Original Article

Association of Obesity with Lipid Profile and Blood Pressure among the Medical Students of Enam Medical College

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Abstract

***Background**: Overweight and obesity are well recognized as "escalating epidemic" in both developed and developing countries. Obesity can cause many health related problems, like cardiovascular diseases (CVD). Both obesity and serum lipids are modifiable factors for CVD. Serum lipid profile of young medical students in Enam Medical College was estimated to determine their CVD risk. **Objective**: To find out the association of obesity with lipid profile and blood pressure. **Materials and Methods**: This cross-sectional analytical study was carried out at Enam Medical College, Savar, Dhaka from July 2019−September 2019. A total of 85 apparently healthy medical students of 1st year to 5th year in Enam Medical College were included for study. Data collection sheet was prepared for the purpose of the study, which included all the variables of interest. Non-probability sampling technique was applied. Weight, height, waist circumference and blood pressure were measured in study subjects. Association of obesity was found with body mass index, lipid profile and blood pressure. Overnight fasting (at least 12 hours) blood specimens were collected from study subjects to estimate the total cholesterol (TC), serum triglyceride, serum HDL-C. With all aseptic precautions 5 mL of venous blood was drawn from anti-cubital vein in a disposable syringe and delivered immediately into a dry clean test tube which was kept in standing position till clot formation. Then serum was separated after centrifuging at 3000 rpm for 5 minutes and collected in microcentrifuge tube, labeled properly and stored in ultrafreezer at −20ºC. All biochemical tests were done at the Department of Biochemistry of EMCH. All collected data were checked, edited and then processed with the help of the software Statistical Package for Social Sciences (SPSS) version 22.0. **Results**: In this study 43 (50.6%) students were male and 42 (49.5%) students were female. The mean difference of WC, SBP, DBP, TG between male and female students were significant ($p<0.05$). The mean difference of BMI, TC, HDL-C and LDL-C were not significant between male and female participants ($p>0.05$). The mean of BMI and WC statistically increased in overweight and obese students ($p<0.001$). Other variables showed no significant difference among the weight group ($p>0.05$). In study subjects, BMI showed weakly positive correlation with SBP ($r=+.175$, $p=0.109$), DBP ($r=+.229$, $p=0.035$), TC ($r=+.246$, $p=0.023$), TG ($r=+.145$, $p=0.183$), LDL-C ($r=+.249$, $p=0.022$) and*

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weak negative correlation with HDL-C (r=-.218, p=0.046). In study subjects, WC showed weakly positive correlation with SBP (r=+.352, p=0.001), DBP (r=+.334, p=0.002), TC (r=+.260, p=0.016), TG (r=+.180, p=0.100), LDL-C (r=+.206, p=0.058) and weakly negative correlation with HDL-C (r=-.170, p=0.120). ***Conclusions****: The epidemic of overweight and obesity is having a huge impact on the physical and social wellbeing of adult in future. Thus, it is concluded that the parameter indicating increased cardiovascular risk such as high TC, TG, LDL-C and low HDL-C in obese group. As TG, TC, LDL-C showed positive correlation while HDL-C showed a negative correlation with both BMI and WC. Hence, both the anthropometric indices (i.e., BMI and WC) can be used both alone and also in combination as a predictor of abnormal lipid profile and as a cardiovascular risk also.*

Key words*: Body mass index; Cardiovascular risks; Lipid profile; Obesity; Waist circumference*

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Introduction

Ischemic heart disease is the major cause of death in developed countries as well as in developing countries.[1] Lipids and lipoproteins are well-known risk factors for ischemic heart disease. Elevated levels of triglyceride, cholesterol and LDL-C are documented as risk factors for atherogenesis.[2] LDL-C in its oxidized or acetylated form has been identified as a major atherogenic particle, as it not only load macrophages with cholesterol for the formation of foam cells but also because it is chemotactic for circulating monocytes, is cytotoxic and can adversely alter coagulation pathways.[3] The blood level of HDL-C in contrast bears an inverse relationship of the risk of atherosclerosis and coronary heart disease that is higher the level, smaller the risk.[4]

Different plasma lipids vary significantly in various population groups due to difference in geographical, cultural, economical, social conditions, dietary habits and genetic makeup.[5,6] Age and gender differences also affect serum lipids considerably.[7]

Measuring the lipid profile (total cholesterol, HDL-C, TG, LDL-C) and the body mass index are considered in deciding the risk factors of atherosclerosis. This study was conducted to assess serum lipids, blood pressure and BMI in healthy young male and female students of Enam Medical College belonging to middle and higher socioeconomic groups and to find any association of obesity with lipid profile and blood pressure.

Materials and Methods

This cross-sectional analytical study was carried out at Enam Medical College, Savar, Dhaka from July 2019−September 2019. A total of 85 apparently healthy medical students of 1st year to 5th year of Enam Medical College were included for study. Purpose and procedure of the study was explained in details and informed written consent was taken from each study subject. Data collection sheet was prepared for the purpose of the study, which included all the variables of interest. Initial evaluation of the subject by history and clinical examination were performed and recorded in the preformed data collection sheet. Non-probability sampling technique was applied. Subjects aged 18−25 years, non-smokers and non-alcoholics and participating willingly, were included in the study. Subjects having any clinical condition like diabetes mellitus, renal disease, cardiovascular disease, endocrinopathy, liver disease and pregnancy and taking any lipid altering medicine were excluded.

Weight, height, waist circumference and blood pressure were measured in study subjects and BMI was calculated for each study subject. Based on BMI, subjects were classified as underweight (BMI <18.5 kg/m^2), normal weight (BMI 18.5–24.9 kg/m^2), overweight (BMI 25.0-29.9 kg/m^2), and obese (≥30.0 kg/m^2). Overnight fasting

(at least 12 hours) blood specimens were collected from study subjects to estimate the total cholesterol (TC), serum triglyceride, serum HDL-C. LDL-C was calculated by the method of Friedwald equation.

With all aseptic precautions 5 mL of venous blood was drawn from anti-cubital vein in a disposable syringe and delivered immediately into a dry clean test tube which was kept in standing position till clot formation. Then serum was separated after centrifuging at 3000 rpm for 5 minutes and collected in microcentrifuge tube, labeled properly and stored in ultrafreezer at −20ºC. All biochemical tests were done at the Department of Biochemistry of EMCH. All collected data were checked, edited and then processed with the help of the software Statistical Package for Social Sciences (SPSS) version 22.0. Association of obesity was found with body mass index, lipid profile and blood pressure.

Laboratory methods

TC and HDL cholesterol were estimated by cholesterol oxidase peroxidase (CHOD/POD) method and serum TG was estimated by glycerophosphate oxidase phenol 4-amino antipyrine peroxidase (GPO-PAP) method. LDL-C was indirectly calculated from TC, HDL-C and TG levels.

Results

In this study total participants were 85 healthy young male and female students of Enam Medical College. Out of them 43 (50.6)% were male and 42 (49.5%) were female. The mean differences of WC, SBP, DBP, TG between male and female were significant ($p<0.05$). And the mean differences of BMI, TC, HDL-C and LDL-C were not significant between male and female participants ($p>0.05$) (Table I). Table II shows the comparison of demographic and biochemical variables among subjects based on nutritional status. The means of BMI and WC were statistically significant in overweight and obese students ($p<0.001$). Other variables shows no significant difference ($p>0.05$).

Table I: Comparison of demographic and biochemical variables between male and female (n=85)

Variables	Male (n=43) Mean±SD	Female (n=42) Mean±SD	p-value
Age (years)	30.56±14.96	26.17±11.29	0.129
BMI (kg/m^2)	26.91±4.10	25.59±5.04	0.186
WC (cm)	92.48±9.95	81.57±9.85	<0.001*
SBP (mm Hg)	114.53±13.84	100.48±11.14	<0.001*
DBP (mm Hg)	76.86±11.44	67.62±9.32	<0.001*
TC (mg/dL)	176.79±34.88	171.78±31.64	0.490
TG (mg/dL)	142.50±73.75	112.81±60.13	0.045*
HDL-C (mg/dL)	41.14±6.84	44.24±10.52	0.111
LDL-C (mg/dL)	105.81±26.33	108.41±29.74	0.670

Data were expressed as mean±SD; Unpaired student t-test was done, *significant

Table II: Comparison of demographic and biochemical variables among subjects based on nutritional status (according to different BMI) (n=85)

Variables	Underweight (<18.5 kg/m^2) (n=4) Mean±SD	Normal (18.5-24.9 kg/m^2) (n=34) Mean±SD	Overweight (25.0-29.9 kg/m^2) (n=26) Mean±SD	Obese (>30 kg/m^2) (n=21) Mean±SD	p values
Age (years)	21.25±2.22	30.79±16.21	28.65±12.86	25.57±10.26	0.384
WC (cm)	72.50±8.35	79.59±6.88	90.46±8.88	97.83±8.48	<0.001*
SBP (mm Hg)	97.50±6.45	104.85±13.62	110.77±12.30	110.00±17.68	0.166
DBP (mm Hg)	62.50±2.89	70.15±11.25	74.62±10.38	74.76±12.60	0.098
TC (mg/dL)	160.03±36.57	165.44±30.95	183.60±32.80	179.89±34.46	0.121
TG (mg/dL)	121.60±38.28	115.00±70.85	144.37±67.35	129.32±70.38	0.439
HDL-C (mg/dL)	48.13±5.19	42.99±10.82	42.30±8.30	41.59±6.65	0.603
LDL-C (mg/dL)	91.83±40.66	100.22±23.59	113.63±26.54	113.04±31.78	0.130

ANOVA-test was done, *significant

Table III shows the correlation of BMI and WC with blood pressure and lipid profile. In study subjects, BMI showed weak positive correlation with SBP (r=+.175, p=0.109), DBP (r=+.229, p=0.035), TC (r=+.246, p=0.023), TG (r=+.145, p=0.183), LDL-C (r=+.249, p=0.022) and weak negative correlation with HDL-C (r=-.218, p=0.046). In study subjects, WC showed weak positive correlation with SBP (r=+.325, p=0.001), DBP (r=+.334, p=0.002), TC (r=+.260, p=0.016), TG (r=+.180, p=0.100), LDL-C (r=+.206, p=0.058) and weak negative correlation with HDL-C (r=-.170, p=0.120).

Table III: Correlation of BMI and WC with blood pressure and lipid profile (n=85)

		Pearson's correlation	
		r values	**p values**
BMI (kg/m^2)	SBP (mm Hg)	.175	.109
	DBP (mm Hg)	.229*	.035
	TC (mg/dL)	.246*	.023
	TG (mg/dL)	.146	.183
	HDL-C (mg/dL)	-.218*	.046
	LDL-C (mg/dL)	.249*	.022
WC (cm)	SBP (mm Hg)	.352**	.001
	DBP (mm Hg)	.334**	.002
	TC (mg/dL)	.260*	.016
	TG (mg/dL)	.180	.100
	HDL-C (mg/dL)	-.170	.120
	LDL-C (mg/dL)	.206	.058

Discussion

The subjects recruited for this study were drawn form medical students and the male subjects were older with larger body weight and waist circumference than the female subjects. Invariably, in these subjects their body weights were proportional to their heights and therefore are comparable.

Furthermore, the mean arterial pressure was significantly higher in males than in females. Apart from the triglyceride concentration, which is higher in males than in females, total cholesterol, HDL cholesterol, LDL cholesterol were similar in the two groups. The difference in triglyceride concentration may be attributed to the fact that males are more active and are able to mobilize stored triglycerides more than the female subjects. In fact, percentage of body fat has been shown to be negatively associated with physical activity, with exercise having pronounced effects on energy expenditure and substrate oxidation.[8] Estrogen in pre-menopausal women potentiates the synthesis of HDL-C, and may thus confer cardioprotection against artherosclerosis.[9] This may account for the higher but not significant level of HDL-C seen in the females than males in this study. Furthermore, the importance of blood pressure, serum cholesterol and protienuria as predictors for cardiovascular disease mortality, fatal and non-fatal myocardial infarction, and stroke is confirmed for patients with Type 1 and Type 2 diabetes mellitus. The presence of coronary artery disease (CAD) in postmenopausal women is independently associated with altered cholesterol metabolism as reflected by low synthesis and inefficient elimination of cholesterol.

The present study showed the mean of WC is statistically increased in overweight and obese students ($p<0.001$). Other variables did not show significant difference among the groups ($p>0.05$). Devi et al[10] compared according to BMI a nonstatistically significant increase in TC ($P>0.05$) and TG ($P>0.05$), and statistically significant increased LDL-C ($P<0.01$), and statistically significant decreased HDL-C ($P<0.001$) level in obese compared to nonobese but both the groups were having values within normal range. Similar observation was reported by Fisberg et al[11] while Njelekela et al[12] observed a significant increase in TC level in obese men. Similar observations were made by Bertsias et al[13], Mataix et al[14] and Nagila et al[15] in their studies. Anthropometric indices (BMI and WC) were found to be increased which was statistically significant ($P<0.001$) in obese compared to nonobese, which was also shown by studies of Rizk and Yousef[16]. Ugwuja et al[17] also observed an increased anthropometric indices in obese subjects.

WC and lipid profile when compared, in obese subjects were found to have increasd level of TC, TG, and LDL-C levels as compared to nonobese, but the difference was not statistically significant ($P> 0.05$) in TC and LDL-C levels but was significant in TG ($P<0.05$) and anthropometric indices (<0.05). A similar finding was reported by Mataix et al[14] who also observed statistically nonsignificant difference in these lipid levels in obese and nonobese men. Bertsias et al[13] found statistically significant increase in TC, TG and LDL-C levels, and decreased HDL-C ($P<0.01$).

The subjects were mainly on carbohydrate diets, which tend to decrease HDL-C levels. Physical activities and stress reminiscent of any college environment in Bangladesh probably compensated for the low level of HDL-C arising from carbohydrate based meal. Plasma lipid levels are also influenced by physiological parameters including age, body weight, percentage body fat, body mass index (BMI), blood pressure, diet and other life styles[9] and this probably explains the finding of this study.

This study showed BMI has weak positive correlation with SBP ($r=+.175$, $p=0.109$), DBP ($r=+.229$, $p=0.035$), TC ($r=+.246$, $p=0.023$), TG ($r=+.146$, $p=0.183$), LDL-C ($r=+.249$, $p=0.022$) and weak negative correlation with HDL-C ($r=-.218$, $p=0.046$). In study subjects, WC has weak positive correlation with SBP ($r=+.352$, $p=0.001$), DBP ($r=+.334$, $p=0.002$), TC ($r=+.260$, $p=0.016$), TG ($r=+.180$, $p=0.100$), LDL-C ($r=+.206$, $p=0.058$) and weak negative correlation with HDL-C ($r=-.170$, $p=0.120$).

In agreement with Devi et al[10] noted anthropometric variables (BMI and WC) were correlated positively with TC, TG, LDL-C, and correlated negatively with HDL-C. In this study, BMI showed weak positive correlation with TC, TG, LDL-C and weak negative correlation with HDL-C. WC showed weak positive correlation with TC, TG, LDL-C and weak negative correlation with HDL-C. Similar observations were also reported in the previous studies.[16,17] As this study was conducted in medical students who are future physicians, it is very important that they should be aware of increasing obesity as this may influence the patients. This study was conducted in 85 medical students. It was recommended to conduct a study with a larger sample size.

The epidemic of overweight and obesity is having a huge impact on the physical and social wellbeing of adult in future. Thus, it is concluded that the parameter indicating increased cardiovascular risk such as high TC, TG, LDL-C, and low HDL-C in obese group. As TG, TC, LDL-C showed positive correlation while HDL-C showed a negative correlation with both BMI and WC. Hence, both the anthropometric indices (BMI and WC) can be used alone and also in combination as a predictor of abnormal lipid profile and as a cardiovascular risk also.

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