مجلة الدراسات التربوية والعلمية - كلية التربية - الجامعة العراقية
العدد السابع والعشرون - المجلد الثالث - علوم الحياة - آذار 2026 م
doi.org/10.52866/esj.2026.03.27.12

Evaluation of some physiological and biochemical parameters in women with type 2 diabetes

Mahmood I. Alkanaani[1] , Ameerah Abdulmunem Yassen[2], Aseel Mokdad Hatam Abdul Wahed[3] , Ghassan Dh. Faisal[4] , Tabarak M. Atta[5], Anas M. Ali[6] , Shahad K. Mahmood[7] , Kamaladdin W. Hussein[8] , Sabaa Dh. Sari[9].
College of Applied Sciences, Samarra University, Samarra
Corresponding Author: E-mail: mahmood.153@uosamarra.edu.iq

Abstract:

Backgroun: Diabetes mellitus (DM) is a metabolic ailment characterized with the aid of continual hyperglycemia.

Aim: This study evaluated glycemic control (HbA1c), renal function (urea, creatinine), liver enzymes (ALT,AST, ALP), and thyroid-stimulating hormone (TSH) ranges in Iraqi ladies with type 2 diabetes mellitus(T2DM).

Methods: Ninety lady contributors had been enrolled: 60 T2DM patients and 30 wholesome controls, elderly 30-70years, recruited from Samarra General Hospital. Biochemical parameters had been analyzed the use of COBAS C111and COBAS e411 analyzers.

Results: T2DM sufferers confirmed substantially elevated HbA1c (7.09±1.44vs 5.26±0.73%, $p<0.01$), ALP (103vs 83.19 U/L, $p<0.05$), ALT (25.58 vs 17.13 U/L, $p<0.05$), AST (22.23 vs 16.64 U/L, $p<0.05$), urea (32.87 vs25.73 mg/dL, $p<0.05$), and TSH (2.06 vs 1.68 mIU/L, $p<0.05$) as compared to controls. Creatinine elevation was not statistically widespread (0.83 vs 0.7 mg/dL, $p>0.05$). Age distribution was comparable among groups(51.38 vs 51. 65 years, $p>0.05$).

Conclusion: Iraqi women with T2DM verified early subclinical impairment in hepatic, renal, and thyroid characteristic. These findings underscore the significance of everyday multi-organ screening in diabetic patients for early detection and prevention of headaches.

Keywords: Diabetic, liver function check, Thyroid-stimulating hormone, Urea, Creatinine.

تقييم بعض المعايير الفسيولوجية والكيميائية الحيوية لدى النساء المصابات بداء السكري من النوع الثاني

محمود إبراهيم الكنعاني [1] ، أميرة عبد المنعم ياسين [2] ، أسيل مقداد حاتم عبد الواحد [3] ،
غسان ظافر فيصل[4] ، تبارك محمد عطا[5] ، أنس محمد علي[6] ، شهد كريم محمود[7] ،
كمال الدين وسام حسين[8] ، سبأ ضياء ساري[9].
كلية العلوم التطبيقية ، جامعة سامراء، سامراء

مستخلص:

الخلفية: داء السكري هو اضطراب أيضي يتميز بارتفاع مستويات الكلوكوز في الدم.

الهدف: هدفت هذه الدراسة إلى تقييم مستوى الهيموغلوبين السكري التراكمي (HbA1c)، وظائف الكلى (اليوريا والكرياتينين)، إنزيمات الكبد (ALT، AST، ALP)، وهرمون تحفيز الدرقية (TSH) لدى النساء العراقيات المصابات بداء السكري من النوع الثاني.

الطرق: شملت الدراسة 90 امرأة: 60 مريضة بالسكري و30 من الأصحاء، تتراوح أعمارهن بين 30–70 عاماً، من مستشفى سامراء العام. تم تحليل المعايير الكيميائية باستخدام أجهزة COBAS C111 و COBAS e411.

النتائج: أظهرت مريضات السكري ارتفاعاً معنوياً في HbA1c (7.09±1.44 مقابل 5.26±0.73٪، $p<0.01$)، ALP (103 مقابل 83.19 وحدة/ لتر، $p<0.05$) ALT (25.58 مقابل 17.13 وحدة/ لتر، $p<0.05$)، AST (22.23 مقابل 16.64 وحدة/ لتر، $p<0.05$)، اليوريا (32.87 مقابل 25.73 ملغم/ ديسيلتر، $p<0.05$)، و TSH (2.06 مقابل 1.68 ملي وحدة/ لتر، $p<0.05$) مقارنة بالمجموعة الضابطة. لم يكن ارتفاع الكرياتينين ذا دلالة إحصائية (0.83 مقابل 0.7 ملغم/ ديسيلتر، $p>0.05$).

الاستنتاج: أظهرت النساء العراقيات المصابات بالسكري من النوع الثاني اضطرابات مبكرة تحت سريرية في وظائف الكبد والكلى والغدة الدرقية، مما يبرز أهمية الفحص الدوري المتعدد الأعضاء للكشف المبكر عن المضاعفات.

الكلمات المفتاحية: داء السكري من النوع الثاني، الهيموغلوبين السكري، إنزيمات الكبد، هرمون تحفيز الدرقية، وظائف الكلى، النساء العراقيات.

Introduction:

Diabetes mellitus (DM) is a metabolic disease characterized through accelerated blood glucose stages (hyperglycemia) (1). Insulin is released by way of pancreatic cells, which allows glucose flow from the blood into frame cells in which it could be saved or used for strength. People with diabetes either cannot make enough insulin or our bodies cannot use the insulin that is made.

Type 2 diabetes mellitus (T2DM) is the maximum commonplace form of diabetes, making up about ninety% of all cases. It is resulting from insulin resistance, which increases blood sugar stages. In 2021, 10.5% of adults around the world had T2DM, that is 536.6 million humans. Several forecasts indicate that the worldwide populace impacted will upward thrust from 422 million to 642 million by means of 2040 (2,three). Over the final ten years, the wide variety of humans with diabetes has long gone up loads due to an getting old populace, genetic elements, awful consuming conduct, a loss of exercise, and greater human beings being overweight (four). Type 2 diabetes and its complications have come to be a virulent disease, specifically in developing nations (5).

The liver is an essential part of maintaining power stability because it reacts to food intake and controls how glucose and lipids are damaged down. The liver is an endocrine organ that releases hepatocytes, which permit it to talk to other organs like the principal apprehensive device, adipose tissue, and skeletal muscle about how well it's miles operating. This conversation is essential for comprehending inter-organ communique and formulating therapeutics for metabolic dysfunction (6,7).

Diabetes is the leading purpose of renal failure, accounting for about 44% of latest instances. Even with diabetes management, the situation can cause persistent kidney disease (CKD) and renal failure. About 24 million humans in the US have diabetes, and approximately one hundred eighty,000 people are stricken by renal failure because of it (8).

The anterior pituitary gland makes thyroid-stimulating hormone (TSH),

which is a glycoprotein hormone. It is the primary issue that makes thyroid hormones and affects the growth of thyroid follicular cells. Higher TSH levels and decrease FT4 stages were connected to a better threat of diabetes and transferring from prediabetes to diabetes. On the alternative hand, high thyroid characteristic protected towards the onset and progression of T2DM (nine,10).

Research Gap and Rationale: In Iraq, the superiority of diabetes varies from 8.Five% to 13.9%, with a notably greater impact on women (eleven,12). Even although this fitness hassle is getting worse, there isn't a whole lot records available on the total multi-organ biochemical profiles of Iraqi women with T2DM. Most cutting-edge studies give attention to character parameters (13,14) in place of a complete evaluation of hepatic, renal, and thyroid characteristic. It is crucial to recognize those multi-gadget alterations for the method of comprehensive screening protocols particularly designed for the Iraqi diabetic population.

The goal of this observe became to assess physiological and biochemical parameters, inclusive of HbA1c, liver enzymes (ALT, AST, ALP), renal characteristic markers (urea, creatinine), and thyroid feature (TSH) in Iraqi girls with type 2 diabetes.

Methods:

Sample collection

Ethical approval became obtained from the Research Ethics Committee of Samarra General Hospital, and written informed consent became acquired from all members. During this study, ninety blood samples had been accrued, all from ladies: 30 samples from healthy people and 60 samples from patients with type 2 diabetes.

Collusion standards: Females elderly 30-70 years; showed T2DM diagnosis based totally on WHO standards (affected person organization); no history of diabetes, liver disease, chronic kidney sickness, or thyroid problems (control institution).

Exclusion requirements: Type 1 diabetes mellitus; pregnancy or lactation; acute infections or inflammatory conditions; modern-day use of medicines affecting liver or renal characteristic (aside from diabetes medicinal

tablets).

Blood samples had been collected from patients attending Samarra General Hospital and from outpatient clinics and laboratories in Samarra, aged between 30 and 70 years. Eight milliliters of venous blood were drawn from patients and healthful people the use of scientific syringes. The serum become then divided and stored in Eppendorf tubes at -20°C till the necessary assessments have been carried out.

Height and Weight Measurement and Body Mass Index Calculation

Height and weight have been measured for sufferers the usage of a non-public scale. Height became measured in meters (m) and weight in kilograms (kg). Body mass index (BMI) turned into calculated consistent with the subsequent system:

$BMI = Weight (kg) / Height^2 (m^2)$

Biochemical and Hormonal tests

HbA1c, Urea ,creatinine, ALT, AST and ALP levels were estimated using Cobas C111 device, while TSH level were estimated using COBAS e411.

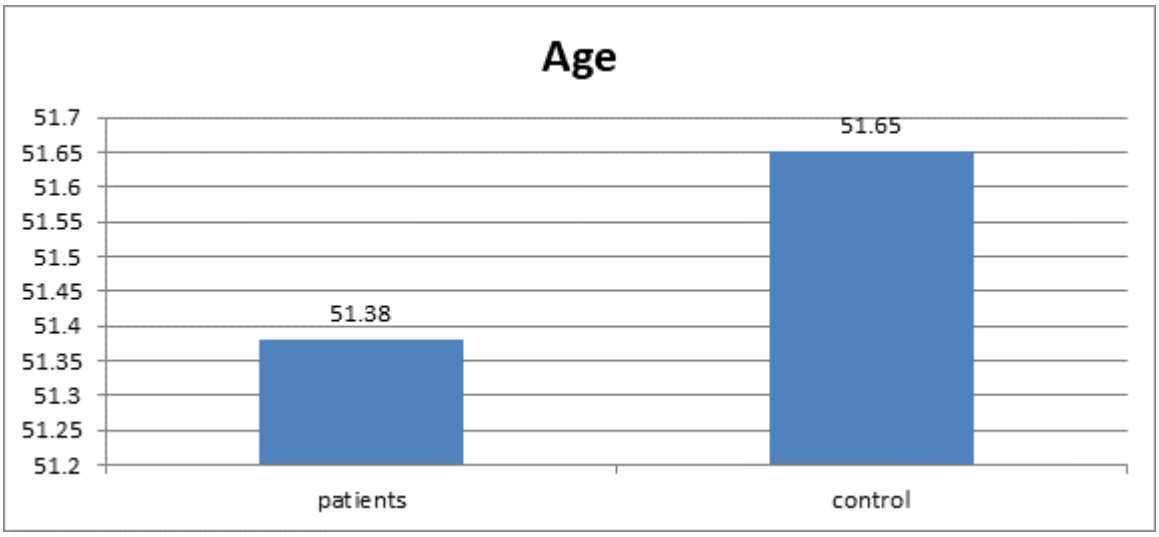
Statistical Analysis

The SAS program(version 9.4, 2012) was utilized to ascertain the influence of various factors on the study parameters. The least significant difference (LSD) test, part of Analysis of Variance (ANOVA), was employed to compare means substantially. The chi-square test was employed to compare percentages. Statistical significance was set at $p<0.05$ and $p<0.01$.

Results

Demographic Characteristics

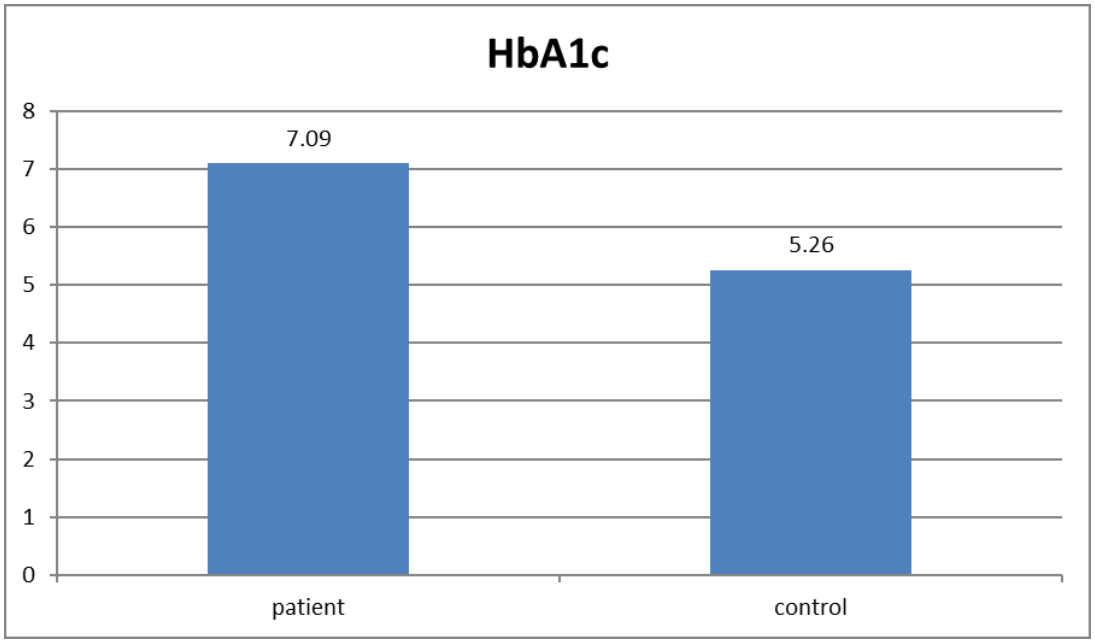
The study showed no significant differences in age's mean between patient group (51.38) and control group (51.65 years, $p>0.05$), as shown in figure(1). Demographic Characteristics.



Figure(1): Mean age in studied groups

Glycemic Control (HbA1c)

The results showed a significant increase in HbA1c level in patients (7.09±1.44%) compared with controls (5.26±0.73%, $p<0.01$), as shown in Figure 2.



Figure(2): Mean HbA1c level in studied groups

In Iraq, approximately one and a half million individuals have diabetes, with prevalence ranging from 8.5% to 13.9%. A local study in Basrah, Southern Iraq, revealed an age-adjusted diabetes prevalence of up to 19.7% among patients aged 19 to 94 years (12). Our results agree with Hami and Muhammed (13) which revealed that HbA1c was elevated in diabetic Iraqi women, and with Al-Shaheeb et al. (14).

Liver Enzyme Activity

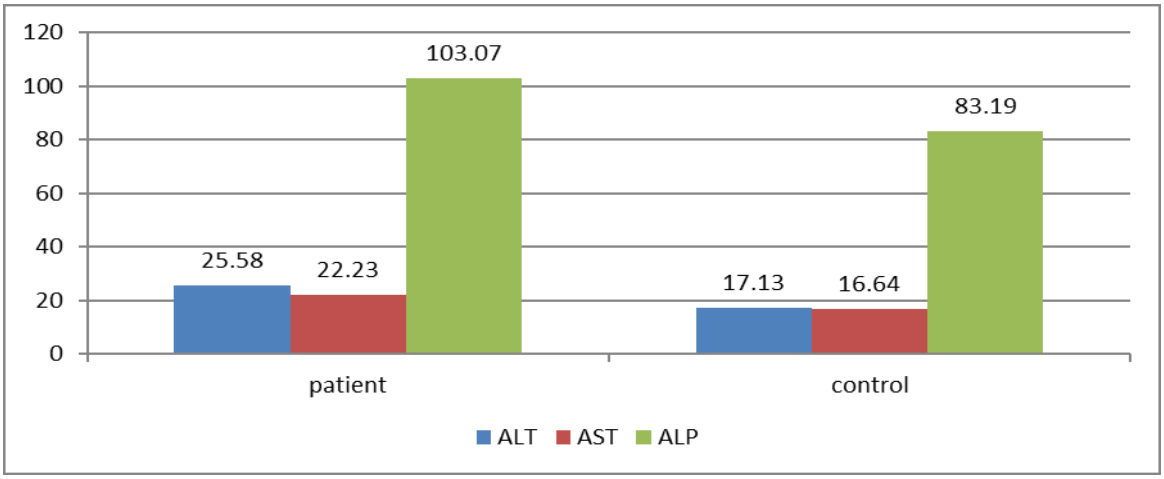
The results in Figure 3 showed a significant increase ($p<0.05$) in liver enzyme activity in patients compared to healthy controls.

Alkaline Phosphatase (ALP): The enzyme rate in healthy people reached 83.19 U/L, while in diabetic women it rose to 103 U/L ($p<0.05$). This elevation may indicate subclinical liver or bone changes related to diabetes (15).

Alanine Aminotransferase (ALT): The results indicated differences between healthy people (17.13 U/L) and those with diabetes (25.58 U/L, $p<0.05$). This finding agrees with Emamian et al. (16), which showed increased mean ALT in diabetic patients. Although the values do not suggest acute liver damage, this increase may be an early warning of minor hepatic changes requiring continuous monitoring (17). Murtadha et al. (18) observed that the higher standard deviation in the diabetic group indicates significant variation in ALT levels, suggesting that liver damage extent varies depending on disease severity or duration.

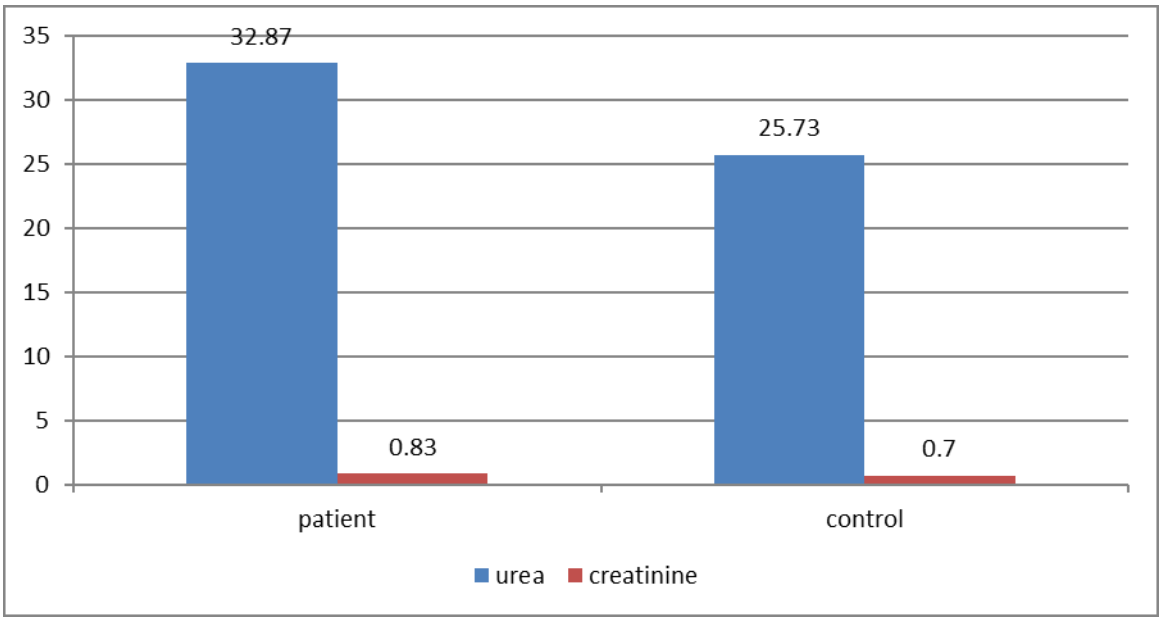
Aspartate Aminotransferase (AST):

The results indicated a slight increase in diabetics (22.23 U/L) compared to healthy people (16.64 U/L, $p<0.05$), which agreed with Jeon et al. (19). Although the level remains within normal limits, the difference may reflect early diabetes effects on the liver requiring continuous monitoring (20,21).



Figure(3): Liver enzymes activity in studied groups

The results in Figure (4) showed a significant increase at the ($p<0.05$) level in urea concentration in patients compared to healthy individuals, while creatinine did not show any significant difference between the two groups.



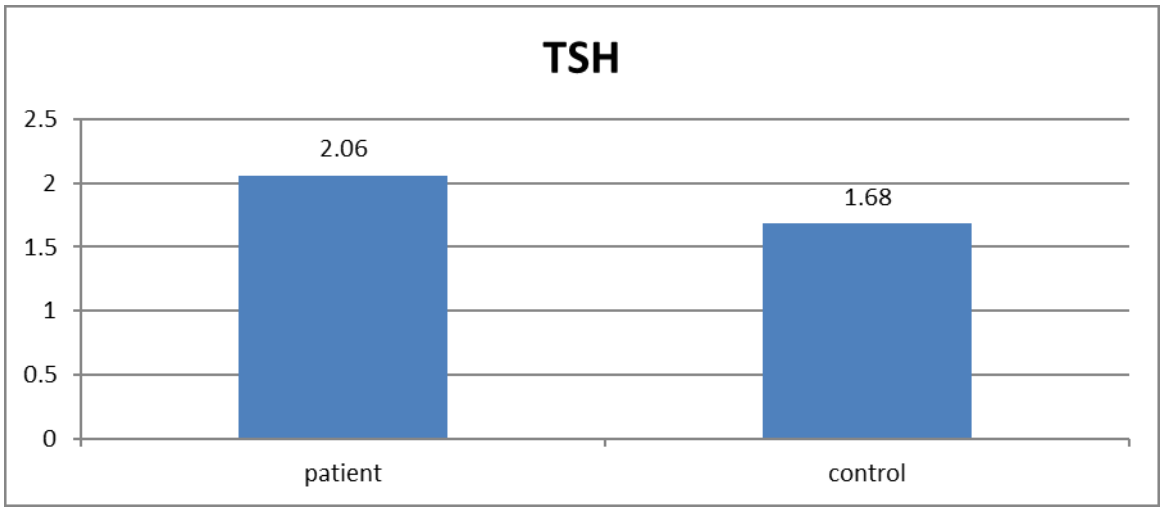
Figure(4): mean level of urea and creatinine in studied groups

Urea: Levels have been 25.73 mg/dL in healthful individuals, whilst they rose to 32.87 mg/dL in diabetics ($p<zero.05$), which agreed with Xie et al. (22). This increase may additionally indicate impaired kidney characteristic, as urea is a metabolic waste product filtered through the kidneys. Although Laville et al. (23) found out that the increase remains inside normal limits, the difference is an early caution signal for normal kidney function tracking to avoid potential renal headaches.

Creatinine: The level in healthy individuals was 0.7 mg/dL, while it was 0.83 mg/dL in diabetic individuals ($p>0.05$), agreeing with Netere and Sendekie (24). Although the increase in creatinine remains within normal range (25), and the statistical difference is not significant, these results support the importance of routinely checking creatinine in diabetic patients to detect early kidney function changes (26).

Thyroid Function (TSH)

TSH levels were slightly higher in diabetic patients, reaching 2.06 mIU/L, compared to healthy individuals at 1.68 mIU/L ($p<0.05$), which agrees with Biondi et al. (27). This difference may be attributed to diabetes effects on the thyroid gland. An increase in TSH within normal range but toward the upper limit may indicate onset of mild hypothyroidism, which is common among diabetics due to hormonal interference and insulin resistance effects (28). Therefore, slight TSH increase in diabetic patients may indicate mild thyroid dysfunction requiring periodic monitoring, especially since thyroid disorders may negatively affect blood sugar regulation (29).



Figure(5): mean level of TSH in studied groups

Discussion

This have a look at gives complete biochemical evaluation of Iraqi ladies with T2DM, revealing subclinical multi-organ disorder.

Glycemic Control

The substantially extended HbA1c (7.09%) shows suboptimal glycemic control in our diabetic cohort, regular with previous Iraqi research (13,14). Poor glycemic manage is a number one driver of diabetic headaches, emphasizing the want for superior diabetes control applications in Iraq.

Hepatic Function

Significant elevation of ALT, AST, and ALP in diabetic patients, though within normal ranges, suggests early hepatic stress. These findings are consistent with international studies (16,19) and Iraqi research (18). The higher standard deviation in enzyme levels among diabetics indicates marked inter-individual variability, likely reflecting differences in disease duration and glycemic control.

Renal Function

Elevated urea ($p<0.05$) indicates early renal dysfunction, consistent with Xie et al. (22). Although creatinine elevation was not statistically significant, the trend warrants attention. The significant urea elevation despite non-significant creatinine change suggests early diabetic nephropathy preceding overt GFR reduction, underscoring the im-

portance of sensitive biomarkers for diabetic kidney disease screening.

Thyroid Dysfunction

The substantially increased TSH ($p<0.05$) shows subclinical hypothyroidism, consistent with Biondi et al. (27) and Zhu et al. (28). In Iraqi diabetic ladies, recurring thyroid screening is usually recommended, as untreated subclinical hypothyroidism can worsen glycemic control and cardiovascular danger.

Clinical Implications

Our have a look at reveals marked variability in physiological responses among diabetic patients, reflecting complex interaction of sickness duration, glycemic manipulate, and comorbidities. These findings emphasize the want for:

Integrated screening protocols incorporating HbA1c, liver enzymes, renal function, and TSH into annual diabetic care in Iraq

Early intervention thru life-style amendment and pharmacological management before irreversible organ harm

Individualized control based totally on affected person-particular metabolic profiles

Cost-effective screening packages to reduce long-time period headaches in Iraq's developing diabetic population

Conclusion

Iraqi women with type 2 diabetes demonstrated significantly elevated HbA1c, liver enzymes (ALT, AST, ALP), urea, and TSH compared to healthy controls, indicating subclinical multi-organ dysfunction. Although most biomarkers remained within normal ranges, their statistical significance highlights early pathophysiological changes. The marked variability in physiological responses among diabetic patients reflects complex interplay of glycemic control, disease duration, and comorbidities. These findings emphasize the critical need for comprehensive multi-organ screening protocols in Iraqi diabetic women to enable early detection, timely intervention, and prevention of diabetes-related complications.

Acknowledgment

Non….

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