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ORIGINAL ARTICLE

Dyslipidemia

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Age- and Gender-Specific Dyslipidemia in Omani Young Adults: Metabolic Links to Cardiovascular Risk

Gulam Saidunnisa Begum[1], Anshoo Agarwal[2], Nida Suhail[3*], Mariah N. Hafiz[3], Mohammed M. Jawad[3], Awadh Elkareem Abass[3], Shefa A. Hejazy[4]

[1]Department of Biochemistry, National University of Science and Technology, College of Medicine and Health Sciences, Sohar Campus, Oman
[2]Pathology Department, Faculty of Medicine, Northern Border University, Arar, Saudi Arabia
[3]Department of Medical Laboratory Technology, Faculty of Applied Medical Sciences, Northern Border University, Arar, Saudi Arabia
[4]Diagnostic Hematology, Clinical Laboratory Sciences, College of Applied Medical Sciences, Umm Al Qura University, Makkah, Saudi Arabia

Abstract

Background: Dyslipidemia is a key modifiable risk factor for atherosclerotic cardiovascular disease that often remains undiagnosed in young adults due to its asymptomatic nature. Early detection and management are crucial to preventing long-term complications. This study aimed to determine the prevalence and patterns of dyslipidemia among young adults and examine its association with age and gender.
Materials and Methods: A cross-sectional analysis was conducted among 1,436 individuals (742 females and 694 males). Lipid profiles were assessed using established clinical thresholds, and gender differences were analyzed with the chi-square test.
Results: Dyslipidemia was present in 69.8% of participants, with the most common abnormalities being high total cholesterol (41.2%), low HDL-C (36.4%), and high LDL-C (34.5%). Low HDL-C was more frequent in females, while males exhibited higher triglycerides and mixed dyslipidemia. Prevalence increased with age, from 53.8% in those aged 20–24 years to 76.6% in the group 36–40 years.
Conclusion: Dyslipidemia is highly prevalent among young adults, with gender-specific and age-related variations. These findings emphasize the importance of early screening, lifestyle modification, and public health interventions to mitigate future cardiovascular disease risk.(**International Journal of Biomedicine. 2025;15(4):668-673.**)

Keywords: cardiovascular risk • dyslipidemia • young adults

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Abbreviations

ACS, acute coronary syndrome; **CAD**, coronary artery disease; **CVDs**, cardiovascular diseases; **HDL-C**, high-density lipoprotein cholesterol; **LDL-C**, low-density lipoprotein cholesterol; **NCDs**, non-communicable diseases; **TC**, total cholesterol; **TG**, triglycerides; **T2DM**, type 2 diabetes mellitus.

Introduction

Globally, cardiovascular diseases (CVDs) remain the leading cause of mortality and disability among non-communicable diseases (NCDs), accounting for approximately 12 million deaths annually and 40–45% of all global deaths. [1–3] Despite global preventive efforts, CVDs continue to be the major cause of death in many countries. Atherosclerosis,

thrombosis, coronary heart disease, and ischemic stroke are major complications associated with dyslipidemia, which plays a critical role in the CVD pathogenesis.[4] According to a study by Saeed et al.,[5] each unit increase in total blood cholesterol triples the risk of CVDs in both men and women. Dyslipidemia, defined by elevated total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), triglycerides (TG), and reduced high-density lipoprotein cholesterol (HDL-C), is a significant, independent, and modifiable risk factor for CVD, metabolic syndrome, and type 2 diabetes mellitus (T2DM).[6–9] Even minor lipid abnormalities markedly increase coronary artery disease (CAD) risk, particularly when combined with other factors like T2DM.[10] In Oman, the National Cholesterol Education Program Adult Treatment Panel III (ATP III) reported an age-adjusted metabolic syndrome prevalence of 21.0%, higher among women (23.0%) than men (19.5%). Low HDL-C (75.4%) and abdominal obesity (24.6%) were the most common components, the latter being significantly more frequent in women.[11]

Lipids are vital for energy storage, hormone synthesis, vitamin absorption, and cell membrane formation. However, their accumulation in the arteries can cause vascular obstruction and organ dysfunction.[12] Among young adults, premature CAD is closely linked to dyslipidemia, hypertension, and smoking.[13] A study at Sultan Qaboos University Hospital (SQUH), Muscat, found a high prevalence of dyslipidemia among young Omanis.[14] Similarly, studies in younger Middle Eastern patients with acute coronary syndrome (ACS) reveal higher rates of modifiable risk factors, notably smoking and hypercholesterolemia, than in older groups.[15]

Given its asymptomatic nature and early contribution to atherosclerosis, early detection and management of dyslipidemia are critical to reducing future cardiovascular burden.

This study aimed to determine the prevalence and patterns of dyslipidemia among young adults and examine its association with age and gender.

Material and Methods

A retrospective cross-sectional observational study was conducted by reviewing the medical records of individuals who were treated at Sohar Hospital, Oman, between January 2024 and December 2024.

Sample Size

The minimum required sample size was calculated using Cochran's formula for estimating a proportion in a population, assuming a 95% confidence level (Z=1.96), a 5% margin of error (e=0.05), and a conservative estimated prevalence (*P*=0.5) to yield the maximum sample size. The initial calculated sample size was 385. However, the present study included 1436 individuals, which significantly exceeds the minimum requirement. This larger sample enhances precision, providing strong generalizability and statistical power to detect significant associations.

Study Design

One thousand four hundred thirty-six subjects were categorized into four age groups: 20-24 years, 25-30 years, 31-35 years, and 36-40 years. This age-based categorization enabled the identification of age-specific trends in dyslipidemia prevalence and associated factors among young adults. The control group was also included and comprised of individuals without dyslipidemia, selected from the same hospital records using matching criteria such as age and sex.

A STEPwise approach was employed to ensure systematic data extraction, facilitate trend identification, and support the development of targeted public health strategies to address non-communicable diseases (NCDs) effectively.[16]

Step 1: Questionnaire-Based Assessment (Information from Case Files): Demographic information, including age and gender, was collected from patient case files.

Step 2: Biochemical Profile: Biochemical data were extracted to assess dyslipidemia prevalence. This included serum lipid profile values, such as TC, LDL-C, HDL-C, and TG.

Data from patient case files dated between January 2024 and December 2024 were extracted from the electronic medical records system using a pre-designed Excel sheet to fulfill the study's objectives. Dyslipidemia was defined using the National Cholesterol Education Program-Adult Treatment Panel III (NCEP-ATP III) criteria, based on the cut-off values outlined below.[16] It was identified by the presence of at least one of six lipid abnormality patterns in the serum lipid profile. According to the NCEP-ATP III classification, dyslipidemia was categorized into six types—four isolated and two combined (or mixed) patterns as outlined below:

- Elevated TC (≥5.2 mmol/L)
- Lowered HDL-C (<1.04 mmol/L in men and <1.3 mmol/L in women)
- Elevated TG (≥1.7 mmol/L)
- Elevated LDL-C (≥3.4 mmol/L)
- Combined (mixed) dyslipidemia (high TG + low HDL-C)
- Combined (mixed) dyslipidemia (high TG + high TC)

Inclusion and Exclusion Criteria

The study included adults of both genders aged 20–40 years with complete records, including lipid profiles (TC, LDL-C, HDL-C, and TG). Exclusion criteria: patients younger than 20 or older than 40 years, incomplete records, pregnancy, CVDs, chronic kidney disease, liver disease, and lipid-lowering drug use.

Statistical Analysis

Data were analyzed using descriptive statistics to determine prevalence rates and inferential statistics to explore associations between variables. The data was entered into Microsoft Excel and coded. The coded data were analysed in SPSS Version 21. The data were further categorized according to age group. Post-stratification, Chi-square and Student t-test were applied. *P*-value <0.05 was considered significant.

Results

A total of 1436 patients were enrolled: 742 (51.7%) were females and 694 (48.3%) were males. The majority of participants were Omani nationals (90.5%), followed by Indians (5.8%) and Egyptians (1.0%). Other nationalities, including Bangladeshi, Filipino, Sudanese, Syrian, and Nepali, each accounted for less than 1% of the study population.

The age distribution of participants showed that 41.0% were between 36 and 40 years, 29.5% between 31 and 35 years, 21.3% between 25 and 30 years, and 8.1% between 20 and 24 years. The mean age was 33.12±5.27 years, with a range of 20–40 years (Table 1). In the study population, dyslipidemia was observed in 69.8% of participants, indicating a high overall burden, whereas 30.2% demonstrated a normal lipid profile (Table 2). Among the various dyslipidemia components, isolated high TC was the most prevalent abnormality, observed in 41.2% of participants, followed by isolated low HDL-C (36.4%) and isolated high LDL-C (34.5%). Isolated hypertriglyceridemia was present in 26.3% of subjects. Combined abnormalities were less common, with TG+TC present in 15.5% and TG+HDL-C in 14.4% of the population (Table 3). Gender-wise analysis showed that the overall prevalence of dyslipidemia was comparable between females (70.2%) and males (69.3%), with a *P*-value of 0.708 (Table 4). However, significant differences were observed in specific components. Low HDL-C was more common among females (39.9% vs. 32.6%, *P*=0.004), whereas high TG was significantly more prevalent in males (33.9% vs. 19.3%, *P*=0.001). Combined abnormalities were also more frequent in males, with higher proportions of TG+HDL-C (17.4% vs. 11.6%, *P*=0.002) and TG+TC (20.0% vs. 11.3%, *P*=0.001). No significant gender differences were found in the prevalence of high TC or high LDL-C. Age-wise distribution revealed a progressive increase in dyslipidemia prevalence with advancing age (Table 5). Overall, dyslipidemia was detected in 53.8% of participants aged 20–24 years, rising to 65.4% in those aged 25–30 years, 67.9% in those aged 31–35 years, and 76.6% in those aged 36–40 years (*P*=0.001). High TC and high LDL-C were significantly more common in older age groups (*P*=0.001 for both), while high TG also showed a significant upward trend with age (*P*=0.004). Combined abnormalities (TG+HDL-C and TG+TC) were more frequent in participants aged ≥31 years (*P*=0.017 and *P*=0.029, respectively). In contrast, the prevalence of low HDL-C did not differ significantly across age groups (*P*=0.201).

Table 1.

Distribution of subjects according to different age groups.

Age group (years)	Frequency	Percentage
20-24	117	8.1
25-30	306	21.3
31-35	424	29.5
36-40	589	41.0
Total	1436	100.0

Table 2.

Overall prevalence of dyslipidemia.

Dyslipidemia	Frequency	Percentage
Yes	1002	69.8
No	434	30.2
Total	1436	100.0

Table 3.

Prevalence of dyslipidemia components.

Dyslipidemia components	Frequency	Percentage
Isolated high TC	591	41.2
Isolated low HDL-C	522	36.4
Isolated high LDL-C	495	34.5
Isolated high TG	378	26.3
Combined abnormal TG+HDL-C	207	14.4
Combined abnormal TG+TC	223	15.5

Table 4.

Prevalence of dyslipidemia according to gender.

Dyslipidemia components	Female (n=742) n (%)	Male (n=694) n (%)	*P*-value
High TC	298 (40.2)	293 (42.2)	0.429
Low HDL-C	296 (39.9)	226 (32.6)	0.004
High LDL-C	239 (32.2)	256 (36.9)	0.062
High TG	143 (19.3)	235 (33.9)	0.001
Abnormal TG+HDL-C	86 (11.6)	121 (17.4)	0.002
Abnormal TG+TC	84 (11.3)	139 (20.0)	0.001
Overall dyslipidemia	521 (70.2)	481 (69.3)	0.708

Table 5.

Prevalence of dyslipidemia according to age group.

Dyslipidemia components	20-24 (n=117) n (%)	25-30 (n=306) n (%)	31-35 (n=424) n (%)	36-40 (n=589) n (%)	*P*-value
High TC	25 (21.4)	119 (38.9)	180 (42.5)	267 (45.3)	0.001
Low HDL-C	37 (31.6)	99 (32.4)	160 (37.7)	226 (38.4)	0.201
High LDL-C	21 (17.9)	97 (31.7)	156 (36.8)	221 (37.5)	0.001
High TG	17 (14.5)	77 (25.2)	106 (25.0)	178 (30.2)	0.004
Abnormal TG+HDL-C	8 (6.8)	35 (11.4)	68 (16.0)	96 (16.3)	0.017
Abnormal TG+TC	7 (6.0)	49 (16.0)	68 (16.0)	99 (16.8)	0.029
Overall dyslipidemia	63 (53.8)	200 (65.4)	288 (67.9)	451 (76.6)	0.001

Discussion

This study found a high prevalence of dyslipidemia (69.8%) among young adults aged 20–40 years, slightly higher in females (70.2%) than males (69.3%). Similar gender trends have been reported elsewhere. Talpur et al.[17] observed dyslipidemia in 75.9% of young adults, with a higher prevalence in females (76.0%) than males (74.2%). Studies from China and Iran also reported higher rates in women—37.6% vs. 34.4% and 55.4% vs. 37.4%, respectively.[18,19] Although our findings did not show a statistically significant difference, the

consistent pattern suggests possible hormonal, metabolic, or lifestyle influences.

Regional comparisons further support these findings. A Middle Eastern meta-analysis reported pooled prevalence rates of 54.08% for dyslipidemia, 32.51% for hypertriglyceridemia, 29.44% for hypercholesterolemia, 32.09% for high LDL-C, and 44.71% for low HDL-C.[20] These values align with our results showing elevated TC (40–42%), LDL (32–37%), TG (19–34%), and low HDL-C (33–40%). Similar patterns were observed by Talpur et al.,[17] who reported high rates of low HDL-C and hypertriglyceridemia among young adults. The high burden of combined lipid abnormalities (TG+HDL, TG+TC) in our cohort also reflects regional trends.

Low HDL-C was significantly more frequent among females (39.9%, P=0.004). Although estrogen generally raises HDL and provides cardiovascular protection, this effect can be offset by poor lifestyle factors. Diets high in saturated fats and sugars, physical inactivity, central obesity, and stress-induced cortisol elevation may suppress HDL-C production while increasing LDL-C and triglycerides.[21] These findings emphasize the interplay between metabolic and behavioral determinants of dyslipidemia, particularly among women.

Dyslipidemia remains a major pathogenic factor for atherosclerotic CVDs.[22] Evidence from China indicates that proper lipid management substantially reduces ischemic CVD incidence and mortality.[23] However, its asymptomatic nature often delays diagnosis, highlighting the need for routine screening and preventive interventions.[24]

Although dyslipidemia prevalence rises with age, its presence in younger adults is clinically significant.[25] The Bogalusa Heart Study demonstrated that early elevations in LDL-C and triglycerides are linked to premature atherosclerosis,[26] suggesting that lipid abnormalities during early adulthood contribute to later cardiovascular events.

In the Arabian Gulf, high rates of diabetes and metabolic syndrome among ACS patients reflect a pattern of atherogenic dyslipidemia characterized by elevated TG, low HDL-C, and small dense LDL particles.[27,28] Even with optimal LDL-C control, these patients face substantial residual cardiovascular risk.[29,30] A study by Al-Rasadi et al.,[31] found that 62% of ACS patients had low HDL-C—the highest reported in regional cohorts. Additionally, familial hypercholesterolemia, a common but underdiagnosed genetic condition, contributes to persistently high LDL-C and increased risk of premature coronary artery disease.[32,33]

Overall, the study highlights a major public health concern in Oman, revealing a high prevalence of dyslipidemia among young adults aged 20–40 years. Of the 1,436 participants, 69.8% had at least one lipid abnormality. Dyslipidemia increased with age, from 53.8% in the 20–24 age group to 76.6% among those aged 36–40, suggesting early onset and progressive worsening. Gender variations were observed, with women showing lower HDL-C and men exhibiting higher TG and mixed dyslipidemia.

These findings underscore the need for early lipid screening, preventive lifestyle modifications, and targeted public health strategies to mitigate future cardiovascular disease risk among young adults.

The study's retrospective cross-sectional nature limits the ability to establish causal relationships between dyslipidemia and demographic or lifestyle factors. It only reflects associations at a single point in time. Additionally, all data were obtained from a single healthcare facility, which may not fully represent the broader young adult population in Oman or in other regions with different socioeconomic and lifestyle backgrounds.

Ethical Considerations

This study was approved by the college ethics and biosafety committee (EBC) NU/COMHS/EBC0018/2025 and the Ministry of Health Research and Ethical Review Committee, North Batinah Governorate (RERAC-NBG) MH/DGHS/NBG: MoH/CSR/25/29558 and was conducted according to Helsinki Declaration Principles. The Ethics Committee waived the consent requirement for participation due to the study's retrospective nature and the use of anonymized, de-identified patient data.

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Competing Interests

The authors have no conflicts of interest to declare.

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***Corresponding author**: Dr. Nida Suhail, E-mail: nsuhail123@gmail.com*