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Research Article

Determination of Matrix Metalloproteinase 10 and Fetuin-A Levels as Excellent Predictive Factors in Iraqi patients with Diabetic Nephropathy

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Abstract:

Background: Diabetic nephropathy (DN) is a significant contributor to end-stage renal failure in individuals with type 2 diabetes mellitus (T2DM). Diabetic nephropathy is characterized by tubular atrophy, glomerular dilation, glomerulosclerosis, interstitial fibrosis, and proteinuria, resulting in deterioration of kidney function. DN, primarily caused by hyperglycemia, accounts for millions of deaths globally and is the leading cause of end-stage renal disease. Matrix metalloproteinase 10 is an enzyme essential for the breakdown of extracellular matrix constituents. Fetuin-A forms soluble complexes with calcium and phosphate to prevent soft tissue mineralization

Objectives: To determine the levels of Matrix Metalloproteinase 10 and Fetuin-A in Iraqi patients with DN, as these factors are considered excellent predictors for early detection.

Methods: The current study was conducted at Baghdad Teaching Hospital / Medical City between August and December 2024, involving 143 males and females aged 35–65 years, divided into four groups based on the albumin-to-creatinine ratio (ACR) criteria. They were: 35 cases of normoalbuminuria, 33 cases of microalbuminuria, 35 cases of macroalbuminuria, and 40 healthy individuals as controls. Auto spectrophotometer techniques were used to estimate uric acid levels and lipid profiles. HbA1c was measured by the I-chroma device, and serum levels of Fetuin-A and matrix metalloproteinase (MMP-10) were measured using ELISA assay.

Results: The results indicated that Fetuin-A levels (234.3±3.11, (270.1±3.91), (356.7±13.11), (110.6±4.22) and matrix metalloproteinase levels (316.5± 10.11), (523.3± 17.01), (522.3±19.61), (209.5±10.12) were significantly higher in the patient groups relative to the control group. Additionally, all patients indicated increased levels of triglycerides and cholesterol compared to healthy controls.

Conclusion: Matrix Metalloproteinase 10 and Fetuin-A are significant prognostic indicators for predicting the first signs of diabetic nephropathy.

Keywords: Albumin-to-creatinine ratio; Diabetes mellitus; Diabetic nephropathy; Fetuin-A; Matrix Metalloproteinase 10.

Introduction:

Diabetic nephropathy (DN) is diagnosed based on the ratio of albumin to creatinine in the patient's urine, which is compared to its normal ratio. Therefore, the names normoalbuminuria, microalbuminuria, and macroalbuminuria were given (1). Researchers have recently focused on studying the complications of diabetes, such as diabetic nephropathy (2) and periodontitis (3). On the other hand, recent studies were of several biochemical factors, such as Fetuin A, FBXW7, apelin, and adipsin, as disease markers (4-6). Diabetes and its complications have become a major global health concern in recent decades, because T2DM is directly linked to metabolic syndrome and an unhealthy lifestyle, and it is more common in obese individuals (7). Its micro-complications include DN, retinopathy, neuropathy, with several factors, including inflammation, proteinuria, and hypertension, that have been linked to the progression of DN from early to advanced stages (8). Additionally, the chance of dying from cardiovascular disease is increased in patients with DN (9). Research indicates that the onset and progression of DN may be significantly influenced by insulin resistance, hyperglycemia, inflammation, and adipose tissue (10, 11).

Fetuin-A, a strong inhibitor of vascular calcification, has been discovered. It was found in the blood of a fetal calf by K. Pedersen in 1944 and then in humans during the 1960s. Fetuin-A forms soluble complexes with calcium and phosphate to prevent soft tissue mineralization (12). The liver, an organ essential to glucose regulation, is the primary producer of the protein Fetuin-A (13), which prevents calcium from building up in arteries (14). Fetuin-A, released by numerous tissues, affects human health through various mechanisms and roles. It prevents undesirable calcification in the blood vessels by inhibiting crystal development and accumulation, while maintaining calcium and phosphate ion stability, without hindering bone mineralization (15). Additionally, it

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regulates bone remodelling (16) and is associated with inflammatory markers in heart and blood vessel calcification, as well as in valves and coronary artery disease (17). Individuals exhibiting insulin resistance and fatty liver demonstrate elevated serum Fetuin-A concentrations. Elevated serum Fetuin-A levels are positively associated with subclinical inflammation and metabolic syndrome, suggesting that Fetuin-A may have a causal role in the etiology of both conditions (18). Moreover, pro-inflammatory signals in glomerular and vascular cells are triggered by high levels of Fetuin-A, which compromise kidney function (19, 20).

The inflammatory effect of perivascular lipids is intensified by Fetuin-A. In T2DM, inflammation affects the kidneys and accelerates the progression of DN (21). Epidemiological investigations have demonstrated markedly increased serum Fetuin-A levels in obesity and its related comorbidities, including T2DM and its microvascular sequelae (22). Chronic kidney disease is considered a risk factor for atherosclerosis. So, the progression of DN causes disturbances in the levels of lipids and lipoproteins due to kidney failure (23).

The enzyme matrix metalloproteinase 10 (MMP-10), sometimes referred to as stromelysin-2, is essential for the breakdown of extracellular matrix (ECM) constituents. This process is essential for both pathological conditions of inflammation and DN, as well as for normal physiological processes like tissue remodelling and reproduction (24). Glomerulosclerosis, tubular atrophy, and interstitial fibrosis are characteristics of DN. The hallmark of the pathogenesis of DN is an increased accumulation of ECM (25). MMP-10 plays a key role in microvascular complications associated with retinopathy and nephropathy. Its levels have been found to be increased in patients with T2DM, which is related to the risk of nephropathy. This could be a therapeutic approach to reduce the risk of diabetic complications. MMPs are involved in physiological processes and embryonic development. The evaluation of MMP-10 levels in patients with Peripheral Artery Disease (PAD) may improve clinical decision-making by identifying high-risk individuals who necessitate vascular assessment and enhanced treatment strategies, ultimately seeking to mitigate cardiovascular complications in PAD patients (26).

Numerous inflammatory and degenerative illnesses are linked to excess production of elevated MMP expression. MMPs may be involved in additional microvascular and macrovascular consequences of diabetes in addition to DN. For instance, atherosclerotic plaques have elevated MMP expression, which may be the cause of plaque rupture. It is believed that changes in MMP expression patterns play a role in the poor wound healing frequently seen in diabetic individuals (27). MMP-10 is raised in the initial phases of renal dysfunction. Diabetic patients had significantly elevated levels of MMP-10 compared to the control groups (28).

This study aimed to evaluate the levels of MMP-10 and Fetuin-A in patients with DN to determine their potential as biomarkers for the early diagnosis of this disorder, which has serious health implications. Additionally, it sought to explore the relationships between these factors and other relevant diagnostic indicators.

Cases and Methods

Patients and controls: The study was conducted at Baghdad Teaching Hospital / Medical City between August and December 2024. One hundred forty-three males and females aged 35 to 65 years participated in this study. The participants included 103 T2DM patients who were seen in the above hospital, alongside 40 healthy individuals serving as the control group.

Study groups: The patients were divided into three groups depending on albumin to creatinine ratio (ACR) values, as follows:

• Normoalbuminuria group (G1): 35 individuals with an ACR < 30 mg/g.
• Microalbuminuria group (G2): 33 individuals with an (ACR) ranging from 30 to 300 mg/g.
• Macroalbuminuria group (G3): 35 individuals with an ACR over 300 mg/g.

Exclusion Criteria

- Patients aged above 65 years.
- Individuals diagnosed with other diabetic complications (neuropathy, retinopathy), and pregnant women.
- Individuals diagnosed with cancer or endocrine diseases.

Sample collection and analysis: Nine ml of blood was taken in the morning from the ulnar vein as a typical fasting blood test for an overnight fast of 8-12 hours, then the blood sample was divided into three aliquots. The first aliquot (3 ml) was placed in gel tubes and permitted to coagulate at room temperature for 10 minutes. After centrifugation at 800 x g for 10 min, the serum was separated and stored at -20°C in Eppendorf tubes. The levels of MMP-10 and Fetuin-A were determined using an enzyme-linked immunosorbent assay/Sandwich ELISA kit from My BioSource (USA). The second portion (3 ml) was utilized for uric acid and lipid profile analyses employing the auto-spectrophotometric technique. The third portion (3 ml) was used to measure HbA1c by I-chroma in an EDTA tube. Urine samples were collected in sterile glass tubes to determine the urine albumin-to-creatinine ratio, which was measured using the FUS 3000 urinalysis device.

Statistical analysis:

The statistical analyses of the data were performed using SPSS software version 29. The normality for the variables was reported using: (Shapiro–Wilk test), especially for small to medium sample sizes. The one-way analysis of variance (ANOVA) was conducted to identify any statistically significant differences

among the means of the four distinct groups: G1, G2, G3, and the control group. ROC analysis was used to determine the biomarkers' optimal diagnostic efficacy, sensitivity, and specificity, with the significance level being $p \leq 0.05$.

Results

The results of lipid profile, HbA1C, and uric acid in patients and controls are shown in Table 1. Cholesterol, HDL-C, and LDL-C results revealed substantial differences among the examined groups. Both triglycerides and VLDL-C results were found to be significantly higher in G2 than G3. The results of HbA1C showed highly significant differences between patients and controls; these results were associated with a hyperglycemic condition compared to controls. Mean uric acid values were significantly lower in the patient groups than in the controls.

Table 1: Mean± SD of lipid profile, HbA1C, and uric acid in the study groups

Groups Parameter	G1 No. (35) Mean ± SD	G2 No. (33) Mean ± SD	G3 No. (35) Mean ± SD	G4 No. (40) Mean ± SD	P Value
Age (years)	51.2±1.40[b]	53.9±1.51	56.6±1.31[b, f]	49.2±1.31	0.0012
Cholesterol (mg/dL)	187.2±7.81[b, c]	195.3±7.62 [d, e]	147.6±6.21[b, d]	161.7±4.11	0.0000
TG (mg/dL)	173.5±15.12	205.1±20.01[d]	127.5±10.11[d]	174.3±8.71	0.0029
VLDL (mg/dL)	34.7±3.12	41.0±4.12[d]	25.5±2.11[d]	34.9±1.72	0.0029
HDL-C (mg/dL)	42.4±1.41[b, c]	40.1±1.62[d, e]	48.1±1.31[b, d]	48.4±0.71	0.000
LDL-C (mg/dL)	110.0±7.51[b, c]	114.2±7.62[d, e]	74.0±6.21[b, d]	78.5±5.22	0.000
HbA1C	9.0±0.31 [b, c]	8.9±0.33[d, e]	6.7±0.22[b, d, f]	4.6±0.08	0.000
Uric acid (mg/dL)	4.3±0.14[c]	4.7±0.22	4.4±0.41[f]	5.7±0.12	0.0005

TG: Triglyceride, VLDL: Very low-density lipoprotein, HDL: High-density lipoprotein, LDL: Low density lipoprotein, HbA1c: Glycated hemoglobin

[a] Significant difference between G1 and G2, [d] Significant difference between G2 and G3

[b] Significant difference between G1 and G3, [e] Significant difference between G2 and G4

[c] Significant difference between G1 and G4, [f] Significant difference between G3 and G4

Yes, we don't need to because we haven't addressed the impact of gender.

Table 2 shows the results of MMP10 and Fetuin-A levels for DN patients compared to the healthy group. Mean MMP10 showed a highly significant increase between the patients and control groups. Furthermore, significant differences among all patient groups (G1, G2, and G3) were identified. The results indicated a significantly increased level of Fetuin-A in patients compared to the control group. Additionally, the results for the patient groups (G1, G2, and G3) indicated a significant increase in Fetuin-A levels.

Table 2: Mean±SD MMP10 and Fetuin-A levels for patients and controls

Groups Parameter	G1 - No. (35) Mean ± SD	G2 - No. (33) Mean ± SD	G3 - No. (35) Mean ± SD	G4 - No. (40) Mean ± SD	P Value
MMP10 (pg/mL)	316.5± 10.11[a, b, c]	523.3± 17.01[a, e]	522.3±19.61[b, f]	209.5±10.12	0.000
Fetuin-A (ng/mL)	234.3±3.11[a, b, c]	270.1±3.91[a, d, e]	356.7±13.11[b, d, f]	110.6±4.22	0.000

a Significant difference between G1 and G2, d Significant difference between G2 and G3

b Significant difference between G1 and G3, e Significant difference between G2 and G4

c Significant difference between G1 and G4, f Significant difference between G3 and G4

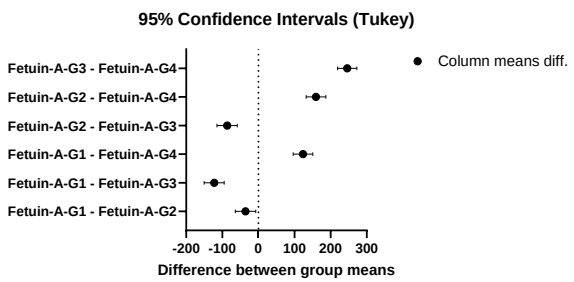

Figure 1: 95% Confidence Intervals and the Variation in Group Means of Fetuin-A

Post-hoc pairwise comparisons were performed utilizing Tukey's HSD test to ascertain the significant differences among the Fetuin-A groups. The 95% confidence interval plot shows the mean differences among all group pairs. Confidence intervals that intersect zero suggest a lack of statistical significance the differences between groups, while intervals that are wholly above or below zero show statistically significant differences between groups. Significant variations were noted among the Fetuin-A groups, since their confidence intervals do not overlap with zero, as shown is Figure 1

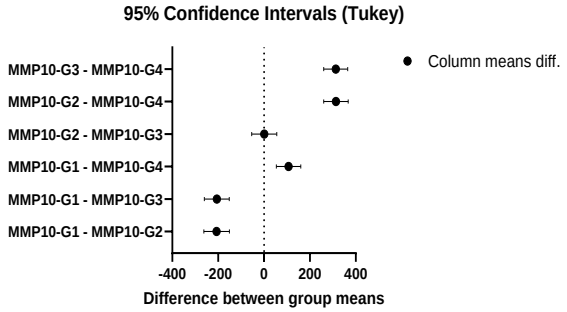

Figure2: 95% Confidence Intervals and the Variation in Group Means of MMP10

Post-hoc pairwise comparisons were performed with Tukey's HSD test. The resulting plot of the 95% confidence interval illustrates the mean differences among all group pairs. Comparisons with confidence intervals that include zero suggest that the respective groups do not exhibit significant differences. In contrast, intervals that are wholly above or below zero indicate statistically significant differences. Significant differences have been detected between different MMP10 groups, as indicated by confidence intervals that do not intersect zero except G2 -G3, as shown is Figure 2.

Receiver operating characteristic (ROC) curve

The ROC curve data for Fetuin-A and MMP-10 in the normoalbuminuria group are shown in Table 3 and Figure 3. The Fetuin A data demonstrated a distinct cutoff value (>165.5) with 100% sensitivity, 100% specificity, and an AUC value of 1, showing it as a possible diagnostic marker. The ROC data analysis for the MMP10 marker revealed a definitive cutoff value (>296.5), showing a sensitivity of 70.5% and a specificity of 95%, with an AUC value of 0.8890, indicating that it is a good diagnostic marker.

Table 3. ROC data of Fetuin A and MMP10 in the normoalbuminuria group

	AUC	95% confidence intervals	Sensitivity%	Specificity%	Cut off
Fetuin-A	1	1.000 to 1.000	100	100	> 165.5
MMP10	0.8890	0.815 to 0.962	70.5	95	> 296.5

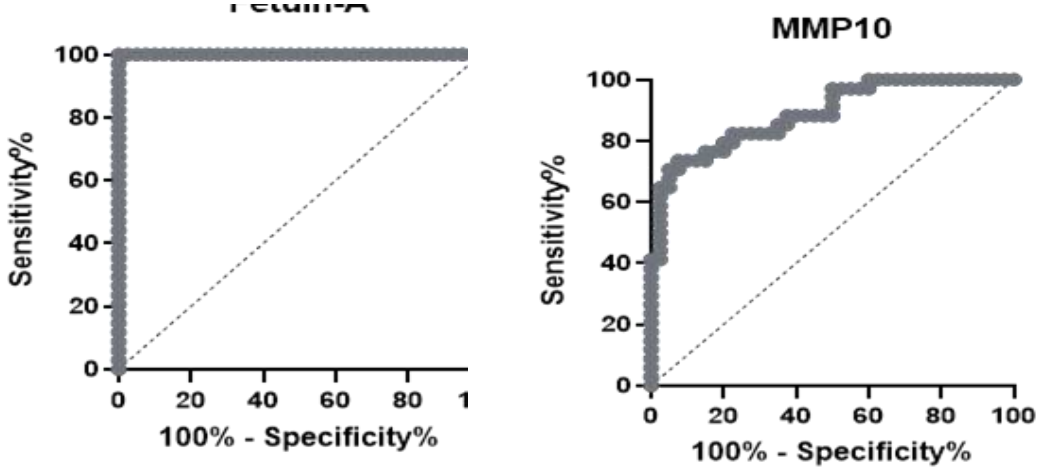

Figure 3: ROC curve analysis of MMP10 and Fetuin-A in normoalbuminuria

The ROC curve results for Fetuin-A and MMP10 in the microalbuminuria group are shown in Table 4 and Figure 4. The Fetuin-A data for this group demonstrated an absolute cutoff value (>207.0), 96.7% sensitivity, 100% specificity, and an AUC value of 0.9977, showing that Fetuin-A is a possible diagnostic marker. The ROC curve analysis for the MMP-10 factor shows a very clear cutoff value (>363.0), with a sensitivity of 96.9%, a specificity of 100%, and an AUC value of 0.9856, indicating that MMP-10 is a possible diagnostic marker.

Table 4. ROC data of Fetuin A and MMP10 in the microalbuminuria group

	AUC	95% confidence intervals	Sensitivity%	Specificity%	Cut off
Fetuin-A	0.9977	0.9921 to 1.000	96.7	100	> 207.0
MMP10	0.9856	0.9571 to 1.000	96.9	100	> 363.0

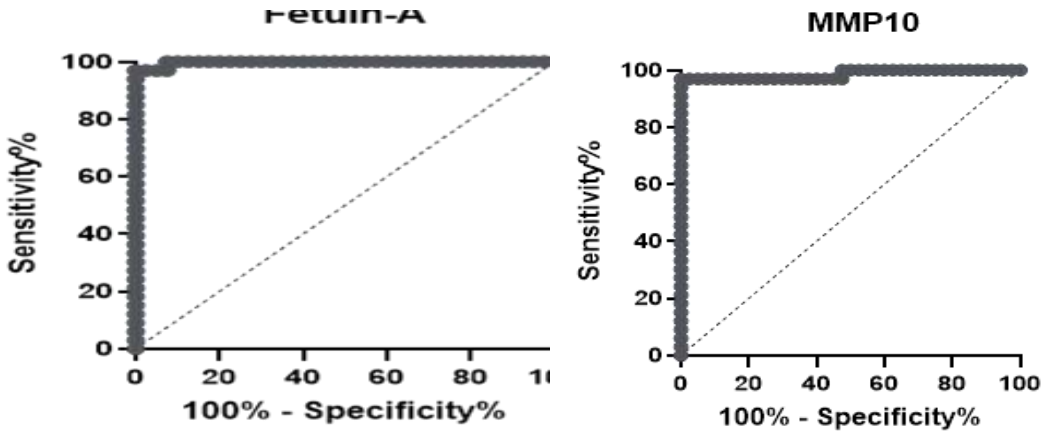

Figure 4: ROC curve analysis of MMP10 and Fetuin-A in the microalbuminuria group

The ROC curve results for the Fetuin-A and MMP10 factors in the macroalbuminuria group are presented in Table 5 and Figure 5. Fetuin-A results of the macroalbuminuria group revealed a clear cutoff value (> 205.6) with 100% sensitivity, 100% specificity, and an AUC value of 1, indicating that Fetuin-A is a possible diagnostic marker. Similarly, the ROC curve results of the MMP-10 factor revealed a very clear cutoff value (> 342.5) with a sensitivity of 100%, a specificity of 100% and an AUC value of 1, indicating that MMP-10 is a possible diagnostic marker.

Table 5. ROC data of Fetuin A and MMP10 in the macroalbuminuria group

	AUC	95% confidence intervals	Sensitivity%	Specificity%	Cut off
Fetuin-A	1	1.000 to 1.000	100	100	> 205.6
MMP10	1	1.000 to 1.000	100	100	> 342.5

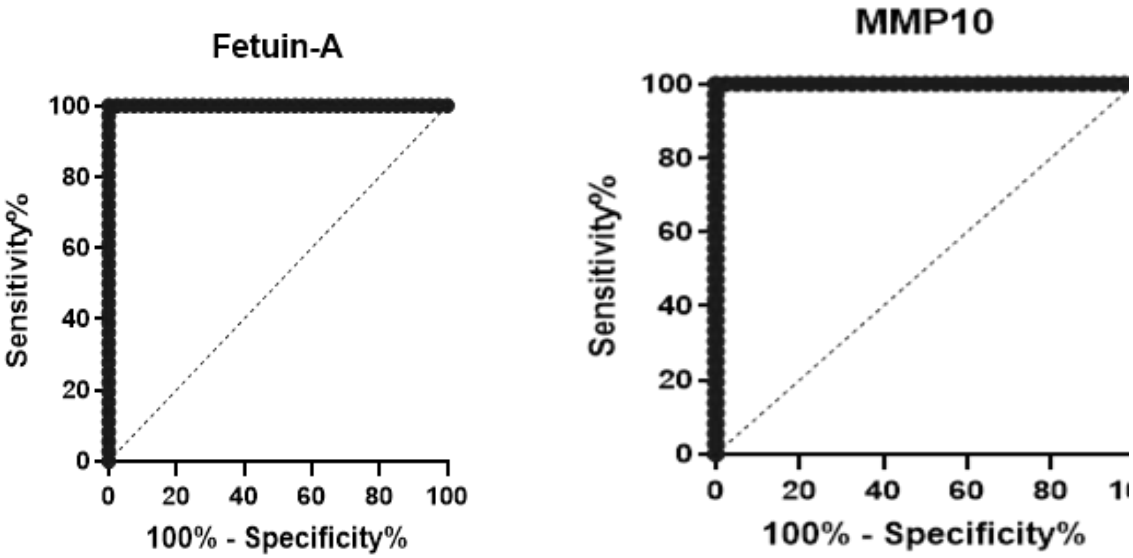

Figure 5: ROC curve analysis of MMP10 and Fetuin-A in the macroalbuminuria group

Discussion

Numerous investigations have been conducted to determine the etiologies of DN, tubular and glomerular impairment, and fibrosis, as well as to predict these disorders early by measuring associated variables (29, 30).

The current study included determining Matrix Metalloproteinase10 (MMP-10) and Fetuin-A, in T2DM patients and the renal complications of diabetes. The above indicators point to the emergence of problems caused by diabetes. Risk factors for DN include inflammation, fibrosis, and high blood sugar (31).

The results of the present study indicated the presence of disturbances in lipid levels in T2DM patients

compared to healthy individuals. These disorders are characterized by a decrease in the level of HDL-C and an increase in the levels of LDL-C, triglycerides, and cholesterol.

The current study found that MMP-10 and Fetuin-A were considerably higher among all study groups. These results are supported by the results of ROC findings, which confirmed the high sensitivity of both these factors to this case of kidney disorders. Moreover, ROC outcomes are in agreement with several previous studies (2), (3).

The disturbance in lipids is associated with T2DM and obesity, as the breakdown of fats into glycerol and free fatty acids leads to increased inflammation as a result of the metabolic changes that can occur as a consequence of obesity development (32).

Chronic DN is attributed to the damage in the glomerular cells, which results in an elevated level of MMP10. This can be a good indicator in monitoring disease progression (33). The results of the current study revealed a highly significant increase in Fetuin-A in all patient groups compared to controls. Moreover, it found highly significant differences among the patient groups themselves, which may be attributed to the presence of an association between Fetuin-A and insulin resistance, obesity or liver disease (34). It was found that Fetuin A has a basic role in many conditions, like T2DM, insulin resistance, non-alcoholic liver disease, cardiovascular diseases, tumors, and brain diseases, in addition to metabolic disorders (35). Fetuin A is utilized as a biomarker in certain cancers, as it functions as a regulator of the inflammation that accompanies cancer, in addition to several other mechanisms, such as regulating cell growth pathways, cell adhesion, and disease invasion (16). Fetuin-A is also related to metabolic disorders associated with thyroid disorders (36), in addition to its association with obesity and insulin resistance in T2DM (37).

The MMP-10 is an enzyme that breaks down the extracellular matrix that provides structural support to tissues. The current study revealed a highly significant increase in MMP 10 in all patient groups compared to controls. Furthermore, highly significant differences were found between normo-albumimuria and both micro and macro albumimuria groups, but no significant differences between micro and macro groups. These outcomes specify that MMP-10 could be a primary biomarker for this disease, with levels increasing significantly from the earliest stages of the disease when compared to healthy individuals (33).

Conclusion

Fetuin-A and matrix metalloproteinase 10 can be significant indicators for the early prediction of diabetes and diabetic nephropathy, corroborated by ROC analysis demonstrating their high sensitivity and specificity for the disease.

Authors' Declarations

We confirm that all the Figures and Tables in the manuscript belong to the current study. Besides, the Figures and images, which do not belong to the current study, have been given permission for re-publication attached to the manuscript. The authors signed on ethical considerations. Approval-Ethical Clearance: The project was approved by the local ethical committee in (Place where the research was conducted or samples collected and treated) according to the code number (CSW-REC1005) on (29/ 7/ 2025).

Conflict of Interest: None

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Data availability: Upon reasonable request, the corresponding author will make the data sets generated and/or analyzed during the current work available.

Authors' Contributions:

Study conception & design: Hiba H. Ismail, Kadhim K. Ghudhaib. Literature search: Hiba H. Ismail. Data acquisition& Data analysis: (Hiba H. Ismail). Manuscript preparation, editing & review: Hiba H. Ismail, Kadhim K. Ghudhaib, Ali A. Dyab Allawi

References

1.Amelia R, Sari DK, Muzasti RA, Fujiati II, Wijaya H. Early detection of diabetic nephropathy based on albumin creatinine ratio (ACR) in type 2 diabetes mellitus patients in Medan, Indonesia. Family Medicine Primary Care Review. 2021;23(2). https://doi.org/10.5114/fmpcr.2021.105903

2. Ibrahim RK, Ghudhaib KK, Allawi AAD. Early prediction of nephropathy in Iraqi patient with diabetes type II by evaluating some relevant biochemical factors. Baghdad Sci J 2024;21(5):1549-. https://doi.org/10.21123/bsj.2023.8008

3. Salmana ZA, Ghudhaiba KK, Fadhilb R. Evaluating Osteocalcin and Osteonectin in serum male patients with type 2 Diabetes mellitus and periodontitis. Eurasian Chemical Communications. 2022;4(2022):295-302. https://doi.org/10.22034/ecc.2022.325049.1307

4. Mohammed SK, Taha EM, Muhi SA. A case-control study to determination FBXW7 and Fetuin-A levels in patients with type 2 diabetes in Iraq. J Diabetes & Metab Disord. 2021;20(1):237-43. https://doi.org/10.1007/s40200-021-00738-x

5. Jaid HK, Khaleel FM, Salman IN, Abd BA. Estimation of Apelin Levels in Iraqi Patients with Type II Diabetic Peripheral Neuropathy. Baghdad Sci J 2023;20(5):1684-91. https://doi.org/10.21123/bsj.2023.7566

6. Farhan LO, Abed BA, Dawood A. Comparison Study between Adipsin Levels in Sera of Iraqi Patients with Diabetes and Neuropathy. Baghdad Sci

J. 2023;20(3):726-33. https://doi.org/10.21123/bsj.2022.7408
7. Kyrou I, Tsigos C, Mavrogianni C, Cardon G, Van Stappen V, Latomme J, et al. Sociodemographic and lifestyle-related risk factors for identifying vulnerable groups for type 2 diabetes: a narrative review with emphasis on data from Europe. BMC Endocrine Disorders. 2020;20(1):134. https://doi.org/10.1186/s12902-019-0463-3
8. Meenakshi S, Bahekar T, Narapaka PK, Pal B, Prakash V, Dhingra S, et al. Impact of fluorosis on molecular predictors in pathogenesis of type 2 diabetes associated microvascular complications. Trace Elem. Med. Biol. 2024;86:127506. https://doi.org/10.1016/j.jtemb.2024.127506
9. Taub PR, Greene SJ, Fudim M. The role of finerenone in the concomitant management of chronic kidney disease-type 2 diabetes and the implication for heart failure prevention and treatment. Heart Failure Reviews. 2025. https://doi.org/10.1007/s10741-025-10520-3
10. Shan J, Ziyi C, and Yu S. Advances in Understanding Diabetic Kidney Disease Progression and the Mechanisms of Acupuncture Intervention. Int J Gen Med. 2024;17(null):5593-609. https://doi.org/10.2147/IJGM.S490049
11. Folestad E, Mehlem A, Ning FC, Oosterveld T, Palombo I, Singh J, et al. Vascular endothelial growth factor B-mediated fatty acid flux in the adipose-kidney axis contributes to lipotoxicity in diabetic kidney disease. Kidney International. 2025;107(3):492-507. https://doi.org/10.1016/j.kint.2024.11.026
12. Mohamed ON, Mohamed MRM, Hassan IG, Alakkad AF, Othman A, Setouhi A, et al. The Relationship of Fetuin-A with Coronary Calcification, Carotid Atherosclerosis, and Mortality Risk in Non-Dialysis Chronic Kidney Disease. Journal of lipid and atherosclerosis. 2024;13(2):194-211. https://doi.org/10.12997/jla.2024.13.2.194
13. Rigal S, Casas B, Kanebratt KP, Wennberg Huldt C, Magnusson LU, Müllers E, et al. Normoglycemia and physiological cortisone level maintain glucose homeostasis in a pancreas-liver microphysiological system. Communications Biology. 2024;7(1):877. https://doi.org/10.1038/s42003-024-06514-w
14. Chekol Abebe E, Tilahun Muche Z, Behaile T/Mariam A, Mengie Ayele T, Mekonnen Agidew M, Teshome Azezew M, et al. The structure, biosynthesis, and biological roles of fetuin-A: A review. Frontiers in Cell and Developmental Biology. 2022; 10 - 2022:01-18. https://doi.org/10.3389/fcell.2022.945287
15. Icer MA, Yıldıran H. Effects of fetuin-A with diverse functions and multiple mechanisms on human health. Clinical Biochemistry. 2021;88:1-10. https://doi.org/10.1016/j.clinbiochem.2020.11.004
16. Odiase P, Ma J, Ranganathan S, Ogunkua O, Turner WB, Marshall D, et al. The Role of Fetuin-A in Tumor Cell Growth, Prognosis, and Dissemination. Inte J Mol Sci. 2024;25(23). https://doi.org/10.3390/ijms252312918
17. Pagan LU, Gatto M, Martinez PF, Okoshi K, Okoshi MP. Biomarcadores em Doenças Cardiovasculares: O Papel da Fetuína-A. Arquivos Brasileiros de Cardiologia. 2022;118. https://doi.org/10.36660/abc.20210980
18. Dogru T, Kirik A, Gurel H, Rizvi AA, Rizzo M, Sonmez A. The Evolving Role of Fetuin-A in Nonalcoholic Fatty Liver Disease: An Overview from Liver to the Heart. Int J Mol Sci. 2021;22(12). https://doi.org/10.3390/ijms22126627
19. Magalhães P, Zürbig P, Mischak H, Schleicher E. Urinary fetuin-A peptides as a new marker for impaired kidney function in patients with type 2 diabetes. Cln Kidney J. 2021;14(1):269-76. https://doi.org/10.1093/ckj/sfaa176
20. Wagner R, Machann J, Guthoff M, Nawroth PP, Nadalin S, Saleem MA, et al. The protective effect of human renal sinus fat on glomerular cells is reversed by the hepatokine fetuin-A. Scientific Reports. 2017;7(1):2261. https://doi.org/10.1038/s41598-017-02210-4
21. Bourebaba L, Marycz K. Pathophysiological Implication of Fetuin-A Glycoprotein in the Development of Metabolic Disorders: A Concise Review. Journal of Clinical Medicine. 2019;8(12). https://doi.org/10.3390/jcm8122033
22. Mehrotra R, Westenfeld R, Christenson P, Budoff M, Ipp E, Takasu J, et al. Serum fetuin-A in nondialyzed patients with diabetic nephropathy: Relationship with coronary artery calcification. Kidney International. 2005;67(3):1070-7. https://doi.org/10.1111/j.1523-1755.2005.00172.x
23. Poznyak AV, Sadykhov NK, Kartuesov AG, Borisov EE, Sukhorukov VN, Orekhov AN. Atherosclerosis Specific Features in Chronic Kidney Disease (CKD). Biomedicines. 2022;10(9). https://doi.org/10.3390/biomedicines10092094
24. Sun X, Liu Y. Matrix Metalloproteinase-10 in Kidney Injury Repair and Disease Inte J Mol Sci. 2022;23(4). https://doi.org/10.3390/ijms23042131
25. Garcia-Fernandez N, Jacobs-Cachá C, Mora-Gutiérrez JM, Vergara A, Orbe J, Soler MJ. Matrix Metalloproteinases in Diabetic Kidney Disease. J Clin Med. 2020;9(2). https://doi.org/10.3390/jcm9020472
26. Li B, Shaikh F, Younes H, Abuhalimeh B, Zamzam A, Abdin R, et al. Matrix Metalloproteinases 7 and 10 Are Prognostic Biomarkers for Systemic Cardiovascular Risk in Individuals with Peripheral Artery Disease. Biomolecules. 2025;15(6). https://doi.org/10.3390/biom15060853
27. Molière S, Jaulin A, Tomasetto C-L, Dali-Youcef N. Roles of Matrix Metalloproteinases and Their Natural Inhibitors in Metabolism: Insights into Health and Disease. Inte J Mol Sci. 2023;24(13):10649. https://doi.org/10.3390/ijms241310649
28. Mora-Gutiérrez JM, Rodríguez JA, Fernández-Seara MA, Orbe J, Escalada FJ, Soler MJ, et al. MMP-10 is Increased in Early Stage Diabetic Kidney Disease and can be Reduced by Renin-Angiotensin

System Blockade. Scientific Reports. 2020;10(1):26. https://doi.org/10.1038/s41598-019-56856-3
29. Ahmad J. Management of diabetic nephropathy: Recent progress and future perspective. Diabetes & Metabolic Syndrome: Clinical Research & Reviews. 2015;9(4):343-58. https://doi.org/10.1016/j.dsx.2015.02.008
30. Lv Y, Ye C, Li Z, Ye J, Cao H, Zhang C, et al. Tubular Injury in Diabetic Kidney Disease: Early Diagnosis and Intervention Strategies. Diabetes/Metabolism Research and Reviews. 2025;41(7):e70098. https://doi.org/10.1002/dmrr.70098
31. Chen Y, Lee K, Ni Z, He John C. Diabetic Kidney Disease: Challenges, Advances, and Opportunities. Kidney Diseases. 2020;6(4):215-25. https://doi.org/10.1159/000506634
32. A. Mitkees N, M. El-Sayed H, M. Gad A, H. Mansour H, A. Mohamed N. FETUIN A AS AN EARLY MARKER OF DIABETIC NEPHROPATHY IN PATIENTS WITH TYPE 2 DIABETES MELLITUS. Al-Azhar Medical Journal. 2020;49(2):785-96. https://doi.org/10.21608/amj.2020.82592
33. Zuo Y, Wang C, Sun X, Hu C, Liu J, Hong X, et al. Identification of matrix metalloproteinase-10 as a key mediator of podocyte injury and proteinuria. Kidney International. 2021;100(4):837-49. https://doi.org/10.1016/j.kint.2021.05.035
34. Öner-İyidoğan Y, Koçak H. Interaction of fetuin-A with obesity related insulin resistance and diabetes mellitus. Turkish Journal of Biochemistry. 2025;50(2):170-82. https://doi.org/10.1515/tjb-2024-0235
35. Jahnen-Dechent W, Heiss A, Schäfer C, Ketteler M, Towler DA. Fetuin-A Regulation of Calcified Matrix Metabolism. Circulation Research. 2011;108(12):1494-509. https://doi.org/10.1161/CIRCRESAHA.110.234260
36. Lafta BT, Aubaid SH, Falih ES. Serum Levels of FABP4 and Fetuin-A as Potential Biomarkers in Thyroid Diseases: A Comparative Study. Al-Rafidain Journal of Medical Sciences (ISSN 2789-3219). 2025;8(2(Special)):S1-7. https://doi.org/10.54133/ajms.v8i2(Special).1362
37. Öner-İyidoğan Y, Koçak H. Interaction of fetuin-A with obesity related insulin resistance and diabetes mellitus. 2025;50(2):170-82. https://doi.org/10.1515/tjb-2024-0235

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تحديد مستويات إنزيم ماتريكس ميتالوبروتيناز 10 والفيتوين-أ كعوامل تنبؤية ممتازة لدى مرضى السكري العراقيين المصابين بإعتلال الكلية

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الخلاصة

خلفية البحث: يعد اعتلال الكلية السكري عاملا رئيسيا في الفشل الكلوي في مرحلته النهائية لدى مرضى السكري من النوع الثاني. يتميز اعتلال الكلية السكري بضمور أنبوبي، وتوسع كبيبات، وتصلب كبيبات، وتليف خلالي، وبروتينية في البول، مما يؤدي إلى تدهور وظائف الكلى. يعزى اعتلال الكلية السكري، الناتج أساسا عن ارتفاع سكر الدم، إلى ملايين الوفيات عالميا، وهو السبب الرئيسي لمرض الكلى في مرحلته النهائية.

الاهداف: تحديد مستويات إنزيم ماتريكس ميتالوبروتيناز 10 والفيتوين-أ كعوامل تنبؤية ممتازة لدى مرضى السكري العراقيين المصابين بإعتلال الكلية.

المنهجية: أجريت هذه الدراسة في مستشفى بغداد التعليمي بمدينة الطب، بين آب وكانون الأول 2024، على 143 من الذكور والإناث الذين تتراوح أعمارهم بين 35 و65 عاما. قسموا إلى أربع مجموعات بناء على المعايير التالية: نسبة الألبومين إلى الكرياتينين (ACR). شمل المسح الإجمالي 35 حالة من البول الألبوميني الطبيعي، و33 حالة من البول الألبوميني الدقيق، و35 حالة من البول الألبوميني الكبير، و40 فردا سليما كمجموعة ضابطة. استخدمت تقنيات مطياف ضوئي تلقائي لتقدير مستويات حمض اليوريك ومستويات الدهون. تم قياس الهيموغلوبين السكري (HbA1c) باستخدام جهاز I-chroma device، كما تم قياس مستويات فيتوين-أ إنزيم ماتريكس ميتالوبروتيناز 10 في المصل باستخدام اختبار ELISA.

النتائج: أشارت النتائج إلى أن مستويات الفيتوين-أ ، (110.6±4.22) ,(356.7±13.11) ,(270.1±3.91) ,234.3±3.11) ومستويات إنزيم ماتريكس ميتالوبروتيناز 10 (209.5±10.12) ,(522.3±19.61) ,(523.3± 17.01) ,(316.5± 10.11) كانت أعلى بشكل ملحوظ في مجموعات المرضى مقارنة بالمجموعة الضابطة. بالإضافة إلى ذلك، أشار جميع المرضى إلى زيادة مستويات الدهون الثلاثية والكوليسترول مقارنة بالضوابط الصحية.

أظهرت النتائج فروقا كبيرة في مستويات فيتوين-أ234.3±3.11)،(356.7±13.11) (270.1±3.91) ، (110.6±4.22) وإنزيم ماتريكس ميتالوبروتيناز 10 (316.5± 10.11)،(522.3±19.61) (523.3± 17.01) ، (209.5±10.12) في مجموعات المرضى مقارنة بمجموعات الضبط على التوالي. أظهر المرضى مستويات مرتفعة من الدهون الثلاثية والكوليسترول مقارنة بالمجموعة السليمة.

الإستنتاجات: أظهرت هذه الدراسة أن إنزيم ماتريكس ميتالوبروتيناز 10 والفيتوين-أ يعدان مؤشرين تشخيصيين ممتازين للتنبؤ بالعلامات الأولى لاعتلال الكلية السكري.

الكلمات المفتاحية: نسبة الألبومين إلى الكرياتينين؛ داء السكري؛ اعتلال الكلية السكري؛ فيتوين-أ؛ إنزيم ماتريكس ميتالوبروتيناز 10.