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Correlation between Serum CD36 Level and Lipid Profile in Patients with Type 2 Diabetes Mellitus, Khartoum State, Sudan

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Abstract

Background: Diabetes mellitus (DM) is a chronic metabolic disorder characterized by hyperglycemia. DM-related dyslipidemia are associated with complications resulting from progressive damage of various organs. CD36 is 88-kD, class B scavenger receptor, expressed on different types of cells. In diabetic patients, LDL particles are glycated with strong level; this increases CD36 expression, initiates foam cell formation and accelerates atherosclerosis. **Objective:** This study aimed to determine the correlation between serum CD36 level and lipid profile among patients with type 2 diabetes mellitus in Zeenam Specialized center, Khartoum State, Sudan, in a period between 2019 and 2022. **Methodology:** Hundred participants at different ages were included in this study; 70 were type 2 diabetic patients (cases) and 30 apparently healthy individual (control). 3 ml of venous blood were collected from the participants by using a sterile needle and syringe into a labeled plain container. Each sample was stood until complete clot occurs. Clotted blood sample was then centrifuged to obtain the serum. Then they were used for measurement of total cholesterol, LDL cholesterol, HDL cholesterol, triglyceride and soluble CD36 levels. Total cholesterol, LDL cholesterol, HDL cholesterol and triglycerides were measured using Biosystem chemistry analyzer BTS-302. Serum CD36 was measured using Microplate Reader (URIT-660). **Results:** The results revealed that serum total cholesterol, LDL cholesterol, HDL cholesterol, and triglyceride levels were significantly higher in patients with type 2 diabetes mellitus compared with control ($P = 0.03$, $P = 0.031$, $P = 0.000$, $P = 0.000$) respectively, while there is no statistically significant differences in serum CD36 level between cases and control ($P = 0.129$). Also this study showed that there is no statistically significant correlation between serum CD36 level and total cholesterol, LDL cholesterol, HDL cholesterol, triglycerides, age and body mass index. **Conclusion:** This study concluded that there

is no statistically significant difference in serum CD36 level between cases and control. And sCD36 level was not correlated with total cholesterol, LDL cholesterol, HDL cholesterol, triglycerides, body mass index, and age.

Keywords

Type 2 Diabetes Mellitus, Serum CD36, Lipid Profile, Sudan

1. Introduction

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by hyperglycemia [1]. Type 2 diabetes mellitus is a persistent and universal threat to human health and global medical care. 463 million people had type 2 diabetes mellitus in 2019, and it is expected that the number of type 2 diabetic patients will reach 700 million by 2045 [2]. In addition to that, the 2017 Global Burden of Diseases studies estimated that high fasting plasma glucose level was the third most common risk factor for disability adjusted life years globally. And it is an important risk factor for cardiovascular diseases [3]. DM-related dyslipidemia are associated with complications resulting from progressive damage of various organs, such as kidneys, eyes, peripheral nerves, heart, and blood vessels. Atherosclerosis is much more aggressive in diabetics than non-DM patients [4]. A Cluster of differentiation 36 (CD36) is 88 kilo Dalton, heavily glycosylated class B scavenger receptor, expressed on the cell surface of different types of cells, such as platelets, monocytes, macrophages, dendritic cells, microvascular endothelial cells, T and B cells, myocytes, adipocytes, some specialized epithelial cells, and immature erythrocytes [5]. CD36 acts as a receptor for wide range of ligands and mediating different signaling pathways according to cell type [4]. It was reported that CD36 has a role in irreversible platelet aggregation as it is a cellular receptor for thrombospondin. In the macrophage it act as a receptor for oxidized LDL (oxLDL), thereby establishing its role as a scavenger receptor, and that CD36 facilitates a membrane fatty acid transport [6]. The modified lipoproteins uptake by scavenger receptors is thought to be central to foam cell formation. Also, scavenger receptors initiate signaling cascades that regulate macrophage activation, lipid metabolism, and inflammatory programs that may influence the development and stability of atherosclerotic plaques [7]. Different studies were revealed that the circulating, non-cell bound, CD36, also known as soluble CD36 (sCD36) protein acts as a marker for altered cell-bound CD36 receptor expression and its plasma level is 4 - 5 fold more increase in obese type 2 diabetic subjects than healthy one. Also it is reported that there was a significant correlation between plasma sCD36 level and atherosclerosis markers [8]. In diabetic patients, LDL particles are glycated with more strong level than their oxidation, this increases CD36 expression, oxidized LDL internalization and cholesterol accumulation in macrophages which initiates foam cell formation and accelerates atherosclerosis [9]. This study aimed to determine the correlation between

serum CD36 level and total cholesterol, LDL, HDL and triglyceride levels.

2. Materials and Methods

2.1. Study Design and Population

This a case control study conducted on Zeenam Specialized Clinical Center in Khartoum, Sudan, in a period from 2019 to 2022. It included 100 Volunteers; 70 participants were type 2 diabetic patients (cases) and 30 were apparently healthy individuals (as control group). Diabetic patients with hypertension, thyroid, renal, heart, liver diseases were excluded from this study.

2.2. Data Collection and Analysis

Data was collected by using a questionnaire. A sufficient copy of the questionnaire was produced. Questionnaires were then filled by the investigator during each time when blood samples collected. Completed questionnaires from selected study areas were collected. Data was then analyzed and tabulated using statistical package for social sciences (SPSS) program version 20, T test, Ann-Whitney test, a crosstabs and correlation were performed.

2.3. Ethical Considerations

This was approved by the research ethical committee (IRB) of the Faculty of Medical Laboratory Science at University of Gezira, Sudan. All participants signed a standard informed consent.

Blood sampling and Collection:

3 ml of venous blood were collected from the participants by using a sterile needle and syringe into a labeled plain container. Each sample was stood until complete clot occurs. Clotted blood sample was then centrifuged to obtain the serum. Then they were used for measurement of total cholesterol, LDL cholesterol, HDL cholesterol, triglycerides and soluble CD36 levels.

2.4. Methods

Total cholesterol, LDL, HDL and triglycerides were measured by enzymatic methods using Biosystem chemistry analyzer BTS-302; Serial No: 801010336, EU. Serum CD36 was measured by Enzyme linked immunosorbant assay using Microplate Reader (URIT-660); Serial No: 660-03448E, China.

BMI was calculated as follows:

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

3. Results

This case control study included 100 samples; 70 samples collected from patients with type 2 diabetes mellitus at different ages and 30 samples collected from healthy individuals as control group. According to age group patients were distributed into three groups; 20 - 40 years (45.7%), 41 - 60 years (15.7%) and above

60 years (38.6%) (Table 1). According to body mass index they also distributed into three groups; normal weight (41.4%), over weight (28.6%) and obese (30%) (Table 2). After conducting the appropriate tests the following results were obtained: serum total cholesterol, LDL cholesterol, HDL cholesterol, and triglyceride levels were significantly higher in patients with type 2 diabetes mellitus (M ± SD = 189.67 ± 43.813, 123.66 ± 38.335, 44.74 ± 13.227, 112.57 ± 40.581) compared with control (M ± SD = 163.67 ± 26.266, 107.1 ± 23.62, 36.07 ± 8.221, 86.63 ± 25.045, $P = 0.03$, $P = 0.031$, $P = 0.000$, $P = 0.000$) respectively, while there is no statistically significant differences in serum CD36 level between cases and control (8.2 ± 13.0432, 3.533 ± 12.494, $P = 0.129$) (Table 3). Also this study showed that there is no statistically significant correlation between serum CD36 level and total cholesterol, LDL cholesterol, HDL cholesterol, triglycerides, age and BMI (Pearson correlation; −0.060, −0.034, −0.066, −0.085, 0.006 and −0.086) respectively, (Sig. 2-tailed; 0.64, 0.791, 0.607, 0.51, 0.961, and 0.502) respectively (Table 4).

Table 1. Distribution of type 2 diabetic patients according to age group.

		Frequency	Percent %
Age	20 - 40 Years	32	45.7
	41 - 60 Years	11	15.7
	>60 Years	27	38.6
	Total	70	100

Table 2. Distribution of type 2 diabetic patients according to body mass index.

		Frequency	Percent %
BMI	Normal weight	29	41.4
	Overweight	20	28.6
	Obese	21	30
	Total	70	100

Table 3. Comparison between serum CD36 level and total cholesterol, LDL cholesterol, HDL cholesterol and triglyceride levels in cases and control.

		N	Mean	STD	*P*. Value
LDL	Case	70	123.66	38.335	**0.031**
	Control	30	107.1	23.62	
HDL	Case	70	44.74	13.227	**0.000**
	Control	30	36.07	8.221	
Cholesterol	Case	70	189.67	43.813	0.03
	Control	30	163.67	26.266	
Triglyceride	Case	70	112.57	40.581	0.000
	Control	30	86.63	25.045	
CD36	Case	63	8.2	13.0432	0.129
	Control	25	3.533	12.494	

(Sig *P*. value less ≤ 0.05).

Table 4. The correlation between serum CD36 level and total cholesterol, HDL cholesterol, LDL cholesterol, triglycerides, body mass index and age.

		LDL	HDL	T. Chol	T.G	CD 36	age	BMI
	Pearson Correlation		0.048	0.933	0.270	-0.034-	0.029	-0.070-
LDL	Sig. (2-tailed)		0.692	0	0.024	0.791	0.811	0.563
	N		70	70	70	63	70	70
	Pearson Correlation			0.320	-0.213-	-0.066-	-0.088-	0.250
HDL	Sig. (2-tailed)			0.007	0.077	0.607	0.467	0.037
	N			70	70	63	70	70
	Pearson Correlation				0.169	-0.060-	0.018	0.042
T. Chol	Sig. (2-tailed)				0.161	0.64	0.882	0.728
	N				70	63	70	70
	Pearson Correlation					-0.085-	0.171	-0.084-
T.G	Sig. (2-tailed)					0.51	0.156	0.49
	N					63	70	70
	Pearson Correlation						0.006	-0.086-
CD 36	Sig. (2-tailed)						0.961	0.502
	N						63	63
	Pearson Correlation							-0.266-
Age	Sig. (2-tailed)							0.026
	N							70

4. Discussion

Diabetes mellitus is an epidemic disease. It is a common cause of hospital admission, and its incidence rising rapidly. In developed countries diabetes is in the top of the most significant diseases. CD36 is heavily glycosylated class B scavenger receptor, expressed on the cell surface of different types of cells. It acts as a receptor for wide range of ligands and mediating different signaling pathways according to cell type. In diabetic patients, LDL particles are glycated with more strong level than their oxidation, this increases CD36 expression, oxLDL internalization and cholesterol accumulation in macrophages which initiates foam cell formation and accelerates atherosclerosis. Different studies were revealed that the circulating, non-cell bound, CD36, also known as soluble CD36 (sCD36) protein acts as a marker for altered cell-bound CD36 receptor expression and its plasma level is 4 - 5 fold more increase in obese type 2 diabetic subjects than healthy one. Also it is reported that there was a significant correlation between plasma sCD36 level and atherosclerosis markers [8]. This case control study was carried out on 70 patients with type 2 diabetes mellitus (cases) and 30 apparently healthy individual (control group) at different ages to determine the correlation between soluble CD36 level and lipid profile. The results of this study revealed

that serum cholesterol, LDL, HDL, and triglyceride levels were significantly higher in type 2 diabetic patients compared with healthy control group, while there is no statistically significant difference in serum CD36 level between cases and control. Also this study found that there is no statistically significant correlation between serum CD36 level and total cholesterol, LDL, HDL, triglycerides, age and body mass index. A previous study done by Alkhatatbeh, M *et al.* found that sCD36 was not correlated with age, body mass index, and lipid profile, and this finding is agree with a current study results. Serum CD36 was not significantly different between subjects with obesity, hyperglycemia, dyslipidemia, hypertension or cardiovascular disease, and those without these abnormalities ($P > 0.05$) [10]. In addition, another study done by Kulkarni, N *et al.* observed that there was a significant increase in serum levels of serum CD36 in patients with Type 2 Diabetes Mellitus (>5 yr) with hypertension compared to healthy controls ($P < 0.05$) [11]. Also CD36 level was significantly higher in obese people with T2DM ($P = 0.00001$) according to Alkhatatbeh, M *et al.* study [12]. A study done by Touré, M *et al.* reported that sCD36 level was not significantly different between the type 2 diabetes groups and control (636.95 and 516.72, respectively, $P = 0.24$) which is agree with the results of our study. Also it revealed that serum CD36 was negatively correlated with HDL-cholesterol levels ($r = -0.52$ $P = 0.0001$) and triglyceride levels ($r = -0.36$ $P = 0.01$) in control subjects. However, in the type 2 diabetes group, sCD36 levels were positively correlated with total cholesterol levels ($r = 0.28$ $P = 0.04$) [13]. Kim, H *et al.* study showed that sCD36 index was significantly increased in patients with T2DM than in peoples with normoglycemia, and there were no differences in age, sex, and body mass index among groups, whereas HDL-C was lower in the T2DM group than in the prediabetes and normal glucose tolerance groups ($P < 0.05$) [14]. In addition a previous study done by Castelblanco, E *et al.* found that in a head-to-head comparison, concentrations of sCD36 were not different between non-diabetic and T2DM subjects (2.84 ng/mL versus 2.62 ng/mL; $P = 0.583$) which is agree with the results of our study. Also they reported that in patients with type 2 diabetes mellitus, significantly higher sCD36 concentrations were found in patients with dyslipidemia ($P = 0.048$) [15].

5. Conclusion

The results of this study concluded that serum CD36 level was not significantly different between type 2 diabetic patients and healthy control group. Also this study concluded that there is no statistically significant correlation between serum CD36 level and total cholesterol, LDL cholesterol, HDL cholesterol, triglycerides, age and body mass index.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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