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The role of kynurenine and tenascin C in Iraqi patients with type 2 diabetes

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Abstract

Kynurenines show a great many natural activities (which are frequently differentiating, for example, cytotoxic/cytoprotective, oxidant/cell reinforcement or supportive of/mitigating. The net impact relies upon their nearby fixation, cell climate, as well as intricate positive and negative criticism circles. The awkwardness among gainful and unsafe kynurenines was ensnared in the pathogenesis of different neurodegenerative problems, mental ailments and metabolic issues, including diabetes mellitus. The aim of this study is to know the effect of diabetes on both Kynurenine and Tenascin C when compared to healthy people and vice versa. A study was conducted on 60 individuals aged 35-50 years, including 20 healthy individuals, and 40 individuals with chronic diabetes. Lipid profile, Uric acid, Urea, Creatinine were measured by spectrophotometer. While HbA1c was measured by iChroma. Insulin test uses a sandwich immunodetection method, while kynurenine. tenascin c by Elisa kits. The results showed Significant differences ($P \leq 0.001$) between the studied groups and healthy individuals, as we note an increase in both Kynurenine and Tenascin c in patients. Conclusion Kynurenine and tensin-C may be a good biomarker for the diagnosis of diabetes.

Introduction

Diabetes mellitus (DM) is likely one of the most seasoned illnesses known to man [1]. Kynurenines show a great many natural activities (which are frequently differentiating, for example, cytotoxic/cytoprotective, oxidant/cell reinforcement or supportive of/mitigating. The net impact relies upon their nearby fixation, cell climate, as well as an intricate positive and negative criticism circles [2]. General, DMT2 In patients often show increased kynurenine metabolism with decreased tryptophan and elevated levels of subsequent metabolites along the KYN pathway tryptophan levels were shown to be associated with decreased insulin secretion and insulin sensitivity as well as increased DMT2 susceptibility. The awkwardness among gainful and unsafe kynurenines was ensnared in the pathogenesis of different neurodegenerative problems, mental ailments and metabolic issues, including diabetes mellitus [3].

Tenascin-C (TNC) is a large hexametric extracellular matrix glycoprotein that is sparsely expressed in normal tissue but transiently expressed at specific sites during inflammation, wound healing, and cancer invasion [4].Increasing evidence has shown the diverse functions

of TNC, particularly its proinflammatory and profibrotic functions [5].Furthermore, TNC is known to be one of the early markers of inflammation and progressing fibrosis in various tissue types, such as the heart [6]. It has been reported that TGF-β-mediated fibrosis in bleomycin-induced lung injury was suppressed in TNC-deficient mice [7]. Several biomarkers that regulate food intake and energy expenditure play vital roles in the development of atherosclerosis by regulating chronic endothelial inflammation in diabetic patients. Different serum TNC concentrations may be able to indicate the different progression of long-term complications, which has indicative functions for secondary and tertiary prevention of diabetes in humans, TNC was almost undetected in normal lungs but significantly upregulated in fibrotic lungs, such as in idiopathic pulmonary fibrosis and chronic hypersensitivity pneumonitis [8].

This study aims to evaluate the levels of kynurenine, tenascin C, and selected biochemical parameters in type 2 diabetes patients.

Materials and Methods

The study was conducted on 60 individuals aged 35–50 years, including 20 healthy individuals who did not take dietary supplements and nutritional supplements, and 40 individuals with chronic diabetes. The Samples were collected from Abu Ghraib General hospital in Baghdad city from October 2024 to February 2025 in Abu Ghraib area, Iraq, for both patients and healthy individuals. 5 ml blood samples were drawn from the patient and controls intravenously using a plastic needle and collected in a regular cylinder. Then the serum was isolated and stored at -20 °C until testing. Fast blood glucose (FBG) was measured by spectrophotometric method, and HbA1c was measured by iChroma. The insulin test uses a sandwich immunodetection method; the reagent antibodies in the buffer bind to the antigen in the sample, form antigen-antibody complexes, and migrate to a nitrocellulose matrix to be captured by other antibodies immobilized on the test strip. Kynurenine and tenascin C were measured. Hypasocin by ELISA Kit: The ELISA kit uses the sandwich ELISA method. The micro ELISA strip plate provided in this kit is pre-coated with a kynurenine-specific antibody. Standards or samples are added to the appropriate micro ELISA strip plate wells and combined with the specific antibody. The groups were divided into three groups:

B1. People with a BMI of (20-24.9)
B2. People with a BMI of (25-29.9)
B3. People with a BMI of (30-35)

Statistically Analysis

Data was analyzed by SPSS 23 statistical test /Student's t-test. The probability: ($P<0.001$=highhly significant) ($P>0.05$ = nonssignificant). Receiver operatizing characteristic (ROC)

Result and Discussion

HbA1c, FBG and Insulin

Table1 showed thelevels HbA1c, FBG and insulin levels in the serum of the control group (healthy), and the serum of patients. Results showed there were a statistically significant ($P\leq0.001$) in patients group compared with control group.

Table 1 : HbA1c, FBG and Insulin levels

Parameters	Mean ± SD of		P value
	Control	Patients	
HbA1c (%)	5.00±0.38	8.5±1.8	≤0.001
FBG (mg/dL)	98.55±12.90	193.5±52.5	≤0.001
Insulin	8.59±1.55	2.9±0.7	≤0.001

The studied results, as shown in Table 1 indicated the presence of a significant significant difference for (HbA1c), as well as for fasting blood glucose (FBG), and also for insulin for patients when compared to the healthy group, as the glucose (HbA1c) for the patients group was (8.5 ± 1.8), while the healthy group was (5.00 ± 0.38) with a significant difference value (P ≤ 0.001). These results are consistent with studies that say that (HbA1c) glycated hemoglobin is one of the indicators of chronic high blood sugar and disease developments [9]. On this basis, blood sugar levels were much higher for patients, as they were (193.5 ± 52.5 mg/dL) when compared to the healthy group, which was (98.55 ± 12.90 mg/dL), where there was a significant difference (P ≤ 0.001). This large increase indicates a problem in the metabolic processes in the body of the diabetic patient, as this sign is considered a vital indicator of diabetes, while we notice a significant decrease in the value of insulin for patients, as it was (2.9 ± 0.7) when compared to the healthy group, which was (8.59 ± 1.55), and this is consistent with [10]. which indicates the presence of a small secretion of insulin in the beta cells in the islets of Langerhans and insulin resistance, which is considered a vital indicator [11]. as it is known that the older the patient gets, the less insulin secretion from the beta cells decreases, which tends to increase the blood sugar level, which ultimately leads to damage to the small blood vessels, which has been confirmed by international research [12]. It is known that the higher the blood sugar level, the more it indicates a lack of insulin secretion or insulin resistance, as the cumulative sugar level (HbA1c) is more than 6.5, which indicates high blood sugar, which leads to future diseases such as cardiovascular diseases, kidney diseases, and diabetic retinopathy [13]. The study should be broader in future studies, and many factors should be taken into consideration, such as sample size, physical activity, and other diseases.

Kynurenine

Table 2 showed the mean (±SD) of the levels of Kynurenine level in the serum of the control group (healthy), and the serum of patients. Results showed there were This study showed that there was no significant difference between the three groups regarding the BMI groups, as B1 was (52.13 ± 3.14), while B2 was (47.19 ± 0.88), while B3 was (46.61 ± 2.96), i.e. there was no significant difference (P>0.05), but at the same time we notice a slight increase in B1, but there was a significant difference between these groups and the control group by (P<0.001) according to the following table.

Table 2: Kynurenine level

Groups (Kynurenine)		Mean ±SD of kynurenine (ng/ml)	
		Control	Patients
Total		29.40 ±1.62	48.77 ±1.23
P-value		52.1<0.01	
BMI (kg/m^2)	B1: 20-24.9	52.13 ±3.14	
	B2: 25-29.9	47.19 ±0.88	
	B3: 30-35	46.61 ±2.9	
P-value		>0.05	

The study also showed, as shown in the table above, high significant differences in kynurenine levels between the values of people with diabetes and healthy people, as the value of the sick people was (48.77 ± 1.23 ng/mL) while the value of healthy people was (29.40 ± 1.62 ng/mL), there was a large significant difference with a value of ($P \leq 0.01$). This study was similar to global studies that indicated that high diabetes in patients is closely linked to high kynurenine levels, which may be due to several reasons, most notably oxidative stress [14], but the differences in the groups of diabetic patients may vary according to the conditions studied and life style. This study also showed that people with normal weight who have diabetes have a high percentage of kynurenine which is due to metabolic processes resulting from tryptophan which is due to oxidative stress and inflammation [15], and in people who fall into group (B2) with a body mass index (52.13 ± 3.14 ng/mL) in which there are two factors at the same time, which are overweight and diabetes on the percentage of kynurenine, while group (B3) patients with diabetes had a body mass index (46.61 ± 2.9 ng/mL) that was not significantly different from healthy people whose body mass index value was (47.19 ± 0.88 ng/mL) when the significant value was ($P > 0.05$). My father points out that people who have diabetes and also a major trait have different metabolic processes due to obesity which affects the kynurenine pathway [16], which is different from the two groups of diabetics B1 and B2 which indicated that diabetes affects in one way or another the kynurenine metabolic processes even if the body mass index was not calculated due to the role of kynurenine in inflammatory processes. This study of diabetic patients indicates that the kynurenine levels in diabetic patients are considered a vital sign and indicator for diabetic patients in the complications of this disease and the causes that result from it [17]. This study agrees with international studies that say that the high kynurenine levels in diabetic patients are due to oxidative stress resulting from metabolic processes, as other studies have shown [18]. In addition to that, it must be noted that other dynamic factors were not taken into account, such as the use of medications and other causes.

C-Tenascin c

Table 3 showed the Tenascin c levels in the serum of the control group (healthy) and the serum of patients. The results showed that there were no significant differences between the three groups with regard to the body mass index groups, as B1 was (2.73 ± 0.16), while B2 was (3.38 ± 0.24), while B3 was (3.04 ± 0.34) meaning that there was no significant difference ($P>0.05$) for Tenascin c, but there was a significant difference between these groups and the control group by ($P<0.001$), as shown in the Table 3.

Table 3: Tenascin c level

Groups (Tenascin c)		Mean ±SD of Tenascin c (ng/mL)	
		Control	Patients
Total		2.01 ±0.15	3.09 ±0.15
P-value		<0.01	
BMI (kg/m^2)	B1: 20-24.9	2.73 ±0.16	
	B2: 25-29.9	3.38 ± 0.24	
	B3: 30-35	3.04 ± 0.34	
P-value		>0.05	

In this study, the results differ from other studies that indicated high levels of tenascin-C, as average level of tenascin-C in patients was (3.09 ± 0.15 ng/mL) higher than the average level of healthy individuals, which was (2.01 ± 0.15 ng/mL), (delete). This is consistent with the evidence that reveals the association of diabetes with the formation of extracellular inflammation, which increases the value of tenascin-C [19].

Also, this study group B1 which had a body mass index ratio in normal weight also had high levels of tenascin-C which were (2.73 ± 0.16 ng/mL) for diabetics when compared to healthy people. These results indicate that even people who have a normal weight diabetes affects the value of tenascin-C levels which are a result of chronic inflammation and increased blood sugar level [20]. (while the second group B2 was (25-29.9 kg/m2) the value of tenascin-C was high as it was (3.38 ± 0.24 ng/mL) which was more or higher group in proportion to the studied groups for diabetes while group (B3) which was (30-35 kg/m2) there was no significant difference between this group and healthy individuals (P value > 0.05) may indicate that in obesity, factors such as adipose tissue inflammation may independently regulate tenascin-C expression, reducing the distinct effect of diabetes in this subgroup [21]. Tenascin-C is a cytosolic protein drawn in with tissue overhauling, disturbance, and fix processes.

The brought levels saw up in diabetic patients suggest its actual limit as a biomarker of disturbance and cardiovascular bet in diabetes. The most raised levels in the overweight subgroup (B2) may reflect a fundamental edge where combined metabolic and provocative stressors drive changes in the extracellular organization. The deficit of gigantic differences in the fat get-together (B3) warrants further assessment to make sense of the gig of weight in the rule of tenascin-C. The saw ascent of tenascin-C levels among diabetic patients is unsurprising with past investigation interfacing hyperglycemia, oxidative tension, and extended tenascin-C explanation [22]. Besides, (delete)have definite a positive relationship among BMI and tenascin-C levels, especially in overweight individuals, supporting the continuous revelations This study has a couple of obstructions, including its cross-sectional arrangement and the shortfall of data on glycemic control (HbA1c). (delete) Future assessment should integrate longitudinal examinations to research the strong association between tenascin-C levels, diabetes, and strength, and to investigate potential supportive interventions zeroing in on tenascin-C [23].

Conclusions

The outcomes affirm the job of diabetes in raising kynurenine levels, especially in non-large and overweight people. These discoveries feature the capability of kynurenine as a biomarker of metabolic and provocative dysregulation in diabetic patients, justifying further examination concerning remedial procedures focusing on this pathway. The outcomes show that diabetes fundamentally raises tenascin-C levels, especially in typical weight and overweight people. This features the capability of tenascin-C as a biomarker of extracellular network redesigning and irritation in diabetic patients. Further investigations are expected to clarify the instruments hidden these perceptions and their suggestions for diabetes the board. Type 2 diabetes is high blood glucose levels brought about by an absence of a compound called insulin. Either your body doesn't make enough or the insulin it accomplishes make doesn't fill in as well as it ought to. This is once in a while called insulin obstruction. An absence of insulin causes glucose from what you gobble or drink to develop in your blood. For this reason, you might encounter the symptoms of type 2 diabetes.

References

1. Gellen B, Thorin-Trescases N, Sosner P et al (2019) ANGPTL2 is associated with an increased risk of cardiovascular events and death in diabetic patients. Diabetologia 59(11):2321

2. Saulnier, P. J., Gand, E., Ragot, S., Ducrocq, G., Halimi, J. M., Hulin-Delmotte, C., ... & SURDIAGENE Study Group. (2024). Association of serum concentration of TNFR1 with all-cause mortality in patients with type 2 diabetes and chronic kidney disease: follow-up of the SURDIAGENE Cohort. *Diabetes care*, *37*(5), 1425-1431.

3. Looker HC, Colombo M, Agakov F et al (2015) Protein biomarkers for the prediction of cardiovascular disease in type 2 diabetes. Diabetologia 58(6):1363–1371

4. Olokoba, A. B., Obateru, O. A., & Olokoba, L. B. (2012). Type 2 diabetes mellitus: a review of current trends. Oman medical journal, 27(4), 269.

5. Azevedo, M., & Alla, S. (2008). Diabetes in sub-saharan Africa: kenya, mali, mozambique, Nigeria, South Africa and zambia. International journal of diabetes in developing countries, 28(4), 101.

6. Chamnan, P., Simmons, R. K., Forouhi, N. G., Luben, R. N., Khaw, K. T., Wareham, N. J., & Griffin, S. J. (2021). Incidence of type 2 diabetes using proposed HbA1c diagnostic criteria in the European Prospective Investigation of Cancer–Norfolk cohort: implications for preventive strategies. Diabetes care, 34(4), 950-956.

7. Imanaka-Yoshida, K.; Tawara, I.; Yoshida, T. Tenascin-C in cardiac disease: A sophisticated controller of inflammation, repair, and fibrosis. Am. J. Physiol. Cell Physiol. 2020, 319, C781–C796.

8. Yonebayashi, S.; Tajiri, K.; Hara, M.; Saito, H.; Suzuki, N.; Sakai, S.; Kimura, T.; Sato, A.; Sekimoto, A.; Fujita, S.; et al. Generation of Transgenic Mice that Conditionally Overexpress Tenascin-C. Front. Immunol. 2021, 12, 620541.

9. Care, D. (2023). Standards of care in diabetes—2023. Diabetes care, 46, S1-S267.

10. Handelsman, Y., Jellinger, P. S., Guerin, C. K., Bloomgarden, Z. T., Brinton, E. A., Budoff, M. J., ... & Wyne, K. L. (2020). Consensus statement by the American Association of Clinical Endocrinologists and American College of Endocrinology on the management of dyslipidemia and prevention of cardiovascular disease algorithm–2020 executive summary. Endocrine practice, 26(10), 1196-1224.

11. Yong, J., Johnson, J. D., Arvan, P., Han, J., & Kaufman, R. J. (2021). Therapeutic opportunities for pancreatic β-cell ER stress in diabetes mellitus. Nature Reviews Endocrinology, 17(8), 455-467.
12. Halcox, J. P., Schenke, W. H., Zalos, G., Mincemoyer, R., Prasad, A., Waclawiw,
M. A& Quyyumi, A. A. (2022). Prognostic value of coronary vascular endothelial dysfunction. Circulation, 106(6), 653-658.
13. Guardado-Mendoza, R., Garcia-Magaña, M. A., Martínez-Navarro, L. J., Macías-Cervantes, H. E., Aguilar-Guerrero, R., Suarez-Perez, E. L., & Aguilar-Garcia, A. (2022). Effect of linagliptin plus insulin in comparison to insulin alone on metabolic control and prognosis in hospitalized patients with SARS-CoV-2 infection. Scientific reports, 12(1), 536.
14. Redza-Dutordoir, M., & Averill-Bates, D. A. (2016). Activation of apoptosis signalling pathways by reactive oxygen species. *Biochimica et Biophysica Acta (BBA)-Molecular Cell Research*, *1863*(12), 2977-2992..
15. Kannan, S. P. A. S., Ali, P. S. S., Sheeza, A., & Hemalatha, K. (2020). COVID-19 (Novel Coronavirus 2019)-recent trends. *Eur Rev Med Pharmacol Sci*, *24*(4), 2006-2011.
16. Rana, A. K., Bhatt, B., Gusain, C., Biswal, S. N., Das, D., & Kumar, M. (2025). Neuroimmunometabolism: How Metabolism Orchestrates Immune Response in Healthy and Diseased Brain. American Journal of Physiology-Endocrinology and Metabolism.
17. De Oliveira, F. R., Fantucci, M. Z., Adriano, L., Valim, V., Cunha, T. M., Louzada-Junior, P., & Rocha, E. M. (2018). Neurological and inflammatory manifestations in Sjögren's syndrome: the role of the kynurenine metabolic pathway. International Journal of Molecular Sciences, 19(12), 3953.
18. Kozieł, K., & Urbanska, E. M. (2023). Kynurenine pathway in diabetes mellitus—novel pharmacological target?. Cells, 12(3), 460.
19. Berdiaki, A., Neagu, M., Tzanakakis, P., Spyridaki, I., Pérez, S., & Nikitovic, D. (2024). Extracellular matrix components and mechanosensing pathways in health and disease. Biomolecules, 14(9), 1186.
20. Lu, H. C., Dai, W. N., & He, L. Y. (2021). Epigenetic histone modifications in the pathogenesis of diabetic kidney disease. Diabetes, Metabolic Syndrome and Obesity, 329-344..
21. Ren, J., Wu, N. N., Wang, S., Sowers, J. R., & Zhang, Y. (2021). Obesity cardiomyopathy: evidence, mechanisms, and therapeutic implications. Physiological reviews, 101(4), 1745-1807.
22. Alves, P. T., de Souza, A. G., Bastos, V. A. F., Miguel, E. L., Ramos, A. C. S., Cameron, L. C., ... & Cunha, T. M. (2024). The Modulation of Septic Shock: A Proteomic Approach. International Journal of Molecular Sciences, 25(19), 10641.
23. Albacete-Albacete, L., Sánchez-Álvarez, M., & Del Pozo, M. A. (2021). Extracellular vesicles: an emerging mechanism governing the secretion and biological roles of tenascin-C. Frontiers in immunology, 12, 671485.24.Care, D. (2018). Medical care in diabetes 2018. Diabet Care, 41(1), S105-S118

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دور الكينورينين والتيناسين سي في مرضى السكري من النوع الثاني العراقيين

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الخلاصة:
تظهر الكينورينات العديد من الأنشطة الطبيعية (والتي غالباً ما تكون متمايزة، على سبيل المثال، سامة للخلايا/واقية للخلايا، تعزيز الأكسدة/الخلوية أو داعمة/مخففة). يعتمد التأثير الصافي على تثبيتها القريب، والمناخ الخلوي، بالإضافة إلى دائرة النقد الإيجابي والسلبي المعقدة. تم توريط الخلل بين الكينورينات المفيدة والضارة في مسببات أمراض المشكلات التنكسية العصبية المختلفة، والاضطرابات النفسية، والقضايا الأيضية، بما في ذلك داء السكري. على الرغم من العلاجات المتاحة، قد يؤدي داء السكري إلى مضاعفات خطيرة واسعة النطاق ومشكلات ميكروووعائية، بما في ذلك أمراض القلب والأوعية الدموية، وأمراض الأوعية الدقيقة، وأمراض الكلى الطرفية، واعتلال الشبكية السكري، والاعتلال العصبي اللاإرادي أو الضعف العقلي. تم إجراء دراسة على 60 فرداً تتراوح أعمارهم بين 35-50 سنة، شملت 20 فرداً أصحاء و40 فرداً يعانون من داء السكري المزمن. تم جمع الفحوصات من العيادة العامة في أبو غريب بمدينة بغداد في عام 2024 في منطقة أبو غريب، العراق. تم قياس ملف الدهون، وحمض اليوريك، واليوريا، والكرياتينين باستخدام جهاز طيف الامتصاص النوعي من نوع "آبل" المصنوع في اليابان، بينما تم قياس HbA1c باستخدام جهاز iChroma. استخدم اختبار الإنسولين طريقة الكشف المناعي الساندويتش، في حين تم قياس الكينورين والتيناسين C-باستخدام أطقم Elisa. أظهرت النتائج وجود فرق معنوي ($P \leq 0.001$) بين المجموعات المدروسة من الأفراد المصابين بالسكري والأفراد الأصحاء، في حين لم تكن هناك فروق معنوية بين المجموعات المدروسة في المؤشرات الأخرى .قد يكون الكينورين والتيناسين-C من العلامات البيولوجية الجيدة لتشخيص داء السكري.