

Prevalence of Dyslipidemia and Associated Factors among the Sub-Urban Bangladeshi Population

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Abstract

Dyslipidemia is highly prevalent in the urban and rural areas of Bangladesh but information in the sub-urban, is limited. The objective of this study was to determine the prevalence of dyslipidemia in sample population who live in the sub-urban area of Bangladesh. Random sampling of the volunteers aged > or = 18 years in Bhaluka upozilla of Mymensingh district was done. After 12-hour fasting, the blood sampling was drawn for the analysis of fasting glucose, total cholesterol, triglycerides, high-density lipoprotein (HDL) cholesterol and low-density lipoprotein (LDL) cholesterol. In the present study, we have shown that there is increasing trend of dyslipidemia even in the sub-urban community. Women had significantly higher body mass index, serum cholesterol and LDL cholesterol levels than men after 40 years of age. Of the study population 16.9% had high TC (e"240 m/dl), and 8.8% had low HDL-C (d"40 mg/dl). The population with high (e"160 mg/dl) LDL-C was 15.7%. In addition, 17.8% had high TG (e"200 mg/dl) and 2.0% had very high TG (e"350 mg/dl). Our findings also suggest a protective role of ordinary Bangladeshi diet such as fish cooked in mustard oil on dyslipidemia. Individually, both fish and the mustard oil are rich in unsaturated fatty acids, and biologically, their beneficial effects are related not only to reduction of blood pressure, but also to lowering of lipids and to their antithrombotic effects. In conclusion, prevalence of dyslipidemia was very high in Bangladeshi sub-urban region. Useful role of fish cooked in mustard oil, as a protective factor needs to be probed further in future longitudinal studies. The observed prevalence of dyslipidemia in this study suggests the need for a comprehensive national policy to control dyslipidemia in Bangladesh. Further surveillance in this population is essential in verifying the impact of dyslipidemia as a risk of cardiovascular disease in Bangladeshi people.

Introduction:

An epidemiological shift in the prevalence of dyslipidemia in developing countries as compared to developed countries has been observed. Studies from India and Bangladesh have shown upward trend in the prevalence of dyslipidemia. Dyslipidemia plays a crucial role in the development of cardiovascular diseases, which has become the leading cause of death in most developed countries as well as in developing countries, including Bangladesh^{1,2}. The prevalence pattern of dyslipidemia in developing countries is different from that in the developed countries. In Bangladesh, a small but very populous and typical developing country, our clinical experience indicates that prevalence of dyslipidemia has increased at a rapid rate among urban dwellers over the last few years.³ Various factors might have contributed to this rising trend,⁴ and among others; consequences of rapid industrialization, such as change in life style pattern, work habit, diet and stress increased population and shrinking employment have been implicated.

The current industrialization rate in Bangladesh is 35% as compared to 5% in the 1950s. With growing industrialization, socio-developmental changes have taken place over last 40-50 years. Dramatic changes in life style from traditional to modern have lead to physical inactivity due to technological advances. Rising affluence has modified the dietary pattern characterized by increased consumption of diets rich in fat, sugar and calories. Furthermore, increasing population growth in each year and technological advances have shrunken the employment opportunities particularly among young generation – leading to stress and inactivity in young persons, including students and laborers.

The present study was designed to investigate the epidemiological features of dyslipidemia in Bangladeshi population: the prevalence and the pattern of dyslipidemia in a sample population from one of the rising industrial sub-urban community of Bangladesh, with the aim of identifying the risk factors and suggesting intervention strategies.

Materials and Methods:

A survey was conducted during 2005–2011 through a cluster multistage sampling to a resident group in the Bhaluka upo-zilla of Mymensingh district. A total of 3,201 individuals (1,499 men, 1702 women), aged \geq 18 years, participated in our cross-sectional survey of validated and structured questionnaire followed by blood analysis for lipid profile.

Place of survey and the population

Bhaluka, a rising industrial sub-urban region in the district of Mymensingh, had been the place of survey. Demographic characteristic of the sample population is given in table I. The place has a tropical climate and is made of Barandra soil in the Bromoputro plain. Though, the local population is stable and usually consumes mixed diet consisting of rice, fish as the chief protein component and mustard oil as the main cooking medium, the migrating population (industry workers) shows a diverse food habit. Moreover, because of rapid industrialization, the dietary habit and lifestyle of the sample population has been changed to some extent: increased consumption junk food rich in fat, sugar and calories, longer working hours, decreased physical activity, altered day-night sleep pattern. Initially, families were randomly selected from an administrative database on families residing in the locality. After selection of the families, all available members of the selected family who were at 18 years of age or above at the time of the study were then included for the door-to-door survey.

Data collection

Assessment of cardiovascular disease risk factors by a trained health assistant comprised administration of a questionnaire was done. The following information was collected from each subject through a validated questionnaire administered by the volunteers: age, sex, education, occupation, income status, weight, height, pattern of salt intake, dietary pattern, meat and fish consumption, history of diabetes, family history of hypertension, smoking including chewing tobacco, past history of any dyslipidemia or any its complications, any symptom referable to target organ dysfunction, previous and present treatment profile, and addictions.

Methods:

The importance of a health check-up and assessment of cardiovascular risk factors was explained. The volunteers had administered the structured questionnaires. After

verifying the questionnaire, the doctors measured the height, weight (without heavy clothing and shoes), and blood pressure for each participant. All potential participants were requested not to eat anything after 20:00 h and to attend the clinic at Bhaluka between 8:00 and 10:00 h on the following day. Venous blood samples (5 ml) were taken for blood analysis. All measurements were done in the laboratory of the Joynal Abedin Free Friday Hospital, Bhagra, Bhaluka, Mymensingh with appropriate internal quality control procedures.

Measurement of blood lipids

Venous blood samples were drawn into ethylenediaminetetra-acetic acid containing vacuum tubes with minimum stasis. Plasma lipids were measured by enzymatic-colorimetric method: Plasma total cholesterol (CHOD-PAP), triglycerides (GPO-PAP) methods. The high density lipoprotein (HDL) cholesterol was measured by phosphotungstic-precipitation method. The low density lipoprotein (LDL) cholesterol was calculated by the Friedewald equation, given that none had Tg level above 400 mg/dl.

Statistical Analysis

Categorization of the plasma lipid levels was done according to the third report of the US National Cholesterol Education Program (Adult Treatment Panel III) []. Prevalence of dyslipidemia with 95% confidence intervals in each group was calculated. All analyses were done using the SAS statistical package (SAS Institute Inc., Cary, North Carolina, USA). We applied chi-square test to find out the results at 5% significance for the select risk factors and outcome variables.

Results:

Table I shows the socio-economic and demographic background of the survey participants. The local participants were mainly fish eaters with a median intake of fish four times in the last 3 days, though they mentioned that main source of fishes is progressively increasing numbers of horticulture farms in the region not the local ponds or water reserves. The meat, milk, egg intake was low; tobacco consumption was very high for both smoking (23%) and smokeless forms (43%). However, the non-local (not born and brought up in the area) shows different food habits, more meat, milk and egg consumption. The mean body mass index (BMI) was 21. The mean systolic and diastolic blood pressures were 115 and 75 mmHg, respectively.

Table-I
Demographic, socioeconomic, and outcome variables

Variables	Categories	Frequency	Percentage (%)
Age in years	>20	267	8.3
	20 – 29	567	17.7
	30 – 39	876	27.4
	40 – 49	323	10.1
	50 – 59	456	14.2
	60 – 69	367	11.5
	<70	345	10.8
Gender	Male	1499	46.8
	Female	1702	53.2
Occupation	Sedentary workers	654	20.4
	Housewives	789	24.6
	Manual Labour	1256	39.2
	Technocrats	502	15.7
Education (years completed)	Less than 5 years	879	27.5
	5 - 10 years	1576	49.2
	More than 10 years	746	23.3

Of the study population 34.4% had borderline high TC, 16.9% had high TC (≥ 240 mg/dl), and 8.8% had low HDL-C (< 40 mg/dl). The population with borderline high, high (≥ 160 mg/dl), and very high (≥ 250 mg/dl), LDL-C was 15.7, 3.5, and 0.9%, respectively. In addition, 15.9% had borderline high TG, 17.8% had high TG (≥ 200 mg/dl) and 2.0% had very high TG (≥ 350 mg/dl). After adjusting for independent variables, TC and TG had the same risk with fasting plasma glucose (FPG) and body mass index. Risk factors of TC and LDL-C were women, age and FPG. Women, age, fish eating were protective factors but tobacco intake and inactivity were risk factors for HDL-C.

Prevalence of dyslipidemia in sample adults aged 18 and over was 16.6%, with 17.0%, 22.9% and 23.4% in the groups of 20-39, 40-59 and over 60 years old, respectively, 22.2% and 15.9% in males and females, respectively, and 21.0% and 17.7% in non-local and local population, respectively. Age and sex-specific prevalence of dyslipidemia showed progressive rise of cholesterol and triglyceride in women when compared to men.

Fig 1 shows the influence of age and sex on distribution of dyslipidemia among the sample population. In participants below 40 years, dyslipidemia showed higher prevalence in men. After 40 years, it showed progressive age-dependent increase up to eighth decade in both. Maximum prevalence of dyslipidemia was 64% among men in seventh decade and women in sixth decade.

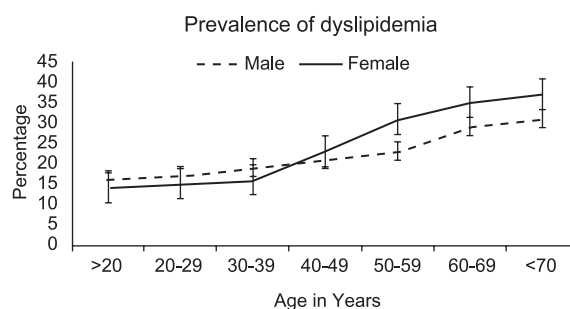


Fig-1: Age and sex specific distribution of dyslipidemia (High TC, high TG and low HDL-C)

Prevalence of dyslipidemia was higher among housewives, sedentary workers, those with high body mass indices, smokers, and individuals who take diet rich in meat, egg, more calories (Table II). After adjusting for the effects of all other factors, people with higher body mass indices were at significantly higher risk of dyslipidemia. Compared to people whose BMI were at the lower quantiles (people with BMI 18.4 or lower), people whose BMI was in the highest quantile (BMI equal to or more than 25.6) were about 2.5 times at risk of dyslipidemia. Finally, after adjusting for the effects of all other factors, compared to people on high fat diet, predominantly fish eaters were about 40 percent lower risk of dyslipidemia. Apparently, education did not have any role on the prevalence of dyslipidemia.

Table-II
Prevalence of dyslipidemia in sample population according to various factors

		%
Occupation	Sedentary workers	20.4
	Housewives	24.6
	Manual Labour	9.2
	Technocrats	15.7
Education (years completed)	Less than 5 years	24.6
	5 - 10 years	25.3
	More than 10 years	23.3
Tobacco usage	Non-smoking	23.7
	Smoking	36.5
Dietary frequency for last 3 days	Meat	22.3
	Fish	16.7
	Milk	20.9
	Egg	23.4

Discussion:

The primary objective of this project was to study the prevalence and the pattern of dyslipidemia in a sub-urban population from a north-east region of Bangladesh. Additionally, the study aimed to identify the various risk factors for dyslipidemia with the purpose to suggest possible interventions based on the risk factor analysis. About 17% of our population had high TC of more than 240 mg/dl. Almost similar level of dyslipidemia observed by others, such as Zaman et al [5] reported 16.1% of high TC in a rural population of Bangladesh, Zhao et al [6] observed high TC in 16.9% case, whereas one study from Thailand showed high TC in 70% of their subjects.⁷ However, Thailand work was based on the elderly population and their cutoff value was different: ≥ 240 mg/dl. The prevalence of high TG was 17.8% in our sample, which is higher than the prevalence in a rural Indian population (9.8%),⁸ but our observed rate was almost similar to a Bangladeshi study 15% [5]. Of our study population only 8.8% had low HDL-C (≤ 40 mg/dl), which is remarkably lower than that of observed by Zaman et al⁵ in their rural subjects (66.4%). However, one study in India reported prevalence of low HDL-C as 30%⁹, while another study reported only 7% in a rural population [8]. We believe high intake of fish and mustard oil was responsible for such lower prevalence of HDL-C.

The point of interest is protective effect of ordinary Bangladeshi diet. The study participants by custom are predominantly fish eater and they also consume mustard oil, which is a principal cooking medium. Mustard oil is

edible oil and it has a right blend of n-3/n-6 polyunsaturated fatty acids, which help in reducing LDL, and it has very low amount of saturated fatty acids. Fish oil is the main source of omega-3 fatty acids (EPA- eicosapentaenoic acid and DHA -docosahexaenoic acid) and also omega-6 fatty acids- two main classes of essential fatty acids. Omega – 3 fatty acid found in fish oil lowers blood triglyceride level and blood pressure possibly through generation of nitric oxide which has vasodilator property. EPA is more effective in reducing triglyceride level and DHA is more effective for reducing blood pressure. Beneficial effect of mustard oil has been observed among Indians in reducing ischemic heart disease in a recent study¹⁰. Countries with an ageing population in developed countries will be expected to have a higher prevalence of dyslipidemia than a developing country with a younger population such as Bangladesh, but there are studies, which have documented a high prevalence dyslipidemia in developing countries¹¹.

Bivariate analysis showed significant relationship of dyslipidemia with age, sedentary occupation, body mass index (BMI), diet, and smoking. Multivariate analysis revealed age and BMI as risk factors, and 'normal Bangladeshi diet' (fish curry with steamed rice) as protective factor with respect to dyslipidemia. Prevalence of borderline high hypercholesterolemia, hypertriglyceridemia and low blood high-density lipoprotein cholesterol (HDL-C) among younger subjects - particularly students and laborers need special attention. Role of normal Bangladeshi diet as a protective factor might have been related to fish-eating behavior of the

sample population, who also use mustard oil as cooking medium - both of which have significant level of essential polyunsaturated fatty acids.

However, several potential limitations should be considered while interpreting the results of this study. First, the dietary data were obtained from a structured questionnaire and therefore response bias could not be ruled out. Data on cooking medium was not sought at the initial survey. However, subsequent surveys and common social norms indicate that the preferred cooking medium for about 98% of the population was mustard oil. Second, when considering dyslipidemia, lipid levels may vary widely from normal to abnormal range and vice-versa. And that we have not analyzed the correlation of socio-economic status with the pattern of dyslipidemia to avoid bias, as participants did not want to reveal their actual income status.

Conclusion:

Dyslipidemia has become one of the important risk factors threatening health of Bangladeshi people, with hypertriglyceridemia and low blood HDL-C as two major types in those aged 18 and over. It is very important to pay more attention to earlier comprehensive prevention and control of dyslipidemia. In the present study, we have shown that there is increasing trend of dyslipidemia even in the sub-urban community. Age and sex specific increase of prevalence of dyslipidemia in both women and men indicate significant role of environmental factors. This suggests public health remedial measures to address growing dyslipidemia in the community through health education about lifestyle changes, dietary modification, and avoidance of sub-urban stress. Our findings also suggest a protective role of ordinary Bangladeshi diet such as fish cooked in mustard oil on dyslipidemia. Individually, both fish and the mustard oil are rich in unsaturated fatty acids, and biologically, their beneficial effects are related not only to reduction of blood pressure, but also to lowering of lipids and to their antithrombotic effects [12]. Useful role of fish cooked in mustard oil, as a protective factor needs to be probed further in future longitudinal studies. The observed prevalence of dyslipidemia in this study and other studies suggest the need for a comprehensive national policy to control dyslipidemia in Bangladesh.

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