Study of Lipid Profile in Adult Population of Bangladesh

Md. Abdul Kader Akanda[1], Zulfikar Ali[1], Kamrun Nahar Choudhury[2], Lima Asrin Sayami[1], Reaz Mahmud Huda[1], Shauket Hossain[3], Minhazul Mohsin[4], Md. Asahaque Ali[5]

[1] Department of Cardiology, NICVD, Dhaka, [2] Department of Epidemiology, National Centre for Control of Rheumatic Fever and Heart Disease, Dhaka, [3] Department of Pharmacy, Jahangirnagar University, Dhaka, [4] International Centre for Diarrhoeal Disease Research, Dhaka, [5] Noagoan Diabetic Society, Noagoan.

Keywords:
Lipid profile

Abstract

Background: *Lipid disorder is a major risk factor for the progression of atherosclerosis. With increasing urbanization and socioeconomic improvement, changing population dynamics is expected to influence disease pattern with rising trends of non communicable diseases. Thus there is a need to screen healthy adults for their lipid pattern with high population dynamics in Bangladesh. Present study was aimed to find out the distribution of lipid profile in adult population of Bangladesh.*

Methods: *A cross-sectional study was carried out among adults age over 18 years residing in an urban and a rural community. A total of seven hundred sixty eight (768) participants were screened. Data included socioeconomic information, behavioural risk factors, anthropometric measurement and biochemical measurement using a pretested questionnaire.*

Results: *Between the urban and rural participants, the mean total cholesterol level was 175.2±37.5 vs. 149.6±23.8 mg/dl, mean triglyceride was 132.5±35.3 vs. 154.7±34 mg/dl and mean low density lipoprotein was 104.0±34.6 vs.79.7±25.5 (mg/dl), respectively (p-value <0.05). There was an increase in total cholesterol with increasing age (OR = 4.53, 95% CI = 3.55-9.52) and economic status between the areas (p<0.05, OR = 1.88, 95% CI = 0.89-2.37). Total cholesterol was found to be high among urban participants and triglyceride level was found to be high among rural population (p<0.05). Factors significantly associated with dyslipidemia were blood pressure, fasting blood sugar and food habits (p<0.05).*

Conclusion: *The result will be used for lifestyle intervention program to maintain the normal level of lipid profile and to achieve primary prevention of coronary artery disease and associated non communicable diseases in the entire population.*

(Cardiovasc. j. 2016; 8(2): 128-134)

Introduction:

Non-communicable diseases (NCDs) are the number one cause of death and disability in the world. According to World Health Organization (WHO) data, 36 million people had died globally in 2008 due to NCDs, accounting for 63% of the total deaths. About 80% of deaths related to NCDs occurred in low- and middle-income countries. Among deaths related to NCDs, cardiovascular diseases were the leading causes. More than 60% of the total deaths related to NCDs occurred due to cardiovascular diseases.[1]

Lipid profile means pattern of lipids in the blood. A lipid profile usually includes the level of total cholesterol (TC), triglycerides (TG), low density lipoprotein (LDL) and high density lipoprotein (HDL). The increased level of TC, TG and LDL is found to be associated with the higher risk of coronary artery disease (CAD) and ischemic stroke.[2-5] On the other hand, population based studies have consistently demonstrated an inverse association between HDL level with the risk of CAD.[6]

Worldwide, a change in population dynamics is observed with increasing urbanization and socioeconomic improvement. This change is expected to influence disease pattern with rising trends of non communicable diseases. Several studies have reported a wide variation in mean population cholesterol levels in different regions

Address of correspondence: Dr. Md. Abdul Kader Akanda, Department of Cardiology, National Institute of Cardiovascular Diseases, Dhaka, Bangladesh. Email: abdulkaderakanda@yahoo.com.

of the world.[7-9] A steady increase of cholesterol levels was noted in Asian countries in the last decades of the 20th century and the trend was increasing faster in urban areas than in rural areas.[10]The problem is expected to extend in a greater magnitude in developing countries due to the increasing number of older population and increasing prevalence of lipid disorders among older population. So, well understanding of lipid profile is becoming an issue of a major concern for the prevention of NCDs like CAD and stroke.

One of the useful strategies for preventing CAD and stroke include measures to control the risk factors. To plan such activities, level of these risk factors like lipid profile must be known. There is a lack of published data regarding the lipid profile of Bangladesh. Considering the situation, the present study was designed to find out the level and distribution of lipid profile in adult health population in given communities.

Methods:

This was a cross sectional study, managed from two co-ordination centres. National Institute of Cardiovascular Disease (NICVD) was the co-ordination centre for urban area and Noagoan Diabetic Society was the co-ordination centre for rural area. Holdings were selected by simple random sampling method from all the holding numbers of the particular block. Household members, above 18 years, were taken as sampling units. A pre-tested questionnaire was used for interviewing the respondents. Another check list was also used for recording physical examination, blood pressure, anthropometric measurements and other findings. Anthropometric measurement was taken by following standard methods. Body weight (kg) was to the nearest 0.1 kg, with wearing light clothing, no shoes. Height (cm) was measured with a measuring tape to the nearest 0.5 cm. Waist circumference was measured at the level of the umbilicus by trained data collector. Systolic and diastolic blood pressures were measured using a sphygmomanometer. All patients had a registration number and contact with concerned co-ordination centres. Next day blood was collected from laboratory division. Twelve-hour fasting blood in the morning had drawn from all of the subjects. Blood was obtained and biochemical measurements were conducted in a routine manner in the specified laboratory. The serum lipid profile and the fasting serum glucose concentration were measured in enzymatic methods. All laboratory report was recorded in the questionnaire. Same process was followed for both urban and rural area.

Lipids levels were classified according to the classification recommended by National Cholesterol Education Program (NCEP) and Adult Treatment Panel III (ATP III) guidelines.[11] Desirable level of TC was < 200 mg/dl, borderline high was between 200-239 mg/dl and high TC was considered when the level was ≥240 mg/dl. LDL was defined as optimal level when it was < 100 mg/dl, near optimal level between 100-129 mg/dl, borderline high between 130-159 mg/dl, high between 160-189 mg/dl and very high when it was ≥190 mg/dl. TG level was considered as normal when it was < 150 mg/dl, borderline high between 150-199 mg/dl, high between 200-499 mg/dl and very high when it was ≥500 mg/dl. Desirable HDL was considered when it was ≥40 mg/dl and low when it was < 40 mg/dl.

For the convenience and simplicity, lipid profile data were represented in two classes - either normal or high. TC level of < 240 mg/dl was considered as normal and TC level of ≥240 mg/dl was considered as high. LDL was considered normal when it was < 160 mg/dl and high when it was ≥160 mg/dl. TG level of < 200 mg/dl was considered as normal and TG level of ≥200 mg/dl was considered as high. HDL was considered normal when it was ≥40 mg/dl and high when it was < 40 mg/dl.

After collection, data was checked for completeness and consistencies by the investigators. Statistical Package for Social Science (SPSS) for windows version 13 was used for data analysis. Data was expressed in percentage, frequency, means and standard deviation. Result was reported as mean ± standard deviation (SD) for qualitative variables and categorical variables was presented as absolute frequencies and percentage. Continuous variable was compared through the student's t-test and for the categorical variable the chi-square test. Suitable test of significance was applied for the results to see the correlation between level of lipid profile with behavioural risk factors of adult healthy population and also dyslipidaemia. Significance will be accepted where the p-value <0.05.

The study protocol was reviewed and approved by the Bangladesh Medical Research Council (BMRC) Ethical Committee [BMRC/NREC/2010-2013/655(1-10)]. Written informed consent was obtained from each participant.

Results:

A total of 768 participants were screened with an equal distribution in urban and rural areas. The general characteristics of the study population in urban and rural areas are summarized in Table I. Between urban and rural participants, there was also no significant difference in mean age, male female distribution, body mass index (BMI) and fruits intake. However, there was significant difference between urban and rural participants in terms of tobacco use, vegetable intake, blood pressure, fasting blood sugar and lipid profile.

Compared to the participants of rural areas, the mean TC and LDL levels were significantly higher among participants of urban areas. Between the urban and rural participants, the mean TC level was 175.2±37.5 vs. 149.6±23.8 mg/dl and mean LDL

Table-I

General characteristics of the study population in urban and rural areas (n=768).

Variables	Urban (n=384)	Rural (n=384)	p value
Age (years)	37.2 ± 6.8	35.5 ± 10.5	0.26
Gender			
Male	183 (47.7%)	191 (49.7%)	0.56
Female	201 (52.3%)	193 (50.3%)	
Tobacco use			
Smoking tobacco	104 (27.1%)	115 (29.9%)	0.05
Chewing tobacco	72 (18.7%)	103 (26.8%)	0.05
Body Mass Index (BMI)			
Normal weight (18.5 – 24.9)	210 (54.7%)	280 (73.0%)	-
Over weight (25 – 29.9)	138 (35.2%)	52 (13.5%)	-
Obese (e”30)	39 (10.1%)	52 (13.5%)	-
Mean BMI	24.6 ± 4.3	24.0 ± 7.5	0.16
Fruits intake			
<80gm	296 (77.1%)	227 (59.1%)	0.21
e”80gm	88 (22.9%)	157 (40.9%)	
Vegetables intake			
<400-500gm	295 (76.8%)	309 (80.5%)	0.001
e”400-500gm	89 (23.2%)	75 (19.5%)	
Clinical parameters			
Systolic blood pressure (mmHg)	114.2 ± 10.5	107.9 ± 10.6	0.02
Diastolic blood pressure (mmHg)	74.4 ± 8.8	72.8 ± 6.2	0.001
Fasting blood sugar (mg/dl)	104.2 ± 25.6	101.3 ± 54.4	0.001
Lipid profile			
Total cholesterol	175.2 ± 37.5	149.6 ± 23.8	0.001
Triglyceride	132.5 ± 35.3	154.7 ± 34	0.001
Low density lipoprotein	104.0 ± 34.6	79.7 ± 25.5	0.001
High density lipoprotein	37.0 ± 8.9	37.3 ± 4.9	0.68

level was 104.0±34.6 vs.79.7±25.5 (mg/dl), respectively, with a p-value <0.05, which was significantly associated. Conversely, the mean TG level was significantly higher among participants of rural areas compared to the participants of urban areas. Between the urban and rural participants, mean TG level was 132.5±35.3 vs. 154.7±34 mg/dl, respectively, with a p-value <0.05, which was significantly associated. Mean high density lipoprotein was similar between urban and rural adults (37.0±8.9 vs. 37.3±4.9 mg/dl, p = 0.68).

The lipid profile among the participants of urban and rural areas by different age groups is abridged in Table II and Table III respectively. Among participants of urban areas, the highest level of TC was found in 40-49 years group; the highest level of both TG and HDL was found in 50-59 years group; and the highest level of LDL was found in 30-39 years group. Among participants of rural areas, the highest level of TC was found in 50-59 years group; the highest level of both TG and HDL was found in 30-39 years group; and the highest level of LDL was found in 40-49 years group.

Lipid profile of the total study population by normal and high level is presented in Figure 1. 76.2% of the participants were within normal level of TC and 23.80% were high level of TC. In case of TG, 74.4% and 25.6% were normal and high level respectively. 77.0% of the participants were within normal level of LDL and 23.0% were high level of LDL. In case of HDL, 40.2% had high and 59.8% had low level of HDL.

Table-II

Lipid profile of urban population by different age groups (n=384).

Age in years	Total cholesterol (mg/dl)	Triglyceride (mg/dl)	Low density lipoprotein (mg/dl)	High density lipoprotein (mg/dl)
18-29 (n=126)	140.4 ± 28.3	132.2 ± 68.2	83.4 ± 22.0	38.6 ± 5.4
30-39 (n=76)	146.0 ± 22.3	121.4 ± 48.9	94.3 ± 28.2	35.8 ± 2.3
40-49 (n=156)	163.1 ± 19.4	136.3 ± 45.2	72.3 ± 25.0	37.0 ± 5.3
50-59 (n=26)	159.0 ± 00.0	193.0 ± 00.0	68.8 ± 00.0	40.3 ± 00.0
Total	175.2 ± 37.5	132.5 ± 35.3	104 ± 34.6	37.0 ± 8.9

Table-III

Lipid profile of rural population by different age groups (n=384).

Age in years	Total cholesterol (mg/dl)	Triglyceride (mg/dl)	Low density lipoprotein (mg/dl)	High density lipoprotein (mg/dl)
18-29 (n=77)	130.4 ± 31.7	179.6 ± 96.2	100.4 ± 31.7	38.1 ± 1.4
30-39 (n=164)	136.6 ± 43.2	207.1 ± 87.4	116.2 ± 42.2	39.5 ± 7.9
40-49 (n=133)	153.7 ± 27.8	188.7 ± 88.2	120.0 ± 23.5	33.4 ± 11.5
50-59 (n=10)	158.0 ± 00.0	102.0 ± 00.0	102.0 ± 00.0	36.3 ± 00.0
Total	149.6 ± 23.8	154.7 ± 34	79.7 ± 25.5	37.3 ± 4.9

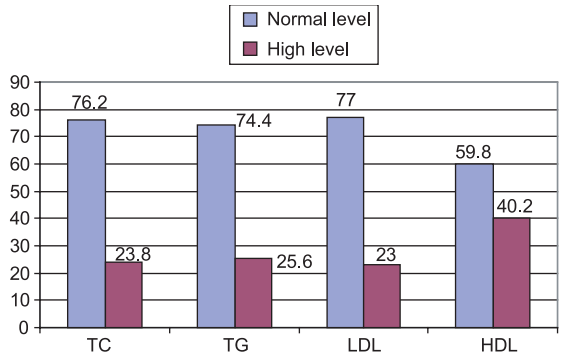

Fig-1: *Lipid profile of study population by normal and high level.*

Age of the respondents, monthly income, use of tobacco, physical activity, food habit, body mass index and waist circumference showed significant association with dyslipidaemia (Table IV). Higher income earning participants were more risk to develop higher cholesterol than low or middle income group participants, OR=1.88 (CI=0.89-2.37) and showed significant result in multivariate logistic model, OR=1.29(CI=o.91-2.17). The participants who are smoker they were higher risk OR=4.78 (CI=3.62-6.32) and also who used to smokeless tobacco, OR=3.62(CI=2.74-4.78). Similar result found in multivariate logistic model in both smoker and smokeless tobacco user. Low consumption of vegetable OR=1.07 (CI=0.97-1.85) were higher risk to develop dyslipidaemia and the participants who had body mass index more than 29, they were also higher risk OR=4.01 (CI=3.42-6.76) to develop dyslipidaemia who had BMI lower than 29. Waist circumference OR=4.01 (CI=3.42-6.76) showed significant result. Similar result showed in multivariate logistic model.

Table-IV

Results of logistic regression analysis to evaluate risk factors for dyslipidaemia among the total study population (n=768).

Indicators	Binomial logistic model OR (95%CI)	Multivariate logistic model OR (95%CI)
Age group		
18-29	1	1
30-39	1.70 (1.12 – 3.92)	1.07 (0.87 – 2.84)
40-49	4.53 (3.55 – 9.52)*	3.89 (3.14 – 8.55)*
50-59	16.31 (8.34 – 22.35)*	12.41 (7.34 – 19.35)*
Income		
Low (≤10000)	1	1
Middle(10001 – 30000)	1.59 (0.81 – 2.13)	1.28 (0.88 – 2.01)
Higher (≥30001)	1.88 (0.89 – 2.37)*	1.29 (0.91 – 2.17)*
Use of tobacco		
Non-tobacco user	1	1
Smoker	4.78 (3.62 – 6.32)*	3.47 (2.85 – 5.19)*
Smokeless tobacco	3.62 (2.74 - 4.78)*	3.61 (2.33 - 4.14)*
Physical activity		
Light	1	1
Moderate	1.36 (0.59 – 6.13)	1.12 (0.51 – 5.81)
Heavy	2.22 (1.29 – 3.41)*	2.01 (1.02 – 3.11)*
Extra Salt intake (>1 TSF)	1.46 (1.18-2.72)*	1.13 (1.04 - 2.21)*
Low consumption of fruits (<80gm)	1.18 (0.97 – 1.66)	0.99 (0.29 – 1.41)
Low consumption of vegetable(<400gm)	1.07 (0.97 – 1.85)*	0.87 (0.41 – 1.33)*
BMI/obesity		
<24.9	1	1
25-28.9	0.56 (0.41 – 0.71)	0.21 (0.17 – 0.97)
>29	2.48 (1.22 – 3.14)	1.97 (1.21 – 2.54)
Waist circumference(M: ≥90cm,F: ≥80cm)	4.01 (3.42 – 6.76)*	3.41 (2.81 – 5.29)*

Discussion:

The present study found that the mean TC and LDL levels were significantly higher among participants of urban areas compared to the participants of rural areas (p=0.001). On the other hand, the mean TG level was found to be significantly higher among participants of rural areas compared to the participants of urban areas (p=0.001). Mean high density lipoprotein was similar between urban and rural adults. Several factors might be associated with these biochemical differences between the two population groups. These populations vary by their socio-economic status, dietary habits, physical activity, and means of livelihood. Rural populations in Bangladesh are usually dependent on agro-based economy and they are required to work in agricultural fields, whereas urban people are less exposed to perform such strenuous physical activities. Such activities are the major influencing factors that regulate the body anabolic and catabolic functions including metabolism of carbohydrate, protein and fat. Earlier studies also reported that modernization related reduced physical activity among urban populations was associated with higher level of plasma cholesterol than their rural counterparts.[12-15] Dietary habit is another factor recognized to be associated with lipoprotein status.[16] In Bangladesh, rural population generally consume plant protein more often than animal protein due to easy access to locally-grown, fresh, and low-cost vegetables. On the other hand, urban populations, usually with higher income, consume higher amounts of animal protein. Vegetable diets contain less saturated fat and cholesterol, and greater amounts of dietary fibre, and their consumption helps lower the level of serum cholesterol.[17] Present study documents the lipid profile of adult population residing urban and rural areas. However, nationwide, randomized, large scale survey is recommended.

Conclusion:

Dyslipidaemia can be modified either by proper life style changes or medical management or by the combination of the both. The result of the present study will be useful for lifestyle intervention program to maintain the normal level of lipid profile and to achieve primary prevention of coronary artery disease and associated non communicable diseases in the entire population.

Acknowledgments:

Authors are very grateful to all the participants for the study. The authors felt immense thanks to physicians, pathologists and pathological staff of the concerned organizations.

Conflict of Interest - None.

Reference:

1. Hunter DJ, Reddy KS. Non-communicable diseases. *N Engl J Med*. 2013; 369(14):1336-1343.
2. Zhang X, Patel A, Horibe H, Wu Z, Barzi F, Rodgers A, et al. Asia Pacific Cohort Studies Collaboration. Cholesterol, coronary heart disease, and stroke in the Asia Pacific region. *Int J Epidemiol* 2003; 32(4):563-572.
3. Nordestgaard BG, Varbo A. Triglycerides and cardiovascular disease. *Lancet*. 2014; 384(9943):626-635.
4. Howard BV, Robbins DC, Sievers ML, Lee ET, Rhoades D, Devereux RB, et al. LDL cholesterol as a strong predictor of coronary heart disease in diabetic individuals with insulin resistance and low LDL: The Strong Heart Study. *Arterioscl Throm Vas* 2000; 20(3):830-835.
5. Bharosay A, Bharosay VV, Bandyopadhyay D, Sodani A, Varma M, Baruah H. Effect of lipid profile upon prognosis in ischemic and haemorrhagic cerebrovascular stroke. *Indian J Clin Biochem* 2014; 29(3):3726.
6. Natarajan P, Ray KK, Cannon CP. High-density lipoprotein and coronary heart disease: current and future therapies. *J Am Coll Cardiol*. 2010; 55(13):1283-1299.
7. Goswami K, Bandyopadhyay A. Lipid profile in middle class Bengali population of Kolkata. *Indian J Clan Biochem* 2003; 18(2):127-130.
8. Limbu YR, Rai SK, Ono K, Kurokawa M, Yanagida JI, Rai G, et al. Lipid profile of adult Nepalese population. *Nepal Med Coll J* 2008; 10(1):4-7.
9. Glew RH, Kassam HA, Bhanji RA, Okorodudu A, VanderJagt DJ. Serum lipid profiles and risk of cardiovascular disease in three different male populations in northern Nigeria. *J Health Popul Nutr* 2002; 20(2):166-174.
10. Khoo KL, Tan H, Liew YM, Deslypere JP, Janus E. Lipids and coronary artery disease in Asia. *Atherosclerosis* 2003; 169(1):1-10.
11. Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) final report. *Circulation* 2002; 106:3143-3421.
12. Gupta R, Guptha S, Agrawal A, Kaul V, Gaur K, Gupta VP. Secular trends in cholesterol lipoproteins and

triglycerides and prevalence of dyslipidemias in an urban Indian population. *Lipids Health Dis* 2008; 7:40.

13. Das SK, Golam Faruque AS, Chowdhury AK, Chisti MJ, Hossain MA, Salam MA, et al. Lipoprotein status among urban populations in Bangladesh. *Atherosclerosis* 2012;223(2):454-457.
14. Nongkynrih B, Acharya A, Ramakrishnan L, Ritvik, Anand K, Shah B. Profile of biochemical risk factors for non communicable diseases in urban, rural and periurban Haryana, India. *J Assoc Physicians India* 2008; 56:165-170.
15. Njelekela M1, Sato T, Nara Y, Miki T, Kuga S, Noguchi T, et al. Nutritional variation and cardiovascular risk factors in Tanzania-rural-urban difference. *S Afr Med J* 2003; 93(4):295-299.
16. Djoussé L, Arnett DK, Coon H, Province MA, Moore LL, Ellison RC. Fruit and vegetable consumption and LDL cholesterol: the National Heart, Lung, and Blood Institute Family Heart Study. *Am J Clin Nutr*. 2004; 79(2):213-217.
17. Craig WJ. Nutrition concerns and health effects of vegetarian diets. *Nutr Clin Pract* 2010;25(6):613-620.