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CORRELATION BETWEEN BODY MASS INDEX AND LIPID PROFILE IN DYSLIPIDAEMIA

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Abstract

OBJECTIVE
To determine the correlation between body mass index (BMI) and lipid profiles in patients with dyslipidaemia visiting a tertiary care hospital.

STUDY DESIGN
Cross-sectional study.

METHODOLOGY
A total of 500 adults aged 18–65 years with dyslipidaemia were enrolled through consecutive sampling. Body mass index and fasting lipid parameters were measured. Associations between BMI and lipid components were analysed using Pearson's correlation, with statistical significance set at $p < 0.05$.

RESULTS
The mean age was 48.36 ± 11.73 years; 280 (56.0%) were females and 220 (44.0%) males. Mean BMI was 28.27 ± 5.67 kg/m². BMI showed a weak but statistically significant negative correlation with triglyceride levels ($r = -0.094$, $p=0.035$), while correlations with total cholesterol, LDL, and HDL were not significant ($p>0.05$).

CONCLUSION
This study demonstrated that body mass index was weakly associated with lipid profile parameters among patients with dyslipidaemia. A statistically significant relationship was observed only between body mass index and triglyceride levels, whereas no meaningful associations were identified with total cholesterol, low-density lipoprotein, or high-density lipoprotein. Overall, body mass index showed limited correlation with lipid abnormalities in the studied population.

INTRODUCTION

Dyslipidaemia, characterized by abnormal levels of lipids in the blood, is a significant risk factor for cardiovascular diseases (CVD) such as coronary artery disease and stroke [1]. Body Mass Index (BMI), widely used to classify obesity, is closely linked with dyslipidaemia, particularly in individuals with type 2 diabetes mellitus (T2DM) [2]. As global obesity rates rise, understanding the relationship between BMI and lipid profiles is crucial for evaluating cardiovascular risk [3]. Several studies have explored the correlation between BMI and lipid profile abnormalities, such as elevated total cholesterol (TC), low-density lipoprotein (LDL), triglycerides (TG), and reduced high-density lipoprotein (HDL) [4].

In a cross-sectional study conducted in a tertiary care hospital in Peshawar, a significant negative correlation between BMI and HDL-C ($r = -0.125$, $p = 0.029$) was reported, suggesting that as BMI increases, HDL-C levels decrease [5]. However, BMI showed no significant correlation with other lipid parameters such as total cholesterol, triglycerides, and LDL-C. These findings suggest that the relationship between BMI and HDL-C may be stronger than with other lipid components in this population, where obesity and dyslipidaemia are highly prevalent [6].

Similarly, a study conducted in central Nepal among diabetic patients found that a large proportion of patients were overweight or obese and had dyslipidaemia. Although correlations between BMI and LDL or HDL were observed, these associations were statistically insignificant, indicating a modest impact of BMI on lipid profiles in diabetic populations [7].

Obesity and dyslipidaemia are often mediated through metabolic changes such as insulin resistance, which contributes to the development of cardiovascular diseases [8]. Elevated BMI affects lipid metabolism by increasing fatty acid flux into the liver, promoting the synthesis of LDL cholesterol and triglycerides while reducing HDL levels [9]. In South Asian populations, BMI has been shown to correlate positively with triglycerides and LDL cholesterol, emphasizing ethnic variability in metabolic risk [10].

Global evidence supports the role of obesity as a major public health challenge, with BMI classification serving as a standard tool for assessing obesity-related risk [11]. Multiple studies have demonstrated a direct association between increasing BMI and dyslipidaemia, hypertension, and diabetes mellitus [12]. Insulin resistance remains a central mechanism linking obesity to cardiovascular disease and lipid abnormalities [13]. Atherogenic dyslipidaemia, characterized by elevated triglycerides and reduced HDL cholesterol, is a hallmark of metabolic syndrome associated with obesity [14]. This association is particularly relevant in developing and South Asian countries, where obesity-related metabolic disorders are rapidly increasing [15].

Body Mass Index (BMI) is therefore closely linked to dyslipidaemia, a major risk factor for cardiovascular diseases. Understanding the correlation between BMI and lipid profiles is crucial for managing cardiovascular risk. While some studies show a strong relationship between BMI and lipid abnormalities, particularly HDL and LDL levels, results remain inconsistent across populations. This study aims to determine the correlation between BMI and lipid profiles in patients with dyslipidaemia, offering insights into better management of obesity-related lipid disorders and early intervention strategies to reduce cardiovascular risk.

METHODOLOGY

This cross-sectional study was conducted in the Department of General Medicine at Khairpur Medical College Teaching Hospital (KMC), Khairpur. Ethical approval was obtained from the Institutional Review Board prior to commencement, and written informed consent was secured from all participants before enrolment. A non-probability consecutive sampling technique was employed. The study population comprised adult patients aged 18 to 65 years of either gender, clinically diagnosed with dyslipidaemia. Individuals on lipid-lowering medications, pregnant women, and those with hepatic, renal, or endocrine disorders known to influence lipid metabolism were excluded. Body Mass Index (BMI) was calculated by dividing weight in kilograms by the square of height in metres (kg/m^2) and expressed in terms of Mean ± Standard Deviation. Dyslipidaemia was defined based on lipid profile values, including total cholesterol >200 mg/dL, LDL cholesterol >130 mg/dL, HDL cholesterol <40 mg/dL in men or <50 mg/dL in women, and triglycerides >150 mg/dL. The lipid profile comprised the measurement of total cholesterol (TC), low-density lipoprotein (LDL), high-density lipoprotein (HDL), and triglycerides (TG), all assessed using standard enzymatic laboratory techniques after a minimum 12-hour overnight fast. A final sample size of 500 was determined using a correlation coefficient of 0.125[3], with a confidence level of 95%, power of 80%, and a significance level of 5%. Clinical assessment and anthropometric measurements were performed by postgraduate trainees with relevant clinical experience. Height was measured using a stadiometer and weight using a calibrated digital scale, both under standardised conditions. Fasting venous blood samples were collected after a minimum 12-hour overnight fast to assess lipid profile parameters through standard enzymatic methods. All demographic and biochemical data were recorded in a structured proforma at the time of patient evaluation. Data analysis included BMI and lipid parameters using Pearson's correlation, with $p < 0.05$ considered statistically significant.

RESULTS

Table I presents the baseline characteristics and lipid profile of the study participants. Among the 500 participants, the mean age was 48.36 ± 11.73 years, while the mean body mass index was 28.27 ± 5.67 kg/m². The lipid profile revealed a mean total cholesterol level of 228.69 ± 30.41 mg/dl and a mean low-density lipoprotein (LDL) level of 148.64 ± 23.13 mg/dl. The mean high-density lipoprotein (HDL) level was 49.32 ± 6.42 mg/dl, whereas the mean triglyceride level was 222.10 ± 69.48 mg/dl. In terms of demographic distribution, 56.0% of the participants were female and 44.0% were male. Most of the participants were from urban areas (77.2%), while 22.8% resided in rural areas.

Table 1: Baseline Characteristics and Lipid Profile of Study Participants (n=500)

Mean ± Standard Deviation		95% Confidence Interval
Age in years = **48.36 ± 11.73**		47.33—49.39
Body Mass Index in kg/m² = **28.27 ± 5.67**		27.77—28.77
Total Cholesterol in mg/dl = **228.69 ± 30.41**		226.01—231.36
LDL in mg/dl = **148.64 ± 23.13**		146.60—150.67
HDL in mg/dl = **49.32 ± 6.42**		48.76—49.89
Triglycerides in mg/dl = **222.10 ± 69.48**		215.99—228.20
	Frequency (%)	
Gender	Male	220 (44.0)
	Female	280 (56.0)
Residential Status	Urban	386 (77.2)
	Rural	114 (22.8)

Table II presents the correlation between body mass index (BMI) and lipid profile parameters among the 500 study participants. BMI showed a weak negative correlation with total cholesterol (r=−0.062, p=0.167), low-density lipoprotein (LDL) (r=−0.012, p=0.784), and high-density lipoprotein (HDL) (r=−0.052, p=0.245); however, these associations were not statistically significant. In contrast, BMI demonstrated a weak but statistically significant negative correlation with triglyceride levels (r=−0.094, p=0.035).

Table II: Correlation Between Body Mass Index and Lipid Profile Parameters (n=500)

Lipid Parameters	Correlation (r)	P-Value
BMI vs Total Cholesterol	-0.062	0.167
BMI vs LDL	-0.012	0.784
BMI vs HDL	-0.052	0.245
BMI vs Triglycerides	-0.094	0.035*

DISCUSSION

Dyslipidaemia remains a major modifiable risk factor for cardiovascular morbidity and mortality, and its clinical assessment continues to pose diagnostic and preventive challenges, particularly in populations with a high prevalence of overweight and obesity. Body mass index (BMI) is frequently used as a surrogate marker of adiposity in routine clinical practice; however, its utility in predicting lipid abnormalities remains inconsistent across populations.

In the present study, the study population predominantly comprised middle-aged adults with a mean age of 48.36 ± 11.73 years, and a higher proportion of females. The mean BMI of 28.27 ± 5.67 kg/m² reflects a largely overweight cohort, consistent with the increasing burden of obesity observed in South Asian populations. Lipid abnormalities were marked, with elevated mean total cholesterol, LDL cholesterol, and triglyceride levels, indicating a high atherogenic risk profile among patients presenting with dyslipidaemia. These findings are in keeping with previous regional data highlighting the clustering of excess body weight and lipid derangements in adult medical populations [1,2].

The key finding of this study was a weak but statistically significant negative correlation between BMI and triglyceride levels ($r = -0.094$, $p = 0.035$), while no significant correlations were observed between BMI and total cholesterol, LDL cholesterol, or HDL cholesterol. The modest strength of this association suggests that BMI alone may not be a reliable predictor of lipid abnormalities in patients with established dyslipidaemia. This observation reflects the multifactorial regulation of lipid metabolism, influenced not only by adiposity but also by metabolic, genetic, and lifestyle determinants.

When compared with previous literature, the findings demonstrate both concordance and divergence. Hussain et al. [3] reported a significant negative correlation between BMI and HDL-C ($r=-0.125$, $p=0.029$) in patients with type 2 diabetes mellitus, whereas no significant association was observed with triglycerides or LDL-C. In contrast, the present study did not demonstrate a significant association between BMI and HDL-C ($r = -0.052$, $p = 0.245$) but identified a statistically significant inverse relationship with triglycerides. Similarly, Bansal et al. [4] reported weak and statistically insignificant correlations between BMI and lipid parameters in a diabetic population from central Nepal, with Pearson correlation coefficients of −0.010 for total cholesterol ($p = 0.905$), −0.085 for triglycerides ($p = 0.326$), −0.050 for HDL cholesterol ($p = 0.562$), and 0.069 for LDL cholesterol ($p = 0.426$), findings that closely parallel the weak and largely non-significant associations observed in the present study and further underscore the variability of BMI–lipid relationships across different populations and disease states.

From a pathophysiological perspective, obesity alters lipid metabolism through increased free fatty acid flux to the liver, enhanced hepatic triglyceride synthesis, and impaired clearance of triglyceride-rich lipoproteins, contributing to atherogenic dyslipidaemia [8,9]. However, BMI does not distinguish between visceral and subcutaneous fat or account for differences in body composition, which limits its ability to reflect true metabolic risk. Contemporary evidence indicates that obesity-related metabolic disturbances are heterogeneous, with considerable inter-individual variability in lipid responses despite similar BMI values, thereby reducing the discriminatory capacity of BMI alone [16]. This may partly explain why only triglyceride levels demonstrated a statistically significant, albeit weak, association with BMI in the present cohort.

The strengths of this study include a relatively large sample size, standardised anthropometric and biochemical measurements, and exclusion of patients receiving lipid-lowering therapy, thereby minimising pharmacological confounding. The use of fasting lipid profiles and consistent diagnostic criteria further enhances internal validity.

Nevertheless, certain limitations must be acknowledged. The cross-sectional design precludes causal inference between BMI and lipid abnormalities. As a single-centre study employing non-probability sampling, the findings may have limited generalisability. Additionally, unmeasured confounders such as dietary habits, physical activity levels, insulin resistance, and measures of central obesity were not evaluated and may have influenced lipid parameters independently of BMI.

CONCLUSION

This study demonstrated that body mass index was weakly associated with lipid profile parameters among patients with dyslipidaemia. A statistically significant relationship was observed only between body mass index and triglyceride levels, whereas no meaningful associations were identified with total cholesterol, low-density lipoprotein, or high-density lipoprotein. Overall, body mass index showed limited correlation with lipid abnormalities in the studied population.

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