

Serum Lipid Profile Among Urban and Rural Bangladeshi Population

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Abstract

Background: There is lack of any evidence based comparative information of lipid profile level between urban and rural population in Bangladesh.

Methodology: Between April and September 2010; applying age stratified (every 5 years interval; 40 to 93 years) randomization technique, 132 individuals aged 40 years and above from the rural Mirzapur were enrolled. On the other hand, 396 (1:3 ratio) urban individuals of Dhaka, the capital city, within same age interval were randomly selected from a total of 3,179 individuals who attended the Clinical Laboratory of icddr, b in Dhaka to investigate their lipid profile, served as control group.

Results: Residents in urban area demonstrated significantly higher level of serum total cholesterol (TC) [rural (4.44 mmol/L) vs. urban (4.84 mmol/L); mean difference (95% CI) p value; -0.40 (-0.61, -0.18) <0.01], LDL cholesterol [2.74 vs. 3.00; -0.24 (-0.45, -0.04) 0.01], triglyceride (TG) [1.56 vs. 2.02; -0.45 (-0.65, -0.23) <0.01], TC:HDL [4.41 vs. 5.10; -0.64 (-0.91, -0.37)], and LDL:HDL [2.78 vs. 3.10; -0.31 (-0.53, -0.09)] compared to the rural population; however, serum HDL level [1.11 vs. 1.00; 0.11 (0.02, 0.21) 0.01], was found higher among rural population.

Conclusion: Findings of the study demonstrated significant higher levels of serum lipoprotein in urban than the rural population of Bangladesh.

Keywords: Bangladesh; Lipid profile; Rural; Urban

Introduction

The prevalence of chronic diseases has been increasing globally for the last few decades [1-3]. Rapid urbanization and changes in the life style due to modernization have been reported to increase the risk for developing chronic diseases [4,5]. Urban people, specially in the developing countries, have sedentary life style, no scope of physical/organized sports, unhealthy food behaviors, and exposure to pollution that make them vulnerable to a double risk of both infection and chronic degenerative ailments [6,7]. Although, Bangladesh is still a relatively low urbanized country compared to other Asian countries, Dhaka city has emerged as a fast growing megacity in recent years ranking the 11th largest city in the world [8]. Individuals living in rural areas of Bangladesh are far different from the urban populations with regard to certain characteristics such as: life style and behavioral practices. Different studies have observed significantly higher prevalence of hypercholesterolemia and LDL hypercholesterolemia in urban populations [9-12]. Studies have investigated trends in the mean total, non-HDL, remnant and total: HDL cholesterol, triglycerides and HDL cholesterol in an urban Indian population [13]. Increased serum lipoprotein triggers micro vascular diseases that in addition to become a burden on affected individuals, also affect their families and the society at large in terms of economic and other hardships. Earlier studies have reported a better lipoprotein status of apparently healthy elderly individuals living in rural Bangladesh [14]. Recent study suggested that people living in the urban Dhaka, Bangladesh have revealed higher risk of increased lipoprotein level [15]. However, there is lack of comparative information on serum lipoprotein status between urban and rural populations of Bangladesh. We, therefore, examined the lipoprotein status of individuals living in a rural community in Bangladesh and compared results with that of an urban population.

Methodology

Study site

We selected the rural participants from those living within the

Demographic Surveillance System (DSS) area of Mirzapur sub-district under Tangail district, located about 40 miles north-west of Dhaka, the capital city of Bangladesh. About 30% of the total DSS populations (over 255 thousands) are aged 40 years or older. The economy of the population is mostly agro-based. A tertiary level hospital with 750-beds, popularly known as the Kumudini Hospital, is located at the centre of the DSS area and serves the study population including people from other sub-districts. On the other hand, the Clinical Biochemistry Laboratory of International Center for Diarrhoeal Disease Research, Bangladesh (icddr,b) has been analyzing biochemical profile of the people living in the Dhaka city and its suburbs for the last four decades. On an average, more than 30 people investigate their fasting lipoprotein status at this laboratory each day. We collected data on the lipoprotein status of the urban population from the laboratory database and compared results with those of the individuals living in rural Mirzapur.

Selection of the participants

From April to September 2010, 132 individuals of both sexes living within Mirzapur DSS area were enrolled after giving written informed consent. Five milliliter (5.0 ml) of venous blood was collected at the Kumudini Hospital before 9:00 am following an overnight fasting after a light fat free meal. All the specimens were transported to icddr,b's Clinical Biochemistry Laboratory in Dhaka within six hours of collection, maintaining the core temperature between +4 to +8°C in

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cooler box. The following analyses were performed using Enzymatic Color Method serum total cholesterol (TC), triglyceride (TG), high density lipoprotein (HDL) and low density lipoprotein (LDL). The same methods were followed for analyses of lipoprotein status of 4,213 Dhaka city dwellers attending icddr,b's Clinical Laboratory Services. Of them, 3,179 anonymous individuals were aged 40 years and above, their results of serum lipid profile were collected from the laboratory database. Applying age stratified (every 5 years interval; 40 to 93 years) randomization technique, for each rural participant, we randomly selected 3 urban individuals (rural to urban ratio of 1:3), in an effort to add to the power of the study and control for the biases to the possible extent.

Data analysis

Data entry and analyses were done using Statistical Package for Social Sciences (SPSS) Windows (Version 15.2; Chicago, IL) and Epi Info (Version 6.0, USD, Stone Mountain, GA). For continuous variables of interest, the statistical significance of the differences in the group means was compared by Student's t-test. In the event of non-normal distribution of data, equivalent non-parametric test was applied. Age and sex specific variations of lipid profiles were assessed.

Results

Mean age of the rural and urban individuals was 57 ± 10 and 55 ± 10 years; where males and females were equally distributed as 1:1.2 and 1:1.2 ratio respectively. Urban population had significantly higher levels of TC, LDL and TG, as well as in TC:HDL and LDL:HDL ratios than the rural population; however, HDL cholesterol level was significantly higher among individuals from rural areas (Table 1). Significant higher levels of these lipoproteins were found among urban females than their rural counterparts, but among urban male, only TG and LDL: HDL were found to be at higher level (Table 2). Lower level of serum HDL, and higher levels of serum TC, LDL, TG and their ratio were observed among middle aged rural population (40–59 years) compared to that of urban population, but among the elderly (60 years and above) no such difference was observed [TC; mean difference (95% CI), -0.05 (-0.39, 0.28)], [LDL; mean difference (95% CI), 0.08 (-0.20, 0.37)], [TG; mean difference (95% CI), -0.35 (-0.73, 0.03)] (Table 3).

Discussion

In this study, we noted better lipoprotein profiles of rural individuals compared to urban especially TC, TG and their ratios. 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 [16,17]. 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. LDL represents the chief pathogenic factor for atherosclerosis and physical activity influences this mechanism by reducing deposition of lipoprotein in the major arterial wall and in the micro vascular lumen [18-20]. Earlier studies reported modernization – related reduced physical activities of urban populations to be associated with higher level of plasma cholesterol than their rural counterparts [12-24]. Another study observed significantly lower levels of lipoproteins among agriculture workers and workers actively involved in physical works compared to sedentary workers [21]. A study reported strong, causal association between regular physical activity and reduced prevalence of chronic diseases such as coronary heart disease, hypertension, diabetes mellitus and osteoporosis [21]. Dietary habit is another factor recognized to be associated with lipoprotein status [25]. 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 fiber, and their consumption helps lower the level of serum cholesterol [26,27]. Animal protein is rich in both saturated and unsaturated fat than vegetable based diet; its consumption in excessive amount, contributes to higher serum lipoprotein. These might explain our findings as living in urban areas had significant higher level of serum TC, LDL, TG, TC:HDL and LDL:HDL cholesterol ratio, and lower HDL-cholesterol. Other than dietary habit, environmental pollution especially air pollution with heavy traffic are major issues as well to be the reason for higher level of lipid profiles in the urban area population [28,29]. We noted urban women to have significantly higher level of total cholesterol, LDL cholesterol, and triglyceride than their rural counterparts, but no such difference was observed between the males living in urban and rural area. We do not have ready explanations for such findings. Although, men in industrialized society have higher rates of coronary heart disease than women [30], body fat distribution could be an important determinant of male/female differences in different lipoprotein levels [31]. Moreover, more often use of contraceptives by urban women than rural might corroborate higher prevalence of hyperlipidemia among urban women than rural as observed in the present study [32,33], although, for such explanation the present study lacks related data. On the other hand, the pathophysiology of this increase with age; is not clear, there is reduction of lipoprotein lipase activity and delayed clearance of triglyceride-rich lipoproteins in elderly might play role in increasing the lipoprotein status. Prevalence of obesity is much higher in the urban women, even in Bangladesh [34,35]. Central obesity is higher as well and most of the women in Bangladesh, even in urban settings are less active, stay at home mostly, and unemployed. Elevated serum atherogenic lipoproteins and their higher ratios to different vasoprotective lipoproteins are primary risk for atherosclerotic changes with increased risk of micro vascular diseases. Higher total cholesterol, LDL-cholesterol and triglycerides, and higher ratio of LDL to HDL and lower serum HDL-cholesterol increase the risk of coronary heart disease, and are considered major risk factors besides smoking and high blood pressure [36]. Recent studies confirm that, increase in obesity, due to sedentary lifestyle [37] and intake of higher amounts of calorie results in multiple dyslipidemias [38]. Lack of physical activity, a feature of urban population, aggravates this process, and our results support that. There are likely several other factors that might influence the serum lipoprotein status among Bangladeshi urban population; however, for this preliminary study we could not perform risk-factor analysis; therefore the knowledge gap could be addressed in carefully

Indicators (mean ± SD)	Rural (n=132)	Urban (n=396)	Mean difference (95% CI)	p-value
TC (mmol/L)	4.44 ± 1.00	4.84 ± 1.28	-0.40 (-0.61, -0.18)	<0.01
HDL (mmol/L)	1.11 ± 0.87	1.00 ± 0.24	0.11 (0.02, 0.21)	0.01
LDL (mmol/L)	2.74 ± 0.86	3.00 ± 1.10	-0.24 (-0.45, -0.04)	0.01
TG (mmol/L)	1.56 ± 1.00	2.02 ± 1.20	-0.45 (-0.65, -0.23)	<0.01
TC:HDL ratio	4.41 ± 1.25	5.10 ± 1.41	-0.64 (-0.91, -0.37)	<0.01
LDL:HDL ratio	2.78 ± 1.05	3.10 ± 1.12	-0.31 (-0.53, -0.09)	0.01

TCL: Total cholesterol; HDL: High density lipoprotein; LDL: Low density lipoprotein; TG: Triglyceride

Table 1: Serum lipoprotein concentration of urban and rural populations.

Indicators (mean ± SD)	Male			Female		
	Rural (n=60)	Urban (n=180)	Mean difference (95% CI)	Rural (n=72)	Urban (n=216)	Mean difference (95% CI)
TC (mmol/L)	4.31 ± 1.00	4.58 ± 1.31	-0.26 (-0.58, 0.05)	4.55 ± 1.01	5.07 ± 1.21	-0.51 (-0.80, -0.22)
HDL (mmol/L)	1.10 ± 1.27	0.90 ± 0.19	0.21 (-0.11, 0.54)	1.11 ± 0.22	1.07 ± 0.26	0.03 (-0.02, 0.10)
LDL (mmol/L)	2.65 ± 0.88	2.84 ± 1.14	-0.19 (-0.47, 0.09)	2.82 ± 0.84	3.11 ± 1.04	-0.29 (-0.56, -0.02)
TG (mmol/L)	1.64 ± 0.84	1.99 ± 1.24	-0.34 (-0.68, -0.00)	1.49 ± 1.00	2.04 ± 1.16	-0.55 (-0.85, -0.25)
TC:HDL ratio	4.73 ± 1.28	5.21 ± 1.40	-0.47 (-0.88, -0.08)	4.15 ± 1.19	3.03 ± 1.10	-0.34 (-0.63, -0.05)
LDL:HDL ratio	2.91 ± 1.09	3.20 ± 1.15	-0.28 (-0.61, -0.05)	2.68 ± 1.01	4.93 ± 1.41	-0.77 (-1.14, -0.41)

TC: Total cholesterol; HDL: High density lipoprotein; LDL: Low density lipoprotein; TG: Triglyceride

Table 2: Serum lipoprotein concentration of rural and urban populations by sex.

Indicators (mean ± SD)	40-59 years			60 years and above		
	Rural (n=44)	Urban (n=131)	Mean difference (95% CI)	Rural (n=88)	Urban (n=265)	Mean difference (95% CI)
TC (mmol/L)	4.39 ± 1.06	4.96 ± 1.30	-0.57 (-0.84, -0.30)	4.56 ± 0.88	4.62 ± 1.23	-0.05 (-0.39, 0.28)
HDL (mmol/L)	1.03 ± 0.22	1.00 ± 0.24	0.04 (-0.01, 0.09)	1.25 ± 1.48	0.99 ± 0.25	0.26 (-0.18, 0.71)
LDL (mmol/L)	2.69 ± 0.91	3.10 ± 1.11	-0.41 (-0.64, -0.17)	2.86 ± 0.75	2.77 ± 1.04	0.08 (-0.20, 0.37)
TG (mmol/L)	1.53 ± 0.83	2.05 ± 1.22	-0.51 (-0.74, -0.28)	1.60 ± 1.10	1.95 ± 1.15	-0.35 (-0.73, 0.03)
TC:HDL ratio	4.39 ± 1.20	5.16 ± 1.38	-0.76 (-1.08, -0.44)	4.46 ± 1.38	4.86 ± 1.46	-0.40 (-0.89, 0.08)
LDL:HDL ratio	2.69 ± 1.00	3.21 ± 1.11	-0.51 (-0.77, -0.25)	2.98 ± 1.15	2.89 ± 1.12	0.08 (-0.29, 0.47)

TC: Total cholesterol; HDL: High density lipoprotein; LDL: Low density lipoprotein; TG: Triglyceride

Table 3: Serum lipoprotein concentration in urban and rural populations by age-stratum.

designed studies in future. We made efforts to eliminate bias to the extent possible, by carefully selecting rural and urban populations for comparison. However, we could not extract information on health status and other socio-demographic (except age and sex), life style and behavioral factors (smoking, diet, drinking status, calorie consumption, physical activity at work and leisure etc.). Evolution of lifestyle-associated morbidities are indeed dramatic in developing countries, and the current paper showed that at least lipid profiles in urban centers in Bangladesh are predicting bad cardiovascular outcomes when compared to rural populations. Unfortunately, this study does only report lipid levels, gender and age in the two groups, but fails to make deductions or even theories on the real effects of this observation. Given the relatively low number of patients would be another limitation. However, significant association between outcome variables such as lipoprotein disorders and independent variables could not be ascertained due to lack of certain related information from laboratory based data. Individuals from the urban and peri-urban area attended the Clinical Laboratory either for regular health check up or came to investigate their biochemical profile due to any kinds of disease condition because of referral by the clinicians. However, high quality performance of the laboratory was our strength. Despite our limitations, our observations were compatible with that of studies conducted in several geographical settings worldwide [9-12]. In our study, rural population had more favorable lipoprotein status than the urban population. Characteristics of urban population, including their dietary habit and physical activities, and factors known to be associated with dyslipidemia, are different from rural population. In addition to life style factors, several environmental factors such as exposure to environmental pollution like air, and sound may aggravate these differences in results between them [28-39]. The present study describes unfavorable lipoprotein status of urban population, but this study was not designed to examine the underlying factors. Because of increasing prevalence of chronic diseases, particularly cardio-vascular and cerebro-vascular diseases, results of our study clearly indicate the need for well-designed study to understand the putative factors for recommending interventions for prevention of hyperlipidemia.

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