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Correlation of HbA1c and Lipids with Obesity in Patients with Type 2 Diabetes in Pakistani Population

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ABSTRACT

Objective: To quantify the correlation between Glycated Haemoglobin, Serum Lipids and overweight/obese Type II patients with diabetes.

Study Design: Cross-sectional study.

Place and Duration of Study: Department of Internal Medicine and Endocrinology/Diabetology, PIMS (FMTI), Islamabad Pakistan, from Jul 2020 to Dec 2020.

Methodology: The study population comprised of severely overweight and obese patients of diabetes. Their laboratory investigations for lipid profile and HbA1c levels were measured. Correlation coefficients between lipid profile, HbA1c levels and obesity were computed.

Results: In this study, 112 patients of diabetes were included in the study. The mean age of patients was 48.2±3.4 years, and females were slightly greater (29,51.8%). The average BMI level was 31.98±3.32kg/m^2. HbA1c was found to be positively correlated with total cholesterol (r= 0.702, *p*-value, <0.001) and BMI (r= 0.231, *p*-value, 0.054) and negatively correlated with HDL levels (r= -0.372, *p*-value, 0.005) in the study patients. HDL was also negatively correlated with BMI levels (r= -0.314, *p*-value 0.01).

Conclusion: HbA1c was positively correlated with BMI and total cholesterol in patients with diabetes. Moreover, HDL significantly negatively correlated with obesity and HbA1c

Keywords: Dyslipidemia, HbA1c, Obesity, Uncontrolled diabetes.

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INTRODUCTION

Diabetes is a heterogeneous group of diseases with features like chronic hyperglycaemia due to various causes and genetic and environmental factors combined. South Asia has a significant representation of diabetes mellitus and can be called one of the large hubs of this condition.[1] The prevalence of diabetes is rising; in 2015, there were around 400 million diabetics worldwide, and it is expected that by the year 2035, this number will jump to around 600 million. Moreover, approximately 175 million people are undiagnosed by this condition.[2] More than 90% of people with diabetes have type 2 diabetes mellitus.[3]

Glycated haemoglobin is considered a gold-standard measure of chronic glycaemia in patients with diabetes. It is a primary indicator for a mean blood glucose level. Dyslipidemia along exceptionally high Low-density lipoprotein (LDL) is common in diabetes mellitus and strongly associated with poor glycaemic control.[4,5] Dyslipidemia is common in type II diabetes and is further linked with insulin resistance, hyperinsulinemia, high blood pressure, and obesity, collectively creating metabolic syndrome firmly correlated with atherosclerosis.[6,7] Atherogenic indices, i.e., TC/HDL-C ratio (<5) and LDL-C/HDL-C (<3.5), are the leading gauge of cardiovascular disease (CVD).[8,9]

There is a need to constantly monitor the levels of lipids and BMI in patients with diabetes so that the consequences in the shape of metabolic syndrome and a heart condition may be averted. Our study aims to understand the correlation between HbA1c, dyslipidemia and obesity in diabetics.

METHODOLOGY

The cross-sectional study was conducted at the Department of Internal Medicine & Endocrinology/Diabetology PIMS (FMTI), Islamabad Pakistan, from July to December 2020 after ethical approval (IERB No.F.1-1/2015/ERB/SZABMU/510) from the university. We calculated the sample size with the anticipated prevalence of obesity and overweight in type 2 diabetes mellitus of 82%.[8]

Inclusion Criteria: Patients with diabetes of either gender, with and without elevated levels of HbA1c were included.

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Exclusion Criteria: Patients with co-morbidities like type 1 diabetes mellitus, gestational diabetes, familial hypercholesterolemia, chronic renal disease (using KDIGO guidelines for evaluation and management of kidney diseases), iron deficiency anaemia (using AGA clinical guidelines for the management of anaemia), and patients on lipid-lowering therapy excluded from the study.

Non-probability consecutive sampling technique was used. The laboratory investigations of the patients for lipid profile and HbA1c levels were measured and noted. The lipid profile constituted Serum total cholesterol (TC), triglycerides (TG), high-density lipoprotein (HDL), and low-density lipoprotein (LDL). An increase in the level above the normal limit was deemed dyslipidemia. HbA1c level >7% was considered elevated.[10]

Statistical Package for Social Sciences (SPSS) version 25.0 was used for the data analysis. Quantitative variables were expressed as Mean±SD and qualitative variables were expressed as frequency and percentages. Using Pearson's correlation coefficients, the relationship between HbA1c levels, lipids and obesity was measured. The *p*-value lower than or up to 0.05 was considered as significant.

RESULTS

The study sample comprised 112 severely overweight and obese patients with diabetes. The mean age of patients was 48.2±3.4 years. Females were slightly greater (58,51.8%) than males.The mean levels of lipids was found raised with a total cholesterol level of 230.87±70.98mg/d, triglyceride level of 241.05±70.82 mg/d, LDL of 113.63±25.36mg/d and slightly low HDL levels of 35.84±14.75mg/d. Similarly, the mean HbA1c level was found to be 8.07±1.77 (Table-I).

Table-I: Mean level of lipids, HbA1c and Body Mass Index (n=112)

	Mean±SD
Total Cholesterol (mg/dL)	230.8±70.9
Triglycerides (mg/dL)	241.0±70.8
LDL(mg/dL)	113.63±25.3
HDL(mg/dL)	35.84±14.7
Hba1c	8.07±1.7
Body Mass Index	31.9±3.3

A further breakdown was done to estimate the parallel coefficients between lipid parameters HbA1c and BMI level in the selected patients with diabetes. HbA1c was found positively correlated with total cholesterol (r=0.702, *p*-value, <0.001) and BMI (r=0.231, *p*-value, 0.054) and negatively correlated with HDL levels (r=-0.372, *p*-value, 0.005) in the study patients. HDL was also negatively correlated with BMI levels (r=-0.314, *p*-value 0.01). In this way, the high HbA1c and low HDL levels were significantly associated with obesity in patients with diabetes mellitus (Table-II).

Table-II: Pearson's correlation between Lipid Profile, Obesity and HbA1c levels in Patients with Diabetes (n=112)

		HbA1c	Total Cholester	Trigly-cerides	LDL	HDL	BMI
HbA1c	r value	-	0.702	-0.188	0.021	-0.372	0.231
	p-value	-	< 0.001	0.165	0.876	0.005	0.054
BMI	r value	0.231	0.118	0.098	-0.122	- 0.314	-
	p-value	0.054	0.387	0.473	0.370	0.018	-

DISCUSSION

This study highlights and validates the significant correlation between hyperlipidaemia, HbA1c and obesity. These results have programmatic implications in early screening of dyslipidemia, metabolic syndrome and resultant cardiovascular disease. Specifically, in this study, HbA1c was positively associated with BMI (r=0.231, *p*-value, 0.054) and negatively related with HDL levels (r=-0.372, *p*-value, 0.005). Moreover, HDL was negatively correlated with BMI levels (r=-0.314, *p*-value, 0.01); thus, this quantification proved again that high levels of HbA1c and low levels of HDL were significantly associated with obesity in patients with diabetes. Many previous studies have proven the correlation between HbA1c, lipid profile, and obesity. One study reported that HbA1c is significantly associated with lipid profile.[10] Babikr *et al*. reported that LDL significantly positively correlated with BMI and HDL negatively correlated with BMI. Thus, obesity becomes an independent predictor of dyslipidaemia in type-2 diabetics.[5]

Many other investigators have also witnessed a significant correlation between HbA1c, lipid profile and obesity.[11-13] Chronic hyperglycaemia causes the glycation of apolipoproteins and impedes the normal pathways of lipoprotein uptake. The dyslipidemia observed in type 2 diabetes advances to enhanced release of free fatty acids from fatty tissue. Compromised insulin-dependent muscle uptake of free fatty acids and boosted fatty acid release to the hepatic tissue is related to diabetic dyslipidemia and cardiovascular disease. One local study has concluded that the complexity of coronary artery diseases increases with time/age, high HbA1c, high LDL-C, raised TGs and reduced HDL-C levels.[14] Moreover, in another study

by Hussain et al., it was found that HbA1c is a reliable glycaemic index & a prognosticator of dyslipidemia.[15]

In this study, younger males between 35 and 45 years were frequently found to be obese. Similarly, the level of HbA1c was also found to be slightly more remarkable in the males. Other previous investigators on gender and age differences in lipids, obesity, and HbA1c have reported mixed results. Like current study findings, some reports have reported that obese males have more deranged HbA1c.[16,17]

However, many found females with more deranged lipid profiles and higher BMI. This variability may be the impact of sex hormones on the dissemination of body fat that sources distorted lipoprotein levels.[18]

LIMITATIONS OF STUDY

The study was conducted on patients of low-middle socio-economic status, which might have affected the outcome since these patients mostly come to government sector hospitals in Pakistan.

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CONCLUSIONS

The study concluded that HbA1c positively correlates with BMI and total cholesterol in patients with diabetes. Moreover, HDL negatively correlates with obesity and HbA1c. There is a constant need to screen and monitor people with diabetes and obesity to manage and control the deteriorating lipids and their consequences. HbA1c can be a strong predictor for dyslipidemia and before identification of dyslipidemia, patients with high HbA1c should be on lipid-lowering therapy to decrease cardiovascular morbidity and mortality.

Conflict of Interest: None.

Author's Contribution

Following authors have made substantial contributions to the manuscript as under:

HUR: & AJ: Study design, drafting the manuscript, data interpretation, critical review, approval of the final version to be published.

FS: & MAA: Concept, data acquisition, drafting the manuscript, approval of the final version to be published.

NT: & AWJ: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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