

BODY MASS INDEX (BMI) AND ITS ASSOCIATION WITH RISK FOR DEVELOPMENT OF CARDIOVASCULAR EVENTS

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Abstract

Background: Cardiovascular diseases are common global problem, causing morbidity and mortality. Various clinical and laboratory parameters have been analyzed to see their risk factors, including lipid profile, BMI, hypertension, and other co-morbid risk factors. Estimation of these parameters may be helpful in determining the early detection of ongoing disease process so that early intervention can be made.

Methodology: This was a cross-sectional study, conducted at a tertiary care hospital. This study was conducted for a period of 3 months. Participants coming for routine check-up were included in the study with age between 40-90 years, both males and females. Participants with known cardiovascular disease or other co-morbid risk factors, and those who were on medication were excluded from the study. The data was analyzed using SPSS 28. Association between BMI with other parameters was analyzed by Chi-square test, and a p-value of <0.05 was considered as statistically significant.

Results: A total of 240 participants were included, with higher ratio of males in relation to females (1.24:1). Most of the respondents falls in the age group 51-60 years (52.5%). The mean age of the respondents were 59.06 ± 7.281 years. Majority of participants (47.5%) were having BMI of obese group, followed by overweight (22.1%). There was strong statistical association between BMI and other lipid profile parameters (e.g., HDL, LDL, TG, and cholesterol) with $p < 0.05$.

Conclusion: Body mass index (BMI) was strongly associated with variation in lipid profile parameters, suggesting that this may be the basic risk factor for development of cardiovascular and other metabolic disorders.

Keywords: Body mass index, Lipid Profile, High density lipoprotein, Low density lipoprotein, Triglycerides, Cholesterol, Cardiovascular.

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INTRODUCTION

Cardiovascular disease (CVD) is one of the leading causes of mortality in the developed, underdeveloped, and developing countries globally, taking an estimated 17.9 million lives each year (WHO_2021). Previous studies evidently showed that population of South Asian Countries (Bangladesh, Pakistan, and India) origin are predominantly prone to cardiovascular diseases when moving to wealthy-populated countries, having rates of minimally 1.5- to 2-fold greater as compared to local white population (1). Cardiovascular disease (CVD) is one of the reasons of the mortality in Pakistani population. The incidence of Cardiovascular disease (CVD) has increased more than 10 times through the last 20 years, independently of the growth of population(2).

Various epidemiological studies have demonstrated a direct relationship of risk factors between body mass index (BMI) and low density lipoprotein (LDL) cholesterol, triglycerides, total cholesterol, and inverted correlation in terms of high density lipoprotein (HDL)(3). The relationship between BMI and lipoprotein levels, particularly low density lipoprotein (LDL) cholesterol, has been recommended to be a participating cause in the increasing numbers of cardiovascular events linked with the obesity(4,5). Moreover, under representation of entities with obesity and specially with morbid obesity in such research restricts assumptions with respect to anticipated lipid profiles in the subgroups.

Reliable valuations suggest an increasing occurrence of CVD risk factors in population of Pakistan(6). However no actual data is available on the CVD burden of this area(7). Mostly, the available work tried to discourse the CVD prevalence depended on self-reported data. Thus, the subjects unaware of their condition suffer from these flaws(8).

Precious observational studies of CVD have confirmed that there is a relationship between BMI and HDL or TG, but no association with LDL (6,9,10). These results have upraised the query of a probable associated factors where levels of LDL even decline with excessive BMI levels (1,8). Hence, this research only focuses on associated factors of lipid profile with BMI.

MATERIALS AND METHODS:

This study was cross-sectional, carried out at a tertiary care hospital. Duration of the study was 3 months (April 2022 to June 2022). The study was approved by the Institutional Review Board. Total of 240 participants were involved in this study. Study included participants who came for routine checkup, gave consent to participate in the study, both males and females, age between 40-90 years and having no cardiovascular active disease. Participants on medication (i.e., anti-cholesterol drugs, antihypertensive drugs, or other drugs related to cardiovascular diseases), active

cardiovascular disease, co-morbid factors, pregnancy, and children were excluded from this study. The body mass index (BMI) of the individuals were measured and were categorized as underweight, normal, overweight, and obese. Parameters of lipid profile such as triglycerides, low density lipoprotein (LDL), high density lipoprotein (HDL), and cholesterol levels were measured as per standard operation procedures.

Data was analyzed through SPSS-28 version. This research based on mixed method (categorical and quantitative variables), so for categorical variables such as gender, BMI groups, age groups, and lipid profile categories, frequencies and percentages were analyzed. Likewise, for quantitative variables such as age and parameters of lipid profile, mean and the standard deviation were analyzed, and to find out association of independent variables with BMI, chi-square test was used.

RESULTS

Table number 1-2 shows the descriptive results of the study. It is clearly seen the table 1 that frequency of male patients was 133 (55.4%) and female were 107 (46.6%). Most of the respondents falls in the age group 51-60 years which is 52.5% of all, while the other age groups such as 41-50, 61-70, 71-80, and 81-90 years were 11.7%, 28.7%, 5.4% and 1.7% respectively (Table 1). However, mean age of the respondents were 59.06 years with standard deviation of 7.281. It is also reported that most of the subjects having weight between 71-90 kg (101/42.1%). The minimum occurrence seen in the weight group 131-150 kg (6/2.5%), while mean and standard deviation of the weight is 83.47, and 18.184 respectively.

Furthermore, 114 (47.5%) have obese BMI, 73 (30.4%) have overweight and 53 (22.1%) falls in normal weight. HDL of 152 (65.5%) were normal with mean value of 41.77 mg/dL and standard deviation is 6.96. Moreover, LDL of most of the participants is high with frequency of 116 (48.3%) and 124 were having normal LDL, mean of the LDL is 142.69 mg/dL with standard deviation of 39.8. However, TG of 125 (52.1%) were high and total cholesterol of 106 (44.2%) were high. Mean of the TG was 166.28 mg/dL and standard deviation was 51.45, while mean and standard deviation of total cholesterol were 203.63 mg/dL and 42.56 respectively (Table 2). The findings were in similar context with earlier published researches(11-13).

Table 1: Descriptive Statistics according to Categorical Variables (n = 240)

Variable	Category	Frequency	Percentage
Gender	Male	133	55.4%
	Female	107	46.6%
Age (in years)	41-50	28	11.7%
	51-60	126	52.5%
	61-70	69	28.7%
	71-80	13	5.4%
	81-90	04	1.7%

Weight (in kg)	51-70	67	27.9%
	71-90	101	42.1%
	91-110	53	22.1%
	111-130	13	5.4%
	131-150	6	2.5%
BMI (kg/m²)	Underweight (<18.5)	0	-
	Normal weight (18.5-24.9)	53	22.1%
	Overweight (25-29.9)	73	30.4%
	Obese (>30)	114	47.5%
HDL (mg/dL)	Lower (<40)	90	34.2%
	Normal (60)	150	65.8%

LDL (mg/dL)	Higher (>60)	-	
	Normal (60-150)	124	51.7%
	Higher (160-189)	116	48.3%
TG (mg/dL)	Lower (<59)	-	
	Normal (<150)	115	47.9%
	Higher (>150)	125	52.1%
Total Cholesterol (mg/dL)	Lower (<35)	-	
	Normal (<200)	134	55.8%
	Higher (>200)	106	44.2%

Table 2: Descriptive Statistics of Quantitative Variables (n = 240)

Variable	Minimum	Maximum	Mean	SE	SD
Age (in years)	44.00	82.00	59.06	.469	7.28
Weight (in kg)	54.00	149.00	83.47	1.173	18.18
Height (in cm)	144.00	168.00	154.82	.366	5.67
HDL (mg/dL)	30.00	55.00	41.77	.449	6.96
LDL (mg/dL)	90.00	285.00	142.69	2.569	39.80
TG (mg/dL)	99.00	380.00	166.28	3.323	51.49
Total cholesterol (mg/dL)	141.00	405.00	203.63	2.747	42.562
hsCRP (mg/L)	1.25	66.81	10.83	.723	11.21

HDL = High density lipoprotein, hsCRP = High sensitivity C-reactive protein, LDL = Low density lipoprotein, SD = Standard deviation, SE = Standard error, TG = Triglycerides

Table 3 describe the dispersal of participant’s characteristics and BMI by lipid profiles by BMI levels. It is clearly seen in the results that there was a statistically strong association among BMI with HDL, BMI with LDL, BMI with TG and BMI with total cholesterol (p = <0.0001, 0.007, 0.007 and <0.012, respectively).

Table No: 3 Association of BMI with HDL, LDL, TG and Total Cholesterol (n=240)

Association of BMI with HDL					
BMI	HDL Lower (N%)	HDL Normal (N%)	HDL Higher (N%)	Total (N%)	p-value
Underweight	-	-	-	-	0.0001
Normal Weight	7 (13.2%)	46 (86.8%)	-	53 (22.1%)	
Overweight	19(26%)	54(74%)	-	73 (30.4%)	
Obese Weight	56 (49.1%)	58(50.9%)	-	114 (47.5%)	
Association of BMI with LDL					
Underweight	-	-	-	-	p-value

Normal Weight	00 (00%)	36 (67.9%)	17(32.1%)	53 (22.1%)	0.007
Over Weight	00 (00%)	40(54.8%)	33(45.2%)	73 (30.4%)	
Obese Weight	00 (00%)	48(42.1%)	66(57.9%)	114 (47.5%)	
Total				240 (100%)	
Association of BMI with TG					
Underweight	-	-	-	-	0.007
Normal Weight	-	33 (62.3%)	20 (37.7%)	53 (22.1%)	
Over Weight	-	39 (53.4%)	34 (46.6%)	73 (30.4%)	
Obese Weight	-	43 (37.7%)	71 (62.3%)	114 (47.5%)	

Association of BMI with Total Cholesterol					
Underweight	-	-	-	-	p-value
Normal Weight	-	38 (71.7%)	15 (28.3%)	53 (22.1%)	0.012
Over Weight	-	42 (57.5%)	31 (42.5%)	73 (30.4%)	
Obese Weight	-	54 (47.4%)	60 (56.6%)	114 (47.5%)	

DISCUSSION

Variation in body mass index (BMI) is related to many diseases including cardiovascular diseases. Previous research supports the relationship between body mass index and lipid profile parameters such as HDL, LDL, TG, and cholesterol and the relationship of lipid profile and body fate distribution has been in discussion over the past decades. In a vast range of participants of BMI including the like hood for being obese, we observed a strong positive correlation between BMI with LDL, HDL, TG, and total cholesterol. The absence of an association between LDL and BMI in a vast range of participants is in disparity with observations resulted from epidemiologic researches that did not comprise an increased ratio of participants with BMI in high ranges (14,15).

The Framingham other larger epidemiologic researches have described an association between obesity and higher risk of cardiovascular-linked diseases (16). The suggested processes for events in cardiac system in patients with obesity consist higher atherosclerosis development associated with hypertension, dyslipidemia, diabetes mellitus, and resistance of insulin (2). The influence of dyslipidemia on cardiovascular mechanisms is usually believed to be majorly because of higher LDL and TC levels (17,18). Though, latest findings have proposed that this pattern of a straight relationship between LDL and BMI may be generalized. Actually, “obesity paradox” has been proposed with a lower than estimated relationship between BMI and LDL (19).

This study showed that the ratio of male (55.4%) to female (46.6%) was higher (1.24:1). Majority of participants were found to be obese (47.5%). Level of HDL was lower in 34.2% and LDL was higher in 48.3%. Though triglyceride and cholesterol levels were higher in 52.1% and 44.2% respectively. Zhang et al showed higher frequency of females, which may be differs due to differences in population size (20). In current study, we observed strong statistical correlation between body mass index (BMI) with lipid profile parameters (e.g., HDL, LDL, TG, and cholesterol) (<0.05). Shamai et al. also performed study to

see the association between similar parameters. In his study, HDL, LDL and TG showed strong association (<0.05), however, total cholesterol did not show any difference (p=0.44) (1).

Ramirez-Velez et al. showed similar results. He also explained the association between various cardio-metabolic parameters including HDL, LDL, TGs, and cholesterol, and body mass index (BMI) (p<0.05) (1,11). Likewise, our results showed the public and clinical importance as derangements of such parameters may lead to many cardiovascular events and metabolic disorders.

The limitation of our study is sample size. As geographical variations and different socioeconomic classes have a variety of changes in lifestyles, association in terms of these categories may help us in more detailed discussion for management. Furthermore, young population (e.g., age <40 years) were not included so age wise association could not be made. Studies on large scales should be performed to see more precise and valuable correlations between these factors.

Conclusion

This study showed strong correlation between body mass index (BMI) and various parameters of lipid profile including HDL, LDL, triglycerides, and cholesterol. Old age individuals, especially who has increased weight, are more likely to develop cardiovascular events with deranged basic parameters. Early detection of these disorders will help us to manage the conditions in adequate time, and similarly, morbidity and mortality can be reduced.

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