AL-KUNOOZE SCIENTIFIC JOURNAL
ISSN: 2706-6231 E ,2706-6223 P
Vol.11 S2 (2025)

Colorimetric determination of serum lipid profile in obese patients in association with diabetes

*Rana A. K. Al-Refai'a Saba Sahib Al-Obaidy Zainab Shakir Abdullah Al-Ali Ahmed Kareem Khaleel Al Qayyim

Department of Chemistry, College of Science, University of Babylon, Iraq.

*Corresponding author E-mail: sci.rana.abdul@uobabylon.edu.iq

Abstract:

Obesity is a serious problem for numerous people especially, those who have chronic diseases. In this project total cholesterol (TC), high density lipoprotein(HDL), low density lipoprotein (LDL), triglyceride (TG) and very low density lipoprotein (VLDL) were determined for 80 adults with obesity, including (40) men 20 of those have type 2 diabetes and (40) women similarly as men 20 of those have the same type of disease. All patients have body mass index BMI (40 > kg/m^2) were selected alongside 30 non obese as a control group which have BMI (20-25 kg/m^2). It has been found that the levels of all the parameters except HDL displayed a significant increase in overweight persons while the HDL level was observed a significant decrease in comparison with control. The effect of gender and diabetes on the level of all parameters has been investigated. The results suggested that lipid profile measurement is a good indicator to control oxidative stress production and inflammation. The aim of this study is to highlighted the relationship between obesity and sugar sensitivity according to serum lipid profile measurements.

Keyword: lipid profile, diabetes and obesity.

Introduction:

Obesity is a metabolic disease defined by disordered weight homeostasis with accumulation of excess adipose tissue [1]. Although historically described as the result of an imbalance between energy intake and energy expenditure with excessive consumption of calorically-dense food and decreased physical activity, our current understanding acknowledges obesity to be a complex disease driven by genetic, environmental, and physiological factors. These include aberrant regulation of feeding behavior, altered thermogenesis in energy expenditure, and dysregulation of adipocyte differentiation [2, 3].

Obesity greatly increases the risk of comorbid conditions, including type 2 diabetes mellitus (T2DM), coronary heart disease, and some cancers [4].

Obesity and related diabetes difficulties are main public health problem in the world, people with obesity have a threefold increased risk of diabetes which causing death among people with non-obese [5]. The strong pathophysiological association of obesity with T2DM emphasizes the role of adipose tissue dysfunction as a primary determinant of insulin resistance and glucose intolerance [6].

Glucose tolerance is a good indicator which is used to estimate how fast glucose released out of blood and whether the body has trouble absorbing of glucose, it is commonly used for diabetes test and insulin-resistance [7] . In the most frequently performed type of the test is an oral glucose tolerance test (OGTT), it is a standard dose of glucose ingested by mouth and its levels are determined after two hours [7].

Recently, a report from the United States has been suggested that during early adulthood (aged 20–30 years) with (BMI > 45) human's life may be reduced expectancy by up to 13 years of men and up to 8 years of woman's due to obesity [8].

Obesity is mortality risk because of unbalance fat tissues disruption resulting in raising in the level of TC and TG [9,10].

HDL is the main component of the reverse cholesterol transport process and either their role in steroidogenic tissues that exhibit delivering cholesteryl esters to steroidogenesis, it is isolated from hypertriglyceridemic [11-13]. In one hand, some HDL-C is frothed from triglyceride rich lipoproteins. On the other hand, insignificant HDL-C comes from arterial macrophages [14,15].

HDL has ability to maintain the absorption of

intestinal fat and digestion, it was reported that obesity is related with increasing the concentrations of TG and decreasing HDL-C, females usually have lower concentration of TG and higher HDL-C than males. However, the effect of gender's type on the level of lipoprotein in obese people still unclear [16,17].

Materials and methods

Ethical approval

The study was approved by university of Babylon, college of science, department of chemistry

Samples collection

Blood samples from the obese men and women ages ranging 20-25 years and non-obese as a control were collected. After clotting, serum was centrifuged as a separation process, the analytical determinations described below were either performed immediately. All samples were evaluated and laboratory tested after 12 h fasting. Then type 2 diabetes patient asked to take a glucose drink and their blood glucose level was measured before and at intermissions after taking sugary drink.

Methods

The concentration of total cholesterol(TC), HDL-C and TG were measured by enzymatic method; with the Spinreact kit, Spain. Whereas, VLDL and LDL were calculated using Friedewald equation.

Statistical analysis

All results were presented as a mean ± SD (standard deviation), comparison between obese patients and control were performed by the student's t- test. Person's correlations were used to determine relationship between parameters studied. A p-value was considered statistically significant and gender effect was studied as well.

Results and Discussion

correlation coefficient of 80 obese participants (40 males and 40 females) was used to measure the relationship between age and BMI. There was no significant correlation shown participants and no relationship (correlation value (r) = -0. 57) .

Discussion

Figure (1) can be confirmed that no relationship between age and BMI in the serum of patients with obesity. However**,** the results obtained that both TC and TG are significantly increased in obese with very low P- value in comparison with control group, the effect is more noticeable in TC as shown in Table 1. Similarly, LDL-C and

VLDL-C in obese were shown higher level than control, while, HDL-C level was decreased significantly in obese for both sexes compared to control as shown in Tables 2.

Overweight and obesity may lead to influencing metabolic effects on cholesterol and triglycerides causing the highest levels of these parameters. Results suggested that the BMI and fat energy ratio appeared to be the main factor causing hyperlipidemia and it is associated with abnormalities of cholesterol metabolism, due to researchers' confidence that the total cholesterol level rises as the body mass index rises [21-23].

This study obtained significantly decreased in the level of HDL in obese patients compared with healthy control due to low metabolic basis of HDL in obese cases, which may be affected production rate of HDL in plasma. **Table 2**

The results of oral glucose tolerance test (OGTT) for obese patients with diabetes display very high value (over 12 mmol/L) while, the level of TG and HDL have remarkably changed compared to obese patient with non-diabetes which means, there is a significant relationship between glucose sensitivity and obesity. That suggested overweight people can be in greater risk of rising type 2 diabetes than others. **Fig 2**

Whereas, there is no effect of diabetes on other parameters p- value > 0.05 (results have been not shown). No correlation has been observed of each of TC and LDL (r= -0.923, -1.021) respectively. Since body fat has a main effect on the serum lipid profile, and females normally have much more body fat than men. Therefore, sex differences have been studied to estimate whether or not affected lipid and lipoprotein levels in the case of obese people. Obese compared with control group of both gender had significantly greater serum TG and VLDL while had lower HDL-cholesterol concentration than no obese samples. Women, compared with men, had a slight lower TG and VLDL with a slight higher HDL-C concentration. **Fig 3**

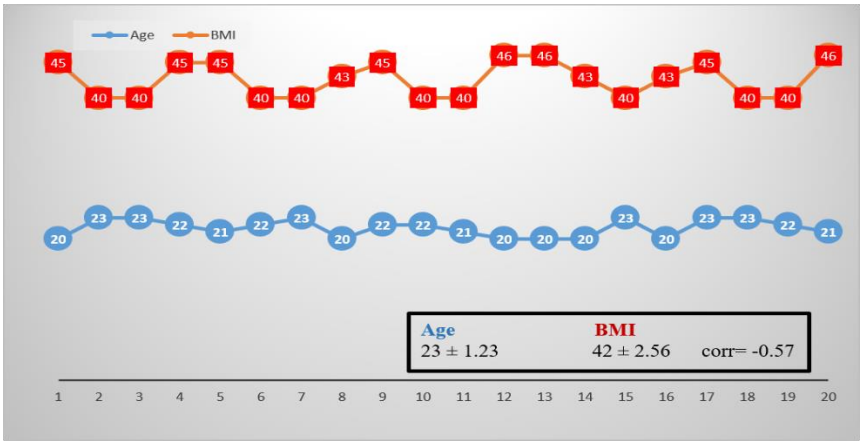

Figure 1: The relationship between age and BMI in obese patients

Table (1) TC and TG levels (mmole/L) in sera of obese and control.

	Parameters	Mean	SD	SE	P-value	Sign
Control Obese	TG	1.24 1.8	0.11 0.5	0.02 0.10	< 0.005	sign
Control Obese	TC	4.9 7.5	0.158 0.474	0.02 0.03	< 0.003	sign

Table (2) lipoprotein concentrations (mmole/L) in sera of obese in comparison with control.

	Lipoproteins diameters	Mean	SD	SE	P-value	Sign
Control Obese	HDL	1.61 0.80	0.072 0.094	0.06 0.02	0.000	significant
Control Obese	LDL	2.092 4.200	0.0761 0.173	0.02 0.03	0.000	significant
Control Obese	VLDL	0.543 1.136	0.122 0.208	0.01 0.02	0.000	significant

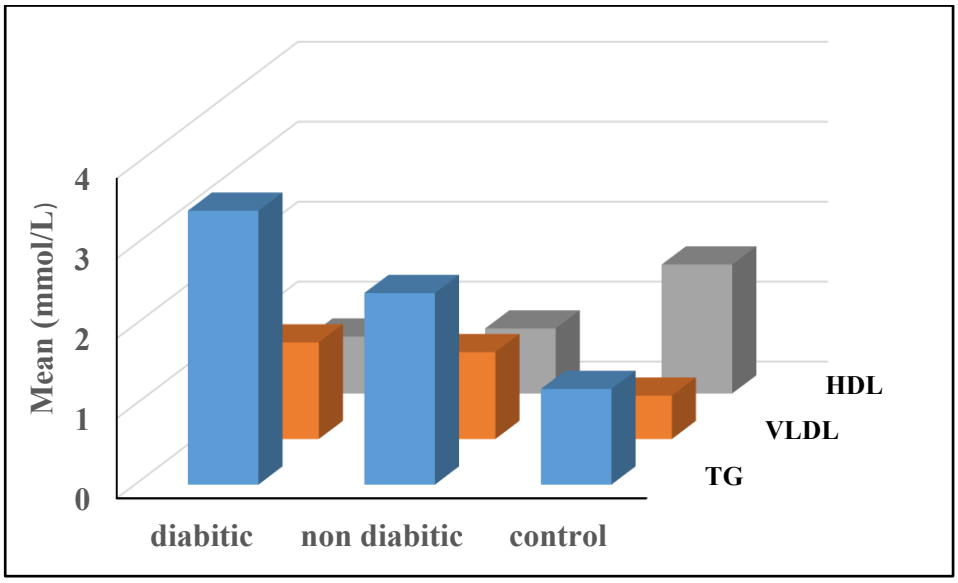

Figure 2: The effect diabetes on the level of HDL, TG and VLDL

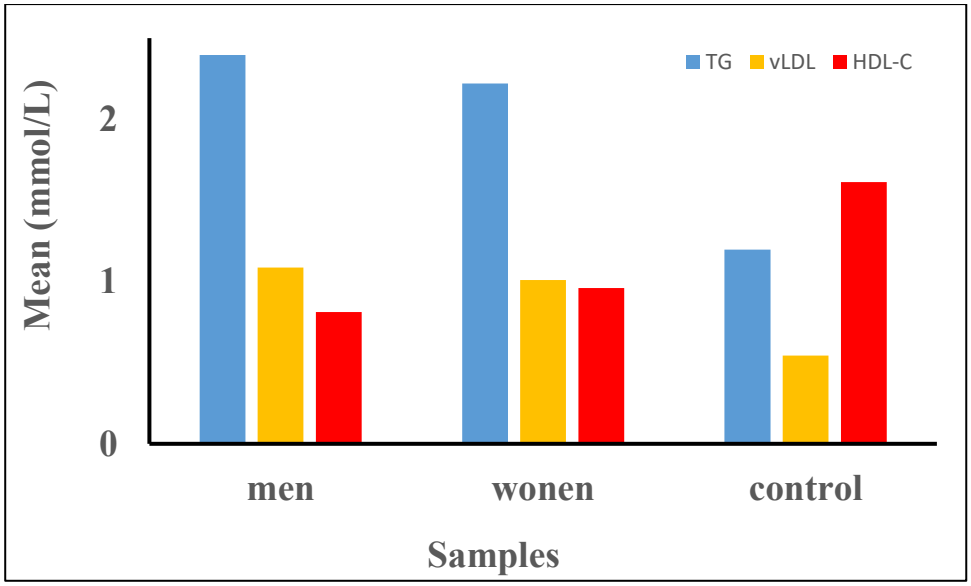

Figure 3: The effect of gender on the level of HDL-C, TG and VLDL

Conclusions

Diabetes type 2 is strongly associated with obesity and both affected serum lipid profile levels as our data suggested. Therefore, changing obese lifestyle such as maintain dietary habits and improve physical activity may necessary to control or prevent obesity. Additionally, families can play important roles to illuminate this problem and may be reasonable to reduce about 40- 50% of the risk of type 2 diabetes.

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التحديد اللوني لفحص الدهون في الدم لدى مرضى السمنة المفرطة المصاحب لمرض السكري

رنا. الرفاعي صباح صاحب العبيدي زينب شاكر عبد الله العلي أحمد كريم خليل القيم *

قسم الكيمياء، كلية العلوم، جامعة بابل، العراق

*: sci.rana.abdul@uobabylon.edu.iq

الملخص

تعتبر السمنة مشكلة خطيرة لكثير من الناس وخاصة أولئك الذين يعانون من أمراض مزمنة. في هذا المشروع تم تحديد الكوليسترول الكلي (TC) والبروتين الدهني عالي الكثافة (HDL) والبروتين الدهني منخفض الكثافة (LDL) والدهون الثلاثية (TG)والبروتين الدهني منخفض الكثافة (VLDL) ل 80 بالغاً مصاباً بالسمنة، منهم (40) رجلاً 20 منهم مصابون بمرض السكري من النوع الثاني و (40) امرأة وبالمثل 20 من الرجال مصابون بنفس النوع من المرض. تم اختيار جميع المرضى الذين لديهم مؤشر كتلة الجسم BMI (40 < كجم/م2) إلى جانب (30) من غير المصابين بالسمنة كمجموعة ضابطة والتي لديها مؤشر كتلة الجسم (20-25 كجم/م2). وقد وجد أن مستويات جميع البارامترات باستثناء البروتين الدهني عالي الكثافة أظهرت زيادة كبيرة في الأشخاص الذين يعانون من زيادة الوزن بينما لوحظ انخفاض كبير في مستوى البروتين الدهني عالي الكثافة مقارنة بالمجموعة الضابطة. تم فحص تأثير الجنس ومرض السكري على مستوى جميع البارامترات. اقترحت النتائج أن قياس مستوى الدهون هو مؤشر جيد للتحكم في إنتاج الإجهاد التأكسدي. الهدف من هذه الدراسة هو تسليط الضوء على العلاقة بين السمنة وحساسية السكر وفقًا لقياسات ملف الدهون في الدم.

الكلمات المفتاحية: ملف الدهون والسكري والسمنة.