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Correlation between lipid profile and BMI in Type 2 Diabetic Sudanese patients

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Abstract: Background: *Diabetes mellitus type II is a metabolic disorder that is characterized by hyperglycemia in the context of insulin resistance and relative lack of insulin. Obesity is thought to be the primary cause of type 2diabetes in people who are genetically predisposed to the disease* ***Objective:*** *To determine the correlation between body mass index (BMI) and lipid profile in patients with Type 2 Diabetes Mellitus (T2DM) .****Methodology: study population:*** *seventy patients with T2DM .* ***Study area and duration:*** *visiting aboagalla Center and difference follow up diabetic center between 2016 to 2021 were included in this study.* ***Sample collection and preparation:*** *Three ml of blood were collected from each participant into anticoagulant tube to obtain plasma and lipid profile were measured by automated chemical analyzer (Cobse C311 Roche).Body weight , body height , and from Roche instrument also anthropometric (body weight, body height, and waist circumference were measured by using the scale.* ***Results:*** *The means of FBG, TRI and HDL levels (168.1 ± 67.4,131.6 ± 63.1and 40.7 ± 24.5 were increased among obese group when compared with normal and overweight groups, without significant differences, Moreover the mean value of CHOL and LDL (176.2 ± 33.0 and 118.1 ± 30.7 respectively) were higher in overweight group when compared with the normal weight and obese groups with insignificant difference .****Conclusion:*** *The results suggest a high total cholesterol in obese group while high level of triglyceride in over weight group and increase level of LDL in normal weight, which might be playing a major role in the development of cardiovascular diseases among diabetic patients.. These results are important to indicate that there is modest impact of BMI on lipid profile.*

Keywords: Lipid profile, Body mass index, Type 2 diabetes mellitus.

Introduction:

Diabetes mellitus type II is a metabolic disorder that is characterized by hyperglycemia in the context of insulin resistance and relative lack of insulin. the prevalence of diabetes mellitus is developing rapidly worldwide and is reaching epidemic proportions. the worldwide incidence of diabetes among adults is anticipated to be 6.four%, affecting 285 million people in 2010 and is expected to increase to 7.7% affecting 439 million humans by 2030(Kolhar and Priyanka ,2017).it is a syndrome of impaired carbohydrate, lipid and protein metabolism resulting from either lack of insulin secretion or reduced sensitivity of the tissues to insulin (Hinge et al, 2019). In Sudan, the national prevalence of diabetes in adults is 7.7% and is expected to reach 10.8% in 2035. obesity is a complicated multifactorial disorder defined as weight/height2 is the most widely used and easy measure of body size (Chooi, Y.C, 2019). The WHO defines obese and weight problems as body mass indexes (BMI) 3 25 and 30 kg/m2 , respectively and expected that 1.9 billion adults had been overweight and 650 million obese in 2016 (https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight). obesity is now appeared as a chronic, progressive disease with remissions and relapses (Bray et al.,2017) and an vital driver of the development of diabetes and many of its related features. (GBD 2019 Risk Factors Collaborators, 2020). GWASs have recognized thousands of genetic loci which can be robustly related to complicated diseases and developments, including seven-hundred for obesity (Yengo et al., 2018) the general obesity is related to female sex and good glycaemic control,while abdominal obesity is related to woman intercourse and insulin treatment (Chetoui,et al ,2021)and at least 400 for type 2 diabetes (Mahajan et al., 2018). Loci associated with type 2 diabetes act predominantly through the perturbation of insulin secretion, (Barroso and McCarthy, 2019) the worldwide incidence of overweight and obesity has doubled since 1980 to an extent that nearly a third of the world's population is now classified as obese or overweight(Chooi, Y.C, 2019) . many previous published information have mentioned that most of patients with T2DM are overweight or obese (Chetoui et al ,2021). Others research have shown a direct relationship between increasing BMI and raised TC, LDL-C, and TG and an inverse correlation with HDL-C. This correlation between BMI and lipoprotein ranges, mainly LDL-C, has been proposed to be a strong contributing danger factor for cardiovascular sicknesses in obese person (Hussain et al, 2019). Dyslipidemia is the most common complication of diabetes mellitus (Kaur, et al ,2017) and this requires early and general screening of lipid profile. there's also an urgent demand for measures that concentrate on tight glycemic, optimal lipid profile control and life style changes is also required to all diabetic patients to obtain goal value of HbA1C ≤ 7 (Shahwan,2019) .

MATERIAL AND METHODS

This study was performed in the Sudan, Gzira state in wed Medani aboagalla center and difference follow up diabetic center between 2016 to 2021. . A total of 70 patients were studied. patients whose taking multinutrition supplementation or having hepatic, renal or metabolic bone disease (such as parathyroid disease)have been excluded from the study for the purpose that the ones situations would possibly have an effect on the carbohydrate and lipid metabolism in diabetes. Also those patients having history of mal absorption syndromes such as celiac disease or active malignancy or with active infection were excluded from the study. Written consent was taken from each subject, fulfilling the mentioned criteria at above, before study inclusion. Study participant were asked to finish a generalized questionnaire that contains demographic data such as beyond and present medical records, and to go back after fasting for more than eight hours . Blood samples have been estimated the levels of glucose and lipid profile. by Cobse C311 from Roche instrument .also anthropometric (body weight, body height, and waist circumference) were taking by using the scale to measurement the wieght and the meter for length

BMI was calculated as follows:

$$\text{BMI}= \frac{(wieght)(Kg)}{(Hight)^2\ (m)^2}$$

After explaining the type of study, written consent was taken from all the subjects. 8-12 hour fasting period, venous blood samples were collected from all the patients. Plasma was separated , plasma lipid profile levels and fasting blood glucose were estimated by fully Automated Analyzer (Cobas c311Rosh diagnostics, Germany).

Ethical consideration:

Ethical approval: Was obtained from health ministry Gezira State

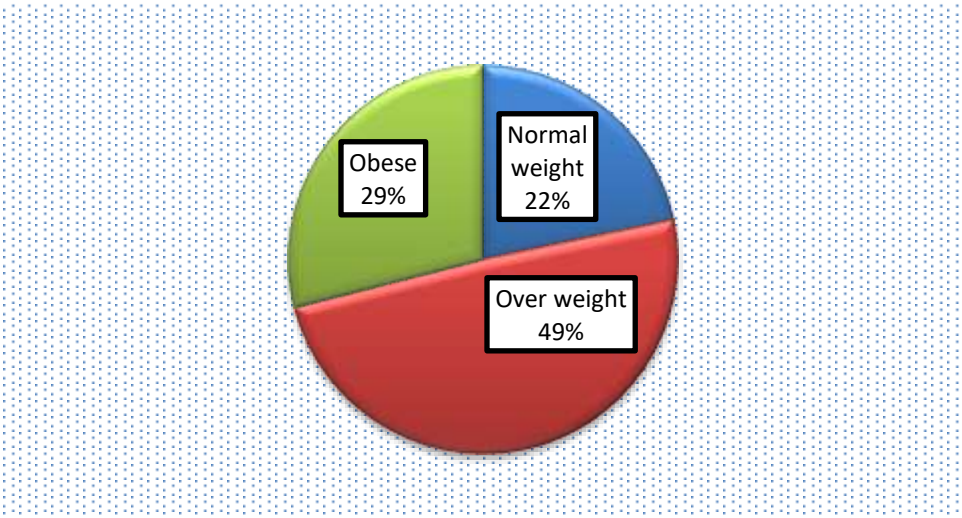
Ethical permission: Was obtained from faculty of medical laboratories sciences. University of Gezira

Informed consent: Information was collected from diabetic patients under privacy and was used only for this study.

Data Collection and Data Analysis

The data was collected by structural a questionnaire and then analyzed using statistical package for social science (SPSS) computer version (22)

Result:



Figures 1 : Classification of patients according BMI

According to who BMI criteria patients were divided into three groups, group one consisted normal weight 15(22%) , group two overweight 34 (49%) and group three obese 20 (29%).

Abnormal frequent feature of lipid profile was showed clearly in normal weight ,over weight group and obese group respectively (22 ,63 and 36) showed in table (1)

Table 1 : Distribution of abnormal lipid profile among study subjects

	Normal weight		Over weight		Obese	
	Frequency	Percept	Frequency	Percept	Frequency	Percept
TCH	1	5	8	13	7	19
TG	1	5	9	14	4	11
HDL	11	50	24	38	13	36
LDL	9	40	22	35	12	34
TOTAL	22	100	63	100	36	100

Table:2 showed that the mean ±SD of serum CHOL level were (159.1 ± 34.8, 176.2 ± 33.0 and 174.3 ± 45.7) in normal weight, overweight and obese respectively with insignificant differences(P=0.332), the mean value of TRI level for normal weight, overweight and obese were 102.3 ± 54.0, 125.1 ± 65.8 and 131.6 ± 63.1 respectively without significant differences(P=0.365) , furthermore, serum HDL was (were 35.3 ± 5.5, 37.3 ± 5.5 and 40.7 ± 24.5) among normal weight, overweight and obese respectively with insignificant differences (P=0.504) and LDL in normal weight, overweight and obese were 105.8 ± 36.1, 118.1 ± 30.7, 110.6 ± 41.4 respectively without significant differences (P=0.496).

Table 2 : Lipid profile among Normal weight, Over weight and Obese

		N	Mean	Std. Deviation	P. Value
CHOL	Normal weight	15	159.1	34.8	0.322
	Over weight	34	176.2	33.0	
	Obese	20	174.3	45.7	
	Total	69	171.9	37.5	
TRI	Normal weight	15	102.3	54.0	0.365
	Over weight	34	125.1	65.8	
	Obese	20	131.6	62.1	
	Total	69	122.0	62.4	
HDL	Normal weight	15	35.3	5.5	0.504
	Over weight	34	37.3	5.5	
	Obese	20	40.7	24.5	
	Total	69	37.8	13.9	
LDL	Normal weight	15	105.8	36.1	0.496
	Over weight	34	118.1	30.7	
	Obese	20	110.6	41.4	
	Total	69	113.2	35.1	

NB:

FBS :Fasting Blood Sugar

TRI: Triglycerides HDL: High density lipoprotein LDL: Low density lipoprotein

.The results of this study showed that BMI was positive correlation (0.092 , 0.196 , 0.035, 0.197 , 0.211 and 0.706) with CHOL,TRI,LDL,TG/HDL ,Age and CW respectively also CW was positive correlation (r=0.706, 0.02 , 0.09, 0.073 ,0.14 and 0.238) with BMI , CHOL,TRI,LDL,TG/HDL and Age respectively otherwise TRI was positive correlation (r=0.196, 0.214 , 0.914, 0.297 and 0.09) with BMI, CHOL , TRI, TG/HDL , Age and CW respectively. TG/HDL was positive correlation (r=0.197, 0.038 , 0.914, 0.340 and 0.14) with BMI , CHOL , TRI, Age and CW respectively while HDL was negative correlation (r=-0.,027,- 0.152 ,- 0.156, - 0.388 , -133, and - 0.127) with BMI , TRI , LDL , TG/HDL , Age and CW respectively and LDL had negative correlation (r=-0.079 ,- 0.156 ,- 0.136, - 0.076 and - 0.073) with TRI , HDL , TG/HDL , Age and CW respectively. The CHOL showed positive correlation with all parameters. The CHOL noted positive correlation(r=0.092, 0.175 , 0.857, 0.038 , 0.014 and 0.02) with BMI , TRI, HDL , LDL , TG/HDL , Age and

CW respectively and finally the Age noted positive correlation(r=0.211 , 0.014 , 0.297, 0.340 and 0.238) with BMI , CHOL , TRI , TG/HDL and CW respectively (table 3)

Table 3 : Correlation analysis between FBS and lipid parameters

	BMI	FBS	CHOL	TRI	HDL	LDL	TG/HDL	Age	CW
BMI	1	0.097	0.092	.196*	-0.027	0.035	.197*	.211*	.706**
CHOL				.214*	0.175	.857**	0.038	0.014	0.02
TRI					-0.152	-0.079	.914**	.297**	0.09
HDL						-0.156	-.388**	-0.133	-0.127
LDL							-0.136	-0.076	0.073
TG/HDL								.340**	0.14
Age									.283**
CW									1

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

FBS :Fasting Blood Sugar

BMI: Body Mass Index

CHOL: Total cholesterol

TRI: Triglycerides

HDL: High density lipoprotein

LDL: Low density lipoprotein

CW : waist circumference

TG/HDL :Ratio between triglyceride and high density lipoprotein

Discussion

T2DM is increasing sharply and is becoming a serious public health problem. We investigated the relationship between BMI and blood lipid profiles with T2DM to improve its diagnosis and prevention and reduce not only a significant economic and societal burden but also a social burden on individuals. A previous study showed that relative risk of T2DM predicted by BMI was 1.18 (95% CI 1.16–1.20), which increased with increasing BMI. BMI serve as parameter to estimate general fat masses. A previous study in Germany has found high prevalence for obesity (23.9%) (Cui et al,2016).

In this study, there are differences between three groups (normal weight, over weight and obese) in the levels of CHOL, TRI, HDL and LDL with insignificant difference was observed. High levels of TRI and HDL were showed in obesity group while high levels of COHL and LDL were showed in over weight (showed in table 1) .These results are in agreement with those obtained by rongtao and others(2016) done in Germany .and This finding was also reported by other study done in Peshawar by Arshad Hussain and others (2019). Higher levels of fat in the cells prevent the action of insulin, and so produce insulin resistance and then the development of type II DM. The high prevalence of obesity has largely been attributed to the dietary habits, which include high intake of fatty and sweet foods and dates, lack of physical activity (Sabahelkhier et al,2016).

This study showed that relative risk of T2DM predicted by BMI, which increased with increasing BMI

The current study found that BMI were positive correlation with all parameters except HDL had negative correlation .while the TRI reported significant positive correlation with all parameters except HDL and LDL Our findings were agree with study done by Khalil and Elsadig in Saudi Arabia(2020), The possible mechanism responsible for hypertriglyceridemia may be due to increased hepatic secretion of very low density lipoprotein (VLDL) and delayed clearance of triglyceride rich lipoproteins, which is predominantly due to increased levels of substrates for triglyceride production, free fatty acids and glucose (Ozder,, 2014) .

Another important finding was that significant correlations were observed in all parameters except HDL and LDL (Table 2). Our findings were in line with a previous study done by Ozder, A., 2014 in Turkey. Results of the correlations study suggest a clear association between hyperglycemia and appearance of dyslipidemia

Conclusion

The present study suggested that common lipid abnormalities during diabetes induced dyslipidemia are hypercholesterolemia and hypertriglyceridemia. Results suggest a high prevalence of dyslipidemia, which might be playing a major role in the development of cardiovascular diseases among diabetic patients. The optimal care for diabetic patients should include routine monitoring of blood glucose and serum lipid profile. Efforts to achieve lifestyle changes, such as weight reduction, physical exercise and smoking should be encouraged and initiated first and then followed by medication with lipid lowering drugs prescribed in evidence-based necessary condition

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