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Original Research

Healthy Bangladeshi individuals having lower high-density lipoprotein cholesterol level compared to age-, gender-, and body mass index-matched Japanese individuals: A pilot study

Muhammad Saiedullah[1], Md. Fazley Rabbi Sha[2], Mohammad Abdul Hai Siddique[3], Zinat Tamannaa[2], Zahid Hassan[1]

[1]Department of Physiology and Molecular Biology, Bangladesh University of Health Sciences, Dhaka, Bangladesh, [2]Department of Applied Laboratory Sciences, Applied Laboratory Sciences, Bangladesh University of Health Sciences, Dhaka, Bangladesh, [3]Department of Cardiovascular Medicine, Tohoku University Graduate School of Medicine, Tohoku University, Sendai, Japan

Address for correspondence:
Muhammad Saiedullah, Department of Physiology and Molecular Biology, Bangladesh University of Health Sciences, Dhaka, Bangladesh. E-mail: md.saiedullah@gmail.com

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ABSTRACT

Background: Bangladeshi population is characterized by highest mortality and morbidity due to coronary artery diseases (CADs). Though some determinants of CAD have been identified, they were not completely elucidated. In this study, we aimed to compare high-density lipoprotein (HDL) cholesterol between Bangladeshi and Japanese adults to explore the cause of higher CAD prevalence in Bangladeshi population. **Materials and Methods:** Fasting blood samples were collected from 34 apparently healthy Bangladeshi adults and age-, sex-, and body mass index (BMI)-matched 34 apparently healthy Japanese adults. Fasting plasma glucose, total cholesterol (TC), HDL cholesterol and triglycerides (TGs), and other biochemical parameters were measured by standard spectrophotometric methods, and low-density lipoprotein (LDL) cholesterol was calculated by Friedewald's formula. **Results:** The mean age of Bangladeshi and Japanese adults were 35.21 ± 7.83 and 34.77 ± 8.12 years, respectively. The mean values of TC, HDL cholesterol, TGs, and LDL cholesterol were 183 ± 36 versus 182 ± 31 mg/dL ($P = 0.911$), 43 ± 8 versus 53 ± 11 mg/dL ($P = 0.001$), 111 ± 25 versus 110 ± 27 mg/dL ($P = 0.966$), and 150 ± 116 versus 95 ± 68 mg/dL ($P = 0.021$) in Bangladeshi versus Japanese adults, respectively. HDL cholesterol in Bangladeshi adults was 10.3 mg/dL lower compared to Japanese adults. **Conclusion:** This study reveals that HDL cholesterol is lower in Bangladeshi adults compared to Japanese adults, which may be partly associated with higher CAD in this population.

KEY WORDS: Coronary artery disease, high-density lipoprotein cholesterol, risk factor

INTRODUCTION

Coronary artery disease (CAD) is the leading cause of death throughout the world. The rate of deaths due to CAD is higher in low- and middle-income countries with progressive increase [1]. South Asians are more vulnerable to CAD events compared to Western and its risk was found to be most in Bangladesh among the South Asian countries [2]. Studies on Bangladeshi immigrants in the UK indicted that Bangladeshi men have 112% higher CAD mortality and 220% higher stroke mortality than Europids [3]. Opposed to the risk factors of CAD, high-density lipoprotein (HDL) plays the major role in cardiovascular protection. The main cardioprotective role of HDL is postulated to be the reverse cholesterol transport [4,5]. It was demonstrated that 1 mg/dl increment of HDL cholesterol is associated with 2-3% reduction of coronary heart disease risk [6]. Other cardioprotective functions of HDL particles include its antioxidative [7], anti-inflammatory [7], antithrombotic [8], and antiapoptotic [9] activities. HDL cholesterol was found to be relatively low and comprises the

most common lipoprotein/lipid abnormality in Bangladeshi rural population [10,11] as well as in urban population [12,13]. Low HDL cholesterol was found to be related with enhanced inflammation in this population [14] that may potentiate other inflammatory cytokines and endothelial dysfunction which are critically involved in the pathogenesis of CAD. Although studies that compare CAD risk factors including dyslipidemia are available, all have done on immigrants in Western countries. Since CAD prevalence is lower in Japanese population [15], this study aimed to compare the traditional lipid parameters, particularly HDL cholesterol in Bangladeshi adults with age-, body mass index (BMI)-, and sex-matched Japanese adults in Dhaka city.

MATERIALS AND METHODS

This comparative study was conducted in the Department of Applied Laboratory Sciences, Bangladesh University of Health Sciences, from July to December 2014. Invitation was circulated to volunteers through personal communication, and consenting study participants were then recruited consecutively. A total of 34 apparently healthy Bangladeshi adult males living in this land through generation and equal number of age-, sex-, BMI-matched Japanese adults living in Dhaka city were enrolled in this study. These Japanese adults came to Bangladesh in the preceding 6 months and working in different organizations. Apparent healthy status was confirmed by a history of absence of any chronic or acute disease in the past 6 months. Height and weight were recorded, and BMI was calculated from height and weight as weight in kilogram divided by height in meter squared. Blood pressure of each participant was recorded using a manual barometric sphygmomanometer by two investigators independently. From each participant, 5 ml of venous blood samples in fasting state (~12 h overnight fasting) were collected in tubes without anticoagulant for lipid analysis and with anticoagulant for plasma glucose estimation. The samples were allowed to clot at room temperature, and serum/plasma was obtained by centrifugation at 3000 rpm for 15 min. Biochemical analyses were done within 12 h of specimen collection. Fasting plasma glucose concentration was measured by automated hexokinase end point method using Dimension RxL Max (Siemens, USA). Serum triacylglycerol (TG) and total cholesterol (TC) were measured by enzymatic end point method, and HDL cholesterol was measured by direct automated method using Dimension RxL Max (Siemens, USA) clinical chemistry analyzer. All kits, calibrators, and quality control materials were purchased from Siemens, USA, through a local distributor. Serum low-density lipoprotein (LDL) cholesterol concentrations were calculated by Friedewald's formula [16]. HDL cholesterol <40 mg/dL was considered as low HDL cholesterol and LDL cholesterol >160 mg/dL was considered as high LDL cholesterol. For TC and TG, ≤200 mg/dL and ≤150 mg/dL, respectively, were considered as healthy reference values. Lipid fractions were compared between cases and controls by two-tailed *t*-test using MedCalc® version 11.2 and GraphPad Prism version 6.01. $P < 0.05$ was considered statistically significant.

Table 1: Clinical and biochemical characteristics of Bangladeshi and Japanese participants

Variables	Bangladeshi participants	Japanese participants	*P* values
Age (years)	35.21±7.83	34.77±8.12	0.823
Gender (male/female)	20/14	20/14	1.00*
Body mass index (kg/m^2)	24.7±3.8	23.1±3.3	0.069
Blood pressure (mmHg)			
Systolic	112±13	111±16	0.712
Diastolic	76±9	72±11	0.124
Fasting plasma glucose (mmol/L)	5.6±0.8	5.3±0.5	0.075
Serum creatinine (mg/dL)	0.99±0.18	0.93±0.16	0.124
Dyslipidemia			
TC	2 (5.9%)	2 (5.9%)	1.00*
HDL cholesterol	15 (44.1%)	5 (14.7%)	0.007*
LDL cholesterol	1 (2.9%)	1 (2.9%)	1.00*
TGs	7 (20.6%)	2 (5.9%)	0.150*

*Fisher's exact test. Results were expressed as mean±SD, number (percent) as appropriate. TC concentration≤200 mg/dL, HDL cholesterol concentration≥40 mg/dL, LDL cholesterol concentration≤160 mg/dL, and triacylglycerol concentration≤150 mg/dL were considered as normal. TC: Total cholesterol, HDL: High-density lipoprotein, LDL: Low-density lipoprotein, TG: Triglycerides

RESULTS

Characteristics of the study participants are shown in Table 1. Bangladeshi adults were matched for age (mean: 34.77 ± 8.12 years) and sex. BMI in the Japanese group was lower than that of Bangladeshi, but the difference was not statistically significant ($P = 0.069$). Among the total participants, only 4 (Bangladeshi, 3; Japanese, 1) had hypertension with medication, and none had a history of diabetes mellitus. No significant difference was observed for fasting plasma glucose between Bangladeshi and Japanese participants ($P = 0.075$). There was no record of using lipid-lowering agents among the selected participants. Among the study participants, hypercholesterolemia (TC >200 mg/dL) was 5.9% in both groups, low HDL cholesterol (<40 mg/dL) was 44.1% versus 14.7% ($P = 0.007$), high LDL cholesterol (>160 mg/dL) was 2.9% in both, and hypertriglyceridemia (>150 mg/dL) was 20.6% versus 5.9% ($P = 0.150$) in Bangladeshi and Japanese participants accordingly.

Figure 1 shows the comparison of lipid fractions (TC, HDL cholesterol, LDL cholesterol, and TG) between Bangladeshi and Japanese participants. No significant difference between Bangladeshi and Japanese participants was observed for TC ($P = 0.911$) [Figure 1a] and LDL cholesterol ($P = 0.966$) [Figure 1c]. Bangladeshi participants had significantly lower HDL cholesterol (mean difference: 10.3 mg/dL, $P = 0.001$) [Figure 1b] and significantly higher TG (mean difference: 54.7 mg/dL, $P = 0.021$) [Figure 1d].

DISCUSSION

HDL particles exhibit multiple antiatherogenic effects [17] which are thought to represent the basis for the cardioprotective properties of HDL particles. The amount of cholesterol

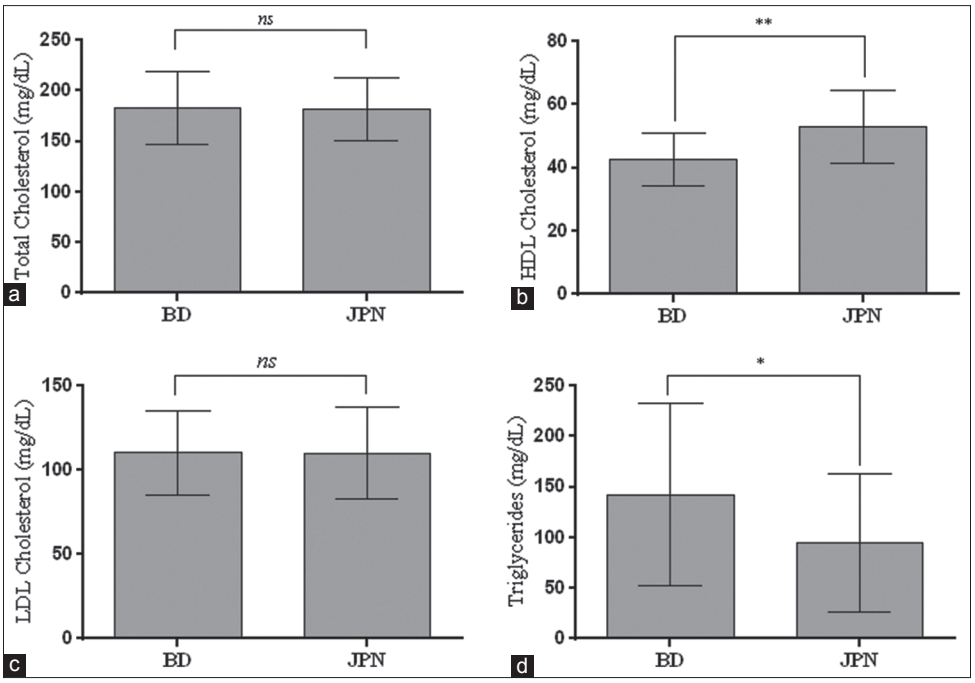

Figure 1: Comparison of total cholesterol (a), high-density lipoprotein cholesterol (b), low-density lipoprotein cholesterol (c) and triglycerides (d) between Bangladeshi (BD) and Japanese (JPN) participants (ns: Not significant; *P < 0.5; **P < 0.01)

transported in HDL particles is measured as HDL cholesterol and low HDL cholesterol, which is an established independent risk factor for CAD [18] and constitutes the most common lipoprotein abnormality among these patients [19,20]. Bangladeshi population is at highest CAD risk among the South Asian as well as Western populations [2,3], which is thought to be related with low HDL cholesterol. However, the pattern of difference with ethnic population is lacking. To find this, HDL cholesterol in healthy Bangladeshi adults was compared with 34 age-, sex-, and BMI-matched apparently healthy Japanese adults.

In Bangladeshi adult groups, HDL dyslipidemia was prominent (44.1%) followed by hypertriglyceridemia (20.6%), and both low HDL dyslipidemia and hypertriglyceridemia were around 3-4 times higher compared to Japanese group. In the present study, mean ±standard deviation of HDL cholesterol in Bangladeshi participants was 43 ± 8 mg/dL which is consistent with a previous report; it was 44 ± 6 mg/dL in normotensive controls in a study carried out by Choudhury *et al*. [21] and 41 mg/dL (range: 25-58 mg/dL) in apparently healthy nondiabetic Bangladeshi adults [22]. However, another study demonstrated remarkably lower HDL cholesterol in nondiabetic apparently healthy controls [23].

In this study, level of HDL cholesterol was found to be significantly lower ($P = 0.001$) in Bangladeshi participants compared to Japanese participants working in Dhaka city, and in terms of absolute value, it was 10.3 mg/dL which may account for about 20-30% greater risk for CAD in Bangladeshi adults compared to age-, sex-, and BMI-matched Japanese adults. It is well established that CAD risk in Japanese population is relatively low [16]. Furthermore, no significant difference was observed for TC and LDL cholesterol compared to Japanese adults, but serum TGs were significantly higher ($P = 0.021$) in Bangladeshi adults.

One possible explanation of lower HDL cholesterol in Bangladeshi adults may attribute to the genetic effect. Hence, further study should address the genetic background and HDL-associated proteins/enzyme as well as their confounders to explore causes behind the low HDL cholesterol in Bangladeshi adults.

CONCLUSION

Low HDL cholesterol is prominent and it is 10 mg/dL lower in Bangladeshi adults compared to Japanese adults, which may be partly associated with higher CAD in this population.

REFERENCES

1. Miranda JJ, Kinra S, Casas JP, Davey Smith G, Ebrahim S. Non-communicable diseases in low- and middle-income countries: Context, determinants and health policy. Trop Med Int Health 2008;13:1225-34.
2. Joshi P, Islam S, Pais P, Reddy S, Dorairaj P, Kazmi K, *et al*. Risk factors for early myocardial infarction in South Asians compared with individuals in other countries. JAMA 2007;297:286-94.
3. Islam AK, Majumder AA. Coronary artery disease in Bangladesh: A review. Indian Heart J 2013;65:424-35.
4. Francis GA. The complexity of HDL. Biochim Biophys Acta 2010;1801:1286-93.
5. Fielding CJ, Fielding PE. Molecular physiology of reverse cholesterol transport. J Lipid Res 1995;36:211-28.
6. Sharma RK, Singh VN, Reddy HK. Thinking beyond low-density lipoprotein cholesterol: Strategies to further reduce cardiovascular risk. Vasc Health Risk Manag 2009;5:793-9.
7. Barter PJ, Nicholls S, Rye KA, Anantharamaiah GM, Navab M, Fogelman AM. Antiinflammatory properties of HDL. Circ Res 2004;95:764-72.

8. Mineo C, Deguchi H, Griffin JH, Shaul PW. Endothelial and antithrombotic actions of HDL. Circ Res 2006;98:1352-64.
9. Riwanto M, Rohrer L, Roschitzki B, Besler C, Mocharla P, Mueller M, *et al*. Altered activation of endothelial anti - And proapoptotic pathways by high-density lipoprotein from patients with coronary artery disease: Role of high-density lipoprotein-proteome remodeling. Circulation 2013;127:891-904.
10. Jesmin S, Islam MR, Islam AM, Mia MS, Sultana SN, Zaedi S, *et al*. Comprehensive assessment of metabolic syndrome among rural Bangladeshi women. BMC Public Health 2012;12:49.
11. Mostafa ZM, Choudhury SR, Ahmed J, Yoshiike N, Numan SM, Sadequl Islam M, *et al*. Plasma lipids in a rural population of Bangladesh. Eur J Cardiovasc Prev Rehabil 2006;13:444-8.
12. Das SK, Golam Faruque AS, Chowdhury AK, Chisti MJ, Hossain MA, Salam MA, *et al*. Lipoprotein status among urban populations in Bangladesh. Atherosclerosis 2012;223:454-7.
13. Alam MB, Ahsan HA, Islam MZ. Pattern of lipid profile and obesity among secretariat employees of Bangladesh. J Med 2009;10:3-6.
14. Ferdousi F, Siddique MA, Kamaluddin SM, Saiedullah M, Ali L. Association of lipid abnormalities with high-sensitivity C - Reactive protein in patients treated with atorvastatin. J Diabetes Metab 2015;6:564.
15. Kita T. Coronary heart disease risk in Japan – An East/West divide? Eur Heart J Suppl 2004;6 Suppl A:A8-11.
16. Friedewald WT, Levy RI, Fredrickson DS. Estimation of the concentration of low-density lipoprotein cholesterol in plasma, without use of the preparative ultracentrifuge. Clin Chem 1972;18:499-502.
17. Kontush A, Chapman MJ. Functionally defective high-density lipoprotein: A new therapeutic target at the crossroads of dyslipidemia, inflammation, and atherosclerosis. Pharmacol Rev 2006;58:342-74.
18. Gordon T, Castelli WP, Hjortland MC, Kannel WB, Dawber TR. High density lipoprotein as a protective factor against coronary heart disease. The Framingham Study. Am J Med 1977;62:707-14.
19. Emerging Risk Factors Collaboration, Di Angelantonio E, Sarwar N, Perry P, Kaptoge S, Ray KK, *et al*. Major lipids, apolipoproteins, and risk of vascular disease. JAMA 2009;302:1993-2000.
20. Sharrett AR, Ballantyne CM, Coady SA, Heiss G, Sorlie PD, Catellier D, *et al*. Coronary heart disease prediction from lipoprotein cholesterol levels, triglycerides, lipoprotein(a), apolipoproteins A-I and B, and HDL density subfractions: The Atherosclerosis Risk in Communities (ARIC) Study. Circulation 2001;104:1108-13.
21. Choudhury KN, Mainuddin AK, Wahiduzzaman M, Islam SM. Serum lipid profile and its association with hypertension in Bangladesh. Vasc Health Risk Manag 2014;10:327-32.
22. Hayat S. Incretin Effect in Prediabetic Subjects. MPhill Thesis, Department of Biochemistry & Molecular Biology, University of Dhaka; 2013.
23. Hossain M, Faruque O, Kabir G, Khan I, Sikdar D, Ali L. Association of serum tumour necrosis factor-α and interleukin-6 with insulin secretion and insulin resistance in subjects with Type 2 diabetes in a Bangladeshi population. S Afr J Diabetes Vasc Dis 2012;9:21-4.

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