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Lipidemic Status in Indo-Aryan (Bangladeshi) and Cushitic (Somali) Adults: A Comparative Pilot Study

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Abstract

Assessment of lipidemic status is crucial for predicting cardiovascular risk. However, few studies have compared lipid profiles in our population with other ethnicities. In this pilot study, we investigated and compared the lipidemic status of individuals of Indo-Aryan (Bangladeshi) and Cushitic (Somali) descent to explore potential genetic, lifestyle, and environmental influences on lipid metabolism. We enrolled sixty participants (30 Bangladeshi and 30 Somali) and measured the lipid profiles - including total cholesterol (TC), high-density lipoprotein cholesterol (HDL-c), triglycerides (TG) using standard spectrophotometric methods, apolipoproteins using standard immunoturbidimetric methods while the formula was applied to calculate LDL cholesterol (LDL-c). Bangladeshi subjects were older (26.1 ± 2.1 vs. 23.4 ± 2.3 years, $p < 0.001$) and had a higher body mass index (22.6 ± 3.2 vs. 19.4 ± 2.6 kg/m², $p < 0.001$) compared to Somali subjects. Compared to Somali, the percentages of HDL-c dyslipidemia was higher (80.0% vs. 43.3%, $p = 0.017$), followed by hypertriglyceridemia (23.3% vs. 3.3%, $p = 0.052$) and hypercholesterolemia (20.0% vs. 6.7%, $p = 0.254$) and elevated LDL-c (16.7% vs. 6.7%, $p = 0.424$). TC and LDL-c levels did not differ significantly between the groups but higher triglyceride levels were observed in Bangladeshi individuals (145±113 mg/dL vs. 78±36 mg/dL, $p = 0.003$) compared to the Somali group. ApoA1 levels were similar between groups, but ApoB levels were higher in the Bangladeshi group, though this difference was not statistically significant ($p = 0.408$). On adjusting confounding variables, lipids and lipoproteins showed no significant association with ethnicity except HDL-c ($\beta = 5.023$, $p = 0.020$). In conclusion, despite similar apolipoprotein A1 and ApoB levels, the Bangladeshi ethnic group has lower HDL cholesterol compared to Somali adults, suggesting a greater cardiovascular risk relative to the Somali group.

Keywords: Dyslipidemia, HDL cholesterol, Bangladeshi, Somali, Indo-Aryan, Cushitic, Ethnicity.

INTRODUCTION

Dyslipidemia, characterized by deviations in the levels of lipids such as cholesterol and triglycerides in the blood, represents a significant risk factor for the development of atherosclerotic cardiovascular disease (ASCVD) on a global scale (Berberich & Hegele, 2022). The timely identification and appropriate management of dyslipidemia are therefore critical in efforts to mitigate the morbidity and mortality associated with CVD. The prevalence of dyslipidemia is observed to be increasing across the world, a trend that extends to low- and middle-income countries, largely attributed to the impacts of urbanization and shifts in lifestyle patterns (Pirillo *et al*., 2021). This rise in developing nations underscores the necessity for studies focused on specific populations to thoroughly understand the burden of this condition and its associated risk factors within diverse ethnic groups. Indo-Aryan populations, predominantly residing in the Indian subcontinent, have been consistently characterized by lipid profiles marked by elevated triglycerides and diminished HDL-c levels, contributing to a heightened cardiovascular risk (Reddy and Yusuf, 2004). Although dyslipidemia represents a universal public health challenge, its prevalence and pattern vary markedly according to regional, genetic, and lifestyle factors. In South Asia, the burden is particularly substantial; numerous studies have documented high rates, ranging from 76% to as high as 90% in various cohorts, driven by a combination of genetic predispositions and rapidly evolving lifestyles (Fatmi *et*

al., 2020; Basit *et al*., 2020; Ali *et al*., 2023; Reddy and Yusuf, 2004). Specifically, Basit *et al*., (2020) in their sub-analysis of the second National Diabetes Survey of Pakistan (NDSP) 2016-2017, reported the prevalence and pattern of dyslipidemia in urban and rural areas of Pakistan, contributing to the understanding of the high dyslipidemia rates in the region. Within this region, Bangladeshi populations have been shown to exhibit notably high prevalence rates, with community-based studies reporting that nearly 90% of adults display abnormal lipid profiles (Islam *et al*., 2023; Ali *et al*., 2023; Bhowmik *et al*., 2018). The upward trends parallel rapid urbanization and dietary transitions, which have important implications for related conditions such as diabetes and prediabetes (Bhowmik *et al*., 2018). In addition, Saeed *et al*., (2021) highlighted that South Asians often exhibit a dyslipidemic profile defined by elevated triglycerides and reduced high-density lipoprotein cholesterol (HDL-c), reflecting both genetic susceptibility and modifiable lifestyle factors. Our previous report has also highlighted the genetic susceptibility of low HDL-c in our population (Saiedullah, *et al*., 2025).

In contrast, Cushitic groups, mainly inhabiting the Horn of Africa, particularly parts of Somalia, now appear to exhibit a distinct lipidemic pattern that may be shaped by traditional dietary practices and evolving urban influences (Obsa *et al*., 2022). A meta-analysis focusing on population-based studies in Africa reported the pooled prevalence estimates for specific lipid abnormalities: 23.6% for elevated TC, 41.1% for low HDL-c, 25.7% for elevated LDL-c, and 16.5% for elevated TG (Noubiap *et al.*, 2018). However, recent decades have witnessed an upward shift with 53% overall pooled prevalence in African populations ranging from 5 – 90% (Obsa *et al*., 2022), driven primarily by transitions in diet, physical activity, and rapid urban migration. Although traditional lifestyle factors in regions such as Somalia may have previously conferred some protection, emerging studies indicate that abnormal LDL-c levels are now observed in 72.6%, followed by elevated TC (53.3%), low HDL-c (48.3%) and elevated TG (42.7%) of adults in these areas (Alıcı and Genç, 2022). This shift underscores a dynamic interplay between long-standing genetic factors and rapid socioeconomic changes in the African context.

Given the distinct genetic ancestries and traditional lifestyles of Indo-Aryan populations and Cushitic populations, this study aims to directly compare their lipidemic status to identify potential differences that may have implications for cardiovascular health. Despite extensive investigations into dyslipidemia within South Asia, direct comparative analyses between these ethnic groups remain limited, hindering a comprehensive understanding of potential ethnic-specific variations that could inform targeted health interventions. Our previous work comparing the lipidemic status between Bangladeshi and Japanese populations revealed that Bangladeshi subjects tend to have significantly higher levels of serum triglycerides coupled with lower concentrations of HDL-c relative to their Japanese counterparts (Saiedullah *et al*., 2017). Building upon our previous findings of significant ethnic variations in lipid profiles between Bangladeshi and Japanese adults, this pilot study seeks to further explore these differences by focusing on the Indo-Aryan and Cushitic ethnic groups, who inhabit regions with distinct environmental and lifestyle factors.

Therefore, this pilot study aims to extend the epidemiological discourse by investigating the differences in lipidemic status among Indo-Aryan and Cushitic young adults. By integrating current evidence from recent studies in South Asia, such as those by Saeed *et al*., (2021), Peltzer (2023), and Bhowmik *et al*., (2018) with insights from our prior comparative work, we intend to elucidate the complex interplay of genetic, environmental, and lifestyle factors that contribute to the observed differences in lipid profiles among these populations. Ultimately, this research is expected to inform the development of culturally tailored interventions and public health strategies to effectively mitigate cardiovascular risk across diverse ethnic groups.

MATERIALS AND METHODS

This pilot study employed a cross-sectional, observational design conducted from July to December 2019. Participants included 30 young adult students (aged 19 – 27 years) of Somali ethnicity residing in Bangladesh and 30 students (20 – 28) of Bangladeshi origin. This age group was selected as it typically represents a relatively healthy segment of the population, before potential increases in dyslipidemia with age. Inclusion criteria required participants to self-identify as Somali or Bangladeshi, be currently enrolled students (full-time or part-time), be within the specified age range, and provide informed consent. Exclusion criteria encompassed individuals with pre-existing conditions significantly affecting lipid metabolism (e.g., familial hypercholesterolemia, type 1 diabetes, chronic kidney disease, liver disease, and thyroid disorders), those taking lipid-lowering medications, pregnant or breastfeeding women, and individuals with acute illnesses or infections at the time of data collection. Before the commencement of the study, ethical approval was sought and obtained from the Institutional Review Board (IRB).

Data collection involved a structured questionnaire, anthropometric measurements, and venous blood sample collection. The questionnaire gathered demographic data (age, sex, ethnicity, education level, socioeconomic status). Anthropometric measurements included height and weight (for BMI calculation), using standardized procedures with calibrated equipment. Venous blood samples (5mL) were collected by trained personnel following a standardized protocol. Participants were required to fast

for 10-12 hours before blood collection, with only water permitted. We collected blood samples in appropriate tubes, labelled them with unique identifiers for anonymity, processed them by centrifugation to separate serum, and stored them under appropriate conditions (freezing at -80°C) until laboratory analysis.

The lipid profile analysis for this study included the measurement of several key parameters in the serum samples collected from participants. These parameters were Total Cholesterol (TC), Low-Density Lipoprotein Cholesterol (LDL-c), High-Density Lipoprotein Cholesterol (HDL-c), and Triglycerides (TG). The analysis of these lipid parameters was conducted in a research laboratory, utilizing standardized enzymatic methods on an automated chemistry analyzer Beckman Coulter AU-480. LDL-C levels were calculated using the formula (LDL-c = TC - HDL-c - TG/5), provided that the triglyceride level was below 400 mg/dL (Friedewald *et al*., 1972). If triglyceride levels were higher, it was calculated using a recently developed formula in our population (Saiedullah *et al*., 2009; Parvin *et al*., 2012; Chowdhury *et al*., 2013) comparable to Martin-Hopkins equation (Samuel *et al*., 2023) for higher TG range. Serum Apolipoproteins i.e., ApoA1 and ApoB levels were measured by immunotubidimetric method using Beckman Coulter AU-480.

Results were expressed as mean with their standard deviations (SD) and number or percentages where applicable. Statistical analyses were performed using appropriate *S-STAT* statistical Software (Pre-release version). The lipidemic status between the two ethnic groups was compared by t-test, Fisher's exact test. To find out the ethnic difference, we performed a multiple linear regression analysis.

RESULTS

A total 60 subjects were included in this study among them 30 were Bangladeshi (BD) and 30 were Somali (S) ethnicity. In the BD group, 23 subjects were male and in the S group, 27 subjects were male. The age distribution of subjects followed a normal distribution (Kolmogorov-Smirnov test) in both groups (BD, p = 0.060 and S, p = 0.551). The age range of the Bangladeshi and Somali subjects was 20 - 28 years and 19 - 27 years respectively and ages were more centred near the median for Bangladeshi and dispersed from the median for Somali (Fig 1). The mean age was higher in Bangladeshi subjects compared to the Somali and the body mass index (BMI) of the Bangladeshi subjects was significantly higher compared to Somali Subjects (p < 0.001) (Table 1).

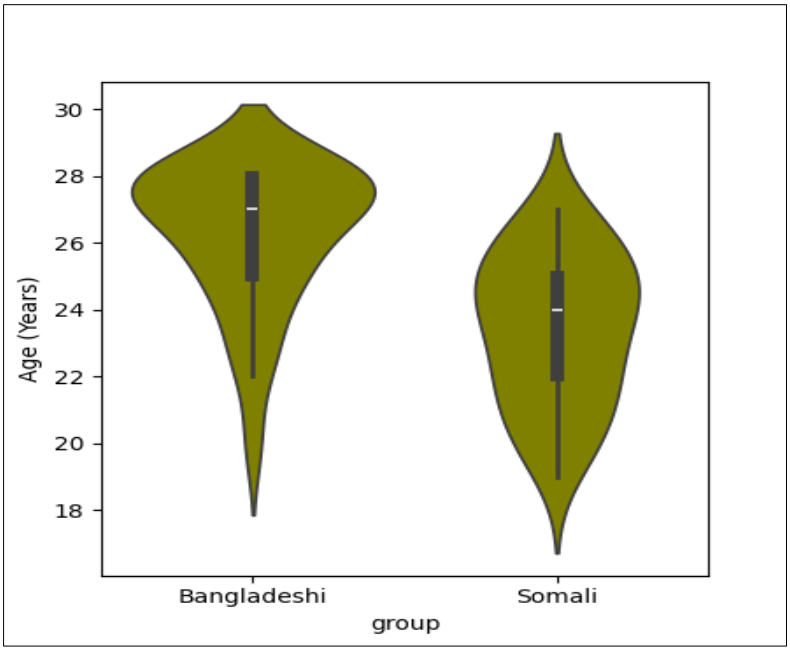

Fig. 1: Age distributions of Bangladeshi and Somali subjects

Table 1: Characteristics of the participants from two ethnicities

	Mean±SD/Number		
Variables	**Bangladeshi (*n*=30)**	**Somali (*n*=30)**	***p*-value**
Age (years)	26.3±2.1	23.4±2.3	<0.001§
Gender(M/F)	23/7	27/3	0.299$
Body mass index (Kg/m^2)	22.6±3.2	19.4±2.6	<0.001§

Results were expressed as mean±SD; §, compared by t test; $, compared by Fisher's exact test

The mean±SD of traditional lipid profiles is presented in Table 2. HDL-c was lower ($p = 0.004$) and triglyceride was higher ($p = 0.003$) in Bangladeshi compared to Somali ethnicity. Total cholesterol and LDL-c were similar in Bangladeshi and Somali individuals. Dyslipidemia, particularly low HDL-c was present in remarkably higher proportions in Bangladeshi individuals compared to Somali individuals ($p = 0.017$, Table 3). Distribution of HDL-c showed that HDL-c values in Bangladeshi subjects were more centred around the median, however, values are more dispersed from the median in Somali subjects (Fig 2).

Table 2: Comparison of lipid profiles between Somali and Bangladeshi subjects

	Mean±SD/Number		
Variables	**Bangladeshi (*n*=30)**	**Somali (*n*=30)**	***p*-value**
Total Cholesterol (mg/dL)	169±32	159±35	0.284
HDL Cholesterol (mg/dL)	37.0±8.5	44.4±10.3	0.004
Triglycerides (mg/dL)	145±113	78±36	0.004
LDL Cholesterol (mg/dL)	105±22	102±33	0.669

Data were expressed as mean ± SD and compared by t-test.

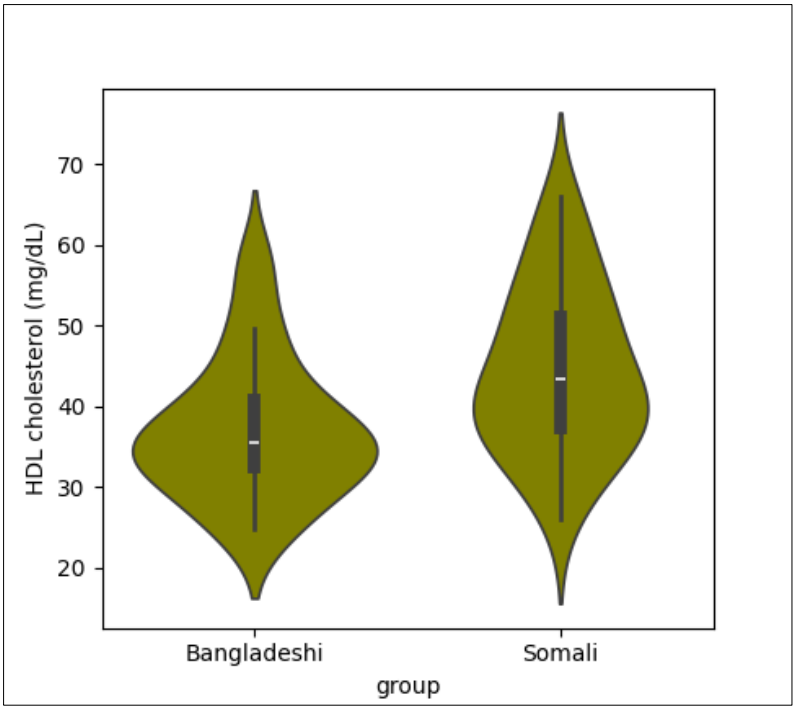

Fig. 2: Distribution of HDL-c values in Bangladeshi and Somali subjects

Table 3: Proportions of dyslipidemia among Bangladeshi and Somali study subjects

Variables	**Bangladeshi (*n*=30)**	**Somali (*n*=30)**	***p*-value**
Total Cholesterol (> 200 mg/dL)	6 (20.0%)	2 (6.7%)	0.254§
HDL Cholesterol (<40 mg/dL for Male and <50 mg/dL for Female)	24 (80.0%)	13 (43.3%)	0.017§
Triglycerides (>150 mg/dL)	7 (23.3%)	1 (3.3%)	0.052§
LDL Cholesterol (>130 mg/dL)	5 (16.7%)	2 (6.7%)	0.424§

Results are expressed as numbers/ Percentages and §, Compared by Fisher's exact test.

The mean±SD of serum ApoA1 concentrations were 128±22 mg/dL and 126±25 mg/dL in Bangladeshi and Somali groups respectively. It shows no significant difference between groups ($p = 0.708$). Serum ApoB concentrations were higher in Bangladeshi subjects compared to Somali subjects but not statistically significant (105±30 mg/dL vs 97±37 mg/dL, p = 0.424). The LDL-c/HDL-c ratio was 2.97±0.96 vs 2.44±1.10, $p = 0.051$ and ApoB/ApoA1 ratio was 0.82±0.21 vs 0.81±0.38, $p = 0.890$.

Multiple linear regression analysis considering age, gender, BMI and ethnicity as independent variables and TC, HDL-c, TG, LDL-c, ApoA1, ApoB and LDL-c/HDL-c ratio, ApoB/ApoA1 ratio as dependent variables presented in Table 5. Only HDL-c showed a

positive association with ethnicity, none of the traditional lipid parameters and ApoA1, ApoB and LDL-c/HDL-c ratio, ApoB/ApoA1 showed any significant association with ethnicity (Table 4) and the association between HDL-c and ethnicity remain significant while HDL-c was considered as the dependent variable and other factors were considered as independent variables (Table 5).

Table 4: Coefficient of lipid parameters and LDL-c/HDL-c and ApoB/ApoA1 ratios in multiple regression analysis

	Total Cholesterol		**HDL Cholesterol**	
Independent Variables	**β**	**p-value**	**β**	**p-value**
Age	0.862	0.675	0.187	0.752
Gender(M)	-16.763	0.175	-2.468	0.485
BMI	0.184	0.908	-0.025	0.956
Ethnicity (S)	-4.017	0.720	8.212	**0.013**
	Triglycerides		**LDL Cholesterol**	
Age	-0.119	0.982	0.868	0.618
Gender(M)	- 12.944	0.677	-11.740	0.261
BMI	4.022	0.317	-0.352	0.793
Ethnicity (S)	- 53.493	0.063	-0.159	0.987
	ApoA1		**ApoB**	
Age	-0.373	0.807	-0.365	0.874
Gender(M)	14.826	0.099	16.393	0.224
BMI	2.741	0.022	-1.427	0.416
Ethnicity (S)	3.418	0.697	-16.726	0.210
	LDL-c/HDL-c		**ApoB/ApoA1**	
Age	0.014	0.834	0.001	0.966
Gender(M)	-0.091	0.815	0.038	0.758
BMI	0.004	0.934	-0.029	0.073
Ethnicity (S)	-0.467	0.190	-0.119	0.330

Table 5: Association of HDL-c with ethnicity

Independent variables	**Coefficient**	**t-value**	**P-value**
Age (years)	0.161	0.489	0.628
Gender (male)	-0.660	-0.292	0.772
BMI (kg/m^2)	-0.278	-1.016	0.315
Ethnicity (S)	5.023	2.428	**0.020**
Total cholesterol (mg/dL)	0.676	6.255	<0.001
Triglycerides (mg/dL)	-0.090	-6.085	<0.001
LDL-cholesterol (mg/dL)	-0.683	-5.335	<0.001
ApoA1 (mg/dL)	0.081	1.704	0.096
ApoB (mg/dL)	-0.036	-0.966	0.340

DISCUSSION

In this pilot study, we have investigated the lipid profiles of young adults from Bangladeshi (Indo-Aryan) and Somali (Cushitic) backgrounds to identify ethnic differences in lipid and lipoprotein statuses. Our findings align with the recognized trend of a higher incidence of coronary artery disease (CAD) in low- and middle-income countries, particularly among South Asians, as highlighted in prior studies by Miranda *et al*., (2008), Islam and Majumdar (2013), and Joshi *et al*., (2007). The data revealed a less favourable lipid profile among Bangladeshi participants, who exhibited significantly lower HDL-cholesterol (HDL-c) levels (p = 0.004) and higher triglyceride (TG) levels (p = 0.003) compared to their Somali counterparts. This unfavourable lipid profile in the Bangladeshi group translated into a higher prevalence of dyslipidemia, with 80% presenting with low HDL-c, 23.3% with hypertriglyceridemia, and 20% with hypercholesterolemia. These observations are consistent with previous research within the Bangladeshi population, where low HDL-c is a predominant abnormality. For example, studies by Bhowmik *et al*., (2018), and Ali *et al*., (2023) have reported low HDL-c prevalence rates of over 90%, and 78.8%, respectively.

In comparison, the Somali group displayed a lower prevalence of dyslipidemia, with 43.3% exhibiting low HDL-c, 3.3% presenting with hypertriglyceridemia, and 6.7% having hypercholesterolemia. While these findings differ from some studies on African populations, such as the AWI-Gen sub-study by Agongo *et al*., (2018), which reported 60.3% low HDL-c, meta-analyses on African populations suggest a broad range of dyslipidemia prevalence. For instance, Noubiap *et al*., (2018) emphasized the low HDL-c as a common characteristic across African cohorts. Additionally, a

study on Somali refugees in Syracuse, NY, conducted by Edmonds *et al*., (2014), reported a prevalence of 26.9% for both low HDL-c and elevated TG, further illustrating the variability in lipid profiles within different Somali subgroups.

While serum ApoA1 levels did not differ between the groups ($p = 0.701$), Bangladeshi participants had higher ApoB levels, though this was not statistically significant ($p = 0.408$). Additionally, the LDL-c/HDL-c ratio was higher in the Bangladeshi group, indicating a trend toward increased atherogenic risk, though the difference was only borderline significant ($p = 0.051$). Multiple regression analysis, adjusted for age, gender, and BMI, identified HDL-c as the only lipid parameter significantly associated with ethnicity ($p = 0.013$).

The observed discrepancies in lipid profiles may be influenced by differences in dietary habits, lifestyle factors, and genetic predispositions between the two ethnic groups, as suggested by Ruixing *et al*., (2007). Notably, Bangladeshi participants exhibited a significantly higher body mass index (BMI) compared to their Somali counterparts ($p < 0.001$), which could contribute to their less favourable lipid profile. The higher proportions of low HDL-c and elevated triglycerides among the Bangladeshi group highlight a potentially increased risk for cardiovascular diseases, warranting further investigation and targeted interventions.

Limitations of this study include its small sample size ($n = 30$ per group) and the exclusive focus on young adults, which may limit the generalizability of its findings to older populations. Future research should aim to involve larger and more diverse cohorts to validate these results and explore the underlying mechanisms driving these ethnic differences in lipid metabolism. Moreover, detailed studies incorporating dietary patterns and physical activity levels would provide deeper insights into the factors influencing lipid profiles in these populations.

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