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The Relation Among Serum Insulin Level and Some Biochemical Parameters in Both Diabetes Type I and Type II Patients

Areeg Modher Khalaf*, Moafaq Mutlak Zeidan
Department of Biology, College of Sciences, Tikrit University, Tikrit, Iraq.

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Corresponding Author

E-mail:
areeg.m.khalaf.bio2022233@st.tu.edu.iq
Mobile:

Abstract

The study evaluates the serum level of Malondialdelyde (MDA), Glutathione (GSH), blood glucose, body mass index (BMI), interlukin-33 (IL-33) in both diabetes type 1 and type 2 patients and to determine their correlation between insulin and other parameters. This study has investigated 90 blood samples for both sexes, were collected from patients with diabetes and divided into (35) blood samples from patients with type 1 diabetes (T1DM) their ages (7-40) years, (35) from patients with type 2 diabetes (T2DM) their ages (40-70) years, and (20) blood samples from healthy individuals, and their ages were comparable to that of the patients with diabetes. Samples were collected from Balad General Hospital, Al-Dhuluiyah, the city of Al-Dhuluiyah, and some outpatient medical clinics, for the period from October 2022 until February 2023. parameters which included: Insulin, interleukin -33 that measured by an Enzyme-Linked Immunosorbent Assay (ELISA) while MDA, GSH and glucose measured by Spectrophotometer. The results of the current study showed increase the level of MDA in the serum of patients with T1DM (0.15340±0.06280) μmol/L and T2DM (0.146±0.045) μmol/L in compared with control at ($P<0.05$). while a significant decrease is in insulin level for both T1DM patients (2.24±0.78) mu/l and T2DM patients (3.93±0.65) mu/l compared to the control group at ($P<0.05$), IL-33, where a significant increase in T2DM (19.09±2.74) pg/ml compared to T1DM and control (17.49±2.76, 16.06±2.43) pg/ml. Furthermore, decrease GSH in both T1DM and T2DM. While increase level of glucose in patients with T1DM, T2DM (173.06±23.10,140.63±23.27) mgldl respectively in compared to the control (87.13±6.16) mgldl. The study concluded an increase level MDA and glucose while decrease level of insulin and glutathione in both T2DM and T1DM. in addition increase Il-33 and BMI in T2DM, but decrease BMI in T1DM.

Introduction

Diabetes is a chronic disease that occurs when the pancreas is unable to produce the hormone insulin, partially or completely, or when the body is unable to effectively use the insulin produced by the pancreas as a result of insulin resistance by the muscles and liver. As a result, glucose channels close and glucose accumulates in the blood, and lead to hyperglycemia. High blood sugar is a common effect that occurs as a result of uncontrolled diabetes, and over time it leads to serious damage to many of the body's systems, especially the nerves, blood vessels, retina, and kidneys [1,2].

The prevalence of diabetes increases all over the world, and that its prevalence among peoples varies due to several factors, including age, genetics, nutrition, climate, social status, and other reasons that contribute to the occurrence of diabetes are hormonal imbalance. The presence of an imbalance in certain fats, proteins, carbohydrates, and electrolytes can result in various symptoms such as increased thirst, frequent urination, significant weight loss, elevated levels of cholesterol and triglycerides in the bloodstream, persistent hunger, and overall weakness [3,4].

Most blood glucose regulation is done by insulin [5]. Any insulin production or function problem produces diabetes, a dangerous disease [6]. Insulin is a peptide hormone that is produced and released by beta cells in the islets of Langerhans in the pancreas. The insulin hormone consists of 51 amino acids and is in the form of two peptide chains: the alpha chain and the beta chain, where the alpha chain consists of 21 amino acids, while the beta chain consists of 30 amino acids, and the two chains are linked by a disulfide bond[7].

MDA, a highly reactive and hazardous consequence of lipid peroxidation, is an organic molecule characterized by the chemical formula $CH2(CHO)2$. It exists as a colorless liquid [8]. MDA is regarded as an indicator of oxidative stress due to its accumulation, which signifies heightened lipid peroxidation and generation of reactive oxygen species (ROS) [9]. MDA is considered to be a biomarker that indicates oxidative stress caused by the oxidation of fats. Its quantification is commonly observed in various tissues, plasma, and serum during investigations related to diabetes [10]. One factor to consider is the significant influence that oxidative damage plays in the given context. The occurrence of diabetes complications is associated with elevated levels of MDA in individuals with diabetes, particularly in instances of atherosclerosis and neurological problems [11,12].

Glutathione is one of the most important non-enzymatic antioxidants. Its molecular weight is 307.3 daltons and its structural formula is $C10H17N3O6S$. It is a tripeptide made from the amino acids cysteine, glycine, and glutamine in two main enzymatic steps. Decreased GSH concentration in RBS, plasma, and monocytes of individuals with type 2 diabetes is accompanied by decreased expression of GCL, GS, GGT [13,14].

IL-33 is a member of the IL-1 family, which controls the activity of innate and adaptive immune cells in adipose tissue. IL-33 is produced primarily by many types of cells such as endothelial cells, osteoblasts, fibroblasts, and adipocytes, smooth muscle cells [15]. IL-33 also plays an important protective role in type 2 diabetes, obesity, cardiovascular disease, and many pathogenic infections [16].

The purpose of this study is to evaluate the serum level of Malondialdelyde (MDA) and insulin in both diabetes type 1 and type 2 patients and to determine their correlation between insulin and other parameters.

Materials And methods

Sample Collection

This study has investigated 90 blood samples were collected from patients with diabetes for both sex, collected from patients with diabetes and were divided into (35) blood samples from patients with type 1 diabetes (T1DM) their ages (7-40) years, (35) from patients with type 2 diabetes (T2DM) their ages (40-70) years and (20) blood samples from healthy individuals that included in this study as control group, their ages ranged from 7 years to 40 years in type 1 diabetes and from 40 to 70 years in type 2 diabetes. Samples were collected from Balad General Hospital, Al-Dhuluiyah, the city of Al-Dhuluiyah, and some outpatient medical clinics after diagnosing the disease according to the standards approved by the World Health Organization, for the period from October 2022 until February 2023. A personal interview was conducted for each person, during which a questionnaire form was filled out that included the sequence, age, height, weight, residence, gender, duration of infection, type of disease, name of treatment.

Samples for the current study were also collected by drawing 5 ml of venous blood from patients were in fasting state (both patients and healthy people). The blood samples were placed in gel tubes and left at room temperature for approximately half an hour until coagulation occurred. Then a centrifugation process was performed at a speed of 3000 revolutions/minute for 10 minutes to obtain the serum and then stored in Eppendroff tubes. After that, the separated serum was kept under freezing until it was used in serological tests. which included parameters: Insulin, interleukin -33 that measured by Sandwich ELISA (Enzyme-Linked Immunosorbent Assay), while MDA, GSH with fasting blood glucose measured by Spectrophotometer. The information collected in a short questionnaire form (Appendix I) that included the measurement of the age, weight and height of each patient included in this study and BMI was calculated by using the following formula: weight in kilograms divided by height in squared meters.

Statistical analysis

The results were analysed statistically using the Minitab-17 statistical program, applying the analysis of variance (ANOVA) test, and the arithmetic means were compared with the Duncan-test with a probability level of 0.05 (17).

Results

Figure 1 illustrates a notable elevation in the concentration of MDA in the serum of individuals diagnosed with both type 1 and type 2 diabetes, as compared to the control group. The level of MDA in patients with type 1 diabetes reached (0.15340±0.06280)μmol/L, and its level increases in patients with type 2 diabetes to reach (0.146±0.045) μmol/L compared to healthy people (0.080±0.031) μmol/L at (P ≤ 0.05).

Figure (2) show a significant decrease in the level of insulin for both type 1 diabetes patients (2.24±0.78)mu/l and type 2 diabetes patients(3.93 ±0.65)mu/l compared to the control group (5.07±1.26) mu/l , With significant differences at the probability level (P<0.05).

Figure (3) showed that there were significant differences at (P ≤ 0.05) in the level of IL-33, where a significant increase was observed in type 2 diabetic patients (19.09±2.74) pg/ml compared to type 1 diabetic patients (17.49±2.76) pg/ml, and control (16.06±2.43) pg/ml.

Figure (4) showed a decrease in the body mass index in patients with type 1 diabetes (21.07±3.20) kg/m^2, while the BMI reached the highest level in patients with type 2 diabetes (32.17±4.97) kg/m^2 compared to control (24.97±. 2.03) kilograms / meter^2, ($P \leq 0.05$).

Figure (5) showed an increase in the level of glucose in patients with type 1 diabetes, as its level reached (173.06±23.10) mg/dL compared to the control (87.13±6.16) mg/dL. We also note an increase in glucose level in patients with type 2 diabetes, as its level reached (140.63±23.27) mg/dL.

Figure (6) showed a significant decrease in the level of GSH for both type 2 diabetes patients (0.119±0.004) µmol/L and type 1 diabetes patients (0.125±0.008) µmol/L compared to the control group (0.133±0.007) µmol/L, ($P<0.05$).

Table (1) show the correlation coefficient (r) between Insulin and all variables in patients with type 1 and type 2 diabetes. There was a positive correlation between Insulin and (BMI, GSH, Glucose, MDA) with the correlation coefficient r = (0.082, 0.042, 0.327, 0.219,), but there was a negative correlation between Insulin and IL-33 with a correlation coefficient of (r=-0.046). which was shown by the regression chart in Figures (3,4,5,6,7,8,9,10).

Furthermore, a positive correlation between Insulin and (IL-33, BMI, Glucose, MDA, with a correlation coefficient of (0.003, 0.089, 0.3, 0.125), but there was a negative correlation between Insulin and GSH with a correlation coefficient of (-0.225), which The regression diagram showed it in Figures (11,12,13,14,15,16,17,18).

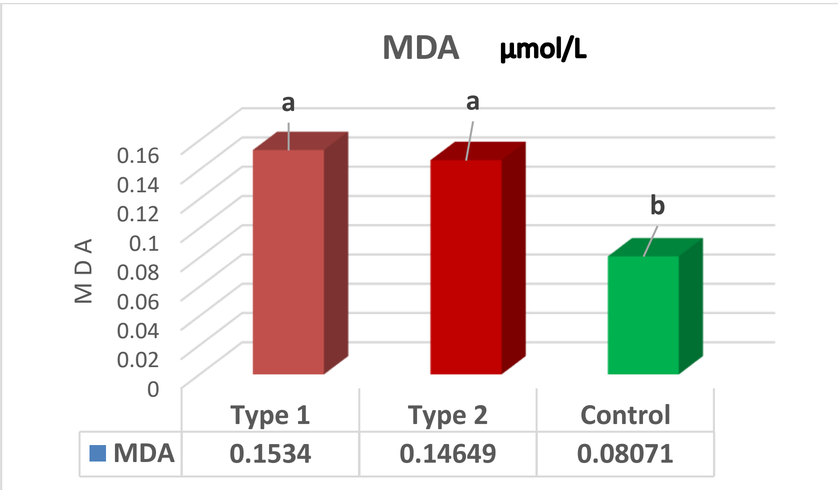

Fig. 1 shows the concentration of MDA in the studied groups

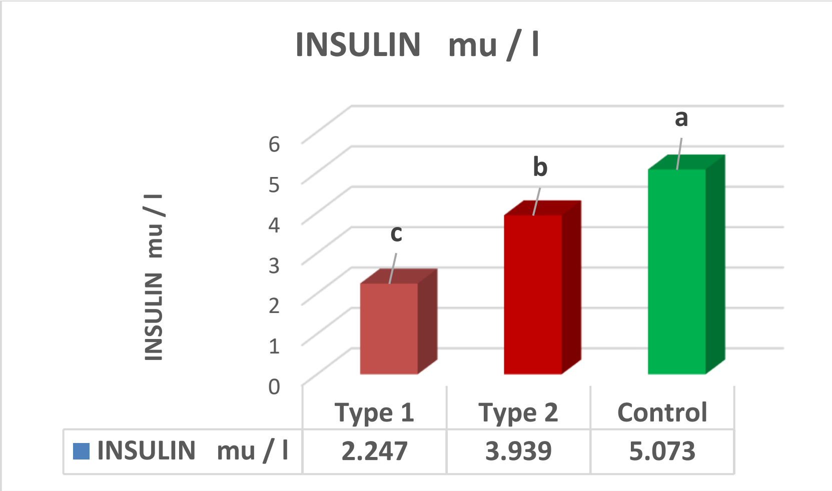

Fig. 2 shows the concentration of Insulin mu/l in the studied groups

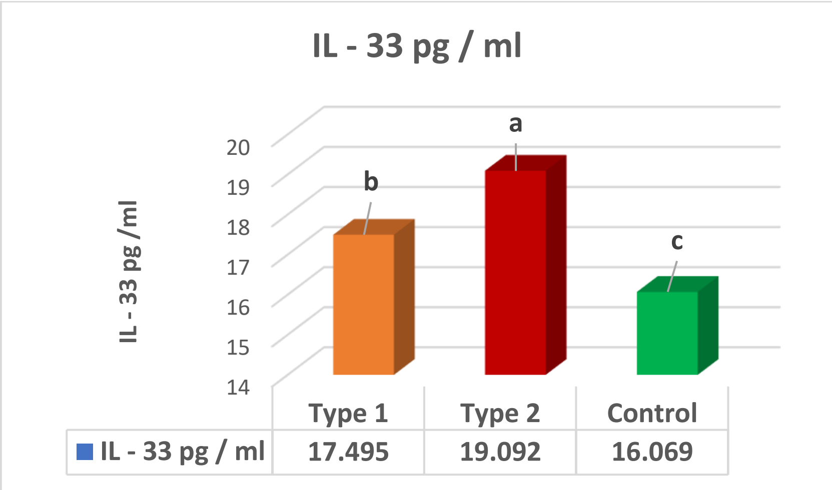

Fig. 3 shows the concentrations of IL-33 ml/pg in the studied groups

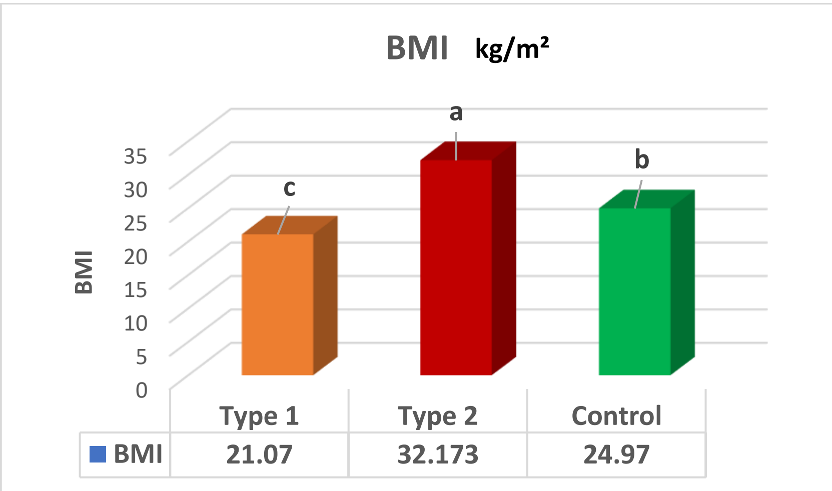

Fig. 4 shows the BMI Kg/m^2 values in the studied categories

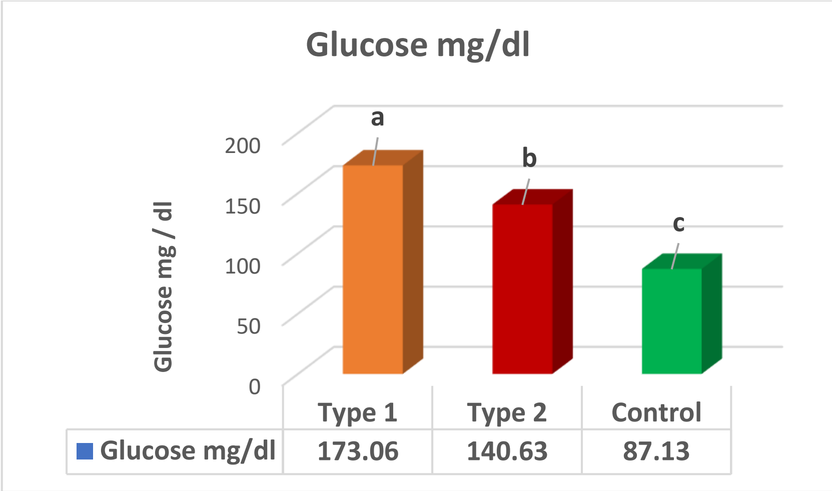

Fig. 5 shows the dl/mg glucose concentrations in the studied groups

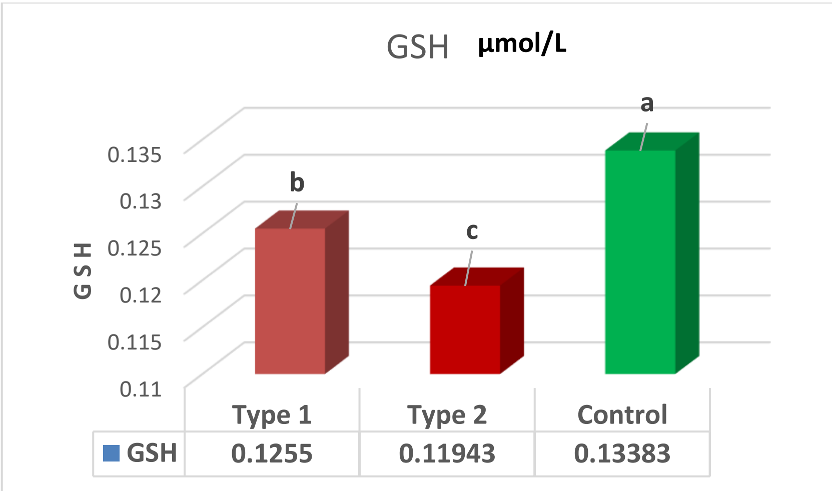

Fig. 6 shows GSH concentrations in the studied groups

Table 1. Correlation coefficient (r) between Insulin with all variables in patients with type 1 and type 2 diabetes

Parameters	**Correlation coefficient(r) (T2DM)**	**Correlation coefficient(r) (T1DM)**
IL-33	0.003	-0.046
BMI	0.089	0.082
Glucose	0.3	0.042
GSH	-0.225	0.327
MDA	0.125	0.219

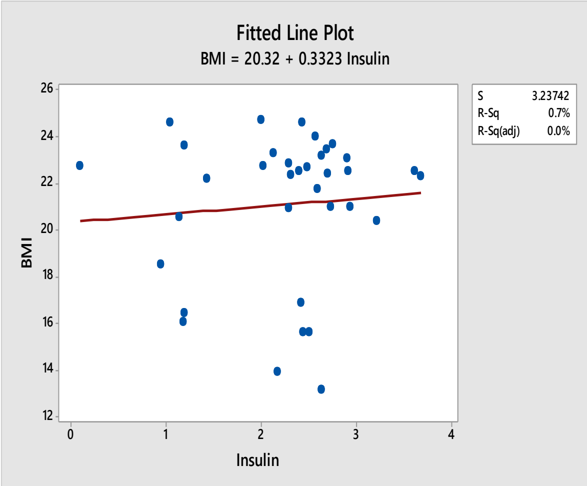

Fig. 7 Association between Insulin and BMI in T1DM patients)

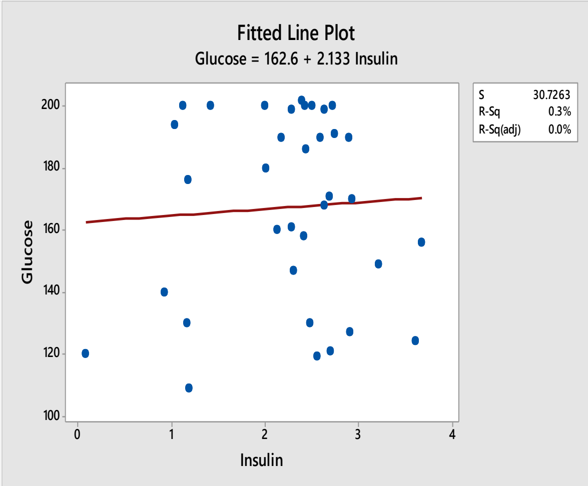

Fig. 8 Association between Insulin and Glucose in T1DM patients)

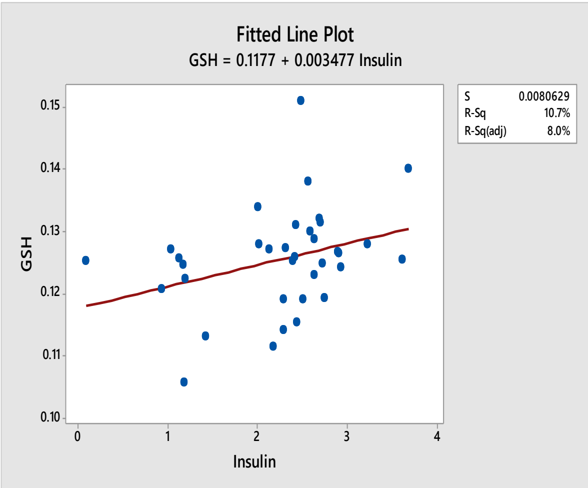

Fig. 9 Association between Insulin and GSH in T1DM patients)

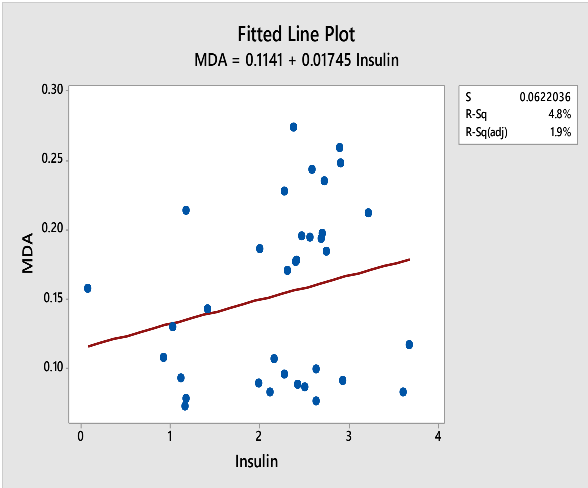

Fig. 10 Association between Insulin and MDA in T1DM patients)

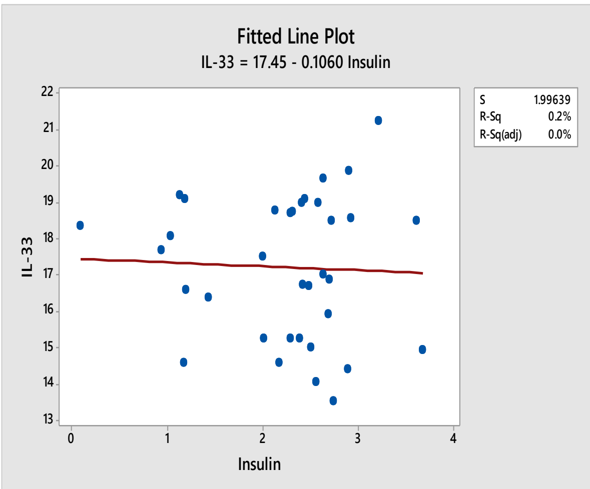

Fig. 11 Association between Insulin and IL-33 in T1DM patients)

In T2DM

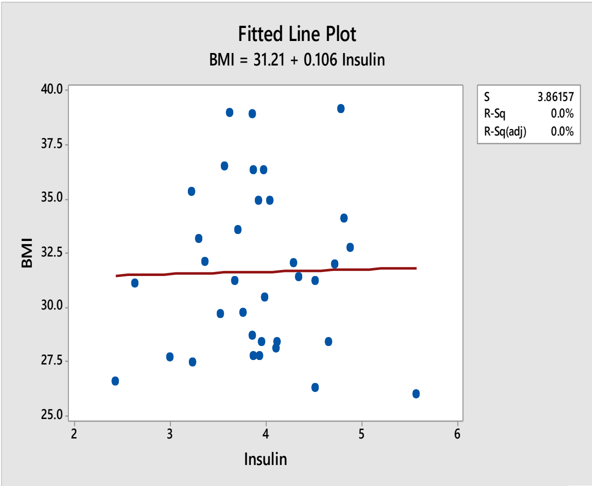

Fig. 12 Association between Insulin and glucose in T2DM patients)

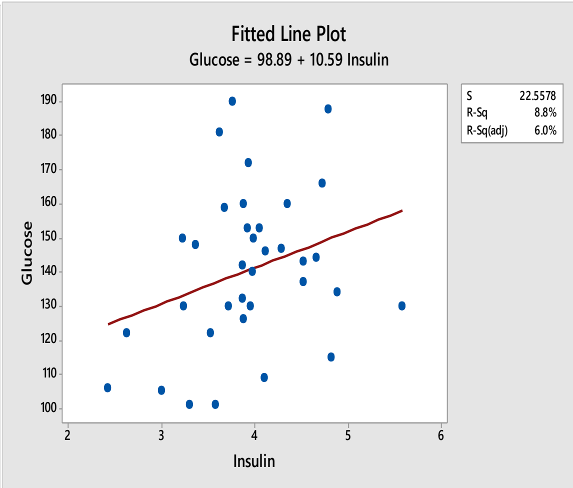

Fig. 13 Association between Insulin and BMI in T2DM patients)

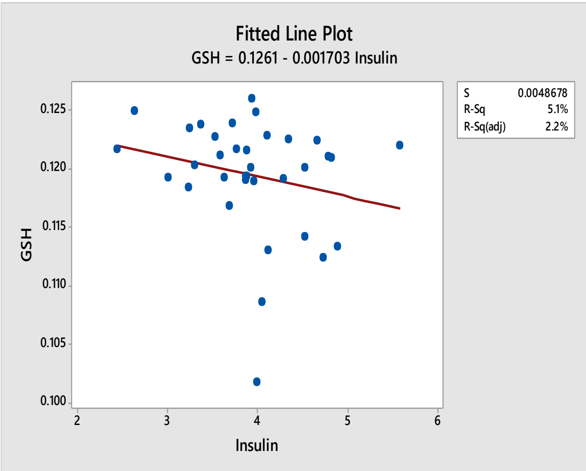

Fig. 14 Association between Insulin and GSH in T2DM patients)

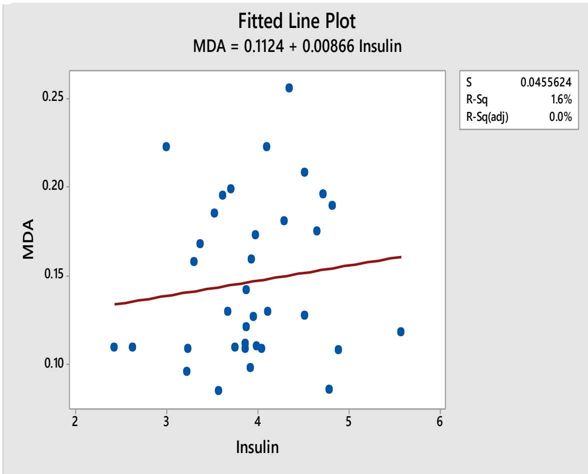

Fig. 15 Association between Insulin and MDA in T2DM patients)

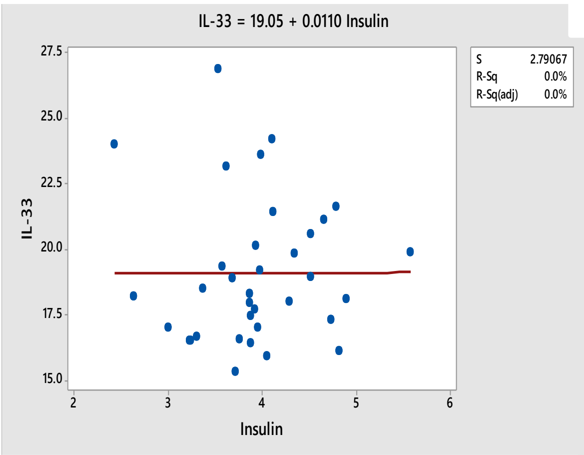

Fig. 16) Association between Insulin and IL-33 in T2DM patients)

Discussion

The results of the current study agreed with the study of [18], who showed a decrease in the level of insulin in patients with type 1 diabetes compared to control. The reason of decrease insulin in diabetic patients is that of the destruction of beta cells that produce insulin and the pancreas stops secreting insulin [19]. Type 1 diabetes often affects younger people, and some cases of people with type 2 diabetes develop to Type 1 diabetes after the disease develops and when the state of insulin resistance continues, the pancreas will become unable to secrete sufficient amounts of insulin. Then, type 2 diabetes will turn into type 1,UNfourtunally there is no treatment other than insulin injections [20].The study that done by [21] also stated that the reason for the high level of the hormone insulin is an increase in the accumulation of fat in the muscles, thus increasing the resistance of the cells to insulin, which leads to an increase in its concentrations in the body. Insulin resistance is also considered one of the main reasons for the high level of insulin, as the body needs to increase its secretion in order to reduce the level of blood glucose.

The results of the current study agreed with the study of [22], which showed a higher level of MDA in diabetic patients compared to control. The reason that causes the oxidative stress plays a vital role in the pathogenesis of diabetes due to its effect on insulin activity through several pathways such as Reactive and generating reactive oxygen species, this can lead to the deterioration of B cells in the pancreas, leading to decreased insulin secretion [23]. Elevated concentrations of MDA have been associated with a range of clinical conditions, including cardiovascular disease, diabetes, kidney disease, and cancer. Consequently, MDA serves as a valuable biomarker for assessing oxidative stress and tissue injury. The results of the study [24] demonstrated elevated levels of malondialdehyde (MDA) in individuals diagnosed with type 2 diabetes in comparison to the control group. This increase in MDA can be attributed to the prolonged exposure to hyperglycemia, which subsequently leads to heightened oxidative stress. Obesity is additionally associated with the induction of oxidative stress through the elevation of endogenous lipid peroxide products [25] MDA, is a molecule known for its pronounced toxicity resulting from lipid peroxidation caused by the detrimental effects of free radicals. The presence of free radicals and the subsequent induction of oxidative stress have been identified as key factors contributing to the pathogenesis of diabetic microangiopathy, ultimately culminating in the formation of diabetic retinopathy [26].

The results of the current study are consistent with the results of [27], which indicated that the increase in IL-33 in diabetic patients is due to inflammation and microvascular complications of diabetes, or the high level of IL-33 may be due to diabetes [28].

The results of body mass index agreed with the study of [29], who indicated a lower body mass index in type 1 patients compared to control, and a higher body mass index in type 2 patients compared to control. The reason may be due to the high level of glucose and insulin in the blood leading to an increase in glucose. Heat in the blood, which turns from the liver into stored fat in the body, thus leading to weight gain and obesity, and then leading to type 2 diabetes and other diseases such as cardiovascular diseases. An increase in the level of glucose in the blood indicates a defect in the secretion of Insulin and this is an indicator of insulin resistance [30].

The results of glucose are consistent with the results of [31], who indicated that the fasting blood sugar level was significantly higher in patients with type 1 diabetes compared to control and in patients with type 2 diabetes compared to control. This fact can be explained by the body's inability to respond to insulin produced by pancreatic beta cells in diabetic patients, or by the fact that the beta cells do not produce a sufficient amount of insulin, which leads to the accumulation of glucose in the blood instead of being absorbed by the body's cells[32].

The results of glutathione agreed with the study of [33], which attributed to a decrease in the level of glutathione in patients with type 2 diabetes compared to control as a result of the occurrence of oxidative stress resulting from excessive glucose in the case of diabetes, as oxidative stress leads to a decrease in the level of antioxidants in general. Including glutathione.

Conclusion

The study concluded increase level MDA and glucose while decrease level of insulin and glutathione in both T2DM and T1DM. in addition increase Il-33 and BMI in T2DM, but decrease BMI in T1DM..

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العلاقة بين الأنسولين وبعض المعايير الكيموحيوية لدى مرضى السكري من النوع الأول والنوع الثاني

اريج مظهر خلف *، موفق مطلك زيدان
قسم علوم الحياة، كلية العلوم ، جامعة تكريت، العراق

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الكلمات المفتاحية:
السكري النوع الاول السكري النوع الثانـي، المالون ثنائـي الديهايد, الكلوتاثيون,كلكوز, مؤشر كتلة الجسم, انترلوكين-33 ، الانسولين

معلومات المؤلف

الايميل:
areeg.m.khalaf.bio2022233@st.tu.edu.iq
الموبايل:

الخلاصة:

هدفت هذه الدراسة الى تقييم مستوى لمالون ثنائي الديهايد (MDA)، الكلوتاثيون، الكلكوز، مؤشر كتلة الجسم، انترلوكين 33، والأنسولين في مصل الدم لدى مرضى السكري من النوع الأول والنوع الثاني وتحديد العلاقة بين الأنسولين والمعايير الاخرى. جمعت 90 عينة دم من مرضى السكري لكلا الجنسين، وقسمت إلى (35) عينة دم من مرضى السكري من النوع الأول (T1DM) لللفئة العمرية (7-40)، و(35) عينة دم من مرضى السكري من النوع الثاني (T2DM) للفئة العمرية (40-70)، و(20) عينة دم من الاشخاص الأصحاء. تم جمع العينات من مستشفى بلد العام والضلوعية ومدينة الضلوعية وبعض العيادات الطبية الخارجيه للفترة من أكتوبر 2022 حتى فبراير 2023. المؤشرات التي شملت: الأنسولين، إنترلوكين -33 التي تم قياسها بواسطة مقايسة الامتصاص المناعي المرتبط بالإنزيم (ELISA) بينما تم قياس MDA وGSH والجلوكوز بواسطة مقياس المطياف الضوئي. أظهرت نتائج الدراسة الحالية زيادة مستوى MDA في المصل من المرضى الذين يعانون من (0.06280 ± 0.15340) وT2DM (0.146 ± 0.045) مقارنة مع السيطرة عند (P <0.05). بينما انخفض مستوى الانسولين معنوياً لدى مرضى (T1DM (2.24±0.78 ومرضى (T2DM (3.93±0.65 مقارنة بمجموعة السيطرة عند (P<0.05). بينما اظهرتIL-33 زيادة معنوية في (T2DM (19.09 ± 2.74)) مقارنة بـ T1DM والتحكم (17.49 ± 2.76، 16.06 ± 2.43). علاوة على ذلك، انخفض مستوى GSH في كل من T1DM وT2DM. بينما ارتفع مستوى الجلوكوز في المرضى الذين يعانون من T1DM و T2DM (173.06±23.10)،(140.63±23.27 على التوالي بالمقارنة مع السيطرة (6.16±87.13). وخلصت الدراسة إلى زيادة مستوى MDA والجلوكوز مع انخفاض مستوى الأنسولين والكلوتاثيون في كل من T2DM وT1DM. فضلا عن زيادة Il-33 ومؤشر كتلة الجسم في T2DM، ولكن انخفاض مؤشر كتلة الجسم في T1DM.وخلصت الدراسة إلى زيادة مستوى MDA وانخفاض مستوى الأنسولين في كل من مرضى السكري من النوع الأول والنوع 2.