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EPIDEMIOLOGY OF DYSLIPIDEMIA AMONG ADULT POPULATION OF BANGLADESH

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Abstract

Background and aims: *evatedEl level serum* of *lipids stimulate atherosclerosis*, *which is the risk factor for stroke, peripheral vascular and coronary heart disease. The aim of this study was to explore the pattern and associated factors of dyslipidemia among Bangladeshi adult population.* ***Material and methods:*** *A descriptive cross-sectional study was conducted at the outpatient department (OPD) of four Medical College Hospitals, Bangladesh. 200 adults aged 20 to 65 years diagnosed case of dyslipidemia were randomly selected. Fasting CHO, HDL, LDL and TG were measured. According to the criteria of the National Cholesterol Education Program-Adult Treatment Panel III (NCEP-ATP III), dyslipidemia was classified into (a) Hyper-lipidemia: TC>200 mg/dl, TG>150 mg/dl, (b) Hyper cholesterolemia: TC>200 mg/dl, (c) Hyper-triglyceridemia: TG>150 mg/dl, and (d) Atherogenic-dyslipidemia: TG>150 mg/dl, LDLC>165 mg/dl.* ***Results:*** *Study found 46% hyperlipidemia, 37% atherogenic dyslipidemia, 13.5% hypercholesterolemia and only 3.5% hypertriglyceridemia. BMI, FBS and HDL-C were significantly higher among female compare to male (p=<0.01, <0.01 and 0.04 respectively). TC and TG were significantly higher among higher calorie intake group in compare to normal intake group (p=0.04).* ***Conclusions:*** *Results of this study concluded that hyperlipidemia and atherogenic dyslipidemia are common and female dyslipidemic patients are susceptible to develop higher BMI, FBS, and HDL-C.*

key words: *Dyslipidemia, hypercholesterolemia, glycemic status and adult population*

Background and aims

Elevated level of certain lipids in blood stimulates atherosclerosis, which is documented as the foremost risk factor for stroke, peripheral vascular and coronary heart disease. Pathogenic character of cholesterol is determined not only by its blood level but also its distribution in lipoproteins. Low density lipoprotein (LDL) carried cholesterol is potentially pathogenic, and the high-density lipoprotein (HDL) carried one is index of a shielding role of lipoproteins against atherosclerosis [2]. The imbalance status of one or more types of lipoproteins in blood is known as dyslipidemia [3] and considered as an established independent major risk factor for CHD. It might even be a prerequisite, occurring before other major risk factors come into play.

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Low concentrations of HDL-C and high concentrations of TGs have been implicated as possible independent predictors of CHD [4], and combinations of these two conditions have been defined as atherogenic dyslipidemia (AD) [5]. A good number of population based prospective studies mostly conducted in Western countries have evaluated the impact of dyslipidemia on CHD [6,7]. Findings from some longitudinal studies which have been conducted in some high and middle income countries of Europe and North American revealed a straight and constant association of TC and LDL-C. An opposite association between low HDL-C and CHD morbidity and mortality was also reported on those studies [8].

Trends of TC level was studied in 180 countries over a 25-year period for assessing the risk factors of global burden of chronic diseases found that the TC level is higher in middle to high income countries. It has also been observed that in high income countries the TC level declined pointedly during this period and in upper middle income countries it persisted unmovable [9]. In some studies, a higher prevalence of lipid abnormalities is also reported among Asians than non-Asians [10,11].

A recent study conducted in Uganda has found prevalence of dyslipidemia among African women is very high [12]. The atherosclerotic CHD has been reported as a leading cause of death and disability not only in countries with a high socio-economic development but also in developing countries [13]. Because of the largest population group, the Asians are suffering from the major part of the global burden of CHD. In addition, since Asians have many different ethnic groups of population who may have different lipid profiles [14]. The INTERHEART investigators reported a higher prevalence of dyslipidemia among study participants living in five South Asian countries (India, Pakistan, Bangladesh, Sri Lanka, and Nepal) compared with participants from other fortyseven countries [11]. These five South Asian countries contribute for about one fourth of the total global population and represent the highest proportion of the burden of CHDs compare to any other part of the world [15]. Based on this scenario, a specific assessment of the pattern of dyslipidemia is important to design and planning for health services need and preventive measures to reduce the mortality and morbidity rates. There is a glaring dearth of literature where the pattern and factors associated with dyslipidemia among the Bangladeshi adult population was examined.

Material and methods

Study design and patients

A descriptive cross-sectional study was conducted at the outpatient department (OPD) of 4 Medical College Hospitals in Bangladesh. A total of 200 adults aged between 20 to 65 years, who were diagnosed case of dyslipidemia and advised for fasting serum lipid profile were selected for this study who were attended from July 2017 to December 2017. As we have conducted this study in four different medical college hospitals from different corner of Dhaka city in Bangladesh, we have enrolled 50 patients from each hospital to make uniform distribution of sample. Fasting CHO, HDL, LDL and TG were measured following the determination of fasting lipid profile.

Laboratory, anthropometric and clinical data collection

Face-to-face interview was conducted by using a pre-tested structured questionnaire to collect the data. Body mass index (BMI) was calculated from height and weight measured by a height-weight scale following standard operation procedure (SOP). 5ml fasting venous blood was

collected by venipuncture between 8.00-9.00 AM. After collection, blood samples were kept into plain tube for 30 minutes for clot formation. Serum was separated from blood sample by centrifugation for 10 minutes at 3,000 rpm with the use of refrigerated centrifuge. Enzymatic endpoint method was used to measure the serum total cholesterol. HDL, LDL and TG were determined by enzymatic color test of quantitative determination in serum and plasma in the Beckman Coulter AU480 analyzer. Serum glucose was measured by enzymatic UV test (hexokinase method) for the quantitative purpose in serum on Beckman Coulter AU480 analyzer. Blood pressure of the subject was measured by a mercury sphygmomanometer placing the cuff on the right arm at seated condition.

According to the criteria of the National Cholesterol Education Program-Adult Treatment Panel III (NCEP-ATP III), dyslipidemia was diagnosed and classified into four phenotypes: (a) Hyperlipidemia: TC>200 mg/dl, TG>150 mg/dl, (b) Hypercholesterolemia: TC>200 mg/dl, (c) Hypertriglyceridemia: TG>150 mg/dl, and (d) Atherogenic-dyslipidemia: TG>150 mg/dl, LDLC>165 mg/dl [7,16]. Underweight, Normal weight, Overweight and Obesity were determined according to World Health Organization guideline. Systolic blood pressure (SBP) 120 mm of Hg and diastolic blood pressure (DBP) 80 mm of Hg were considered as normotensive and SBP >120 mm of Hg and DBP >80 mm of Hg was considered as hypertensive. A subject who participates in moderate to forceful activity for a duration of ≥30 minutes in a day for at least 5 days in a week was considered as regular physical activity. Fasting blood glucose level >6.1 mmol/L was referred to diabetic.

Statistical analysis

Statistical Package for Social Science (SPSS, version 21) program was used for the analysis of data. One-way ANOVA and post-hoc LSD test were used to examine the differences in the serum levels of FBS among the study subjects with different dyslipidemia type. Cross-tabulation using Chi-square test was performed for the comparisons of fasting lipid profile among study subjects of different age groups. Student t-test was performed to see the gender variation among dyslipidemic subjects, mean ± SD values were used for level of significance. A 'p' value <0.05 was considered as statistically significant.

Results

Of the 200 participants, 56 % (n= 112) were male and rest of them were female. The proportion of dyslipidemia was higher among the 36 to 45 years age group 52.5% (n=105) compared to 46 to 65 years 26.5% (n=53) and 20 to 35 years 21.0% (n=42) age groups. Among the participants, 70.5% (n=141) attained higher secondary level education, 42% (n=84) represents middle income group, 72% (n=145) reported no regular physical exercise, 80% (n=160) reported normal calorie diet. The highest proportion of dyslipidemia was reported among the over-weight 52.5% (n=105), hypertensive group 59.0% (n=118), and the diabetic group 55.0% (n=110).

The pattern of dyslipidemia is summarized in Table 2. Out of the 200 participants, 46% (n=92) had hyperlipidemia (TC>200 mg/dl, TG>150 mg/dl,), 37% (n=74) had atherogenic dyslipidemia (TG>150 mg/dl, LDLC>165 mg/dl), 13.5% (n=27) had hypercholesterolemia (TC>200 mg/dl) and only 3.5% (n=7) had hypertriglyceridemia (TG>150 mg/dl).

Tables 1. Baseline characteristics of the study participants.

Characteristics		Frequency (n)	Percentage (%)
Gender	Male	112	56.0
	Female	88	44.0
Age group	20 to 35 Years	42	21.0
	36 to 45 Years	105	52.5
	46 to 65 Years	53	26.5
Education	Illiterate	33	16.5
	Up to HSC	141	70.5
	Above HSC	26	13.0
Socioeconomic status	Low Income	40	20.0
	Medium Income	84	42.0
	High Income	76	38.0
Physical activity	No Physical Exercise	145	72.5
	Regular Physical Exercise	55	27.5
Diet pattern	Normal Calorie	160	80.0
	High Calorie	40	20.0
BMI status	Under weight	4	2.0
	Normal weight	48	24.0
	Over weight	105	52.5
	Obese	43	21.5
Blood pressure status	Normal	82	41.0
	Hypertensive	118	59.0
Glycemic status	Diabetic	110	55.0
	Non-diabetic	90	45.0

Table 2. Pattern of dyslipidemia.

Type of Dyslipidemia	Frequency (n)	Percentage (%)
Hyperlipidemia	92	46.0
Atherogenic	74	37.0
Hypercholesterolemia	27	13.5
Hypertriglyceridemia	7	3.5

For BMI and FBS, a significant difference was found among the different gender groups. Table 3 shows that among the dyslipidemic subjects, BMI and FBS of female were significantly higher than the male patients (p=0.00 and 0.04 respectively). However, differences in the SBP and DBP between the male and female were statistically insignificant. The mean ± SD level of HDL-C among the female was significantly higher compared to the male (p=0.00) due to gender variation of HDL-C reference value. The mean ± SD levels of TC and TG were significantly higher among the participants who reported high calorie diet compared to the normal calorie diet (p=0.04) and (p=0.01).

Comparison of FBS among the study participants with different types of dyslipidemia shown that the mean ± SD levels of FBS was significantly higher among the hyperlipidemia group compared to the hypercholesterolemia group (p=0.04) (Table 4).

Table 3. Comparisons of different parameters according to gender and diet pattern among the dyslipidemic subjects

Parameter	Gender		
	Male	Female	
BMI	25.76±3.67	28.99±5.44	p=<0.01
SBP	87.95±14.01	85.28±12.58	p=0.16
DBP	136.96±23.75	133.98±19.57	p=0.34
TC	235.51±44.44	240.51±45.61	p=0.44
HDL-C	37.34±8.05	43.15±9.32	p=<0.01
LDL-C	135.7±48.41	141.15±46.37	p=0.42
TG	318.59±192.65	294.84±227.07	p=0.42
FBS	7.43±3.17	8.51±4.38	p=0.04
Diet pattern			
	Normal calorie	High calorie	
TC	234.72±40.40	249.67±58.75	p=0.04
HDL-C	39.65±8.91	40.88±9.78	p=0.44
LDL-C	138.26±43.31	137.45±62.09	p=0.92
TG	289.5±163.11	382.67±325.21	p=0.01

Table 4. Comparison of FBS among the study subjects with different dyslipidemia types.

Dyslipidemia Type	FBS
HL (n=92)	8.43±4.15
HC (n=27)	6.82±2.82
HT (n=7)	6.23±2.12
AD (n=74)	7.82±3.63
Multiple Comparisons	LSD Level of Significance
HL vs., HC	0.04
HL vs., HT	0.14
HL vs., AD	0.30
HC vs., HT	0.71
HC vs., AD	0.24
HT vs., AD	0.28

Table 5. Comparisons of Glycemic Status among the Study Subjects with Different BMI Status.

Status of BMI	Glycemic status
	FBS
UW (n=4)	7.65±2.47
NW (n=48)	7.27±3.20
OW (n=105)	9.86±5.08
OB (n=43)	7.32±2.65
Multiple Comparisons	LSD Level of Significance
UW vs., NW	0.2451
UW vs., OW	0.8394
UW vs., OB	0.862
NW vs., OW	0.0001
NW vs., OB	0.9454
OW vs., OB	0.0011

Comparisons of Glycemic status among the participants with different BMI status shows that the serum means ± SD levels of FBS was significantly higher among the overweight group compared to the obese group (p=0.00) as well as to the normal weight group (p=0.00) (Table 5).

Discussion

This study was carried out at the outpatient department (OPD) of 4 Medical College Hospitals in different places of Dhaka city, Bangladesh to assess the pattern and factors associated with dyslipidemia among the Bangladeshi adult population. Our results found that the proportion of dyslipidemia was a bit higher among the 36 to 45 years age group in compare to the other groups. A recent study found that highest rate of dyslipidemia among 30-39 age group of man and 40-49 years age group of women, which is similar to our finding [17]. It was also found that dyslipidemia was higher (70.5%) among the participants attained higher secondary level education. A recently published paper from China has mentioned that dyslipidemia was positively associated with level of education [18]. In terms of income, we have found that majority of the dyslipidemic patients were middle- or higher-income group. It is might be due to less physical activity which we have found later that 72% of the participants had no regular physical exercise. It has been supported by previous study conducted among Chinese population [18]. We have found that the highest proportion of dyslipidemia among the over-weight (52.5%) group. Several previous study among Asian population have found the similar results [19-20]. In our study, hypertensive group had more dyslipidemia (59.0%) in compare to non-hypertensive group, and also among the diabetic group (55.0%) in compare to non-diabetic group. Serum lipid concentrations among the Asian populations is

stated in many previously studies and found the similar results [19-21].

In our study, most common types of dyslipidemia were Hyperlipidemia (46.0%) and Atherogenic Dyslipidemia (37.0%). Several recent studies have described pattern of dyslipidemia among Asian population [21-23], which are somehow supportive to our results. The level of TC and TG were found higher among female compare to male and were statistically significant. A hospital based cross-sectional study reported that increased calorie intake is positively correlated with total cholesterol levels [23]. In most of the western countries, high TC is counted as one of the common lipid disorders. With the course of time, western foods have been gaining attention and popularity among the Bangladeshi population that results in changes of their dietary pattern. Hence, it acts as one of the contributors to the high TC in Bangladesh. We found that dyslipidemia was higher (72.5%) among participants without a habit of regular physical exercise. The previous study also reported a significant difference in the total cholesterol levels of subjects who exercised and those who were not involved in any physical activity.

Our study findings shown an unswerving pattern of association of increasing prevalence of dyslipidemia with increased fasting blood glucose, and blood pressure. Increase in the BMI was significantly associated with the FBS level. These findings show the relationship of the abnormalities of glucose metabolism with generalized over weight and obesity among the adult Bangladeshi population with dyslipidemia. Results indicating the possible involvement of insulin action in the development of obesity. An inverse linear association between body mass index (BMI) and age at diagnosis of type 2 diabetes has been reported [24,25]. A significant positive association of SBP and DBP with age was reported in our study. Change in blood pressure status in the study participants was significantly associated with the change of their age groups. However, we found hypertensive dyslipidemic subject were significantly higher in 35 to 45 years age group. Although differences in the SBP and DBP among the study subjects with different dyslipidemia types were statistically insignificant. The prevalence of obesity has been observed more in urban settings compare to rural, and it found more common among the women than men [26]. Our study site was Dhaka an urban area of Bangladesh and the study finding was consistent with this study.

Conclusions

This study concludes that hyperlipidemia and atherogenic dyslipidemia are more common types of dyslipidemia among adult population in Bangladesh and female dyslipidemic patients are more susceptible to develop higher BMI, FBS, and HDL-C. High calorie intake adult population have higher chance of increased level of TC and TG in compare to normal calorie intake group. Hyperlipidemic adults have higher chance of increase level of FBS in compare to the hypercholesterolemia group. We would like to recommend Bangladeshi women to maintain their BMI within normal range and also to check FBS and lipid profile on a regular basis. So they might be able to better control of dyslipidemia. We also recommend Bangladeshi adult population to be cautious of calorie intake.

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