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Relation between Insulin Resistance and Lipid profile in a Sample of Iraqi Type 2 Diabetic Patients

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Abstract

Insulin resistance syndrome refers to a group of disorders that are more common in people who are Metabolic syndrome, one of them such as dyslipidemia. Through alterations in insulin metabolic signaling and reductions in bioavailable NO, compensatory hyperinsulinemia associated with insulin resistance contributes significantly to the pro-inflammatory, pro-oxidative milieu that contributes to endothelial dysfunction and compromises endothelial integrity. Objective, this study was planned to determine level in T2DM patients, and interpretation of insulin resistance HOMA-IR with lipid profile level-Methods, sixty patients and thirty controls were nvolved for this study.

It is found that, insulin, FPG, HbA1c, lipid profile were measured for all subjects. It is found that (20.49*vs*.14.21µIU/ml) and HOMA-IR (12.60 *vs*.5.72) were significantly higher in patients as have elevated lipid levels. Serum insulin was found to be significantly higher in diabetic patients compared with healthy control group (P<0.0001). A significant high level of insulin resistance in diabetic groups when compared with healthy control. There is a negative correlation between HOMA-IR and HDL-C in diabetic patients. In patients group HOMA-IR

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was showed in positive correlation with TG and TC. In conclusion, the development of atherosclerosis is aided by dyslipidemia coupled with insulin resistance.

Keywords: Type 2 diabetes mellitus, Serum insulin, HOMA-IR, lipid profile

العلاقة بين مقاومة الأنسولين والدهون في عينة من مرضى السكري من النوع الثاني العراقيين

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الخلاصة

تشير متلازمة مقاومة الأنسولين إلى مجموعة من الاضطرابات الأكثر شيوعًا لدى الأشخاص المقاومين للأنسولين، أحدها مثل عسر شحميات الدم. من خلال التغييرات في إشارات التمثيل الغذائي للأنسولين والتخفيضات في NO المتوفر حيوياً، يساهم فرط أنسولين الدم التعويضي المرتبط بمقاومة الأنسولين بشكل كبير في بيئة مؤيدة للالتهابات، مؤيدة للأكسدة تساهم في اختلال وظيفي في البطانية وتضر بسلامة البطانة. تم التخطيط لهذه الدراسة لتحديد الأنسولين المصل في مرضى السكري النوع الثاني، وتفسير مقاومة الأنسولين HOMA بمستوى ملف الدهون. تم تجنيد 60 مريضًا و 30 عنصر تحكم لهذه الدراسة. تم قياس مؤشر كتلة الجسم نسبة الخصر الى نسبة الحوض، مقاومة الأنسولين، الأنسولين، FPG، HbA1c، ملف تعريف الدهون لجميع المواد. كان متوسط الأنسولين في الدم (20.49 مقابل 14.21 ميكرومتر / مل) ومقاومه الانسولين HOMA-IR (12.60 مقابل 5.72) أعلى بشكل ملحوظ في المرضى كما كان لديهم ارتفاع في مستويات الدهون. تم العثور على أنسولين مصل الدم أعلى بشكل ملحوظ في مرضى السكري مقارنة مع مجموعة التحكم الأصحاء (P <0.0001). كما ان هناك مستوى عالٍ من مقاومة الأنسولين لدى مجموعات مرضى السكري مقارنةً بالتحكم الصحي. هناك علاقة سلبية بين HOMA-IR و HDL-C في مرضى السكري. في مجموعة المرضى وجد أن HOMA-IR لها علاقة إيجابية مع الدهون الثلاثيهTG و الكوليسيترولTC. في الختام، فإن تطور تصلب الشرايين يساعده عسر شحميات الدم يكونمقترنًا بمقاومة الأنسولين.

الكلمات المفتاحية: داء السكري من النوع 2، مصل الأنسولين، HOMA-IR ، الدهون.

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Introduction

Diabetes mellitus is a global health problem linked to obesity and a sedentary lifestyle, which increases cardiovascular mortality and morbidity significantly [1]. Lipid abnormalities play a key role in these anomalies [2]. High levels of serum proinsulin, total cholesterol, triglycerides, low-density lipoprotein (LDL), very low-density lipoprotein (VLDL), glycated hemoglobin (HbA1c), microalbuminuria, hypertension, low HDL concentration, and increased body mass index (BMI) have all been linked to coronary heart disease and insulin resistance [3]. In addition the obesity, increased abdominal fat, particularly visceral fat, is a powerful predictor of insulin resistance[4,2]. Lifestyle changes [5,6] . The most natural approach to combating the consequences of excessive food consumption and sedentary habits such as insulin resistance, obesity, and type 2 diabetes (T2D) mellitus [7], can improve all of these derangements [5,6]. According to previous report [8] , there is no evidence that changing one's lifestyle reduces all-cause mortality and inadequate data to imply a benefit on cardiovascular and microvascular events. Similarly,previous studies [9]. Show at the impact of weight loss and lifestyle changes on cardiovascular events in overweight or obese persons with T2D, was stopped after ten years since it didn't reduce the number of cardiovascular events. [10].On the other hand, weight loss and exercise can both help with insulin resistance and dyslipidemia. Certain anti-diabetic medications might help people with type 2 diabetes mellitus improve their lipid profile by reducing insulin resistance. The objective of this study was planned to determine the serum insulin in T2DM patients, and interpretation of insulin resistance HOMA with lipid profile level.

Materials and Methodes

Sixty diabetic T2M individuals (Iraqi subject) ranging of age from Average. (37-70 years old) with an average age of (49.33±6.640) years. Type 1 diabetes, metabolic syndrome, how excluded if all patients have Lipidprofile changes, high serum glucose and high waist circumferences, pregnant women, smokers, liver disease, renal disease, and hypertension were all excluded from this study.

Healthy Subjects

The study included thirty healthy individuals as a control volunteers of both sexes who were comparable to type 2 diabetes mellitus patients in terms of age Average (37-70 years). The controls were chosen based on the following physician criteria: Non-diabetic, non-hypertensive, and clear of acute disease, with no history of alcohol consumption or smoking.

Sample Collection

About 10 ml blood specimen were collected from the patients and control individual, the collecting specimens were after 12-15 hours of fasting and they , were obtained between 8:00 and 11:00 am. The blood sample was divided into two aliquots the first portion added , ethylene di-amine tetra acetic acid (EDTA) (1.5 mg/ml) was utilized to estimate HbA1c in less than three hours. The serum was collected from the second part by dispensing the sample in a plain tube and allowing it to clot at room temperature (22°C). The serum was then collected after centrifuging at 3000r.p.m. The serum was divided into various sections, each containing 500l, and stored into Eppendorf tubes in the freezer (-20° C) until use.

Anthropometries Measurements

The age, weight, height, waist circumference (WC), and waist circumference to height ratio (WHR) were measured anthropometrically. The Body Mass Index (BMI) is determined using a formula that contains the basic equation of weight divided by the square of height. The waist to height ratio (WHtR) equals waist in centimeters divided by height (centimeters) (WHtR= Waist/Height). It is considered the best indicator of metabolic and cardiovascular disease than BMI.

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Homeostasis Model Assessment (HOMA-IR)

Insulin resistance (IR) was measured using a variety of techniques. The homeostasis model assessment (HOMA) is calculated using fasting insulin (µU /ml) and glucose (mg/dl), as stated in the equation below. Insulin resistance is crucial to investigate since it is linked to the balance of various metabolic pathways (Matthews et al, 1985).

HOMA-IR= [glucose(mg\dl) × fasting insulin(µU/ml)] /405

Statistical Methods

The data were entered into the computer database structure, and statistical analyses were performed using the SPSS version 25 computer program (Statistical Package for Social Sciences) to confirm the difference in median between more than two groups was statistically significant, the ANOVA test was used. Serum insulin , BMI, FSG HbA1c, and lipid profile. The parametric statistical technique used to investigate the significance of the difference in averages between two groups was the independent t-test (analysis of variance).

Results and Discussion

Features of T2DM groupings of patients and Healthy Subjects

Anthropometries parameters among T2DM patient groups and healthy subjects o. The average age distributions of T2DM patients (49.29±52.262) and healthy subjects (48.18± 3.60) T2DM patients had a BMI of (28.88± 0.67) kg/m2, which was close to healthy people's (27.43± 0.90 kg/m2). Overall adiposity was calculated using the BMI. The results of the statistical analysis didn't show any significant differences in WHR, and WHtR in diabetic patients (1.10 ± 0.074, and 0.53± 0.02 respectively). Waist- height Ratio and Waist-Hip Ratio results shown (means± SD) is no different significant ($p>0.05$) between diabetic groups and control group (Table 1) . The minimum circumference between the thorax and the hips was considered as the waist circumference. The waist circumference was utilized to calculate the distribution of body fat. Higher BMI was found to be inversely related to HDL and directly related to. Increased atherosclerosis linked to dyslipidemia [11], insulin resistance, hypertension, and diabetes [12] were suggested reasons that causing the cardiac events in obese patients. Increased TC [13] and LDL cholesterol [14] are thought to be the primary causes of dyslipidemia's influence on cardiac events. Recent evidence suggests, however, that the conventional wisdom of a direct relationship between BMI and LDL cholesterol is oversimplified. In fact, a weaker-than-expected association between LDL and BMI has been described as a("obesity conundrum") [15].However, it is certain that central fat, rather than peripheral fat, is linked to insulin resistance, and that visceral fat, rather than subcutaneous abdominal fat, is more closely linked to insulin resistance.

Table 1: Anthropometries parameters of T2DM patient groups compare with health group

Variables	T2DM patients (n = 60)	Healthy subject (n = 30)	p- Value
Age mean ± SE	49.295±2.262	48.18 ± 3.60	0.876
Sex n. (%) Male Female	 31(51.67% 29(48.33%)	 18(60%) 12(40%)	 0.321 0.211
BMI mean ± SE	28.88 ± 0.67	27.43 ± 0.90	0.170
WHR	1.09 ± 0.05	0.89 ± 0.03	0.538
WHtR	0.66 0.08±	0.56 ± 0.02	0.547
Disease duration (years)	7.98 ± 7.12	-	-

Metabolic factor of T2DM groupings of patients and healthy subjects

Patients showed a significantly higher of the mean FSG (216.3±15.25 mg/dL than controls 96.43± 6.10 mg/dL) (at P ≤0.001). The mean percentage of HbA1c also increased significantly (at P ≤0.001) in the patients (8.215±0.12 while control was 5.72± 0.29). Despite the fact that insulin serum levels were significantly higher in T2DM patients (20.4949±2.5 vs. 14.21 ±2.12IU/ml) and HOMA-IR (12.60±1.765 vs. 3.83± 0.709), there was no statistical significance (at p > 0.05) between T2DM patients and controls groups (Table 2)

Table 2: Means ±SD for FSB, Insulin, HOMA-IR level

Variables	T2DM patients (n = 60)	Healthy subject (n = 30)	p- Value
FSB	216.3±15.25	96.43 ± 6.10	0.000
HbA1C%	8.215±0.12	5.72 ± 0.29	0.000
Insulin	20.4949±2.5	14.21± 2.12	0.000
HOMA-IR	12.60±1.765	3.83 ± 0.709	0.001

Diabetes is defined by high blood glucose levels, which are linked to a high risk of diabetic microvascular consequences such retinopathy and nephropathy. According to epidemiological research, a plasma glucose level of 11.1 mmol/l 2 hours after a glucose challenge reflects a significant increase in risk [16]. Type 2 diabetics have a disrupted insulin response as well as abnormalities in their pancreatic islet cells. It's unclear if the latter is a primary deficiency or a result of the former. Insulin production abnormalities have been observed in type 2 diabetes patients, which may represent the -cell's inability to adjust in the face of peripheral resistance [17]. Hyperglycemia has been shown to be toxic to the -cells, suggesting that a self-reinforcing cycle of glucose intolerance and progressive -cell injury may contribute to disease development [18]. Given the possibility that hyperinsulinism is an early compensatory strategy for insulin resistance. Because diabetes is so common in the general population and is a risk factor for chronic vascular complications like heart disease and stroke, which frequently lead to brain death [19]. In the diagnosis of early type 2 diabetes in at-risk people, diagnostic criteria based on FPG criteria are generally insensitive. In high risk people, measuring HbA1c improves the sensitivity of screening [20].

Lipid Profile of T2DM in the Groupings of Patients and Healthy Subjects

The lipid profile of Cholesterol, Triglyceride, HDL, LDL, VLDL,) showed in the diabetic patients (194.20 ± 6.32, 197.30 ± 13.24, 43.60 ± 1.41, 115.63 ± 9.01, 39.93± 2.56 respectively), However, they didn't show any different significant in diabetic patients when compared with

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control group that showed (168.37 ± 11.74, 139.06 ± 40.05, 39.25 ± 2.51, 93.91 ± 9.90, 39.25 ± 7.68 respectively), in the p-value >0.05 Table (4).

Table 4: Mean ±SD for lipid profile of T2DM groupings of patients and healthy subjects

Variables	T2DM patients (n = 60)	Healthy subject (n = 30)	p- Value
Cholesterol	194.1±4.8	180.07±8.96	0.136
Triglyceride	204.13±12.1	178.27±19.8	0.246
HDL-C	42.8±1.02	42.56±1.5	0.890
LDL-C	115.9±5.6	103.0±7.5	0.182
VLDL-C	39.71±2.10	35.47±3.94	0.299

Diabetes type 2 is considered a complicated condition in which glucose and fat metabolism are disrupted [21]. Insulin has a wide range of effects on mammalian lipid metabolism. It increases fatty acid synthesis in the liver, adipose tissue, and the gut. Insulin has also been linked to a boost in cholesterol production. Lipoprotein lipase activity is also elevated in white adipose tissue. From this perspective, assessing various lipid fractions and lipid peroxide in patients with Diabetes Mellitus may be useful in determining patient prognosis and preventing complications or subsequent diseases [22].In diabetes 2 patients, hyperlipidemia is defined by abnormal lipid profile readings, which may include high levels of plasma cholesterol, triglycerides, or both, or low levels of high-density lipoprotein cholesterol (HDL-C) In diabetes 2 patients, hyperlipidemia is defined by abnormal lipid profile readings, which may include high levels of plasma cholesterol, triglycerides, or both, or low levels of high-density lipoprotein cholesterol (HDL-C)[23] .

Correlation Between HOMA-IR and Lipid Profile in Diabetic Patients

The correlation Between Insulin resistance HOMA-IR and TG, TC and HDL shown in the figure (A, B, C)

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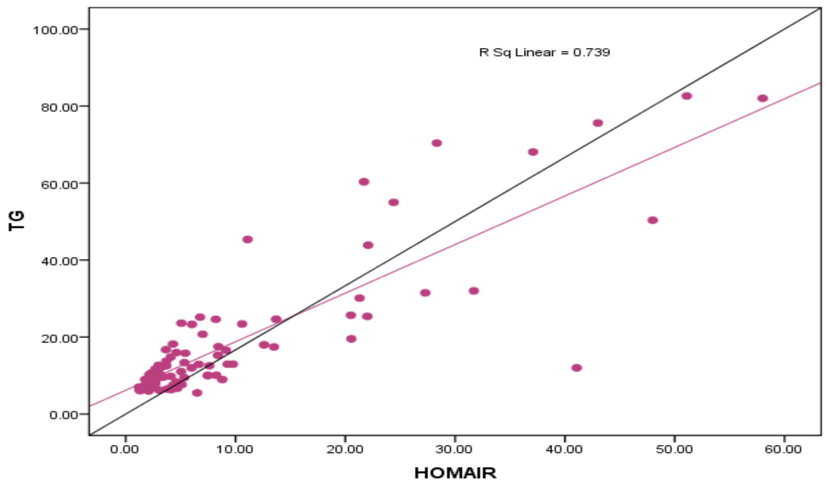

Figure (A): Correlation between insulin resistance (HOMA-IR) and TG

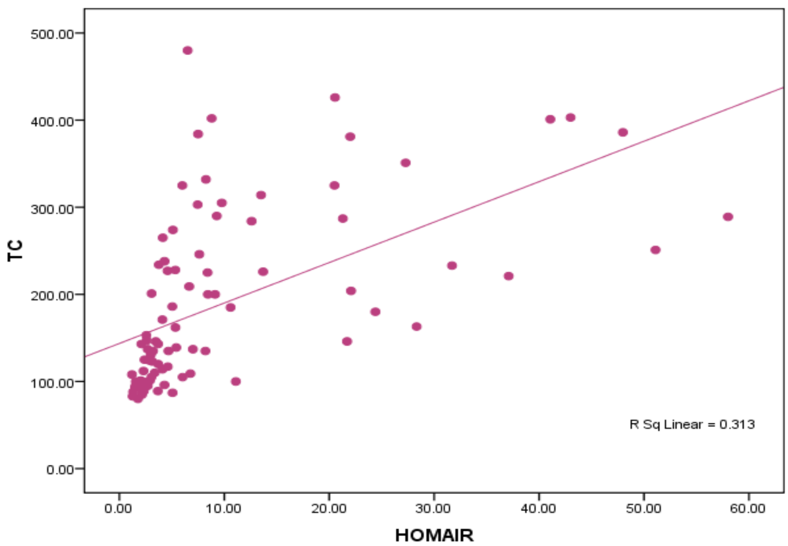

Figure (B): Correlation between insulin resistance (HOMA-IR) and TC

In a broad range of T2DM patients, we here are strong positive association between insulin resistance (HOMA-IR) and both TG, TC as shown in the figure (A&B) and significant inverse association with HDL as shown the figure C.

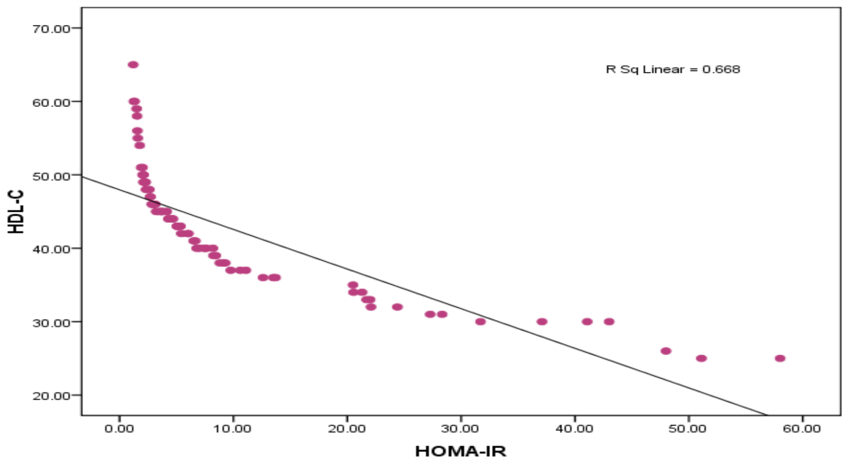

Figure (C): Correlation between insulin resistance (HOMA-IR) and HDL

Conclusion

The development of atherosclerosis is aided by dyslipidemia coupled with insulin resistance. Although significant research has been done to understand the complex etiology of this dyslipidemia.

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