Ibrahim Card Med J 2024; 14 (1): 12-18

ORIGINAL ARTICLE

Lipid Profile Distribution and Dyslipidemia in Cardiac Patients:A Study at National Institute of Cardiovascular Diseases, Dhaka, Bangladesh

Md. Nurul Amin[1], Ghulam Mohammed Faruque[2], Shitil Ibna Islam[3]

ABSTRACT

Background & objective: Dyslipidemia, marked by abnormal lipid levels, is a significant risk factor for cardiovascular diseases (CVD), a leading cause of global morbidity and mortality. In Bangladesh, changing lifestyles and dietary habits have increased overweight and obesity rates, making it crucial to examine lipid profiles in cardiac patients. However, research on lipid profile distributions among ischemic heart disease patients at institutions like the National Institute of Cardiovascular Diseases (NICVD) in Dhaka is limited. This study aims to analyze lipid profile distributions in cardiac patients at NICVD, focusing on age and gender variations.

Methods: This cross-sectional study involved 924 patients presenting with cardiac symptoms at NICVD between 2000 and 2009. Participants' lipid profiles were assessed using enzymatic colorimetric methods to measure total cholesterol (TC), triglycerides (Tg), high-density lipoprotein (HDL), and low-density lipoprotein (LDL). Dyslipidemia was defined using criteria proposed in the Textbook of Nutrition, "Contemporary Nutrition". Accordingly, dyslipidemia was identified when the TC:HDL ratio was > 4.5 or when the Tg:HDL ratio was > 3.5. The types of dyslipidemia were classified as serum total cholesterol (TC) ≥ 200 mg/dL (hypercholesterolemia), triglycerides (TG) ≥ 150 mg/dL (hypertriglyceridemia), low-density lipoprotein (LDL) cholesterol ≥ 130 mg/dL (elevated LDL) and high-density lipoprotein (HDL) cholesterol < 40 mg/dL for men and < 50 mg/dl for women (Low HDL).

Results: The study sample had a mean age of 49.6 ± 11.9 years, predominantly male (70%). Significant findings included that 37.4% of patients presented with hypercholesterolemia, 62.4% showed hypertriglyceridemia, and an alarming 82.9% had low HDL levels. Moreover, when assessing dyslipidemia through TC:HDL and TG:HDL ratios, nearly 90% of patients were identified as dyslipidemic. Age-related analysis indicated notable reductions in lipid parameters among older patients, except for triglycerides. Furthermore, gender disparities emerged, with elevated TC and LDL levels being more prevalent among females compared to males, with a strikingly 20-fold higher risk of low HDL observed in females compared to males ($p < 0.001$).

Conclusions: The high prevalence of dyslipidemia among cardiac patients at NICVD emphasizes the urgent need for targeted public health strategies in Bangladesh. This study provides critical insights into age and gender disparities in lipid profiles, highlighting the necessity for tailored health education and management interventions to mitigate cardiovascular risks in the population.

Keywords: Lipid profile, prevalence, pattern, dyslipidemia, cardiac patients etc.

Authors' information:

[1]***Dr. Md. Nurul Amin,*** *PhD. Senior Fellow International Diabetes Federation (IDF), Associate Professor (Research & Development) & Executive Editor (Ibrahim Cardiac Medical Journal), Ibrahim Cardiac Hospital & Research Institute, Shahbag, Dhaka, Bangladesh.*

[2]***Prof. Dr. Ghulam Mohammed Faruque,*** *Professor of Cardiology & Sr. Consultant, Department of Cardiology, Ibrahim Cardiac Hospital & Research Institute, Shahbag, Dhaka, Bangladesh.*

[3]***Shitil Ibna Islam,*** *Senior Research Officer, Department of Research & Development, Ibrahim Cardiac Hospital & Research Institute, Shahbag, Dhaka, Bangladesh.*

Correspondence: ***Dr. Md. Nurul Amin,*** *Mobile: +880 1753 178452, E-mail: mdamin01@yahoo.com*

INTRODUCTION:

Dyslipidemia, characterized by abnormal lipid levels in the bloodstream, is a significant risk factor for cardiovascular diseases (CVD), which are among the leading causes of morbidity & mortality worldwide.[1] In Bangladesh, where lifestyle changes and dietary habits have evolved rapidly with increasing trends in overweight & obesity, understanding the distribution of lipid profiles among cardiac patients is crucial. However, there is a paucity of local research addressing the lipid profile distributions specifically among ischemic heart disease patients at health institutions such as the National Institute of Cardiovascular Diseases (NICVD) in Dhaka, which serves as a vital cardiac care provider in the region.

The global burden of dyslipidemia has increased over the past few decades and is considered an important public health menace both in developed and developing countries.[2] Several studies have reported an increased prevalence of dyslipidemia, a modifiable risk factor of CVD, in South Asian Countries including Bangladesh.[3-7] Keeping pace with the increasing incidence of dyslipidaemia, the incidence of CVD in Bangladeshi adults is also going up, particularly in the urban population.[8] Determining the prevalence & pattern of dyslipidemia therefore carries immense significance in preventing the progression and incidence of cardiovascular diseases in Bangladesh. Describing the prevalence & pattern of dyslipidaemia in patients presenting with cardiac symptoms at NICVD will therefore provide clinicians with critical insights into the prevalence of dyslipidemia and their demographic correlates. Such information is essential for shaping tailored interventions, and guiding public health measures aimed at mitigating cardiovascular risk factors.

Previously several studies determined the prevalence of dyslipidemia in Bangladeshi adults; however, most of these studies were conducted at small scales either on hypertensive or diabetic individuals.[9] There is a lack of robust statistics on the overall status of dyslipidemia and its demographic determinants in patients presenting with cardiac ailments.

The present study addresses this gap by systematically analyzing lipid profile distributions among cardiac patients, and examining how these profiles vary across different age groups and genders. By elucidating the relationships between age, sex, and lipid profiles, the study can also inform individualized therapeutic strategies & health education programs tailored to specific patient cohorts. Moreover, comparing these retrospective data with the recent study data will help analyzing the changes in the lipid profile of individuals in the region during the last 15 years, which have implications in the management of future cardiovascular diseases.

METHODS:

The present cross-sectional study was conducted on a total of 924 patients (enrolled in the study between 2000- 2009) with cardiac symptoms attended at the Out-patient Unit of the Cardiology Department of NICVD. The study analyzed the lipid profiles of the patients, including the distribution of key parameters such as total cholesterol (TC), triglycerides (Tg), high-density lipoprotein (HDL) cholesterol, and low-density lipoprotein (LDL) cholesterol using enzymatic colorimetric methods. A semi-automated bioanalyzer was used to measure all the biochemical markers. All biochemical measurements were done in the NICVD's laboratory using similar methods. The prevalence of dyslipidemia was determined based on the established diagnostic criteria. Accordingly, either TC:HDL ratio > 4.5 or Tg:HDL ratio > 3.5 was considered dyslipidaemia (Contemporary Nutrition[10]). The different types of dyslipidemia were defined as serum TC ≥ 200 mg/dL (hypercholesterolemia), TG ≥ 150 mg/dL (hypertriglyceridemia), LDL-C ≥ 130 mg/dL (elevated LDL) and HDL-C < 40 mg/dL for men and < 50 mg/dl for women (Low HDL).

Statistical analyses were performed (using Statistical Package for Social Sciences (SPSS), version 23.0) to assess the potential associations and correlations of age and sex with lipid profile variations and dyslipidemia. The test statistics used to analyze the data were descriptive statistics, and inferential statistics [Unpaired t-Test, Chi-square (χ^2) Test, and Pearsons's correlations] with the level of significance being set at 5%. The findings obtained were described below in two parts as 1) Descriptive Statistics, and 2) Inferential Statistics.

RESULTS:

1. Descriptive Statistics

1.1 Demographic Characteristics

The sampled population exhibited a wide age range, with a mean age of 49.6 ± 11.9 years (range: 11 – 95 years). Over three-quarters (75.6%) of patients were middle-aged (ranging between 30 – 60 years), with 33.4% falling within the 40 – 50 year age group, 29.5% in the late middle-aged segment, and 12.7% in the early middle-aged category. A sizable proportion (21%) were 60 years or older, while a smaller percentage (3.4%) were under 30 years old. The sex data demonstrated a marked male predominance, with over 70% of participants being male and 28.5% female, resulting in a male-to-female ratio of approximately 7:3 (Table I).

1.2 Distribution of lipid profile:

The distribution of lipid profiles among the patients in this study revealed notable findings. Over one-third (37.4%) of the patients had serum total cholesterol > 200 mg/dl, and 34.2% had LDL cholesterol ≥ 130 mg/dl. While the prevalence of hypertriglyceridemia was more or less common (62.4%), the prevalence of low HDL (< 40 mg/dl for males and < 50 mg/dl for females) was staggeringly high (82.9%) among the patients. The mean or median values of the individual lipids along with their ranges are illustrated in Table II.

1.3 TC/HDL and TG/HDL ratio:

In this study, dyslipidaemia was defined in terms of serum TC to HDL ratio or TG to HDL ratio. Accordingly, patients with TC to HDL ratio > 4.5 or TG to HDL ratio > 3.5 were considered as having dyslipidaemia. In terms TC:HDL > 4.5, over 70% of patients were dyslipidaemic and TG:HDL > 3.5, nearly three-quarters (74%) of patients were dyslipidaemic. When either of the two conditions TC:HDL > 4.5 or TG:HDL > 3.5 was taken into account, nearly 90% of the patients were considered to have dyslipidaemia (Table III).

2. Inferential Statistics:

2.1 Age-Related Disparities in Lipid Profiles

A meticulous scrutinization of lipid profiles across distinct age strata unveiled noteworthy distinctions in lipid parameters. Upon comparing middle-aged and late middle-aged patients (60 years or under) with elderly patients (over 60 years), all lipid profiles, but serum triglycerides, demonstrated a statistically significant reduction in the older patient cohort ($p = 0.002$, $p = 0.038$, and $p = 0.023$, respectively). As prevalence of hypercholesterolemia, raised LDL, Low HDL, and hypertriglyceridemia were compared between the two age cohorts, none but low HDL was found to be staggeringly higher among the older cohorts than their younger counterparts ($p=0.17$) (Table IV).

2.2 Gender Disparities & Dyslipidemia in Lipid Profiles

A thorough investigation into the gender-based variances in lipid profiles has yielded compelling insights within the scope of our study population. Noteworthy is the markedly higher prevalence of elevated serum total cholesterol levels (≥ 200 mg/dl) among female participants (44.5%) as opposed to their male counterparts (34.6%), accentuating a 1.5-fold escalation in the susceptibility to heightened cholesterol levels exhibited by females, a statistically robust outcome (odds ratio = 1.5, 95% CI = 1.1 - 2.0, $p = 0.005$). Furthermore, the occurrence of elevated LDL cholesterol (≥ 130 mg/dl) was notably more pronounced among females (39.9%) than males (31.9%), with females presenting a 1.5-fold increased predisposition towards elevated LDL levels relative to males (odds ratio = 1.5, 95% CI = 1.1 - 1.9), although this differential failed to attain statistical significance ($p = 0.201$). Remarkably, females exhibited a staggering 20-fold higher risk of low HDL cholesterol levels compared to their male counterparts (odds ratio = 20, 95% CI = 7.3 - 53.7, $p < 0.001$). Conversely, no statistically discernible inequality manifested in the triglyceride distribution between the male and female cohorts ($p = 0.908$) (refer to Table V for a comprehensive overview).

2.3 Correlation Between Age and Lipid Profiles

Delving into the Spearman correlations between age and various serum lipid parameters elucidated distinctive trends. Age (measured in years) evinced significant negative correlations with serum total cholesterol and triglycerides ($r = -0.135$, $p < 0.001$;

r = -0.092, p = 0.005, respectively), indicating a decrement in these lipid constituents with advancing age. Although serum LDL and HDL levels exhibited negative correlations with age, these associations did not attain statistical significance (r = -0.064, p = 0.051; r = -0.055, p = 0.095) (Table VI and Figures 1–4 for detailed correlation matrices).

Table I. Distribution of patients by their demographic characteristics (n = 924)

Demographic characteristics	Frequency	Percentage
Age (years)		
< 30	32	3.4
30 – 40	117	12.7
40 – 50	309	33.4
50 – 60	272	29.5
≥ 60	194	21.0
Sex		
Male	661	71.5
Female	263	28.5

***Mean age** = 49.6 ± 11.9 years; **range** = (11 – 95) years.

Table II. Distribution of patients by their lipid profile (n = 924)

Lipid profile (mg/dL)	Frequency	Percentage	Mean ± SD or Median ± SEM	Range
Total cholesterol*				
≥ 200 (raised)	346	37.4	186.3 ± 46.2	41-385
< 200 (normal)	578	62.6		
LDL*				
≥ 130 (elevated)	316	34.2	112.8 ± 39.8	22-230
< 130 (normal)	608	65.8		
HDL*				
Low	766	82.9	35.8 ± 6.1	14-64
Normal	158	17.1		
Triglycerides#				
≥ 150	577	62.4	170.0 ± 3.9	24 -1279
< 150	347	37.6		

*Mean ± SD; #Median ± SEM.

Table III. Distribution of patients by their TC/HDL and TG/HDL ratio (n = 924)

TC/HDL and TG/HDL ratio	Frequency	Percentage
TC:HDL		
> 4.5 (Dyslipidaemic)	661	71.5
≤ 4.5 (Normal)	263	28.5
TG:HDL		
> 3.5 (Dyslipidaemic)	684	74.0
≤ 3.5 (Normal)	240	26.0
Either TC:HDL > 4.5 or TG:HDL > 3.5		
Yes	826	89.4
None	98	10.6

***Mean age** = 49.6 ± 11.9 years; **range** = (11 – 95) years.

Table IV. Association between the age of the patients and lipid profile

Lipid profile	Age (years) > 60 (n = 139)	Age (years) ≤ 60 (n = 785)	p-value
Serum TC (mg/dL)			
Mean ± SD	175.3 ± 43.5	188.3 ± 46.4	0.002#
Raised	45(32.4)	301(38.3)	0.180*
LDL (mg/dL)			
Mean ± SD	106.3 ± 35.3	113.9 ± 40.4	0.023#
Raised	44(31.7)	272(34.6)	0.493*
HDL (mg/dL)			
Mean ± SD	34.6 ± 5.7	35.9 ± 6.2	0.017#
Low	125(89.9)	641(81.7)	0.017*
Triglycerides (mg/dL)			
Mean ± SD	186.3 ± 105.4	201.5 ± 121.2	0.127#
Raised	81(58.3)	496(63.2)	0.270*

Figures in the parentheses indicate the corresponding %; ***Chi-squared (χ^2) Test.** was done to analyze the data. #Data were analyzed using an **Unpaired t-Test** and were presented as **mean ± SD.**

Table V. Association between sex and lipid profile

Lipid profile (mg/dL)	Sex: Female n = 263	Sex: Male n = 661	Odds Ratio (95% CI of OR)	p-value
Total cholesterol				
≥ 200	117(44.5)	229(34.6)	1.5(1.1 - 2.0)	0.005
< 200	146(55.5)	432(65.4)		
LDL				
≥ 130	105(39.9)	211(31.9)	1.5(1.1- 1.9)	0.021
<130	158(60.1)	450(68.1)		
HDL				
Low	259(98.5)	507(76.7)	19.7(7.3 - 53.7)	< 0.001
Normal	4(1.5)	154(23.3)		
Triglycerides				
≥150	165(62.7)	412(62.3)	1.0(0.8 -1.4)	0.908
<150	98(37.3)	249(37.7)		

Figures in the parentheses indicate the corresponding %; ***Chi-squared (χ^2) Test.** was done to analyze the data.

Table VI. Correlation between average Age (years) and lipid profile

Correlated variables: Independent (X)	Correlated variables: Dependent (Y)	Correlation Coefficient (r)	Level of significance (p-value)
Age (years)	Total cholesterol (mg/dL)	-0.135	<0.001
	LDL (mg/dL)	-0.064	0.051
	HDL (mg/dL)	-0.055	0.095
	Triglycerides (mg/dL)	-0.092	0.005

ORIGINAL ARTICLE

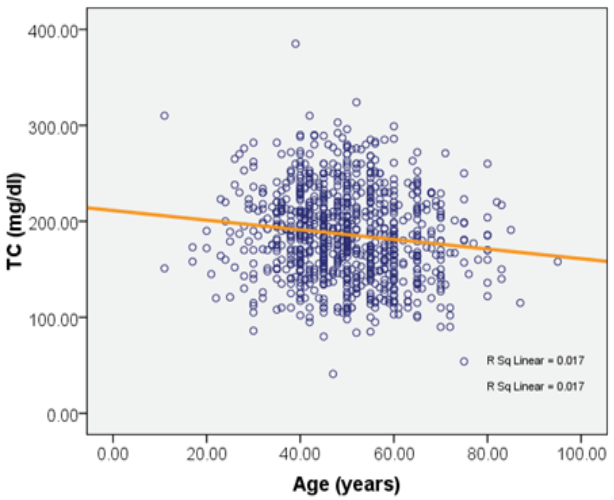

Fig. 1: Correlation between TC (mg/dL) and Age (years)

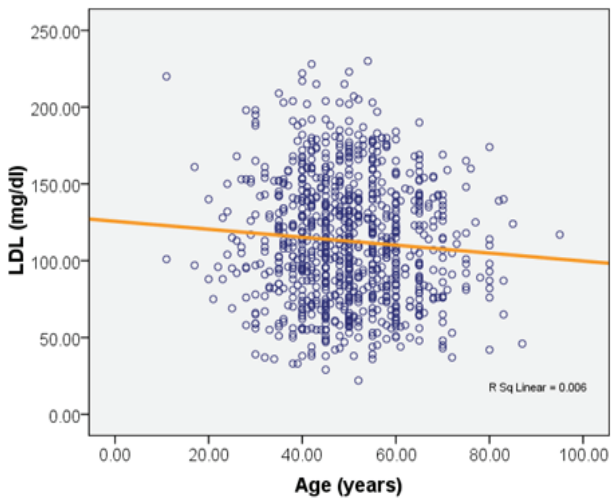

Fig. 2: Correlation between LDL (mg/dL) and Age (years)

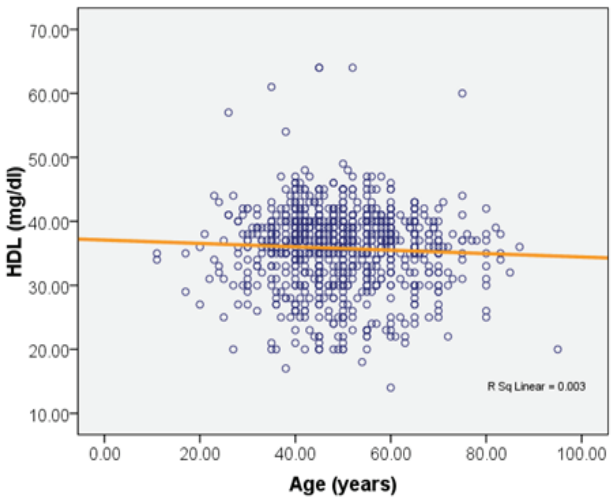

Fig. 3: Correlation between HDL (mg/dL) and Age (years)

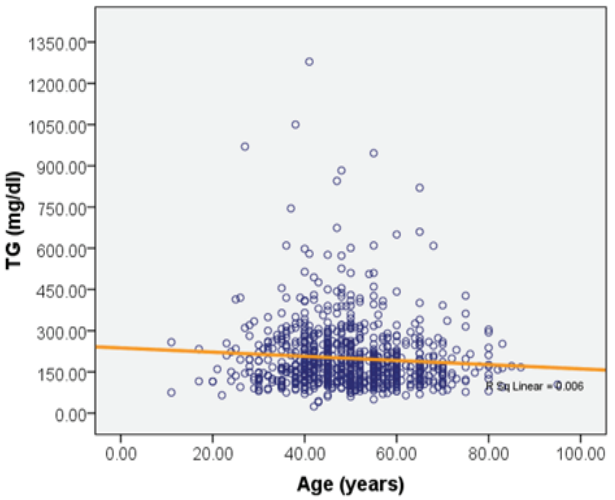

Fig. 4: Correlation between TG (mg/dL) and Age (years)

DISCUSSION:

This study provides essential insights into the distribution of lipid profiles and the prevalence of dyslipidemia among cardiac patients attending the National Institute of Cardiovascular Diseases (NICVD) in Dhaka, Bangladesh. The findings of the present study demonstrated the alarming rates of dyslipidemia, revealing that nearly 90% of patients exhibited abnormal lipid levels, with notably high prevalence rates of HDL cholesterol (82.9%) and elevated triglycerides (62.4%). Consistent with these findings, Ali and associates[9] in a recent study in Bangladesh demonstrated an overall prevalence of dyslipidemia of 89% with no significant difference between male (90.1%) & female (85.7%) subjects. Importantly, low HDL emerged as the most prevalent form of dyslipidemia observed, occurring in 78.8% of participants, followed by hypertriglyceridemia (51.7%). When participants were stratified into healthy control, hypertensive, and diabetic groups, the prevalence of lipid abnormalities was significantly higher in the diseased populations compared to the healthy controls. Comparable studies from neighboring countries, including India and Pakistan, have also reported high dyslipidemia prevalence in the general population. For instance, a study by Joshi et al[6] found an overall dyslipidemia prevalence of nearly 80% among the Indian

population, with low HDL-C at 72.3%. Meanwhile, a recent study from Pakistan reported a staggeringly high prevalence of dyslipidemia (98.1%) with the prevalence of low HDL-C in men and women being 83.9% and 90% respectively.[11] According to a systematic review study, the global prevalence of dyslipidemia in adults is estimated to range from 20-80%, depending on the definition and criteria used.[12]

In the present study, the demographic analysis indicates a distinct age-related pattern in lipid profiles, suggesting that as patients age, certain lipid parameters, particularly total cholesterol, and HDL, tend to decrease, while older patients do exhibit an alarmingly higher prevalence of low HDL (90%) than younger cohorts do (81.7%). This points to the necessity for age-adjusted approaches in managing lipid-related risk factors in cardiac patients. The epidemiology of dyslipidemia varies by region, age, sex, and ethnicity and is influenced by genetic and environmental factors fortifying the findings of the present study.[2] A recent study showed that women generally tend to have higher HDL cholesterol and lower LDL cholesterol than men, but this advantage diminishes after menopause.[13] However, comprehensive & updated data on the epidemiology of dyslipidemia is currently lacking in different populations and settings.

The prevalence of dyslipidemia in children and adolescents is increasing, especially in developed countries, due to the rising rates of obesity, sedentary lifestyles, and unhealthy diets.[14] Results from a US study reported that 7% of children and adolescents aged 6 to 19 had high total cholesterol, and 22% had at least one lipid abnormal. Dyslipidemia in childhood can persist into adulthood and increase the risk of premature cardiovascular disease warranting that the condition should be treated at its incipient stage to reduce the global burden of morbidity and mortality.[13] Given the increasing trends of overweight and obesity in Bangladesh as well as in neighbouring countries, these results highlight a crucial public health concern, emphasizing the urgent need for targeted interventions aimed at managing dyslipidemia in this population.

This scholarly research lays the groundwork for understanding the complex interplay between gender, age, and lipid profiles of cardiac patients who attend the NICVD and other cardiac centers in the region. The findings derived from the study suggest optimizing patient care strategies, and fostering tailored interventions aimed at ameliorating cardiovascular risk profiles.

CONCLUSION

This study underscores the alarming rates of dyslipidemia, with notably high prevalence rates of low HDL cholesterol and elevated triglycerides. The study highlights that elderly patients exhibit statistically significant reductions in various lipid profiles compared to middle-aged and late middle-aged patients, with the exception of serum triglycerides. Notably, while conditions such as hypercholesterolemia and elevated LDL showed no significant differences, low HDL levels were markedly higher in the older cohort. This suggests that, despite overall improvements in lipid profiles in the elderly, low HDL remains a prevalent concern that warrants further investigation and management in this age group. Furthermore, the pronounced gender disparities observed, particularly the higher prevalence of high total cholesterol and low HDL among females, underscore the need for sex-specific public health strategies and personalized management plans. The findings contribute to the broader understanding of dyslipidemia within the context of cardiovascular health in a Bangladeshi population, filling a significant knowledge gap. This knowledge is crucial for healthcare providers in devising tailored interventions and for public health officials in designing comprehensive programs aimed at mitigating cardiovascular disease risk factors. Future studies should continue to explore these dynamics with longitudinal designs to further elucidate the trends and causes of dyslipidemia among different demographic groups in Bangladesh.

REFERENCE:

1. Pappan N, Awosika AO, Rehman A. Dyslipidemia. 2024 Mar 4. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan–. PMID: 32809726.
2. Pirillo A, Casula M, Olmastroni E, Norata GD, Catapano AL. Global epidemiology of dyslipidaemias. *Nat Rev Cardiol*. 2021;18:689–700. https://doi.org/10.1038/s41569-021-00541-4
3. Kumar Das S. Serum Lipid Profile Among Urban and Rural Bangladeshi Population. *J Obes Weight Loss Ther*. 2012;02.https://doi.org/10.4172/2165-7904.100014.
4. Islam N, Rahman MZ, Choudhury S, Afrin L, Rahman S, Aftabuddin M. Prevalence of Dyslipidemia and Associated Factors among the Sub-Urban Bangladeshi Population. *Univ Heart J*. 2012;8:15–19. https://doi.org/10.3329/uhj.v8i1.11662.
5. Mithal A, Majhi D, Shunmugavelu M, Talwarkar P, Vasnawala H, Raza A. Prevalence of dyslipidemia in adult Indian diabetic patients: A cross sectional study (SOLID). *Indian J Endocrinol Metab*. 2014;18:642. https://doi.org/10.4103/2230-8210.139220
6. Joshi SR, Anjana RM, Deepa M, Pradeepa R, Bhansali A, Dhandania VK, et al. Prevalence of Dyslipidemia in Urban and Rural India: The ICMR–INDIAB Study. Goel K, editor. *PLoS ONE*. 2014;9:e96808. https://doi.org/10.1371/journal.pone.0096808
7. Gupta R, Rao RS, Misra A, Sharma SK. Recent trends in epidemiology of dyslipidemias in India. *Indian Heart J*. 2017;69:382–392.https://doi.org/10.1016/j.ihj.2017.02.020
8. Chowdhury MZI, Haque MA, Farhana Z, Anik AM, Chowdhury AH, Haque SM, et al. Prevalence of cardiovascular disease among Bangladeshi adult population: a systematic review and meta-analysis of the studies. *Vasc Health Risk Manag*. 2018;14:165. https://doi.org/10.2147/VHRM.S166111
9. Ali N, Samadder M, Kathak RR, Islam F. Prevalence and factors associated with dyslipidemia in Bangladeshi adults. *PLoS One*. 2023;18(1):e0280672. doi: 10.1371/journal.pone.0280672.
10. Wardlaw GM. Contemporary Nutrition: Issues and Insights. In: Malinee V, Russell J, editors (3rd ed.). James Smith; 1997: 210.
11. Basit A, Sabir S, Riaz M, Fawwad A, NDSP members, Abro MUR, et al. NDSP 05: Prevalence and pattern of dyslipidemia in urban and rural areas of Pakistan; a sub analysis from second National Diabetes Survey of Pakistan (NDSP) 2016–2017. *J Diabetes Metab Disord*. 2020;19:1215–1225. https://doi.org/10.1007/s40200-020-00631-z
12. Mohamed-Yassin MS, Baharudin N, Abdul-Razak S, Ramli AS, Lai NM. Global prevalence of dyslipidaemia in adult populations: a systematic review protocol. *BMJ Open*. 2021;11(12):e049662. doi: 10.1136/bmjopen-2021-049662
13. Pappan N, Awosika AO, Rehman A. Dyslipidemia. [Updated 2024 Mar 4]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK560891/
14. Xia Q, Chen Y, Yu Z, Huang Z, Yang Y, Mao A, Qiu W. Prevalence, awareness, treatment, and control of dyslipidemia in Chinese adults: a systematic review and meta-analysis. *Front Cardiovasc Med*. 2023;10: 1186330.DOI:10.3389/fcvm.2023.1186330