MED-PHOENIX: JOURNAL OF NATIONAL MEDICAL COLLEGE

ORIGINAL ARTICLE

GENDER DIFFERENCES IN LIPID PROFILE IN DYSLIPIDEMIC PATIENTS VISITING HETAUDA HOSPITAL

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Date of Submission : March 22, 2024
Date of Acceptance : March 30, 2024
Date of Publication : June 25, 2024

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Citation:
Joshi BR, Yadav T, Amit AK, Rizal S. Gender Differences in Lipid Profile in Dyslipidemic Patients Visiting Hetauda Hospital. Medphoenix. 2024;9(1):7-11.

DOI:*https://doi.org/10.3126/medphoenix.v9i1.67178*

Conflict of interest: None, ***Funding:*** None

Publisher: *National Medical College Pvt. Ltd.*
MedPhoenix - Journal of National Medical College (JNMC); 2024,9(1), available at www.jnmc.com.np

ISSN:2631-1992 (Online); ISSN:2392-425X (Print)

ABSTRACT

Introduction: *Dyslipidemia has long been considered as one of the risk factors of cardiovascular disease. There are limited data on risk factor stratification at community level in our region. This hospital-based research has provided an insight to gender as the latent burden of risk factor and laid the groundwork for making strategies for policymakers and future prospective research.*

Materials and Methods: *This study employed the retrospective design with census sampling and included 7,922 patients sent for lipid profile testover the duration of seven months. Demographic information and lipid profile data were extracted from the hospital records. Subgroup analysis of dyslipidemic patients according to gender and age (≤ 50 years and > 50 years) was done. Ratios of total cholesterol to high density lipoprotein, triglyceride to high density lipoprotein and non-high-density lipoprotein were also calculated and analyzed among groups.*

Results: *Among the 7,922 patients included in the study, (6546) 82.63% were diagnosed with dyslipidemia. Gender-wise distribution revealed that 42.08% of dyslipidemic patients were male, while 57.92% were female. Females exhibited significantly higher levels of total cholesterol ($p < 0.001$), LDL cholesterol ($p < 0.001$), and non-HDL cholesterol ($p < 0.01$) compared to males. Conversely, males showed significantly higher levels of triglycerides and TC/HDL ratio ($p < 0.01$).Age-wise analysis indicated distinct patterns:In the ≤ 50 years age group, males displayed significantly deranged lipid profiles and ratios compared to females. However, in the > 50 years age group, females exhibited significantly higher levels of total cholesterol, triglycerides, LDL cholesterol, and non-HDL cholesterol compared to males. Notably, a higher number of males (557) displayed increased triglyceride and decreased HDL in tandem compared to females (492).*

Conclusion: *The study showed increased prevalence of dyslipidemia and highlighted the apparent gender specific disparities in lipid profile in people residing in the catchment area of provincial hospital.*

Keywords: *Cholesterol, Dyslipidemia, Gender, Triglyceride*

INTRODUCTION

Dyslipidemia is a common metabolic disorder characterized by abnormal levels of lipids in the blood, including cholesterol and triglycerides. It is a significant risk factor for cardiovascular diseases (CVDs), such as coronary artery disease and stroke, which are leading causes of morbidity and mortality worldwide.[1] Prevalence of dyslipidemia is found to be increased in Nepal.[2, 3]

While dyslipidemia affects both men and women, there is growing evidence of gender-specific differences in the lipid profile of dyslipidemic patients.[4] Despite the well-established association between dyslipidemia and cardiovascular diseases and other metabolic diseases, there is limited study involving large cohort, regarding gender differences in the lipid profile of dyslipidemic patients in Nepal. Gender-specific differences in lipid profiles have been observed in various populations globally. Identifying gender-specific differences in lipid profiles has practical implications for clinical practice. Tailoring treatment strategies based on these variations can lead to more effective risk stratification, treatment selection, and prevention efforts.

Thus, this study aims to identify the gender differences in lipid profile in dyslipidemic patients and also elucidate the differences in lipid profile in various age groups of male and female dyslipidemic patients.

MATERIALS AND METHODS

This is a retrospective hospital based cross-sectional study conducted in Department of Biochemistry, Madan Bhandari Academy of Health Sciences, Hetauda, Nepal. The data of dyslipidemic patients were retrieved from laboratory software of the hospital. A total of 7,922

patients were included in study by census sampling during the period of 18th October 2022 and 14th May 2023 (7 months). Criteria to classify the case as dyslipidemic was based on ATP III guideline of optimal lipid profile requirement in the adults that included total cholesterol > 200 mg/dl, low density lipoprotein > 100 mg/dl, high density lipoprotein < 40 mg/dl in male and < 50 mg/dl in female and triglyceride > 150 mg/dl when tested in the serum. Both isolated and mixed dyslipidemia were included. All the patients sent for lipid profile at hetauda hospital were included in the study except for the ones whose complete lipid profiles were not obtained.

Serum total cholesterol was estimated by CHOD-POD method, high density lipoprotein by immunoinhibition method, triglyceride by GPO-PAP method, and direct LDL by immunoinhibition method (for triglyceride> 400 mg/dl) in Biochemistry lab of Hetauda hospital using the standardized protocol of fully automated clinical analyzer P500 (Diatron, Hungary). Friedwald's formula was used for calculated LDL (if Triglyceride <400 mg/dl). Ratios TC/HDL and TG/HDL was calculated. Non-HDL cholesterol was calculated as (total cholesterol – HDL cholesterol).

Ethical clearance was obtained from institutional review committee (IRC) of Madan Bhandari Academy of Health Sciences, Hetauda (Ref no: IRC-034-079). The study adhered to ethical guidelines, ensuring patient confidentiality and privacy.

The collected data were processed and analyzed using statistical software MS-Excel 2013 and SPSS version 20. First data was entered in excel and then transferred to SPSS for analysis. Data were evaluated for normality by Kolmogorov-Smirnov test and all variables were found to be deviated from normal. So, descriptive statistics were presented as median, quartiles and percentage to summarize the demographic and lipid profile characteristics of the study population. Some descriptive data were also presented in bar diagram. Gender differences in lipid profiles were assessed through comparative analysis, using non parametric test, Mann-Whitney U test. The p-value <0.05 was considered statistically significant.

RESULTS

Out of the total patient's data (7922) enrolled in the study 6546 (82.63%) were found to be dyslipidemic.

Gender wise distribution of study population

Chart below shows the gender wise distribution of study population. 2755 (82.83%) out of 3326 male patients were found to be dyslipidemic. 3791 (82.48%) out of 4596 patients were found to be dyslipidemic.

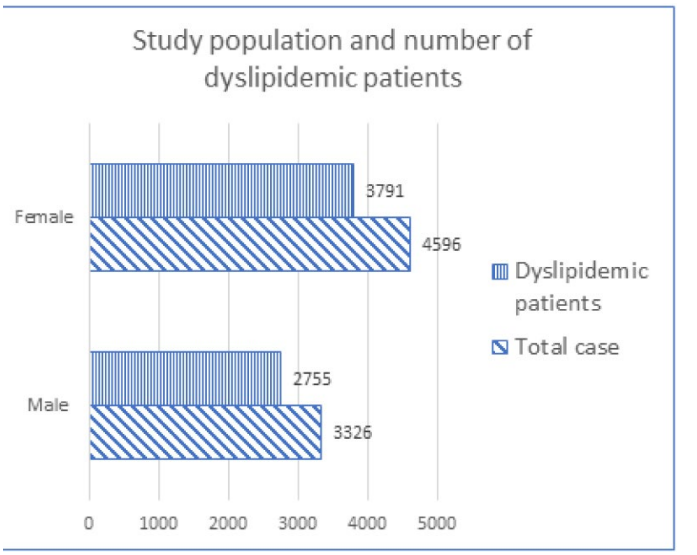

Figure 1: Bar diagram showing gender wise distribution of study population

Gender wise differences in lipid profile parameters

Concentration of lipid profiles and different ratios of the whole cohort is shown in Table. The median age of the study population was found to be 52 (43-62) years. There was no significant difference in age distribution among male and female.

The difference in median value of lipid profile parameters in Table 1 showed that total cholesterol (TC) was found to be higher in female than male. But triglyceride level in male was found to be significantly higher than female ($p < 0.001$). LDL cholesterol and HDL cholesterol was found to be higher in females.

Table 1: Gender wise differences in lipid profile parameters

	All cases	Male *	Female *	P-value
N	6546	2755	3791	
Age	52 (43-62)	52 (42-62)	52 (43-61)	0.40
Total Cholesterol (mg/dl)	196 (168-225)	193 (164-224)	198 (172-226)	<0.001
Triglyceride (mg/dl)	185 (142-252)	195 (151-272)	180 (135-239)	<0.001
LDL-C (mg/dl)	113 (86-139)	108 (80-135)	116 (91-141)	<0.001
HDL-C (mg/dl)	42 (40-45)	41 (39-44)	42 (40-46)	<0.001
TC/HDL	4.6 (4.0-5.33)	4.66 (4.0-5.43)	4.56 (4.0-5.26)	0.002
Non-HDL-C	153 (127-181)	151 (124-181)	154 (129-181)	0.001
TG/HDL	4.45 (3.27-6.17	4.78 (3.59-6.83)	4.24 (3.08-5.75)	<0.001

*Mann-Whitney U test to evaluate the difference in median between male and female population

Age-wise variation of differences in lipid profile among male and female population

Distribution of study population by age in two groups, less than 50 years and more than 50 years is shown in

Table 2. Below age of 50 years triglyceride was found to be significantly higher in male than female. But in age group of greater than 50 years there was no significant difference in triglyceride among male and female. It was also found that lipid profile deranged in female population after age of 50 years.

Table 2: Age-wise variation of differences in lipid profile among male and female population

	Less than or equal to 50 years			Greater than 50 years		
	Male	**Female**	**P-value**	**Male**	**Female**	**P-value**
N (%)	1302 (19.89)	1680 (25.66)		1453 (22.20)	2111 (32.25)	
Total Cholesterol (mg/dl)	198 (168-229)	194 (171-220)	0.10	188 (160-218)	201 (172-230)	<0.001
Triglyceride (mg/dl)	214 (162-302)	178 (130-240)	<0.001	180 (140-246)	183 (140-238)	0.56
LDL-C (mg/dl)	109 (81-138)	114 (90-138)	0.001	107 (79-133)	119 (92-144)	<0.001
HDL-C (mg/dl)	41 (38-43)	42 (40-60)	<0.001	41 (39-44)	42 (40-47)	<0.001
TC/HDL	4.78 (4.16-5.62)	4.55 (4.02-5.24)	0.002	4.54 (3.86-5.26)	4.57 (3.97-5.27)	0.065
Non-HDL-C	156 (129-187)	151 (129-177)	0.005	147 (120-176)	156 (129-184)	<0.001
TG/HDL	5.27 (3.80-7.61)	4.21 (3.00-5.80)	<0.001	4.4 (3.31-6.10)	4.24 (3.12-5.73)	<0.001
LDL/HDL	2.69 (2.02-3.36)	2.65 (2.13-3.24)	0.85	2.57 (1.94-3.20)	2.67 (2.11-3.30)	<0.001

Mann-Whitney U test to evaluate the difference in median between male and female population in two age groups

Increased triglyceride and low HDL in tandem

Bar diagram showing the number of male and female patients with both increased TG and low HDL is shown in figure 2. Number of male population was found to be higher than female population who have increased triglyceride and low HDL in tandem.

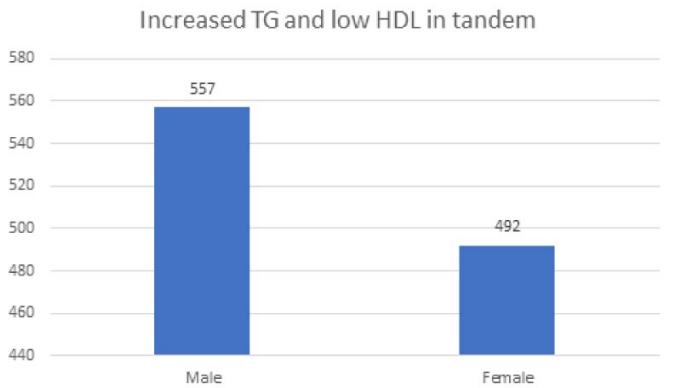

Figure 2: Distribution of increased TG and Low HDL in tandem in male and female population

DISCUSSION

Our study examined gender differences in lipid profiles among dyslipidemic patients of one provincial representative hospital of Nepal and further analyzed the data based on age categories. Female subjects were found to be more affected in contrast to popular saying of male are more prone to dyslipidemia. Female subjects were found to have higher total cholesterol, LDL and HDL level compared to men. In contrary, male subjects were found to have higher level of triglyceride. Subgroup analysis by age wise distribution showed male subjects were more affected than female subjects in age group less than 50 years while the result reversed in case of age group greater than 50 years. Menopause and hormonal changes in female may be attributed to our findings in age group analysis. These findings contribute to the existing literature on gender disparities in dyslipidemia and provide valuable insights into the variations in lipid profiles within specific age groups.

Several studies have shown variations in lipid profiles between men and women with dyslipidemia. For instance, a study by Kolovou et al. showed, women had higher TC and HDL level and lower TG level than men consistent with our result.[5] However our result also showed increased LDL-C in women compared to men. Additionally, another retrospective study with large cohort in China also emphasized the gender differences in lipid profile among dyslipidemic patients and also reported peak prevalence in dyslipidemia in different age group in male and female.[6]

The observed gender differences in lipid profiles among dyslipidemic patients can be attributed to various factors. Hormonal influences, such as estrogen in premenopausal women, are believed to contribute to higher HDL-C levels and lower LDL-C levels, thereby offering some protection against CVD.On the other hand, postmenopausal women often experience changes in lipid profiles due to declining estrogen levels, leading to an increase in LDL-C and a decrease in HDL-C levels.[4, 7]

Regarding triglyceride (TG) levels, our study demonstrated that in the age group less than or equal to 50 years, males had higher TG levels compared to females. This finding is consistent with previous research suggesting higher TG levels in young males.[5, 8] Interestingly, in the age group greater than 50 years, no significant difference in TG levels between males and females was observed. This may be attributed to hormonal changes associated with menopause, which could influence TG levels similarly in both genders.

In terms of high-density lipoprotein cholesterol (HDL-C) and low-density lipoprotein cholesterol (LDL-C) levels, our study found consistent gender differences across both age groups. On analysis of whole samples, females exhibited higher HDL-C levels and higher LDL-C levels compared to males. Subgroup analysis by age also showed similar type of findings. Our study finding is consistent with previous studies that showed by Russo et. al and Grundy et. al.[1, 9] These findings highlight the protective effect of estrogen on HDL-C levels and the potential cardiovascular risk associated with elevated LDL-C levels in females.

The TC/HDL ratio provides valuable information about the balance between "bad" cholesterol (LDL-C) and "good" cholesterol (HDL-C) in the bloodstream. A high TC/HDL ratio indicates an increased risk of CVD, as it suggests elevated levels of LDL-C and/or low levels of HDL-C. Numerous studies have highlighted the clinical significance of the TC/HDL ratio in predicting cardiovascular risk. [10, 11, 12]

The TC/HDL ratio was lower in females in the age group less than or equal to 50 years, indicating a more favorable lipid profile in this group consistent with study done by Ouchi et al. in 2019.[13] However, no significant difference was observed in the TC/HDL ratio between genders in the age group greater than 50 years. This finding suggests that the gender-specific protective effect on the TC/HDL ratio may diminish with age.

Non-HDL cholesterol represents the total cholesterol content in all atherogenic lipoproteins, including LDL (low-density lipoprotein), IDL (intermediate-density lipoprotein), VLDL (very low-density lipoprotein), and remnants (triglyceride-rich lipoproteins). [14, 15]

Furthermore, our study revealed gender differences in non-HDL cholesterol levels depending on age categories. Non-HDL cholesterol was higher in males in the age group less than or equal to 50 years but higher in females in the age group greater than 50 years.

The TG/HDL ratio, a marker of atherogenic lipid profile, was found to be higher in males in both age groups, indicating a higher risk of cardiovascular events in this subgroup. This finding corroborates the result of previous research demonstrating the association between increased TG levels and low HDL-C levels in males. Moreover, our study revealed a higher proportion of males with increased TG levels and low HDL-C levels in tandem, suggesting that males may be more susceptible to dyslipidemia characterized by elevated triglycerides and low HDL-C levels which is in agreement with previous study. [5]

CONCLUSION

In conclusion, our findings highlight significant gender differences in lipid profiles among dyslipidemic patients, with variations observed in total cholesterol, triglycerides, HDL-C, LDL-C, TC/HDL ratio, non-HDL cholesterol, and TG/HDL ratio. The age categories further elucidate the influence of age-related hormonal changes on lipid profiles. Tailoring treatment strategies based on these gender-specific differences in lipid profiles can optimize lipid control and reduce the risk of cardiovascular events.

LIMITATION

The study has several limitations, including its retrospective design, which relies on existing data and may be subject to incomplete or missing information. The study's findings are limited to the specific patient population and setting of Hetauda Hospital, which may limit the generalizability of the results to other populations or healthcare settings. Despite many limitations, it is the first study of its type to highlight the gender difference of dyslipidemia in large cohort of Nepalese population and this study paves the way for necessity of conducting prospective studies with larger sample sizes to validate the findings and establish causal relationships between gender and lipid profile differences and extend the research to multiple healthcare centers and diverse populations to enhance generalizability.

CONFLICT OF INTEREST: None

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