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FREQUENCY AND RELATION BETWEEN BMI AND LIPID PROFILE IN TYPE 2 DIABETIC PATIENTS WITH CARDIOVASCULAR COMPLICATION IN THE SUDANESE POPULATIONS (WHITE NILE STATE)

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Abstract

Objective: The study aimed to explore the correlation between body mass index (BMI) and lipid profiles in type 2 diabetic patients (T2DM) with cardiovascular disease (CVD) in White Nile State.

Method: It involved 200 participants from various hospitals, divided equally into two groups. The first consisted of T2DM patients with CVD, while the second comprised healthy non-diabetics. Participant samples were processed and analyzed using appropriate techniques. Statistical analysis was performed using the SPSS program.

Results: The findings indicated significant dyslipidemia in the case group compared to the control group, a notable positive correlation between BMI and total cholesterol (TC), LDL, and HDL, and a significant negative correlation between BMI and triglycerides (TG).

Conclusion: BMI does not accurately assess adiposity and, therefore, may not reflect cardiovascular complications in patients with Type 2 Diabetes Mellitus (T2DM) accurately. It is suggested that alternative measures like leptin levels and waist circumference could be more effective in predicting dyslipidemia and cardiovascular complications.

Keywords: Body Mass Index, Type 2 Diabetes Mellitus, Lipid Profile.

Introduction

Diabetes mellitus is a chronic metabolic disorder marked by hyperglycemia due to impaired insulin secretion, action, or both [1]. Type 2 diabetes mellitus (T2DM), accounting for over 90% of diabetes cases globally [2], arises from a combination of defective insulin secretion and insulin resistance [3]. Dyslipidemia, often associated with atherosclerosis, can be exacerbated by T2DM through disrupted carbohydrate metabolism, insulin resistance, and obesity, potentially leading to cardiovascular disease (CVD) [4, 5, 6]. Although the precise mechanisms of dyslipidemia remain unclear, insulin resistance is a key factor in its development. Dyslipidemia's hallmark traits are elevated triglycerides (TG) and low-density lipoprotein (LDL), along with decreased high-density lipoprotein (HDL). This can be traced back to an increased release of free fatty acids from insulin-resistant adipocytes, which, coupled with high hepatic glycogen levels, boosts TG production and subsequent very low-density lipoprotein (VLDL) secretion. Elevated VLDL and TG levels can suppress HDL formation and raise LDL levels. Moreover, insulin resistance modifies several enzymes involved in HDL synthesis [7].

Obesity, defined as a body mass index (BMI) of 30 kg/m2 or higher [8], is a major risk factor for T2DM [9]. It is closely linked to T2DM, with over 85% of individuals with the condition being overweight or obese [10]; however, not all obese individuals develop T2DM [11]. The rising prevalence of severe obesity in adolescents may heighten diabetes risk and precipitate the onset of its advanced complications [12]. Although BMI is a somewhat imprecise measure of body fat, it remains a commonly used gauge for adiposity [13].

Methodology

Study area and sample collection

The study incorporated various hospitals in White Nile State, with a total of 200 participants split into two groups of 100 each. The case group consisted of diabetics with cardiovascular complications, while the control group comprised 100 healthy volunteers from different hospitals in White Nile State. After fasting overnight, samples were collected from each participant. 7.5 ml of venous blood was aseptically drawn and divided into three portions: the first for glucose estimation using a fluoride oxalate tube, the second placed into a heparin tube for lipid profile analysis, and the third into an EDTA container for glycosylated hemoglobin (HbA1c) measurement. Participants' weight (kg) and height (m) were recorded to calculate the body mass index (BMI) (kg/m^2) using the formula: BMI = weight (kg) / height^2 (m)^2. Data analysis was conducted using the SPSS program, employing Pearson's correlation for assessing correlations and independent t-tests and ANOVA for comparing means of different parameters.

Results:

BMI: In the case group BMI, the minimum value was 19.50, the maximum value was 65.10, and the mean value was 27.85. For the control group, the values were lower. They were 17.9, 56.0, and 24.32 representing the minimum, the maximum, and the mean values, respectively (refer to Table 1).

Fasting Blood Glucose (FBG) and HBA1c:

As shown in table (1) fasting blood glucose was significantly higher among the case group, compared with the control group while the increase in HBA1c was insignificantly higher.

Table 1. BMI, FBG and HBA1c values for case and control

Parameter	Control N=100 Mean ±Std. Deviation	Cases N=100 Mean ±Std. Deviation	P. value
FBG (mg/dl)	112.7±38.2	177.3±86.7	0.000
HbA1c (%)	5.7±4.4	8.8±1.5	0.621
BMI kg/m2	24.3±4.8	27.85 ±6.02	0.138

Lipid Profile: Table 2 illustrates the lipid profiles of the case and control groups. It supports dyslipidemia among the case group compared with the control group, as TC, TG, and LDL were significantly higher and HDL was significantly lower in the case group compared with the control group.

Table 2. Lipid profile for case and control

Parameter	Control N=100	Cases N=100	P value
	Mean ±Std. Deviation		
TC (mg/dl)	173.1±27.4	231.5±67.1	0.000
TG (mg/dl)	75.6±15.1	127.9±73.3	0.000
LDL (mg/dl)	84.4±20.2	142.3±62.9	0.000
HDL (mg/dl)	78.5± 14.9	44.9±17.6	0.039

Correlation between BMI and lipid parameters.
As shown in Table (3) Pearson's correlation of BMI and lipid profile parameters showed a significant positive correlation between BMI and TC (p = 0.01), LDL (p=0.035), and HDL (p = 0.039) and a significant negative correlation between BMI and TG (p-value = -.021).

Table 3. Correlation between BMI and Type 2 diabetes mellitus in case samples

		BMI	TC	TG	LDL	HDL
BMI	Pearson Correlation	1				
	Sig. (2-tailed)					
	N=100					
TC	Pearson Correlation	.010	1			
	Sig. (2-tailed)	.919				
	N=100					
TG	Pearson Correlation	**-.021**	.231	1		
	Sig. (2-tailed)	.836	.021			
	N=100					
LDL	Pearson Correlation	.035	.710	.378	1	
	Sig. (2-tailed)	.733	.000	.000		
	N=100					
HDL	Pearson Correlation	.039	.845	-.012	.572	1
	Sig. (2-tailed)	.700	.000	.910	.000	
	N=100					

Discussion

Our study indicated a significant rise in fasting blood glucose (FBG) among the case group compared to the control group, yet the increase in HbA1c was not significant. This may be due to the inclusion of prediabetic and diabetic individuals in the control group, where the mean HbA1c was 5.7 ± 4.4. Conversely, the case group participants are on hypoglycemic medications, which could contribute to lower HbA1c levels.

In diabetes mellitus, typical dyslipidemia characteristics include elevated triglycerides (TG), low-density lipoprotein (LDL), and decreased high-density lipoprotein (HDL) [7]. Our findings align with this, as both TG and LDL levels were significantly higher and HDL levels were significantly lower in the case group compared to the control group. As for the correlation between body mass index (BMI) and dyslipidemia, BMI showed a significant positive correlation with total cholesterol (TC), LDL, and HDL and a significant negative correlation with TG. This was unexpected since BMI is a measure of adiposity, which is a known major contributor to dyslipidemia. Our results contrast with those of Shamai et al., (2011), who reported a negative correlation between BMI and HDL and a positive one with TG [14]. Similarly, Hussain 2019 observed a negative correlation between BMI and HDL, which differs from our findings, but he reported no significant correlation between BMI and LDL [15]. Alkhalidy et al., (2021), found no association between BMI and cardiovascular disease (CVD), whereas waist circumference was strongly linked to CVD [16], supporting Shah and Braverman's assertion that BMI underestimates adiposity [13].

Conclusion

Our research indicates that patients with type 2 diabetes mellitus (T2DM) and cardiovascular disease exhibit

dyslipidemia, characterized by elevated triglycerides (TG), low-density lipoprotein (LDL), and decreased high-density lipoprotein (HDL). Body mass index (BMI) is not a precise indicator for evaluating adiposity, so it is not reliable for predicting cardiovascular complications in T2DM patients. Alternative measures such as leptin levels and waist circumference should be considered for predicting dyslipidemia and cardiovascular complications.

Informed Consent:
Before the commencement of the study, all participants were assured of the confidentiality of their data. Then the objective and data processing were made clear to them before they signed written consents.

Conflict:
The authors declare no conflict of interest.

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