsorption equation models. The experimental data have been applied using Langmuir and Freundlich.

1.7.1. Freundlich model :

The Freundlich isotherm can be expressed using equation (3), which works well for an especially heterogeneous surface [34].

$$q_e = K_F * C_e^{1/n}$$
 [3]

 K_F represents the Freundlich constant ((mg g⁻¹) (L mg⁻¹) (1/n)), which is associated with the bonding energy, and n (g L⁻¹) denotes the degree of adsorption divergence from linearity.

1.7.2. Langmuir model:

The Langmuir model can be stated if the adsorption surface is completely homogeneous as in the following equation (4).

$$q_e = \frac{Q_{max}K_LC_e}{1 + K_LC_e}$$
[4]

where K_L (L mg⁻¹) is the Langmuir constant which represents the adsorption energy and Q_{max} (mg g⁻¹) is the maximal monolayer adsorption capacity.

A dimensionless constant separation factor (RL) is defined to assess the adsorption process's favorability. The adsorption process is irreversible when RL is zero, favorable when RL is between (0 - 1), linear when RL is equal to 1, and unfavorable when RL is greater than 1. Equation (5) can be used to define the R_L value [35].

$$\mathbf{R}_L = \frac{1}{(1 + \mathbf{K}_L * \mathbf{C}_i)}$$

1.8. Kinetic

of adsorption:

[5]

Examining the rate of adsorption and the quantity of time needed for adsorption to reach equilibrium is important. Many empirical models may be used to predict the kinetics of a solid-liquid interface adsorption in order to better understand and investigate the adsorption mechanism. There was discussion of pseudo-first order, pseudo-second order and Elovich kinetic models. were employed to determine the MB adsorption kinetics on P-GGS. Equation (6,7,8) [36,37,38].

$$q_t = q_e(1 - e^{-k_1 t})$$
[6]

$$q_t = \frac{k_2 q_e^2 t}{1 + k_2 q_e t}$$
[7]

$$q_t = \frac{1}{\beta} \ln(\alpha\beta t + 1)$$
[8]

1.9. Thermodynamics study

The identification of the thermodynamic parameters necessary to improve understanding of the adsorption reaction's nature and feasibility involves calculating the change in enthalpy ΔH° , entropy ΔS° , and Gibbs free energy ΔG° . At various temperatures, every parameter was calculated, and the values of ΔH° , ΔS° , and ΔG° were determined using equations (9,10,11).

$$\Delta G^{\circ} = -RTlnK_L$$
 [9]

$$\Delta G^{\circ} = \Delta H^{\circ} - T \Delta S^{\circ}$$
 [10]

$$\ln K_L = \frac{\Delta S^{\circ}}{R} - \frac{\Delta H^{\circ}}{RT}$$
 [11]

The universal gas constant is R (8.314 J mol K-1), the equilibrium constant is KL, and the absolute temperature is T (°K) [39, 40].

2. Result and discussion

2.1. Studying of batch adsorption parameters:

2.1.1. initial pH:

pH is a crucial element. Therefore, when green grape seeds P-GGS are used for removal MB dye, the ionization state of the dye molecules is affected by the solution's pH. Since MB is a cationic dye, it gives the water a positive charge. The degree of ionization of the dye varies with pH values, which affects the extent to which the dye is attracted to the adsorbed surface. The adsorption capacity and removal efficiency of MB dye can be improved by regulating and adjusting the pH of the solution. To ascertain the surface charge of P-GGS, the value of zero-point charge (pH_{pzc}) was measured. The pH_{PZC} of P-GGS was obtained as 5.4. This indicates that the surface of the material is positively charged below the pH_{pzc} and negatively charged above the PHp_{zc}.

Fig.1 shows the MB dye removal efficiency on P-GGS with varying pH range from (2 - 10). Investigations were performed at different initial pH (2 - 10) of the solution for a specific dose of 0.15 g, MB concentration (50 ppm) and the adsorbent contact time is 90 minutes. The maximum of removal efficiency (96.67%) was reached at pH 6. According to the pHpzc measurement of the adsorbent, the pHpzc value of P-GGS at 5.4. That is, when pH > pH_{pzc}, as a result, the adsorbent surface will become negatively charged above this pH and will be able to absorb the cationic dye which carries a positive charge. This is explained by the increased H⁺ concentration When the pH is low, resulting in the dye's competition. Low dye adsorption efficiency results from unoccupied cationic adsorption sites. The adsorbent's exterior becomes negatively charged upon a rise in the pH value. As a result, the positively charged cationic dye has an easier time sticking to the surface. This makes contaminants with a positive charge more attractive to electrostatic fields. Because the adsorbent and dye combine to generate a dissolved OH⁻, the dye absorption level falls as the PH level rises. This aligns with other research findings [41, 42].



Figure 1: Effect the PH of MB adsorption and point zero charge (PHpzc) for the PGG-S. (time 90 min, dose 0.15g/50 mL, C₀50 mg/50 mL, and temp. 30 °C).

2.1.2. Initial concentration of adsorbate:

Fig. 2 illustrates how differences in the initial concentration of dye lead to an increase in the quantity of dye adsorption, or qt (mg/g), by P-GGS adsorbent. Every experimental run was carried out using a range of MB dye concentrations, from 10 to 80 mg/L. The other parameters of the experiment were consistent. The amount of dye adsorption at equilibrium increased from 3.00 mg/g to 15.66 mg/g with a rise in initial dye concentration from 10 to 50 mg/L. One of the objectives is to test the removal efficiency of P-GGS adsorbent within low concentration ranges of MB dye. This is because the mass transfer of dye resistance between the aqueous and solid phases is overcome by the first rise in dye concentration, which functions as a catalyst. Both the great initial availability of the adsorbent's active sites and the significant initial mass transfer contributed to the early high adsorption rate. Additionally, the relationship between the dye molecules and the adsorbent is improved by the rise in starting concentration. As a result, in response to an initial rise in dye concentration, the amount of dye adsorption increases with a higher mass transfer driving force. Many other researchers have already shown a similar trend in the amount of dye adsorption. [43, 44, 45].



Figure 2: Effect the Co of MB adsorption on P-GGS. (PH = 6, Time 90 min, Dose 0.15 g/50 ml, and Temp. 30 °C).

2.1.3. Dose of adsorbent:

Avoiding material waste after the equilibrium phase has been reached requires careful consideration of the adsorbent dosage. Fig. 3 illustrates the impact of varying the P-GGS dosage 0.05–0.6 g/L on MB elimination. With a rise in P-GGS dose, A general trend of increasing MB removal rate with decreasing adsorption capacity (qe) was observed. The removal rate was 97% at the low dose of P-GGS adsorbent (0.3 g/L), indicating that at all examined doses, the percentage of adsorption increased gradually. In the adsorption system, such outcomes are commonly seen as an increase of dose results in increasing surface sites, which in turn leads to a rise in the percentage of adsorption it can be concluded that the P-GGS surface's active sites facilitated contact with the majority of MB molecules at low doses of adsorbent. Since there was no discernible increase in the percentage of adsorption beyond this dose, Consequently, the optimal P-GGS dosage was determined to be 0.3 g/. Conversely. The adsorption capacity dropped from 43 to 4 mg/g when the adsorbent dose was raised from 0.05 to 0.6 g/L. The decrease in adsorption capacity (qe)(mg/g) with increasing adsorbent dose was caused by a change in the flow or concentration gradient between the solute concentration in the mixture as well as the solute concentration on the adsorbent's surface. Therefore, As the adsorbent dose increased, less dye was adsorbed onto the unit weight of the adsorbent, which led to a decrease in equilibrium adsorption capacity[46]. Adsorption of MB on walnut shell powder has been shown to exhibit similar adsorption behavior [47].



Figure 3: Effect the adsorbent dosage on % removal efficiency & qe of MB adsorption on P-GGS. (pH = 6, Co = 50 mg/L, temperature = 30 °C, and time = 90 min).

2.1.4. Contact time :

The effects of contact time in the range 15–140 min was studied using a constant concentration (50g/L) of dye solution, adsorbent of dose 0.3 g, pH 6.0 and 30 °C as the temperature. Fig. 4 displays the removal efficiency of MB as a purpose of contact time. As the time of contact rose, so did the percentage of adsorption. The outcomes demonstrated that MB adsorption onto P-GGS needed a time of equilibrium of roughly 90 minutes. To guarantee equilibrium, 140 min were spent with the samples. for the trials that followed. Could be because there were more empty positions on the sorbent available at the beginning, increasing the concentration gradients between the sorbent in the solution and the sorbents on the sorbent's surface. the removal efficiency reached nearly constant levels after 90 minutes, hence 90 minutes was the ideal amount of time [48].



Figure 4: Effect the time adsorption MB on P-GGS. (PH = 6, Co = 50 mg/50L, dose 0.3g/L, and temp. = 30 ∘C).

2.1.5. Effect of temperature and MB dye adsorption's thermodynamic behavior on P-GGS adsorbent:

Since the effect of temperature in batch adsorption studies determines whether the adsorption reaction is exothermic or endothermic. Here, specific thermodynamic parameters are calculated at different temperatures. Thus, using 0.3 g of P-GGS adsorbent and 50 mL of MB dye solution with a quantity of 80 mg/L at pH 6, Studies on batch adsorption were conducted to determine to how efficiency of removal MB by P-GGS adsorbent. at four different temperatures of 20 to 50 °C. Fig. **5** show the effect of solution temperature on MB dye adsorption by the adsorbent. At 20°C, the removal efficiency was 84%, while there was a slight improvement in the dye removal efficiency, reaching 98% when the temperature increased to 50°C. Thus, it indicates that the reaction associated with the adsorption process is endothermic. The reason for this outcome is because rising temperatures allow the adsorbed molecules to have greater kinetic energy, which makes it easier to enter the internal cavities of the adsorbed particles. Furthermore, the dye becomes more soluble at higher temperatures, and The intensity of forces interacting with the surface of the adsorbent and adsorbate increases in significance [49].



Figure 5: Effect of temperature of MB adsorption on P-GGS (PH = 6, Co = 50 mg/50L, dose 0.3g/L, and time = 90 min).

In order to determine the changes in enthalpy of adsorption (ΔH°) and entropy of adsorption (ΔS°), which are derived from the ln Kd vs. 1/T Van't Hoff plot's slope and intercept. The values are utilized to determine the values of Gibb's free energy changes ΔG° , the value of negative ΔG° , which is exclusive to the MB adsorption onto P-GGS adsorbent, indicates that this type of adsorption mechanism is spontaneously and preferred. Furthermore, as indicated the adsorption of MB dye at the solid/liquid by a negative value of ΔG° interface is highly advantageous. Additionally, the process appears to be more suitable at high temperatures, such as 328 K, as the free energy increases with temperature. Adsorption occurs mostly as physical adsorption when the value of ΔH° between (-22.7-80 kJ/mol). The disorder and randomness of dye adsorption at the solid/liquid interface are shown by positive values of ΔS° . as listed in Table **1** [50,51].

 Table 1: Thermodynamic Parameters for adsorption of MB on P-GGS adsorbent at different temperature.

Parameter	293	Temperature (K) 303	313	323
$\Delta G^{\circ} \text{ kJ mol}^{-1})($	-2.8433			
$\Delta H^{\circ} \text{ kJ mol}^{-1}$) (-22.7986	-3.9746	- 4.9775	-5.8116
$\Delta S^{\circ}kJmol^{-1} K^{-1})($	-0.0880			

2.2. Characterization of P-GGS adsorbent :

The adsorbent surface's functional groups and their alterations throughout the adsorption process are described by the FT-IR spectra. Fig **6.** FT-IR spectra display the adsorbent's MB adsorption .Several peaks were seen in the functional group region ($4000-1500 \text{ cm}^{-1}$) and

fingerprint region ($<1500 \text{ cm}^{-1}$), demonstrating the biomass's complex and heterogeneous nature. These peaks align with the structural elements of the grape seed and their respective functional groups. before adsorption the -OH group of grape seeds appeared the broad band to form at 3344 cm⁻¹ It moved to the frequency 3327 cm⁻¹ due to deformation throughout the process of adsorption. The methylene groups of the hydrocarbon chains of lipids, lignin, or tocopherol cause the bands of C-H and CH₂ groups to appear at frequencies of 2800–2900 cm⁻ ¹, during MB adsorption, there was a little shift for these groups. Furthermore, the peak at 1737 cm⁻¹ is linked to the C=O stretching of the ester groups as triglycerides. It can be found in grape seed constituents such lignin, pectin, and fatty acids and their esters [52]. A band that is associated with the asymmetric C=O and aromatic ring C=C stretching in the carboxyl group found in protein molecules, pectin, hemicellulose, and phenolic compounds appears at 1662cm⁻ ¹which experienced deformation during dye adsorption [53]. In relation to the lignocellulosic components of the seeds, phenolic compounds, associated with aromatic C-C stretching, can be seen at 1525 cm⁻¹ and 1444 cm⁻¹. The cyclic C-O-C groups, CH₃-CO-O-, and C-H esters of aromatic compounds are linked to the signal at 1163 cm-1. Finally, the peaks in the range at 873 cm^{-1} and 779 cm^{-1} are linked with the =CH₂ vibration or -HC=CH- (trans/cis) bending seen in unsaturated fatty acids and tocopherols. In MB adsorption on P-GGS the adsorbent's functional group has moved and fused into other linked groups, [54].



Figure 6: FTIR spectra of P-GGS adsorbent both prior to and during MB dye adsorption.

Fig. 7 displays the P-GGS adsorbent's SEM pictures. The photos amply demonstrated the morphological variations brought about by the adsorption technique. in (**Fig.7a**)The surface of the adsorbent was uneven prior to the adsorption operation, with a rough surface and corner cuts. On a surface of P-GGS, many protrusions and cavities could also be seen. (**Fig. 7b**) appearance became hazy following dye adsorption, showing that the dye had filled in these protrusions.

The qualitative elements composition of the P-GGS adsorbent both before and after the adsorption process was determined using the EDX analysis, as shown in **Fig .8** Prior to adsorption, it was discovered that the primary constituents on the surface of P-GGS were C and O, which are prevalent elements in adsorbents. Where C and O accounted for about 80%. However, after adsorption, the percentage of C increased to 71.03%, while the percentage of O decreased to 27.43%, and element S appeared. This indicates that MB dye was adsorbed on a surface of P-GGS adsorbent as (**Fig. 8b**).



Figure 7: SEM image at (10µm), of a) P-GGS before adsorption and b) P-GGS adsorbent after adsorption of MB dye.



Figure 8: EDX analysis of a) P-GGS adsorbent and b) P-GGS adsorbent after MB adsorption.

XRD patterns of P-GGS adsorbent (Supplementary **Fig. 9**). According to the Scherrer equation (Eq **12**). The crystallite size of the P-GGS adsorbent particles was determined by XRD

analysis to be around 9.14 nm. The particles exhibited highest intensity at theta 46°, P-GGS adsorbent spectra show distinct peaks at $(2\theta^{\circ}) = 15.21^{\circ}, 24.62^{\circ}, 28.42^{\circ}, 30.69^{\circ}, \text{and } 46.66^{\circ}$.

$$D = \frac{\lambda K}{\beta \cos^2 \theta}$$
 [12]

where K represents the Scherer constant (0.94), β is the whole breadth at half-maximum height, D is a crystallite size, and λ is the X-ray radiation wavelength (1.5406 nm). (FWHM), where θ represents the Bragg's diffraction angle [55].



Figure 9: XRD Spectra of P-GGS adsorbent before adsorption of MB.

2.3. Non-linear adsorption isotherms and kinetic studying:

2.3.1. Adsorption Isotherms studying :

Adsorption isotherm models that are widely recognized are the Freundlich and Langmuir isotherms. In this work, the isotherms were utilized to establish the connection between the amount of dye is adsorbed and its equilibrium concentration within the solution. 0.3 g/L of P-GGS was added to the 50 mg/L MB solution at pH 6 and 50 C, and The blend was stirred for 90 minutes. Typical nonlinear Freundlich (Equation (3) and Langmuir (Equation (4) .The adsorption data was investigated using isotherm models for MB adsorption onto P-GGS adsorbent, a Freundlich isotherm illustrates heterogeneous surfaces without needing monolayer capacity. Whereas a Langmuir isotherm assumes that energetically equivalent locations will adsorb monolayers.

The equilibrium isotherm data for MB dye adsorption onto P-GGS adsorbent are displayed in Fig **10.** together with nonlinearly fit models. The distinctive parameters of both models were estimated using a nonlinear regression analysis, and the results are listed in Table

2. The findings indicated that fitting experimental data to the Freundlich model is not beneficial. The value of heterogeneity factor (1.49 > 1) was greater than the permitted range. Despite a high correlation coefficient of 0.946 for the adsorbent, making the implementation of this model challenging. However, the Langmuir model provided adequate findings for characterizing the equilibrium isotherm for the adsorbent with an R² value of 0.963. This presupposes a monolayer of contact between the molecules of the adsorbate and the adsorbent surface with having the highest sorption capacity of (Q_{max} 44.55 mg g⁻¹). Finally, the corresponding R_L values 0.143, confirming that the MB dye was effectively absorbed by P-GGS [56,57].



Figure 10: Non-linear isotherm models for adsorption MB on P-GGS adsorbent.

2.3.2. Kinetic studying:

 Table 2: Isotherm Parameters of a Langmuir and Freundlich `models for MB dye adsorption on

 P-GGS adsorbent .

	Langmuir model	Freundlich model		
R ²	$K_L (L/mg) \qquad Q_{max} (mg g^{-1})$	R ² n		
K	R_L	$K_{\rm f}({ m mg/g})$		
0.068	0.110 44.55 0.143	0.946 1.486		
0.908	0.117 44.55 0.145	5.40		

The mechanism of MB dye adsorption onto the P-GGS adsorbent was ascertained by employing three nonlinear kinetic models: pseudo-first-order (PFO), pseudo-second-order PSO), and Elovich models. The curve plots of the kinetic models are displayed in Fig **11**, and Table **3**. Contains a list of their parameters. Compared to the PFO (0.461) and PSO (0.832)

models, the Elovich model yielded a higher regression factor (\mathbb{R}^2) value of 0.937, suggesting that MB's adsorption on surface of P-GGS adsorbent followed the Elovich model. thus, the Elovich equation is satisfied in chemical adsorption processes, which means that systems with heterogeneous adsorbing surfaces can use it. On the other hand, the $q_{e, cal}$ values that were found match the $q_{e,exp}$ values. Other studies also noted this pattern [58,59].

Table 3: Parameter of non-linear kinateic for MB adsorption on P-GGS adsorbent .

Pesude- first order				Pesu	de-second o	rder		Elovich			
Adsorbate	Co mg/L	qe Exp. mg∕g	qe,Calc. mg∕g	K1 1/min	R ²	q _{e,Calc.} mg/g	K2 g/mg min	R ²	α mg/g min	β mg /g	R ²
MB	50	8.17	7.89	0.19	0.461	8.05	0.090	0.832	1.073E ¹⁰	3.63976	0.937





2.4. Compared to other adsorbents:

A comparison with other adsorbents reported for the similar purpose, such as waste agricultural adsorbents, was done in order to evaluate the effectiveness of P-GGS adsorbent for adsorption for removal MB dye.

Adsorbent	Adsorbate	Q _{max} (mg g ⁻¹)	Ref.
Extract pine seeds corn cobs Nascent Rice Husk acid/base treated rice husk pumpkin seed shells bean peel waste Archi dendron jiringa Seed Shells Pre-Treatment of Green Grap Seeds	MB MB MB MB MB MB MB	35.2 73.16 24.48 93.5 48.98 140 44.64 44.55	[60] [61] [62] [63] [64] [65] [66] Present study
			5

Table 4:	The	maximum	adsorption	capacity	of MB	dye b)y	different	adsorbents
			-				•		

3. Conclusion

This study focuses on the effectiveness of grape seeds as an adsorbent and their subsequent application as a low-cost, effective substitute material for removing cationic dye (methylene blue dye) was investigated and the optimum operating conditions such as adsorbent dosage, pH, initial MB concentration and contact temperature were determined. Grape seeds produced as industrial waste showed their efficiency in removing MB dye from aquatic solution. The maximum of adsorption capacity was 44.55%. According to the study's findings, the MB dye's adsorption on P-GGS adsorbent, followed the langmuir model. This indicates that an adsorption process is consistent with chemisorption, and the nonlinear kinetic data obtained followed the kinetic of Elovich model. Furthermore, Table **4** illustrates that P-GGS adsorbent adsorption capacity efficiency is favorable when compared to earlier research. Consequently, the produced adsorbent exhibits intriguing application benefits and high adsorption capability. It can be applied as an economical locally available adsorbent to remove cationic dyes through a range of media.

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Correlation Between Sociodemographic and Clinical Features with Type 1 and 2 Diabetes in Najaf, Iraq

Mayyada Bassim Rasul Aldbagh ¹

Abstract

The aim of this study was to study the socio-demographic and clinical features of diabetic patients. It was conducted in Najaf Governorate in 2022, and included 1786 diabetic patients (males and females). The current study revealed statistically significant differences in some risk factors such as age, gender, marital status, occupation, educational level, body mass index, family history, smoking status and comorbidities (hypertension, brain and heart diseases), while these differences were not recorded in residency cases. The study showed that most of the participants in the sample (85.2%) had type 2 diabetes, and this type starts late in life with an average of fifty years, compared to type1 (14.8%), which starts early with an average of twenty years. While married women were more likely to have type 2 compared to men. While men were more likely to have type 1, in general, unmarried individuals were less likely to have type 2 diabetes compared to married individuals. The study also showed an association between marital status, family history, education, income level, lifestyle, and the presence of other diseases such as hypertension, heart disease, and diabetes. These findings suggest the importance of considering these factors when developing strategies for diabetes prevention and management. In conclusion, further research involving a bigger sample size is necessary. Moreover, health centres must to establish educational initiatives to enhance public awareness on the risk factors associated with diabetes. These findings can elucidate those who may be at heightened risk for certain forms of diabetes. Armed with this knowledge, healthcare providers can design enhanced strategies for the prevention and control of diabetes in the region.

Keywords: Sociodemographic; Clinical; Type 1 and Type 2 Diabetes; Iraq.



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Introduction

Type 1 and Type 2 diabetes mellitus (T1DM and T2DM) constitute an escalating global health issue and a significant source of morbidity, death, and societal expenses [1]. Research demonstrates a considerable rise in prevalence across numerous nations, including Iraq, particularly in regions like Basra, where diabetes prevalence escalated from 5% in 1978 to 19.7% in 2012 [2,3]. Sociodemographic and clinical factors, including age, genetic predispositions, stress, malnutrition, family history, and additional variables, have contributed to the onset of Type 1 Diabetes Mellitus (T1DM) [4]. The rise in the prevalence of T2DM in older adults is directly associated with age or indirectly influenced by other age-related factors. factors that increase the risk of this disease [5]. The researcher aimed in this study to identify the socio- demographic, and clinical factors of diabetic patients and to know the relationship between them and the types of DM in Najaf Governorate, Iraq, in 2022, with the aim of better understanding the nature of DM in this region and developing more effective strategies for its prevention and treatment.

Materials and Methods

Our study included a random sample of 1786 diabetic patients, selected from Al-Sadr Teaching Hospital in Najaf Governorate for a full year during 2022. Demographic and clinical data were collected from both genders from the hospital's electronic medical data, which included age, gender, marital status, educational level, and occupation, and they also looked at factors such as smoking habits, place of residence, and family history of diabetes. They used SPSS version 26 to analyze the information (frequency, percentage, mean, Pearson chi-square test) they collected from the participants. In this study, results were considered statistically significant if the p-value was less than 0.05.

Results and Discussion

The study in Najaf investigated several factors that might be linked to different types of diabetes. These factors included age, gender, marital Status, family background (diabetes in the family), occupation, residence, educational level, lifestyle habits like smoking, body mass index (BMI), and other health conditions like high blood pressure or brain and heart disease. Statistically significant differences (P < 0.05) were found in all studied factors except for residence, where no statistically significant differences were observed in the data (Table 1 and 2).

The study showed that most of the participants in the sample (85.2%) had type 2 diabetes compared to type1 (14.8%). While women (50.6%) were more likely to have diabetes compared to men (49.4%).

	Т					
Socio-demographic Features	Type-1 265(14.8%)	Type-2 1521(85.2%)	Total 1786(100.0%)	P-value		
1-9	49(18.5%)	1(0.1%)	50(2.8%)			
10-19	95(35.8%)	87(5.7%)	182(10.2%)			
20-29	54(20.4%)	91(6.0%)	145(8.1%)			
30-39	45(17.0%)	137(9.0%)	182(10.2%)	-		
40-49	15(5.7%)	308(20.2%)	323(18.1%)	<0.001*		
50-59	7(2.6%)	475(31.2%)	482(27.0%)	χ2		
60-69	0(0.0%)	285(18.7%)	285(16.0%)	=714.804		
70-79	0(0.0%)	116(7.6%)	116(6.5%)			
80-89	0(0.0%)	17(1.1%)	17(1.0%)			
90-99	0(0.0%)	4(0.3%)	4(0.2%)			
Age for onset of DM	M±SD	(Range)	45.92±18.557 (1	-99)		
Age for onset of T1DM	M±SD	(Range)	20.75±12.167 (1-58)	<0.001*		
Age for onset of T2DM	M±SD	(Range)	50.31±15.777 (6-99)	<0.001		
		Gender				
Male	158(59.6%)	725(47.7%)	883(49.4%)	<0.001*		
Female	107(40.4%)	796(52.3%)	903(50.6%)	χ2 =12.433		
	N	Aarital Status				
Single	167(63.0%)	29(1.9%)	196(11.0%)	<0.001*		
Married	98(37.0%)	1492(98.1%)	1590(89.0%)			

Table 1: Socio-demographic features of diabetes patients

				χ2 =856.456
Family history				
Yes	150(56.6%)	648(42.6%)	798(44.7%)	<0.001*
No	115(43.4%)	873(57.4%)	988(55.3%)	χ2 =17.335
		Occupation		
House wife	31(11.7%)	734(48.3%)	765(42.8%)	
Student	114(43.0%)	13(0.9%)	127(7.1%)	
Free work	62(23.4%)	471(31.0%)	533(29.8%)	<0.001*
Employee	22(8.3%)	201(13.2%)	223(12.5%)	~0.001
Retired	1(0.4%)	101(6.6%)	102(5.7%)	= 852.220
Child	35(13.2%)	1(0.1%)	36(2.0%)	
	E	lucation Level		I
Illiterate	63(23.8%)	770(50.6%)	833(46.6%)	
Primary School	90(34.0%)	455(29.9%)	545(30.5%)	<0.001*
Middle School	45(17.0%)	120(7.9%)	165(9.2%)	~0.001 ~2
High School	40(15.1%)	71(4.7%)	111(6.2%)	=99.060
College & higher	27(10.2%)	105(6.9%)	132(7.4%)	
		Residence		
Urban	250(94.3%)	1432(94.1%)	1682(94.2%)	1.000
Rural	15(5.7%)	89(5.9%)	104(5.8%)	χ2 =0.000

The present study showed that 482 (27.0%) of the diabetic patients were in the age group of 50–59 years with a mean age of 46 years. This illustrates the role of aging in the development of type 2 diabetes [6]. Similar findings showed an increasing prevalence of diabetes with advancing age, decreased physical activity, obesity, and body mass index [7,8].

Our results also revealed information about marital status, married people (89.0%) were the majority of Iraqi diabetics; this may be due to the influence of early marriage, which was similarly reported by Ebrahim et al. [9]. Our results also revealed information about occupation; housewives (42.8%) occupied a high percentage of diabetics in Iraq; the possible reason may be related to the educational level or perhaps the lack of opportunities for women to obtain a suitable job in Iraqi society. This result was supported by Mansour et al. and Al-Rubaye [8, 10]. Our study also showed an association between illiteracy (46.6%) and diabetes, which is consistent with many studies [7, 8, 11, 12]. This may be due to the low association of literacy with low knowledge of medical information. This lack of knowledge makes them more susceptible to chronic diseases such as diabetes, and reduces their chances of managing these diseases effectively. Overall, the study provides valuable insights into factors potentially linked to diabetes in Najaf. This information can be helpful in developing strategies for diabetes prevention, education, and management in the region.

The study did not find a significant difference in the number of diabetes cases between people living in urban and rural areas in Najaf. However, the largest proportion (about 94.2%) were from urban areas. As for smoking status, most of our patients with diabetes (75.7%) were non-smokers. Our possible explanation for this result is that the majority of Iraqi patients with diabetes were female, and they are more compliant with the existing social norms in Iraq about avoiding smoking; Alsaadawi and Nwaokoro et al. had closer results to our study [13,14].

Regarding family history of diabetes, a higher proportion of type 1 diabetes patients (56.6%) showed a family history compared to type 2 diabetes patients (42.6%), demonstrating the role of family in the development of T1D; similarly, our result was similar to the study of Qarawi et al. and Ibrahim et al. [6,9]. The present study showed that most adult T2D patients had hypertension (16.4%), obesity (98.7%), and cerebrovascular diseases (3.7%); this was interpreted as diabetes combined with poor lifestyles such as unhealthy diet, poor sleep, stress, and lack of physical activity had a significant impact over a long period of time in the development of these previously mentioned diseases among diabetic patients; this result was consistent with other studies [10,12,15].

In summary, our study showed that diabetes (especially type 2 diabetes) is a health problem in Iraq, especially among women. Socio-demographic status and health features (hypertension, obesity, brain and heart diseases) are predisposing factors for diabetes. This helps us to establish a screening and accelerate intervention program for diabetes prevention in Iraq.

	Ту	tus	P-value						
Clinical features	Type-1	Type-2	Total						
	265 (14.8%) 1521(85.2%)		1786(100%)						
	Smoki	ng status							
Smokers	43 (16.2%)	320 (21.0%)	363 (20.3%)	0.011*					
Non-smokers	218 (82.3%)	1134 (74.6%)	1352 (75.7%)	0.011°					
Ex-smokers	4 (1.5%)	67 (4.4%)	71 (4.0%)	χ2 -9.102					
BMI									
Thin (<18.5)	95 (95.0%)	5 (5.0%)	100 (5.6%)	<0.001*					
Normal (18.5-24.9)	109 (61.6%)	68 (38.4%)	177 (9.9%)	<0.001					
Overweight (25-29.9)	46 (12.8%)	313 (87.2%)	359 (20.1%)	-082.460					
Obese (=>30)	15 (1.3%)	1135 (98.7%)	1150 (64.4%)	-982.400					
	Como	rbidities							
High blood pressure	2 (0.8%)	249 (16.4%)	251 (14.1%)	<0.001* χ2					
				=44.280					
Brain and heart diseases	0 (0.0%)	56 (3.7%)	56 (3.1%)	0.003* $\chi 2 = 8.897$					

Table 2: Clinical features of diabetes patients

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Partial Substitution of Nickel for Yttrium and Its Effect On the Structural and Electrical Properties of The YBCO System

Azhar Mudher Hashem ¹

Abstract

Many elements in the center of the periodic table, as well as semiconductors and alloys, exhibit the superconductivity phenomenon [1]. The phenomena is found in highly magnetic materials, which are defined as having double electrons in their outer orbits, implying that their magnetic moment is zero. When the temperature of these materials is lowered to almost zero degrees [2],

The critical temperature (Tc), critical magnetic field (Hc), and critical current density (Jc) are three crucial parameters that define the condition of superconductivity. Each of these parameters is dependent upon the other two, and when the value of any one of them changes or rises, the superconducting state collapses and returns to its normal state when any of these parameters surpasses its critical value.

The aim of this study is to know the amount of effect that occurs on the electrical and structural properties of the material through the partial replacement of yttrium with nickel, as well as to know the optimal percentage of replacement.

Superconducting compounds were prepared using the solid-state reaction approach, substituting nickel for yttrium in replacement ratios of 0.05, 0.1, 0.15, 0.2, and 0.25. The compound powders were formed by grinding the materials using the manual grinding and electrical mixing processes, and then they were formed into tablets. Thickness (about 0.2) cm.

Additionally, the samples were sintered at temperatures ranging from 0 to 850 degrees Celsius for a full day. Upon completion of sample production, a variation in mesh parameters is seen, with the optimal value occurring at a concentration (X = 0.1).

Keywords: Partial Substitution, Solid State Reaction, Yttrium, Nickel, YBCO System, XRD.



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Introduction

Relying on their electrical conductivity, materials are categorized as conductors, semiconductors, insulators, and superconducting materials. A special circumstance known as the latter occurs when a variety of metals and alloys are cooled to a temperature lower than their critical temperature; the temperature varies according to the composition. superconducting [3]. In addition to its excellent magnetic property, one of the most significant characteristics of this critical temperature is its ability to transfer electric current without resistance [4].

When the material's magnetic permeability is perfect and its electrical resistance is zero, it is in its optimal state as a superconductor. YBa2Cu3O6+ δ , the perovexite combination, is regarded as a ceramic material [5]. In addition to the yttrium layers mediating the CuO layers along the c-crystalline axis, the CuO2 layers mediate the perovskite structure of the YBCO system [6].

This research aims to observe the increase in the critical temperature through partial replacement of nickel instead of yttrium with replacement ratios (x = 0,0.05,0.1,0.15,0.2) in the compound $Y_{1-x}Ni_xBa_2Cu_3O_{6+^{\delta}}$ superconductor.

How to prepare

First, pure elemental oxides were employed, as seen in Figure (1), in accordance with the system's superconducting mechanism (YBCO). The SSR samples were prepared using the solid-state reaction method after the proper amounts of these oxides were weighed. Preparing the necessary weights of element oxides is the first step in the preparation phases, which are represented by a number of procedures. The next step is grinding, which is accomplished in two stages: first with a manual mortar and subsequently with an electric mixer. Following the completion of the grinding stage, the materials are dried in a specialized oven to remove any remaining moisture. Following that, a hydraulic press was used to compress the samples into disc-like shapes. For one minute, a pressure of 7 tons/cm2 was applied. The last step in the preparation process is sintering the samples in an appropriate oven set to 850 degrees Celsius for 24 hours at a heating rate of 10 degrees Celsius per minute. Following this, the samples are allowed to cool at the same rate until they reach room temperature.



Figure 1: A photograph showing the oxides of the elements used in preparing the compound

Four sensors were employed in the system to measure the electrical resistance. The current flowing through the sample is essential to this system's operation. The voltage across the electrodes drops as the current passes through the sample. The following relationship was used to compute the electrical resistance [7].

where V is the sample's voltage, t is the disk's thickness, L is the distance between the electrodes, W is the sample's width, and *I* is the current passing through the sample.

The electrical resistance curve as a function of temperature and the following relationship were used to calculate the crucial transition temperature [7]:

$$\frac{\text{Tc (Onset)+Tc (Offset)}}{2} = Tc (Mid)....(2)$$

where Tc (Mid) is the average temperature, Tc (Onset) is the beginning transition temperature, and Tc (Offset) is the ultimate transition temperature, or when ($\rho = 0$) [8].In the YBCO system, superconductivity is caused by the formation of copper oxide layers. When these layers are added to the system's crystalline structure, oxygen can enter and exit the system, which results in the concentration of gaps.

In order to notice the change in critical temperature (Tc), the primary objective of the research is to examine the impact of partially substituting nickel for yttrium (Y) in the superconducting compound. $Y_{1-x}Ni_xBa_2Cu_3O_{6+^{\delta}}$.

Results

The pure sample underwent an XRD examination in the first step, with a replacement ratio of x=0, signifying the system's high phase (YBCO). In addition to some impurities, we observed the production of the high phase (Y123), and the high phase and impurity formation are the causes of these alterations. The crystalline structure is distorted as a result of faults in the stacking of the (c) axis, which are caused by either a reduction in oxygen or irregularities in positive ions [9]. The sample's lattice constants were then computed quantitatively by utilizing equation (3)[10] and Bragg diffraction to get the Meller and (2 θ) coefficients for each Summit.

The findings, which demonstrated that every sample had an orthorhombic structure, were fairly consistent with typical computations. Additionally, phase ratios were computed using Equation (4) and a comparison with standard diagrams. [10].

$$(V_{Ph})\% = \frac{\sum I_0}{\sum I_1 + \sum I_2 + \sum I_{other(peaks)}} \times 100\% \dots \dots (4)$$

I stands for the peaks' intensity at each phase. Additionally, the ratio (c/a) was computed. Equation (5) was used to get the unit cell density.

where V is the unit cell volume (cm³) and NA is the number of avocados (Particles/gm.mol). On the other hand, Wm stands for molecular weight (amu). Equation (6) was used to compute the transition width.

$$\Delta T = (Onset) - T(Offset) \dots (6)$$

Subsequently, the energy gap for the superconducting samples—which arises from the effective attraction between electrons in superconductors—was computed using the following relationship: [11]

$$\therefore Eg = 3.53KBTc \dots (7)$$

The energy gap is denoted by Eg, the Boltzmann constant by KB, and the critical transition temperature by TC.

As seen in Table (1), the findings revealed a variety of data and values. The temperature and sintering time are the causes of these outcomes. The mobile mass has a longer period and more energy when the sintering temperature and duration are increased. When time is involved, this is crucial for achieving thermodynamically balanced phases. With respect to the sample's high-phase composition, all of these outcomes are favorable. Long sintering entails adding more copper oxide layers to the low-phase compositions. [12]



Figure 2: XRD diagram of the group's samples is shown

 Table 1: shows the change in VPh(H), VPh(L), lattice parameters, (c/a), density, and crystallinity with different Ni concentrations.

sampla	Concen	Vph	Vph($\mathbf{a}(\mathbf{A}^{0})$	h(1 ⁰)	$c(\Lambda^0)$	cla	dm	crysta
sample	tration	(H)	(L)	a(A)	U(A)		U/a	(g/cm ³)	llinity
0 X	0	0.76	0.23	3.804	3.8340	11.729	3.0832	8.48373	80.6
A2	0.05	0.71	0.28	3.8886	3.8236	11.970	3.0795	8.15903	91.4
B2	0.1	0.81	0.18	3.529	3.8932	11.968	3.3904	8.82521	75.6
C2	0.15	0.76	0.23	3.704	3.9345	11.644	3.1432	8.55244	80.42
D2	0.2	0.75	0.25	3.871	3.9200	11.992	3.0974	7.97413	60.46
E2	0.25	0.73	0.26	3.678	3.9442	11.683	3.1766	8.56355	81.1

From Figure (2), which displays the (XRD) diagram of the group's samples, where (c/a) and crystallinity with partial addition of nickel oxide We discover that the sample with the replacement ratio (X = 0.1) has the best compositional characteristics. This is evident from the high phase's growth to 0.81% = Vph (H), as well as from the low phase's decline and increase
in density. As a result, it can be said that this sample is the best one for substituting nickel for yttrium, followed by the sample with the replacement ratio (X=0.15). In contrast, the percentage of high phases in the other samples decreased to 0.71% when compared to the pure sample, and sample A2's crystallinity rose to 91.6%. This is because this addition served to somewhat influence the replacement process because the replacement percentage was lower than the effective percentage. In contrast to a pure sample, the tertiary phase composition is negative. The proportion of high phases in samples C2, D2, and E2 was comparable to that of the pure sample. The group's samples' prior behavior demonstrates that when the electrons in the orbitals shift, the lattice constant lengths can also vary. For every sample, there was a discrepancy in the lattice constants, a \neq b \neq c. This indicates that the molecule has a normal rhombic crystal structure in all samples, and this variation may also exist. The lattice parameters are distorted as a result of the variation in ionic radii [13]. As indicated in Figure (3) and Table (2), the electrical resistivity was next measured as a function of temperature (Tc). The findings were compared to determine which samples had the best electrical conductivity and (Tc).



Figure 3: illustrates how the critical temperature (Tc) affects the decrease in resistivity.

The area around (Tc(on), which is the point at which the material transitions into the superconducting state, is where we see that all samples exhibit metallic behavior (Figure 3). Using the energy gap (Eg) and the average critical temperature of transition (Δ Tc) and (Tc(mid)), we discover that all samples exhibited superconducting behavior with a variance in the critical transition temperature. In addition to various distortions and flaws in the crystal structure brought on by the partial substitution of nickel for yttrium, the presence of certain low phases and impurities is what causes the variations in values. according to Table (2).

sample	Concentrati on	Tc(off) K	Tc(on) K	Δ Τ Κ	Tc(mid) K	Eg(ev)
0 X	0	96.3	99.5	3.2	97.9	0.02931
A2	0.05	95.6	98.9	3.3	97.25	0.02911
B2	0.1	110.1	112.1	2	111.1	0.03352
C2	0.15	104.7	106.1	1.4	105.4	0.03187
D2	0.2	102.7	105	2.3	103.85	0.03126
E2	0.25	102.2	104.3	2.1	103.25	0.03116

Table 2: shows the change in the initial and final critical temperature, average temperature,transition width, and energy gap for samples with different addition ratios

From Table (2) we find that the best sample in this addition is sample B2, which recorded the highest value of the critical temperature, reaching 110.1 K. Also, the Tc(of) increased to 110.1 K and the Tc(on) to 112.1 K. The energy gap value also increased to ev. 0.33 As for the transition width, it decreased to K2, and this indicates an improvement in the superconductivity of the compound. This means for this replacement that this sample is the optimal sample, followed by sample C2, then samples D2 and E2, while for sample A2 we find a convergence between its critical transition temperature and the critical transition temperature. For the pure sample, this means that this percentage of replacement did not change the properties of the substance much. The findings of the X-ray diffraction (XRD) analysis of these samples are in agreement with the resistivity test results as a function of temperature. Based on the information above, we determine that sample B2, which has a replacement ratio of 0.1 for partial substitution of nickel for yttrium, is the best sample.

Conclusions

The creation of the superconducting compound was part of the present investigation. (Y1+xNixBa2Cu2.8Zn0.2O6).

Successfully at an annealing temperature of 850°C for (24 hours) with partial replacement of nickel instead of yttrium (Y).). The results showed that all samples exhibit metallic behavior in terms of changing their electrical resistance with decreasing temperature before transforming into a superconducting state, and that the type and quantity of replacement are absolutely necessary to obtain the highest percentage of the upper phase.

X-ray diffraction analysis revealed that every sample had a rhombic structure.

The ideal ratio for substituting nickel for yttrium through high phase elevation, higher density, and achieving the maximum critical transition temperature Tc (off)110.1 K was determined to be x = 0.1. The critical temperature Tc (off) was 96 K in the 2020 study[14] .and Tc (off)104.8 K in 2021 at x=0.15 [15].For this reason, we believe that the critical temperature is the ideal value to obtain a superconducting material.

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Investigation of Flow Characteristic and Heat Transfer Coefficients for NanoFluids in Pipes

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Abstract

This study presents a CFD simulation of a turbulent flow through a pipe with water and Al2O3 and TiO2-water nanofluids with a 36 mm diameter of nanoparticles. The circular pipe has diameter 0.01 m and length 1 m, with a fix heat change at the conduct wall. This simulation done by ANSYS FLUENT 2020 R2. Different Reynolds number are used (10000 – 50000) to method the numerical investigates. Many concentrations of both nanofluids (0%, 4%, 6%, and 8%) were used. The model was validated by Gupta and et.al results. The results show the types of nanofluids do not influence on relation between pressure drop and velocity that is proportional relation. In addition, they shows the influence of Reynold number on pressure that is seen as proportional. Also the effect of concentrations of nanofluids on pressure drop is seen as proportional. For Nusselt number versus Reynold number the relation is proportional for different concentrations of nanofluids.

Keywords: Nanofluid, Pressure drop, Reynolds number, Nusslet number, Velocity of Nanofluids.



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Introduction

The term "nanofluids" refers to a mixture of suspended nanoparticles and the base fluid, which significantly enhances the base fluid's energy transfer process. Researchers are interested by their better thermal conductivities when compared to traditional fluids for heat transmission and fluid flow in pipes.

By employing nanofluids, it is possible to decrease the size of tools used for heat transfer and increase the coefficient of fluid flow and heat transfer. Many works have been focused on nanofluids and his related with fluid and heat transfer in pipes similar to Masoud Jamali et.al. [1] Created a flow of nanofluids within a two-dimensional tube. They discovered that for base and nanofluids, the Nusselt number and heat transfer coefficient rises as the Reynold number does. Additionally, when the diameter of the nanoparticles increased from 35 to 70 nm, the typical heat transfer coefficients in water/CuO nanofluid decrease by 1.77% and 1.65% at 1% and 4% concentrations. CuO has a lower heat transfer coefficient than alumina. Heat transfer and hydraulic properties investigated numerically for double pipe heat exchanger with water/Al₂O₃ nanofluid by Hyeon Taek Nam et.al. [2]

For fluid flow, they found when flow rate increase the pressure drop increase, additionally, it discovered that convectional heat transfer enhanced with increasing nanofluid flow rate, as evidenced by the high Nusselt number and heat transfer coefficient. On the other side, using parallel and counter flow configurations for heat exchanger by Abdulaziz S. Alhulaifi [3]. He investigated numerically of heat transfer of nanofluids and showed that Nusselt number increase when increase Reynold number for counter and parallel heat exchangerZeinali Heris [4] investigated the convective heat transfer of an Al2O3/water nanofluid in laminar flow through a circular tube with a constant wall temperature boundary condition was investigated experimentally.

According to his research, the heat transfer coefficient of nanofluids rises as the Peclet number does. He investigates how the heat transfer coefficient rises because of particle interactions and fluctuations. Using a single-phase model, Goutam Saha et al. [5] examined the characteristics of heat transfer and nanofluid flow in a pipe. They looked at a number of parameters, including the concentration of nanoparticles, Reynolds number, and the impact of Brownian motion. The addition of nanoparticles to a base fluid significantly enhanced the coefficient of transfer of this heat, according to the findings of S. Gupta's [6] numerical and analytical CFD investigation of a heat transfer increase in turbulent flow via a circular pipe employing nanofluid. Additionally, demonstrate how Reynolds numbers and nanofluid

concentrations rise in tandem with the coefficient of heat. Azraf Azman et al. [7] used a hybrid nanofluid of Al2O3-CuO/Water to numerically study the flow properties and heat transfer efficiency in saw tooth corrugated pipes. Khalid N. Alammar et al. [8] examined the impact of Prandtl number and nanofluid on flow and heat transfer characteristics in pipes. They found that as compared to homogeneous flow, heat transfer enhanced by up to 20% when Prandtl number increased in heterogeneous flow. In this paper, fluid flow and heat transfer are investigated using nanofluids flow in pipe with different concentrations. Ansys fluent 2020R2 using to do the simulation. The model was validated by values from another research.

Methodology

1. General Equations

The presence of nanoparticles in fluids leads to developed the equations of conservations for one phase in pipes [9]

Mass conservation:-

 $\nabla .(\rho_m V^{\rightarrow}) = 0$ ------ (1)

Momentum conservation:-

$$\nabla .(\rho_m V \overrightarrow{V} \overrightarrow{V}) = -\nabla P + \nabla .(\tau - \tau_t)$$
 ------(2)

Energy conservation:-

 $\nabla (\rho V \stackrel{\sim}{C}_p T) = (\lambda \nabla T - C_p \rho_m v_t) \dots (3)$

2. Nanofluids' thermophysical characteristics

Since the simulation technique's results have a major impact, the computation of the nanofluid thermophysical characteristics is important. Using equations 4–7 from the classical theory of mixtures, the thermophysical characteristics of nanofluids through different particle concentrations were computed and used for CFD simulation.

The equations applied for this work listed below.

For density

 $\rho = (1-\emptyset) \rho_b f + \emptyset \rho_n f ------ (4) [10]$

For specific heat

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$$cp=(\emptyset(\rho cp)_nf+(1-\emptyset)(\rho cp)_bf)/(\emptyset\rho_nf+(1-\emptyset)\rho_bf)$$
 ------(5)[11]

For viscosity

 $\mu_n f = [(1/(1-\emptyset)^2.5)] \mu_b f ------(6) \emptyset > 4\% [12]$

For thermal conductivity

 $k_nf=k_bf[(k_nf+2k_bf+2\emptyset(k_nf-k_bf))/(k_nf+2k_bf-2\emptyset(k_nf-k_bf))] ------(7) [13]$

			- /	1
Materials	Density	Thermal	Specific heat of	Viscosity
	(Kg/m^3)	conductivity	fluid (J/Kg.K)	(Kg/m.s)
		(W/m.K)		
Water	998.816	0.606	4180.029	9.98e-4
Al ₂ O ₃	3880	36	773	NA
TiO ₂	4250	8.953	686.2	NA

Table 1. Thermophysical properties of water and (Al₂O₃ and TiO₂) nanoparticles

Table 2. Thermophysical properties of water and Al₂O₃ nanoparticles

$\Phi\%$	Density	Thermal	Specific heat	Viscosity
	(Kg/m^3)	conductivity	of fluid	(Kg/m.s)
		(W/m.K)	(J/Kg.K)	
4	1114.06	0.7058	3705.4	9.011e-4
6	1171.68	0.7878	3503.093	1.164e-3
8	1229.31	0.8235	3319.756	1.229e-3

Table 3. Thermophysical properties of water and TiO₂ nanoparticles

$\Phi\%$	Density	Thermal	Specific heat	Viscosity
	(Kg/m^3)	conductivity	of fluid	(Kg/m.s)
		(W/m.K)	(J/Kg.K)	
4	1128.86	0.6908	13881.588	9.011e-4
6	1193.88	0.7384	17939.8	1.164e-3
8	1258.91	0.79	21578.776	1.229e-3

3. Boundary Condition

From Gupta et.al. [6] The boundary conditions taken to do the validation on it as shown in table -1-

Properties	Value
Length of pipe	1m
Diameter of pipe	0.01 m
Diameter of nanoparticles	36mm
Heat flux	500 Kw/m ²
Concentrations of nanofluids	0%,4%,6% and 8%
Condition of outlet boundary	outflow

Table	-1-	Boundary	Conditions
Lanc	-	Doundar y	Contaitions



Figure 1. 2D Geometry of Pipe

4. Mesh of Model

Ansys fluent CFD software program 2020R2 was used to make the simulation for this paper. The number of iteration 1000, number of Nodes 9223 and Elements 8800 and sizing 2.5e-4, profile update interval 1. Figure 2 show the model mesh.



Figure 2. Mesh of Model

Validation

Gupta et.al. [6] Investigated the heat transfer improvement in turbulent flow in a circular pipe by nanofluid. They studied the influence of adding nanoparticles on heat transfer coefficient and Reynold number. Figure 3 shows the validation of the present study by comprising it with Gupta's study for effect of Re on bulk temperature lengthways pipe axis at $\Phi = 4\%$ of Al2O3 nanoparticles. The results noticeably show convergence.



Figure 3. Validation of present work with Gupta work for effect of Re on temperature of bulk through pipe axis at $\Phi = 4\%$ of Al₂O₃ nanoparticles

Results and Discussion

1. Influence of Reynold number on pressure in nanofluids

Figure 3 shows the relationship between static pressure and Re along the pipe in Al_2O_3 with concentration 4%. It show that the magnitude of static pressure increase with Re but decrease along the pipe, this is because the velocity of nanofluid decrease with length of pipe increase.



Figure 4. effect of varying Re on static pressure through pipe axis at $\Phi = 4\%$ of Al₂O₃ nanoparticles

2. Effect of type of nanofluids on pressure drop

Figure 5 shows the influence of nanofluid's type on pressure drop. With fixed concentration in 4% for example. It seen that pressure drop increase with increasing velocity of nanofluids with both Al_2O_3 and TiO_3 nanofluids, but the increasing in Al_2O_3 greater than in TiO_3 . This is because the lower mean velocity provides less velocity gradient between the nanofluids and wall of pipes; this is leads to reduce the wall shear stress.



Figure 5. Pressure drop versus velocity of Nano fluids Al₂O₃ and TiO₃ for Φ=4%

3. Effect of concentrations of nanofluids on pressure drop

Figures 6a and 6b show the effect of concentrations of nanofluids on pressure drop, for both figures the pressure drop increase with increase velocity of nanofluids with different concentrations but this magnitude increase with increasing the concentrations of nanofluids. This is because pressure drop dependents on viscosity and density of the nanofluids, so the increasing in the concentrations leads to increase in density and viscosity and cause increase in pressure drop.



Figure 6a. Pressure drop versus velocity of nanofluid Al₂O₃ at different concentrations





4. Effect of concentrations of nanofluids on Nusselt number

Figures 7a and 7b show the relationship between Nu and Re number at various concentrations of nanofluids, it seen the relation is proportional. According to Impact of magnitude of nanofluid's concentrations is not much, in other words the may.



Figure 7a. Nusselt number versus Reynolds number at different concentrations of Al₂O₃



Figure 7b. Nusselt number versus Reynolds number at different concentrations of TiO₂

5. Effect types and concentrations of nanofluids Nusselt number

The Re was fixed at 10000 and used the two types of nanofluids to show the influence of nanofluid's types on relation Nu and volume fraction of nanofluids as shown in figure 8. It seen the relation for Al2O3 is almost linear and for TiO2 is proportional increase, this is because a greater Nu number at the same Re number is the result of an increasing volume percentage of nanoparticles, which is what gives them their large heat transfer performance.



Figure 8. Nusselt number versus concentration of Nanofluids at Reynolds number 10000

Conclusion

The effect of nanofluids on heat transfer and fluid flow numerically investigated. The influence of nanofluid's types and nanoparticle volume fraction was studied, the results show the following:

- 1. The pressure drop decrease along the pipe at various Re number.
- 2. Pressure drop increase with increase in velocity at different types of nanofluids.
- 3. Pressure drop increase with increase in velocity at different concentrations of nanofluids.
- 4. Nu number increase when increase Re number at various concentrations of nanofluids.

Nomenclatures

D	diameter of the pipe, m
d	diameter of nanoparticles, m
t	thickness of the nanolayer
Nu	Nusselt number
k	kinetic energy of turbulence, m2/s2
q	heat flux of wall, W/m2
Re	Reynolds number
C_p	p fluid's specific heat, J/kg K
V	velocity of flow, m/s
t	temperature, K
Subscript	
f	base fluid
0	Inlet condition
t	turbulent
b	bulk
nf	nanofluid
av	average
Greek Symbols	
Φ	volume concentration of particle
3	dissipation of turbulent kinetic energy, m2/s3
μ	dynamic viscosity of the fluid, kg/ms
ρ	density of the fluid, kg/m3

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Analysis of the Initial Three Bands to Effectively Represent the Spectrum Reflected from Various Land Cover Types in Landsat-7 Satellite Imagery

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Abstract

This study aims to find the accuracy band of satellite images for Satellite image of Land Sat-7- can be representing for any type of land cover. Where this study is concerned with the spectrum reflected from the land covers. Where it depends on compatibility between two things. The first thing is the spectral band of each image from images of Satellite Landsat -7-. The second thing is the being reflected spectrum from the land cover. The higher the compatibility between these two things leads to give the better image would be represented from other images. In this study, a satellite image of the Alexandria region was taken in the Arab Republic of Egypt because the land cover of this area is diverse. This image consists of six digital images and each of these images taken with a special band. Only the top three photographs were collected; the rest will be used in future studies. Then a geometric correction was made to each image then an unsupervised classification was created for each image. Then colored in a special color for each classification. Then arrange tables for each image. It results in a general table to discuss the outcome of this study.

They are also regarded as pro-studies for previous studies. It is also useful for researchers as they are directly studying the representation packages of land cover without image filtering or modification.

Keywords: Satellite Images, Landsat-7-, Unsupervised Classification, Agriculture, Urban, Land Cover.



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Introduction

The process of collecting data regarding the Earth's surface without direct contact is termed remote sensing. This is achieved by energy detection and recording, data processing, analysis, and application [1]. Non-imaging sensors can also facilitate remote detection by sensing radiated energy from a distance [2]. To commence remote detection, you will require an energy source that provides illumination or supplies electromagnetic energy for your research objectives. Atmospheric Radiation (B): As energy transits from its source to its target, it will intermingle with the air and integrate into the surrounding atmosphere. Upon traversing the air and arriving at the target, the energy interacts with the target, functioning in conjunction with it according to the characteristics of both the target and the radiation. Subsequent to the dispersion of energy, we employ a sensor to monitor the generated electromagnetic radiation. Once data is captured by a sensor, it must be transmitted, typically in electronic format, to a receiving and processing device, where it is combined into a visual representation. Understanding and Analyzing (F): The information centers on the completed light objective via the external and/or digital/electrical representation of the processed image. The concluding phase of remote sensing is application, which entails utilizing the insights derived from the target's symbols to enhance comprehension, uncover new information, or address a problem. Satellite images, the principal product of remote sensing, are digital photographs that contain extensive information about the region they depict.

1. Digital images and digital data:

Pixels fill the spaces between the fields and rows that make up digital picture data. A pixel is the smallest detectable region on Earth, and it consists of three coordinates (X, Y, and Z). Its location is denoted by the coordinates (X, Y). The value of reflection, as measured (represented by the digit DN), is denoted by the letter Z. In accordance with what is depicted in figure 1. The quantity of EMR reflected or radiated from a certain region of Earth's surface is represented in each pixel as a DN [3].

2. Grey level thresholding and level slicing:

Thresholdding for darkness is accomplished with a simple lookup table that divides the image's darkness into two groups, those below and those over a user-specified threshold. Thresholding is only one method among several for creating a photographic double veil. The purpose of these veils is to restrict the region of an image that is subsequently processed. In this

technique, pixels with qualities below an investigator-defined dark level are separated from those with qualities above this value, creating two groups.

An improvement method called "level cutting" divides the Digital Numbers allocated along the x-axis of a photo histogram into a series of "cuts" at intervals chosen by the researcher. All of the DN values in the input picture that fall within a specified interval are consolidated into a single DN value in the output picture [1].

3. Image Classification:

An advanced image's pixels are sorted into one of many evenly distributed groups called "topics". This private data might then be used to provide timely maps of the spatial distribution shown in the image. In most cases, multispectral data is used to carry out the arrangement, and each pixel's out-of-this-world example provides the quantitative basis for categorization. As far as the item or type of area cover these elements truly speak to on the ground, the goal of picture arrangement is to recognize and represent, as an unusual dark level (or shade). The Spectral Reflectance curve for three land coverings across many spectral bands is depicted in Figure 2 below [4].

The arrangement of images is a crucial part of sophisticated image analysis. A "lovely picture" or picture showing a wealth of colours highlighting various parts of the central area is impressive, but it serves little use if the viewer doesn't understand what they represent. Supervised classification and unsupervised classification are the two most used approaches to classification [5].

3.1. Supervised Classification:

Managed clustering allows us to identify instances of the Information classes (i.e., area spread type) of interest in the image. Preparing places are exactly what they sound like. The photo processing software framework is then utilized to provide a realistic depiction of the reflectance for each data type. This step, sometimes known as "mark examination," might involve anything from simply adding to a representation the mean or the intensity of reflectance across all groups to doing elaborate point-by-point analyses of the mean, fluctuations, and covariance across all groups. After an accurate depiction of each data category has been made, the image is ranked by analyzing the reflectance of each pixel and deciding which of the marks it favors more. Figure 3 below shows the Supervised Steps categorization [6].

3.2. Unsupervised Classification:

Unsupervised classification is a method that analyses large quantities of pixels and divides them into distinct classes based on the presence of regular patterns in the image data. Unsupervised grouping, in contrast to managed grouping, does not need examiner determined preparation information. The rationale for this is that values from the same distribution type should be close to one another in the estimate space (i.e., have similar dim levels), whereas data from other classes should be comparatively very much separated (i.e., have totally different dim levels). It is necessary to compare the ordered data with some kind of reference data (such as larger-scale symbolism, maps, or site visits) in order to zero in on the personality and enlightening estimates of the phantom classes that result from unsupervised order because, based on regular groupings of the picture values, the character of the otherworldly class will not be initially known. Thus, in the controlled approach, we characterize useful data classifications and then investigate their phantom repairability; however, in the unsupervised approach, the PC chooses horrifyingly separate class and then describes their data value. [3]

More and more businesses tasked with maintaining GIS databases over the long term are opting for unsupervised setup. The reason for this is the availability of extremely fast and requiring few operating parameters frameworks that use grouping techniques. As a result, GIS analysis is becoming feasible for anyone with only a fundamental familiarity with remote sensing to try clusters that fulfil standard guide accuracy standards. This apparatus, when combined with appropriate ground truth exactness evaluation methods, can provide a very fast approach for producing high-quality area spread information on a continuing basis [7].



Figure 1. Curves Of Spectral Reflectance Of Three Land Covers

4. Spectral Signatures (Spectral Reflectance of Land Covers):

Interference from outer space generally speaking, this is the rule that enables remote observation to discern the phantom reflectance or ghostly brightness at a distance far off from the surface [8].

Normal area coverings, such as plant, soil, and water, exhibit three distinct curves of horrifying reflectance, as shown in Figure (2). Vegetation has a high reflectance in the near infrared region, as seen in the figure (2), however three low minima can be attributed to assimilation. Each haunted place contains soil with significantly superior properties. The infrared spectrum is completely absorbed by water [9].

5. The satellite Landsat7 System:

Starting around 30 years ago The Landsat-7 mission's remote sensing assessment of the landmass sets a new benchmark. Calibrated multispectral observations of the earth's surface obtained by Landsat sensors have proven useful for monitoring several types of land cover [10], including forests, grasslands, cities, and rivers.

	Landsat 7	Wavelength (µm)	Resolution (m*m)
	Band 1	0.45-0.52	30 * 30
Enhanced	Band 2	0.52-0.60	30 * 30
Thematic	Band 3	0.63-0.69	30 * 30
Mapper Plus (ETM+)	Band 4	0.77-0.90	30 * 30
	Band 5	1.55-1.75	30 * 30
	Band 6	10.40-12.50	(60*60) or (30*30)
	Band 7	2.09-2.35	30 * 30
	Band 8	0.52-0.90	15 * 15

Table 1. The bands of Landsat (ETM+) with a spatial resolution

The relationship between the spectral signature and satellite images of Landsat7

The reflectivity of various land covers is depicted in Figure 2 below, which also demonstrates the correlation between the bands of the land7 satellite and the spectral signature of the various land cove classes. Additionally, the figure illustrates the times when the reflectance value between land covers at each band of the land7 satellite gets closer and when

it gets further apart. Interference in land cover categorization occurs as reflectance values from distinct land cover classes converge [11].



Figure 2. Spectral Signature Of Land Cover

Aim of the study

This research set out to find the optimal band for representing ground cover in LandSat-7 satellite photos by comparing the categorization of these bands' data with actual data collected from the ground in the study region in Alexandria, Egypt.

Methodology of research

In this section, we'll go over the experiments that were conducted. This section will describe the study's practical implications. It entails a number of distinct procedures.:

1. Data entry:

In this step, a spatial data entry used in this study are satellite images from Landsat7 ETM⁺ image.

Satellite photos from the Landsat7 ETM+ were utilised as a spatial data entry in this research.

The entire digital processing chain will be shown. Satellite images, as well as their processing and classification, are included. The ERDAS programme (It automates geospatial workflows, ideal for remote sensing, environmental modeling, urban planning and disaster management.) is used for all of these procedures. Landsat 7 ETM+ satellite sensors collected the picture used in the investigation. The research region was captured in a satellite picture,

which is a collection of digital photographs. The captured satellite image shows the city of Alexandria, located in Egypt.



Figure 3. Multispectral Bands

This area was picked because of the variety of habitats it offers. Where the ocean, farmland, cities, and transportation infrastructure are located. These digital pictures are assembled from smaller sets of pictures such as these:

The MS (Multispectral) consists of a stack of images with six different spectral bands combined into a single file. On December 6, 2006, each was absorbed by a distinct electromagnetic radiation band. Figure 3 depicts the spectral widths of these bands in nanometers, as given in table (1).

a) The picture in a single-color space (Pan): This following picture (5) displays an image captured by the multispectral scanning sensor (MSS) with a bandwidth of (520-900) nm and a resolution of (14m*14m).

2. Geometric correction:

A UTM grid spacing of 30 meters was used to geometrically rectify a Landsat7 ETM+ satellite picture. Ground control points were found using topographic maps at a resolution of 1:50,000 and GPS measurements made using a Garmin device. The geographic control points utilized to derive the geometric transform were evenly dispersed across the research region. In order to get the coefficient for the first order linear transformation, equations used in the resampling procedure, linear regression was employed. The accuracy of the image-to-map rectification procedure was measured using the Root Mean Square (RMS) error metric, where 0.7 is the threshold for user-specified acceptability.



Figure 4. Panchromatic

3. Image classification:

Classification of satellite pictures follows the process of geometric correction. Using the ERDAS programmer, the first three images were classified using unsupervised classification.

Independent categorization: No information about the land covers in the region being categorized is required for the unsupervised classification (also known as clustering). The satellite data is processed in two stages when using an unsupervised classification method:

1- The program first analyses the full image, and then, based on various parameters such as the maximum number of clusters; and spectral distance, generates clusters (groups of points in spectral feature space) and calculates the mean value for each cluster.

2- In the second run, the method uses the computed mean values to determine the spectral distance between each pixel and the mean value for each cluster. The entire image was then labeled using the minimal distance decision rule. Each picture pixel is assigned to the cluster that has the least spectral distance, as shown by this criterion. After the picture was classified, an unsupervised classification image was generated, and a signature output file was also generated (the signature was retrieved during the clustering phase). In the supervised classification procedure, that signature file is used as input. With a maximum of 12 repetitions and a convergence criterion of 0.99, an unsupervised classification method is executed. Clustering allowed for unsupervised classification to provide 100 distinct categories. The picture categorization tables are presented in the following paragraphs. From the first to the third picture, this is what happens:

3.1. Classification of the first image (B_1): Classify this image unsupervised classification. Table (2) represents the classification of this image. After that some processors procedures were carried out on the table as follows: **3.1.1.** The classifications that have no representation in the image have been delete.

3.1.2. Classification is assigned by color-coding each region.

3.1.3. Classifications with similar ground cover were grouped together. They represent four types of land cover (marine area, urban area, agricultural area and roads).

ID	Class No.	Histogram	Class type	Intensity
1	Class 1	445	Agr+sea	V.L.+V.L.
2	Class 3	1560	Agr+sea	Low+Low
3	Class 7	2066	Agr+sea	Low+Low
4	Class 11	3510	Agr+sea	Low+Low
5	Class 15	5415	Agr+sea	Med+Low
6	Class 19	9805	Agr+sea	Hi.+Med
7	Class 23	38147	Agr+sea	V.H.+Med
8	Class 27	33127	Agr+sea	Med+Hi.
9	Class 32	22792	Agr+sea	Med+Hi.
10	Class 36	36506	Agr+sea	Med+Hi.
11	Class 40	27799	Agr+sea	Med+Hi.
12	Class 44	11908	Agr+sea	Med+Med
13	Class 48	4868	Agr+sea	Med+Low
14	Class 52	3029	Agr+sea	Med+Low
15	Class 56	2188	Agr+sea	Low+Low
16	Class 60	1688	Agr+sea	Low+Low
17	Class 64	1398	Agr+sea	Low+Low
18	Class 68	1098	Agr+sea	Low+Low
19	Class 72	954	Agr+sea	Low+Low
20	Class 76	794	Agr.+Ro.	V.L+Low
21	Class 80	2297	Agr.+Ro.	V.L+Low
22	Class 84	3865	Agr.+Ro.	Low+Hi.
23	Class 88	6229	Ur.+Ro.	Low+Hi.
24	Class 92	7991	Urban	Hight
25	Class 96	11909	Urban	V.Hight
26	Class 100	3598	Urban	Hight

 Table 2. Shows The Data of Classification of B1 Image

3.2. Second image (B₂) was classified unsupervised classification. Table (3) represents the classes of this image.

ID	Class No.	Histogram	Class Type	Intensity
1	Class 1	33	Sea	V.Low
2	Class 2	56	Sea	V.Low
3	Class 5	53	Sea	V.Low
4	Class 8	262	Sea	Low
5	Class 11	14423	Sea	Hight
6	Class 14	13287	Sea	Hight
7	Class 17	7028	Sea	Medium
8	Class 19	9525	Sea	Hight
9	Class 22	31698	Sea	V.Hight
10	Class 25	17909	Sea	Hight
11	Class 28	13020	Sea	Medium
12	Class 31	20184	Sea	Hight
13	Class 34	17312	Sea	Hight
14	Class 37	9740	Sea	Medium
15	Class 39	6218	Sea	Medium
16	Class 42	4599	Agr.	Medium
17	Class 45	4630	Sea	Medium
18	Class 48	5359	Sea	Low
19	Class 51	5603	Agr.	Medium
20	Class 54	5222	Agr.	Medium
21	Class 56	4404	Agr.	Medium
22	Class 59	3828	Agr.	Medium
23	Class 62	3191	Agr.	Medium
24	Class 65	2552	Agr.	Hight
25	Class 68	2049	Agr.	Low
26	Class 71	1634	Agr.	Low
27	Class 74	1332	Agr.	Low
28	Class 76	1129	Agr.	Low
29	Class 79	817	Agr.	Low
30	Class 82	782	Agr.	Low
31	Class 85	2040	Urban	Low

Table 3. Data of Classification of B2 Image

32	Class 88	3063	Roads	Medium
33	Class 91	4046	Roads	Hight
34	Class 94	7177	Roads	Hight
35	Class 96	9765	Urban	V.Hight
36	Class 99	8634	Urban	V.Hight
37	Class 100	2382	Urban	Medium

3.3. The third image (B₃) was classified unsupervised classification.

Table 4. Data	of Classification	of B3 Image
---------------	-------------------	-------------

ID	Class No.	Histogram	Class Type	Intensity	
1	Class 1	10	sea	V.Low	
2	Class 3	49	sea	V.Low	
3	Class 5	49	sea	V.Low	
4	Class 7	28	sea	V.Low	
5	Class 9	39	sea	V.Low	
6	Class 10	67	sea	V.Low	
7	Class 12	92	sea	V.Low	
8	Class 14	157	sea	V.Low	
9	Class 16	231	sea	V.Low	
10	Class 18	1663	sea	Low	
11	Class 20	13301	sea	Hight	
12	Class 22	18012	sea	Hight	
13	Class 23	20366	Agr+sea	V.L+High.	
14	Class 25	47292	Agr+sea	V.L+V.Hi.	
15	Class 27	37056	Agr+sea	V.L+High.	
16	Class 29	11660	Agr+sea	Low+Med.	
17	Class 31	6717	Agr+sea	V.L.+Low	
18	Class 33	4573	Agr+sea	V.L.+Low	
19	Class 35	2754	Agr+sea	V.L.+Low	
20	Class 36	2571	Agr+sea	V.L.+Low	
21	Class 38	2588	Agr+sea	Low+Low	
22	Class 40	2653	Agr+sea	Low+Low	

23	Class 42	2826	Agr+sea Med.+Low		
24	Class 44	2756	Agr+sea Med.+Low		
25	Class 46	2588	Agr+sea	Med.+Low	
26	Class 48	2394	Agr+sea	Med.+V.L.	
27	Class 50	2292	Agr+sea	Med.+V.L.	
28	Class 51	2093	Agr+sea	Med.+V.L.	
29	Class 53	1989	Agr.	Low	
30	Class 55	1949	Agr.	Low	
31	Class 57	1833	Agr.	Low	
32	Class 59	1671	Agr.	Low	
33	Class 61	1541	Agr.	Low	
34	Class 63	1403	Agr.	Low	
35	Class 64	1409	Agr.	Low	
36	Class 66	1189	Agr.	Low	
37	Class 68	1079	Agr.	Low	
38	Class 70	1045	Agr.	Low	
39	Class 72	903	Agr.	Low	
40	Class 74	861	Agr.	Low	
41	Class 76	784	Agr.	Low	
42	Class 77	726	Agr.	Low	
43	Class 79	699	Agr.	Low	
44	Class 81	621	Agr.	Low	
45	Class 83	596	Agr.+Ro. V.L.+V.L		
46	Class 85	562	Agr. Low		
47	Class 87	462	Agr.+Ur. Low+Low		
48	Class 89	901	Agr.+Ro. Low+Low		
49	Class 90	1672	Agr.+Ro. Low+Me		
50	Class 92	2645	Ur.+Ro.	L.+Hight	
51	Class 94	4831	Roads Hight		
52	Class 96	9407	Urban	Hight	
53	Class 98	12935	Urban	V.Hight	
54	Class 100	4396	Urban	Hight	

4. Field survey and its comparison with the data of all the bands:

The study region was surveyed in the field, and the data collected there was afterwards coded. Using this data with the ARC GIS programme. For the examined region, percentages of coverage by each of the four types of vegetation were calculated. The percentages were as follows, as in figures (6&7):

1- Marine area (59%). 2- Agriculture area (24%).

3- Roads (3%). 4- Urban area (14%).

Table 5. Shows The Data of Classification of All Bands

	Images of Alexandria satellite by different spectral bands							
	B ₁		B ₂		B ₃		Tot.	Tot.
classes	N. of classes	P. C.	N. of classes	P. C.	N. of classes	P. C.	SUM	P. C.
Marine	15	58%	19	51%	20	37%	54	46%
Agr.	4	15%	10	27%	24	44%	38	33%
Roads	2	8%	1	3%	2	4%	5	4%
Urban	5	19%	7	19%	8	15%	20	17%
sum	26	100%	37	100%	54	100%	117	100%



Figure 5. Percentage of Each Three Classes

5. Analysis of the results:

Table 5 shows the results of a comparison between these plausible percentages and their corresponding percentage numbers.:



Figure 6. The Percentage Of Each Land Cover

1- The image of the first band (B_1), the range of this band is (450nm – 520 nm):

This image has been classified unsupervised classification and has a number of classes (26) classes from (100) classes, which are the lowest in images of number of classifications. As the remaining number of classifications (74) was neglected due to the lack of representation on the image (Histogram = 0).



Figure 7. proportion of each class in image B1

When comparing the percentages of the four types of land covers in the table (2) with their percentages in fact we observe the following as in figure (7):

A. Marine area has percentage of the total number of classifications is (57%), while the realistic percentage of the maritime area is (59%). (A ratio of classifications very close to real ratio).

B. Agriculture area has percentage of the total number of classifications is (15%), while the realistic percentage of the maritime area is (24%). (Less than the much realistic percentage and considered too far away from it).

C. Roads has percentage of the total number of classifications is (8%), while the realistic percentage of the maritime area is (3%). (Much larger than the realistic percentage and considered too far from it).

D. Urban area has percentage of the total number of classifications is (20%), while the realistic percentage of the maritime area is (14%). (Larger than the realistic percentage and considered far from it).

Either when referring to table number two, the classification table of the first image.

Note that most classifications differ from one another.

Where the overlap between agricultural land and roads is in only (3) classifications.

Overlap between roads and urban areas in only (1) classification.

Overlap between agricultural land and marine in (19) classification.

23 Undifferentiated classifications, 3 Differentiated classifications.



2- The image of the second band (B_2), the range of this band is (520nm - 600 nm):

Figure 8. proportion of each classes in image B2

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This image has been classified unsupervised classification and has a number of classes (37) classes from (100) classes, which are the number of classes are lower in this image. As the remaining number of classifications (63) was neglected due to the lack of representation on the image (Histogram = 0).

When comparing the percentages of the four types of land covers in the table (3) with their percentages in fact we observe the following, As in figure (8):

A. Marine area has percentage of the total number of classifications is (52%), while the realistic percentage of the maritime area is (59%).

(A ratio of this classification are less to real number of classifications).

B. Agriculture area has percentage of the total number of classifications is (27%), while the realistic percentage of the maritime area is (24%). (Slightly larger than the realistic ratio).

C. Roads has percentage of the total number of classifications is (3%), while the realistic percentage of the maritime area is (3%). (Which is a proportion identical to the real rate).

D. Urban area has percentage of the total number of classifications is (19%), while the realistic percentage of the maritime area is (14%). (Larger than the realistic percentage and considered far from it).

Either when referring to table number three, the classification table of the second image.

Note that all classifications differ from one another. There is no overlap between the classifications.

3- The image of the third band (B_3) , the range of this band is (630 nm - 600 nm):

This image has been classified unsupervised classification and has a number of classes (54) classes from (100) classes, which are the medium number of classifications in this image.



Figure 9. proportion of each classes in image B3

As the remaining number of classifications (74) was neglected due to the lack of representation on the image (Histogram = 0).

When comparing the percentages of the four types of land covers in the table (4) with their percentages in fact we observe the following:

A. Marine area has percentage of the total number of classifications is (37%), while the realistic percentage of the maritime area is (59%). (A ratio of this classification are very low from real ratio).

B. Agriculture area has percentage of the total number of classifications is (44%), while the realistic percentage of the maritime area is (24%). (A ratio of this classification are very high from real ratio).

C. Roads has percentage of the total number of classifications is (18%), while the realistic percentage of the maritime area is (4%). (A ratio of this classification are very high from real ratio).

D. Urban area has percentage of the total number of classifications is (4%), while the realistic percentage of the maritime area is (15%). (A ratio of this classification are very low from real ratio). As in figure (9).

In this image the ratio of the four classifications are very far from the realistic ratio.

Either when referring to table number four, the classification table of the third image.

Note many of the classifications are undifferentiated.

Where the overlap between agricultural land and marine area is in (16) classifications.

Overlap between roads and agricultural areas in only (4) classification.

Overlap between urban and agricultural areas in only (1) classification.

Overlap between roads and urban areas in only (1) classification.

22 Undifferentiated classifications, 32 Differentiated classifications.

Conclusion

Upon examining the tables and data pertaining to band image classification. Distinct tables for each image can aggregate and synthesize information to elucidate outcomes.

Compares land cover percentages of images to ratios.

This enumerates land cover classification inaccuracies by type. Sea: B1, B2, B3. Error rates in classification bands. Extent North of Claim, Marine Agriculture constitutes 61%, while Transportation accounts for 27%. Three percent Differences in total urban composition Shot B2 exhibits the least error margin, succeeded by B3 and B1. Consequently, the optimal photographs and discrepancies in land cover classification been examined. Contrast the classification percentage with the actual ratio and identify the most effective visual representation (optimal band). The integration of urban and rural vegetation can provide benefits to transportation systems.

Their reflection corresponds to the quantity, offering a novel perspective on class mix analysis. As one approaches and departs, the reflectance of land cover classes varies across bands.

The preliminary image an augmentation in reflectance (17% of total reflectance) diminishes the classes to 26. Marine and agricultural zones intersect in 19 out of 26 categories. B-2 Image This image comprises 37 categories and exhibits a reflectance of 28%. Reflectivity separation delineates picture classification. The 34% reflectance range categorizes this image into 54 distinct classifications. Agricultural and maritime zones possess 22 out of 54 characteristics. The spectral fingerprints of various land cover types help distinguish bands. B2 more correctly captures land cover types than other classes for several reasons. Minimal error margin. This band classifies its assortment.

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