Journal for Research in Applied Sciences and Biotechnology

www.jrasb.com

ISSN: 2583-4053

Volume-1 Issue-3 || August 2022 || PP. 120-127

https://doi.org/10.55544/jrasb.1.3.16

Sex Analysis of Lipid Profile in Diabetes Patients with and without Over Weight in Tikrit City/Iraq

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www.jrasb.com || Vol. 1 No. 3 (2022): August Issue

Received: 09-07-2022	**Revised:** 30-07-2022	**Accepted:** 09-08-2022

ABSTRACT

Background: **The overweight is one of the main reasons for the development of diabetes, so the lipid profile is different between the diabetes and the healthy people. In addition, there is a variation between the lipids profile according to sex difference in the diabetes patients. The main goal of the current study was to assessment the relationship between lipid profiles-based sex difference of diabetes patients (with and without overweight) and control group.**

Methodology: **In this study, the glucose level and lipid profiles were determined for one hundred and forty volunteers, thirty-nine of them were healthy as a control group (25 females and 16 males), and one hundred and two had diabetes, 50 diabetes with overweight (25 females and 25 males) and 52 diabetes without overweight (27 females and 25 males).**

Results: **Concerning the results of glucose level, the results of the current study showed significant differences between males and females in HbA1c test of control group (P=0.024) and in PPG test of Diabetes without overweight group (P=0.033). On other hands, our results found variation between men and women in other groups but not reach to significant differences. While the results of lipids profile showed significant differences between males and females in HDL_C test of diabetes without overweight group (P=0.0246) and in LDL_C test of control group (P=0.02). At the same time, our results recorded variation between men and women in other groups but not reach to significant differences.**

Conclusions: **The research presents important results on the differences between sex and its content of lipid profiles in diabetic patients, although some differences did not reach at significant level, but they showed clear sex differences.**

Keywords- Diabetes; Overweight; Lipids profile; Sex difference.

I. INTRODUCTION

Diabetes mellitus is a metabolic disease that is characterized by hyperglycemia associated with alterations in carbohydrate, protein, and fat metabolism (1). Chronic hyperglycemia due to impaired insulin secretion from pancreatic β-cells, hyperglucagonemia because of compensatory glucagon secretion from pancreatic α-cells, insulin resistance in peripheral target tissues, and hyperlipidemia are its main characteristics (2). About 537 million adult's individuals are living with diabetes (3). Concurringly, global type 2 diabetes mellitus (D2M) cases continues to increase, and it is expected to there will be >590 million diabetes patients will diagnosed with this condition by 2035 (4). This trouble is particularly worrying in the Middle East countries where the average prevalence is more than double (14.8–20%) of Western countries (5).

Although the mechanisms contributory in developing diabetes mellitus are unclear, it is well confirmed that obesity is an important factor that enhances the possibility of DM development. Actually, it is supposed that obesity may represent for between 80–85% of the risk of developing T2M, a reasoning firmed by studies highlighting an 80-fold increase in the risk of developing D2M by obese individuals compared to those with normal body mass index (BMI) (6,7). Lipid abnormalities in diabetic patients, often termed "diabetic

Journal for Research in Applied Sciences and Biotechnology

www.jrasb.com

ISSN: 2583-4053

Volume-1 Issue-3 || August 2022 || PP. 120-127

https://doi.org/10.55544/jrasb.1.3.16

dyslipidemia" (8). Furthermore, the causes of hypertriglyceridemia in diabetes patients are related with insulin resistance and hyperglycemia, involving overproduction of triglyceride (TG) lipoproteins in the liver, decreased triglyceride lipoprotein clearance, and probably disordered in postprandial lipoprotein metabolism (9,10), but the pattern of the different lipids may vary between access to health care, economic levels and ethnic groups (11,12). Prior studies that have noted the importance of analyses of trends in serum lipid levels and differences in dyslipidemia characteristics were limited to several countries, but without an invariable and comparable global analysis (13).

Males and Females demonstrated marked differences in susceptibilities to complex or multifactorial diseases such as diabetes and atherosclerosis, regardless of the fact that they share usually similar genetic profiles and environmental interactions (14). Based only at the global data of T2D, as standardized across all age groups, the mostly of data from populations of Asian descent and Western European suggest a slightly higher prevalence of T2D among males than females (15, 16, 17). Whereas, no sex differences were recorded in data of developing diabetes from US population (18) and from sub-Saharan Africa population (19).

In spite of this, little is known about the gender differences in the relationship between lipid profiles, over weight and their association with diabetes. In this study, we analyzed the relationship between lipid profiles of diabetes mellitus in overweight and non-overweight patients based on sex difference.

II. MATERIAL AND METHODS

2.1. Population Study

In the study, a local volunteer's sample was recruited from Tikrit city/Iraq. One hundred and forty-one volunteers, thirty-nine of them were healthy as a control group (25 females and 16 males), and one hundred and two had diabetes, 50 diabetes with overweight (25 females and 25 males) and 52 diabetes without overweight (27 females and 25 males). In agreement with the Declaration of Helsinki Principles, Ethical approvals were come by from the local committee in the College of Science / Tikrit University.

2.2 Biochemical analysis

Biochemical tests were conducted for all volunteers in current study, which included the following tests: the Fasting Blood Glucose (FBG) test, the postprandial glucose (PPG) test and the Hemoglobin A1c (HbA1c) test to determine the level of glucose in the patients and healthy groups. As for the lipid profile examinations, they included the following tests: Total Cholesterol (TC) test, Triglycerides (TG) test, High Density Lipoprotein (HDL) test, Low-density Lipoprotein (LDL) test and Very Low-density Lipoprotein (VLDL) test.

2.3. Statistical analysis

T-test and mean ± SD were used to compare the result between male and female. P values is 0.05 or lower (<0.05) was trumpeted as level of significance. Data have been analyzed by GraphPad Prism program version 9.3.1/2022.

III. RESULTS

The characteristics of the study participants based on categories of glucose blood status are displayed in Table 1. Descriptive mean (± SD) between Male and Female: Regarding the results of the fasting blood glucose (FBG) test, the results did not show any significant differences between males and females in all groups of studies, with a slight increase in the mean ± SD in females compared to males in the both group of diabetes patients. For the postprandial glucose (PPG) test, a significant difference was found between males and females in the group of diabetic-non overweight patients (P=0.033), while in other groups there was a slight increase in the mean ± SD of females compared to males, but it did not reach the significant level. In the hemoglobin A1c (HbA1c) test, a significant difference was found between males and females in the healthy group (P = 0.024), while in the other groups there was a slight increase in the mean ± SD for males compared to females, but it did not reach the significant level.

Table 1: Glucose Level of Diabetic Patients and Healthy Subjects according sex.

Cases	Variable								
	FBG (mg/dL)			PPG (mg/dL)			HbA1c %		
	Male	Female	p-value	Male	Female	p-value	Male	Female	p-value
Diabetes with overweight	137.68 ±37.5	127 ±44.5	*P*=0.356	177.2 ±35.6	194.35 ±51.6	*P*=0.817	7 ±0.7	6.86 ±1.2	*P*=0.878
Diabetes without overweight	183.86 ±60.4	158.5 ±70.2	*P*=0.177	244.5 ±63.9	203.15 ±69.4	***P*=0.033**	8±1.7	7.6 ±1.8	*P*=0. 41
Control	84.32 ±8.6	85.9 ±7.4	*P*=0.55	91.85±13.4	94.88 ±7.9	*P*=0.382	5 ±0.3	5.23 ±0.3	***P*=0.024**

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The mean ± SD and p value of triglycerides (TG) between male and female are showed in Figure 1. The results of *the* present study showed there is no significant differences between males and females. However, our data registering high in the mean ± SD values in diabetes patients with overweight compared to other groups, as males recorded the highest value compared to females. While the equal value between males and females in diabetes patients without overweigh. While the mean was high in females compare with males in healthy group.

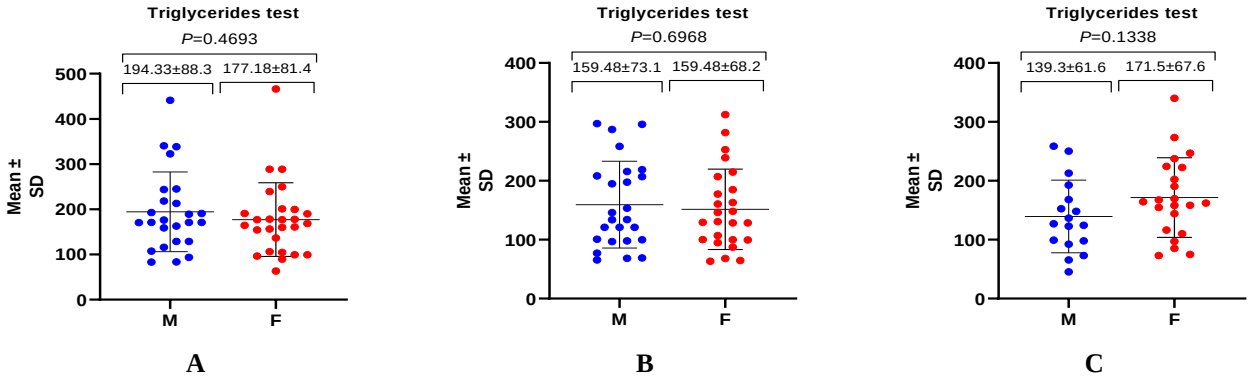

Figure 1: Scatter plot for triglycerides distribution (mg/dL) between males (M) and Females (M). A= diabetes with overweight, B= diabetes without overweight and C= control.

The mean ± SD and p value of total cholesterol (TC) between male and female are displayed in Figure 2. The results of the current study showed that there were no significant differences between males and females in all of the study groups. Noting that increase the mean ± SD values of total cholesterol appeared in diabetes patients with overweight compared to other groups, as females recorded the highest value compared to males. While the mean was higher in males than females in both other groups, healthy group and diabetics without over weight.

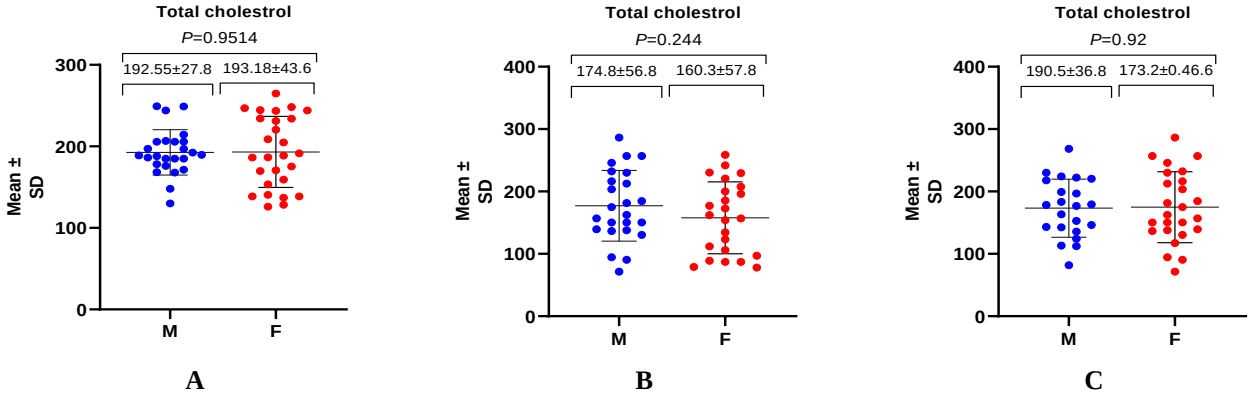

Figure 2: Scatter plot for total cholesterol distribution (mg/dL) between males (M) and Females (M). A= diabetes with overweight, B= diabetes without overweight and C= control.

The mean ± SD and p value of High Density Lipoprotein (HDL) between male and female are represented in Figure 3. In this study, we found that there was a statistically significant (p=0.0246) between males and females in diabetes without overweight. It can also be noted that the mean ± SD value was higher in female's compared males in all study group. The mean ± SD and p value of Low-density Lipoprotein (LDL) between male and female are set out in Figure 4. As Figure 4 (C) shows, there is a significant difference (p = 0.02) between males and females in control group. Also, from this Figure, it can be seen that the mean ± SD value was higher in males compared females in all study group.

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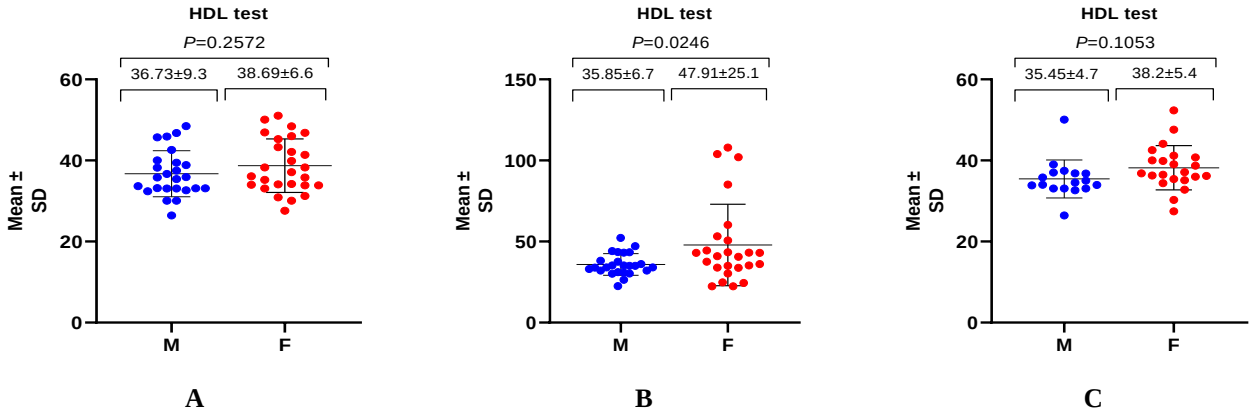

Figure 3: Scatter plot for HDL distribution (mg/dL) between males (M) and Females (M). A= diabetes with overweight, B= diabetes without overweight and C= control.

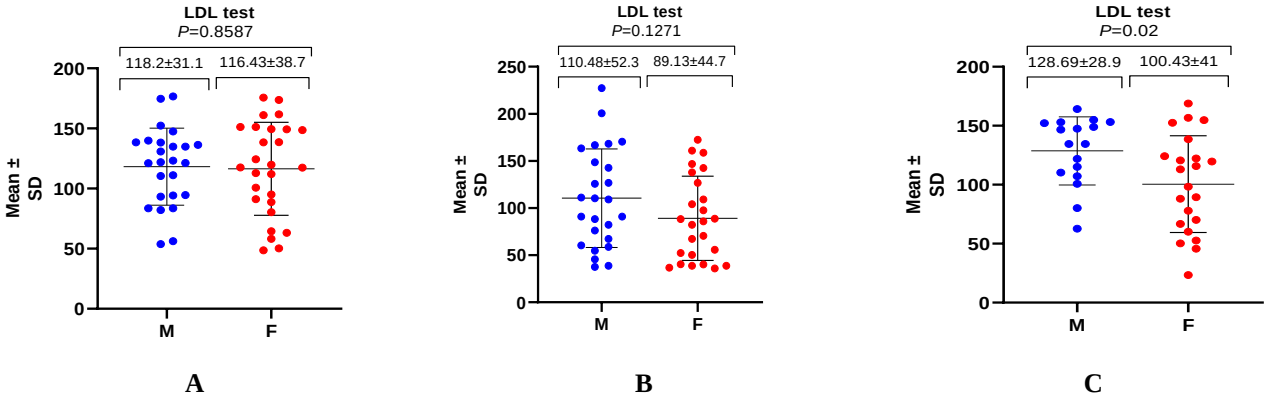

Figure 4: Scatter plot for LDL distribution (mg/dL) between males (M) and Females (M). A= diabetes with overweight, B= diabetes without overweight and C= control.

The mean ± SD and p value of Very Low-density Lipoprotein (VLDL) between male and female can be compared in Figure 5. Further statistical tests revealed no significant differences between males and females in population study. It is apparent from our data that low level in the mean ± SD values appeared in control group compared to both diabetes groups. Also, females recorded the small raise in the mean ± SD value compared to males in both control and diabetes without overweight groups, While the mean value were close in the group of diabetes with overweight.

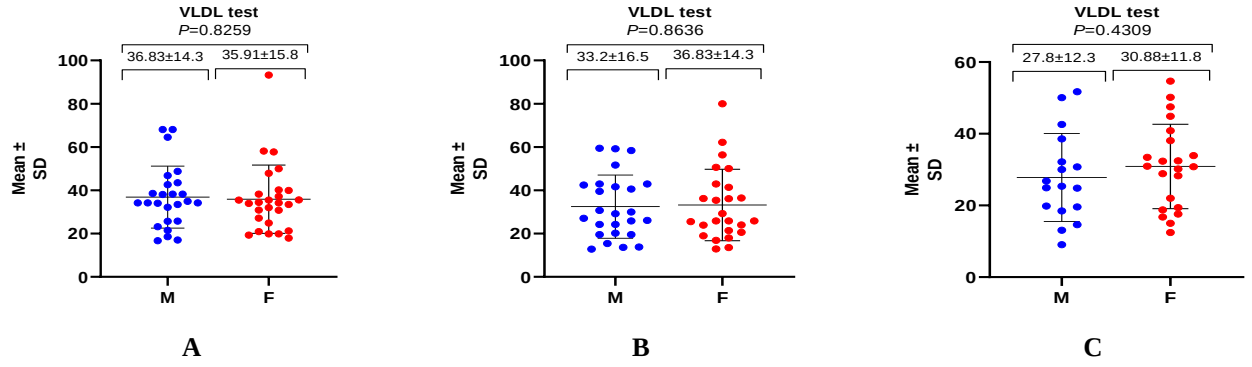

Figure 5: Scatter plot for VLDL distribution (mg/dL) between males (M) and Females (M). A= diabetes with overweight, B= diabetes without overweight and C= control.

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ISSN: 2583-4053

Volume-1 Issue-3 || August 2022 || PP. 120-127

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IV. DISCUSSION

Diabetes is one of the common diseases in the study area, in addition to its direct or indirect relationship to other diseases. In this study, the difference between males and females in terms of the severity of diabetes was addressed, and in some detail, the lipid profile between males and females were investigated among the study groups.

From the results of FBG and HbA1c, we note that there is increase in the level of glucose in males compared to females in both patients group, but not reach at statistically significant. Many previous studies confirmed that FPG and HbA(1c) level in males is higher than in females (20,21,22). As for the results of the PPG test, the differences were not significant with the increase in glucose level in females compared to males in both the control and diabetic groups. It has been suggested that higher body muscle and/or more quickly intestinal glucose absorption in males than females is accountable for this difference (23, 24). Interestingly, there was an increase in the PPG level in males and it reached at significant difference in the diabetic with overweight group (P=0.033), and the results also recorded an increase in the HbA1c concentration in females and reached at significant difference in the control group (P=0.024). This may be due to the fact that sex differences appear between males and females, including sex chromosomes, gene expression, sex hormones, anatomy and physiology (25,26). In addition to other reasons related to age, lifestyle, nutrition system, environmental factors and some associated diseases.

The results of the triglycerides level test showed an increase in the mean among diabetics groups in compared with the control group, interestingly that the most increase was in males. Except mean TG level in diabetic women without overweight, the Comparison of the findings with those of other studies confirms Increased TG level was associated with a diabetic risk in both sexes (27). In the healthy group, we notice an increase in the level of females compared to men, these findings of the current study do not support the previous research that suggests in young adulthood, men tend to have higher triglyceride levels than women (28). Triglyceride-Glucose is possibly useful for predicting T2DM in clinical practice. It is a possibility mediator of association between BMI and risk of developing T2DM (29). The reason may be due to vary in the female's age, lifestyle, race and genetic factors.

Through the results of total cholesterol, there are no significant differences between the study groups, but generally, the concentration level were almost equal in the diabetes with overweight, but in both heathy and diabetes without overweight group the means TC were lower in females compared to males. Usually large fluctuations in total cholesterol levels raise the risk of diabetes (30). In general, the total cholesterol level is lower in diabetic patients (31, 32). In agreement with the present results, previous studies have demonstrated that Diabetic men had higher levels of total cholesterol compared to diabetic women (33). In addition, other factors influencing the gender difference for example: before reaching menopause, the total cholesterol in women was higher than in men of the same age (34). In results of HDL_C tests, there was no significant differences between males and females in both control and diabetics with overweight groups, while we notice a significant difference (p=0.0246) between females and males in the diabetic without overweight group. Also, that HDL_C mean was higher in females versus males in all study groups. In general, a low level of HDL_C is associated with diabetes risk (35). In accordance with the present results, previous studies have demonstrated that women have a higher level than men in HDL_C (36, 37, 38). Before the age menopause, HDL_C levels are higher in women compared with men of the same age because the female sex hormone estrogen look to enhance this good cholesterol (39). In addition to gender, there may be other reasons that lead to the discrepancy in the level of HDL, such as race, ethnic groups, and geographical difference. For example: Native Americans carrying the R230C (rs9282541) variant in ABCA-1, which is apparent associated with low HDL-C levels, obesity and type 2 diabetes (40, 41). In LDL_C mean, there are no significant differences between males and females in both diabetes groups. While there was significant differences between males and females in healthy group. In general and by matching for age, sex and body weight, LDL_C levels in individuals with diabetes are not higher than those in individuals without diabetes (42). After menopause, LDL_C levels raise, commonly exceeding those of age-matched men (39). On other hands, Obesity increases the level of LDL cholesterol your liver makes (43). Also, the genetic effect may have a significant influence, in some cases, high LDL_C is inherited. Familial hypercholesterolaemia is form of inherited condition characterized by higher than normal levels of LDL_C blood cholesterol (44).

Regarding the results of VLDL-C, there are no significant differences between males and females in all study groups. Poorly controlled type 1 diabetes and type 2 diabetes are associated with raised concentration of VLDL_C (45). These results seem to be consistent with other research which found that VLDL_C clearly showed higher values in the order of type 2 diabetic patients with obesity (46).

V. CONCLUSIONS

The present study was designed to determine the association of lipids profile in diabetes patients with and without overweight based on sex difference. Regarding the results of glucose level, the results of the current study showed significant differences between males and females in HbA1c test of control group

ISSN: 2583-4053

Volume-1 Issue-3 || August 2022 || PP. 120-127

https://doi.org/10.55544/jrasb.1.3.16

(P=0.024) and in PPG test of Diabetes without overweight group (P=0.033). While the results of lipids profile showed significant differences between males and females in HDL_C test of diabetes without overweight group (P=0.0246) and in LDL_C test of control group (P=0.02). The evidence from this study suggests that variation in lipid profile in diabetes may be based on sex differences. Notwithstanding the relatively limited sample and age data, this work offers valuable insights into diabetes development between men and women. Further investigation and experimentation sex difference into diabetes is strongly recommended.

Author Contributions: Author Contributions: Asmaa S. Mohammed: Sample collection and carried out the research. Maan H. Salih: Supervision, involved in designing the protocol, analyzed the data, and Writing - Review of the manuscript. Maksood A. M.Al-Doori: Supervision, planned the study, Sample collection, and helped in carried out the research. All authors read and approved the final version of manuscript.

Conflicts of Interest*:* no conflict of interest.

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ISSN: 2583-4053

Volume-1 Issue-3 || August 2022 || PP. 120-127

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