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Prevalence and Anthropometric Correlates of Dyslipidemia Among Students of a Tertiary Institution: A Cross-Sectional Study

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ABSTRACT

Background: Dyslipidemia is characterized by abnormal concentrations of circulating lipids and lipoproteins and represents an important modifiable risk factor for future cardiometabolic disease. Although lipid abnormalities are frequently investigated in adults, they may also occur during adolescence and early adulthood. Lifestyle patterns, dietary habits, physical inactivity, excess body weight, and other metabolic factors may contribute to the development of abnormal lipid profiles in young individuals.

Objective: The present study was conducted to determine the prevalence of dyslipidemia and evaluate the distribution of serum lipid parameters according to sex, age, body mass index (BMI), and waist–hip ratio (WHR) among students of a tertiary institution.

Methods: A cross-sectional study was conducted among 200 apparently healthy students aged 16–35 years, comprising 100 males and 100 females. Participants were recruited between May and October 2021. Following an overnight fast, venous blood samples were collected for estimation of total cholesterol (TC), triglycerides (TG), and high-density lipoprotein cholesterol (HDL-C). Low-density lipoprotein cholesterol (LDL-C) was calculated using the Friedewald equation. Anthropometric measurements included height, weight, waist circumference, and hip circumference. BMI and WHR were subsequently calculated. Dyslipidemia was defined according to the stated National Cholesterol Education Programme criteria.

Results: The overall prevalence of dyslipidemia was 62%. Low HDL-C was the most frequently observed abnormality (22%), followed by elevated TC (21%), elevated TG (11%), and elevated LDL-C (8%). Abnormal TC and TG levels were more frequent among males, whereas low HDL-C was more common among females. The difference in LDL-C between males and females was statistically significant ($p = 0.022$). Serum lipid concentrations did not differ significantly across age groups. TC, HDL-C, and LDL-C differed significantly across BMI categories ($p = 0.017$, $p = 0.002$, and $p = 0.002$, respectively), whereas TG did not differ significantly ($p = 0.617$). Among females, TC differed significantly according to WHR category ($p = 0.021$).

Conclusion: A considerable proportion of students demonstrated abnormal lipid profiles, with low HDL-C and elevated TC representing the predominant lipid abnormalities. Variations in lipid parameters were observed according to sex, BMI, and WHR. These findings highlight the importance of early awareness regarding healthy dietary practices, regular physical activity, and maintenance of a healthy body weight among young adults.

Keywords*: Dyslipidemia; Lipid profile; Body mass index; Waist–hip ratio; Young adults; Tertiary institution; Prevalence.*

INTRODUCTION

Dyslipidemia refers to an abnormal concentration or distribution of lipids and lipoproteins in the circulation. Common lipid abnormalities include elevated total cholesterol (TC), increased low-density lipoprotein cholesterol (LDL-C), elevated triglycerides (TG), and reduced high-density lipoprotein cholesterol (HDL-C) [1,2]. Dyslipidemia may broadly be classified into primary and secondary forms. Primary dyslipidemias are generally associated with genetic abnormalities, whereas secondary dyslipidemias may arise in association with lifestyle factors, dietary patterns, medications, or underlying medical conditions [3].

Dietary habits and lifestyle behaviours are important determinants of lipid metabolism. Among young people, increasing consumption of energy-dense foods together with reduced physical activity may contribute to the development of adverse metabolic profiles. The transition from adolescence to adulthood is frequently accompanied by changes in dietary habits, physical activity, and body composition, which may increase the likelihood of developing cardiometabolic risk factors.

Although dyslipidemia is commonly considered a condition of adulthood, lipid abnormalities can also occur during adolescence and early adulthood [8,9]. The presence of abnormal lipid concentrations at a young age is clinically relevant because cardiometabolic risk factors may persist into adulthood and contribute to the subsequent development of conditions such as diabetes mellitus, hypertension, and cardiovascular disease [8,10].

Body composition is also closely related to lipid metabolism. Increased BMI and central adiposity may be associated with adverse lipid profiles, particularly elevated TC and LDL-C and reduced HDL-C. Waist–hip ratio (WHR) provides an additional anthropometric measure of body fat distribution and may provide useful information regarding central adiposity.

Despite the importance of early identification of lipid abnormalities, information regarding dyslipidemia among students and young adults remains limited in many settings. Assessment of lipid profiles in this population may therefore provide useful information for identifying early metabolic abnormalities and promoting preventive health practices.

The present study was undertaken to determine the prevalence of dyslipidemia among students of a tertiary institution and to evaluate serum TC, TG, HDL-C, and LDL-C according to sex, age, BMI, and WHR.

MATERIALS AND METHODS

Study Population

The study population comprised students enrolled at Ebonyi State University. The university has four campuses located within the state capital and has an estimated student population of approximately 20,000. Students from different levels of study were considered for participation.

Study Design and Duration

A cross-sectional prevalence study was conducted between May and October 2021. A total of 200 students, comprising 100 males and 100 females, were recruited. Participants were between 16 and 35 years of age and provided consent before participation.

Participants were apparently healthy and did not demonstrate obvious physical signs of illness at the time of recruitment. Individuals receiving medications known to affect cholesterol metabolism were excluded.

Laboratory investigations were performed at the Ebonyi State University Ultramodern Diagnostic and Research Laboratory.

Data Collection and Fasting Blood Sampling

Participants were instructed to undergo an overnight fast before blood collection. Venous blood samples were collected at approximately 8:00 AM on the following morning.

Information regarding personal characteristics and medical history was obtained using a structured self-administered questionnaire.

Anthropometric Assessment

Height was measured using a meter rule to the nearest 0.1 cm, while body weight was measured using a digital weighing scale to the nearest 0.1 kg.

Waist circumference was measured using a flexible measuring tape at the level of the superior iliac crest at the end of normal expiration. Hip circumference was also measured using the same tape.

BMI was calculated using the following formula:

BMI = Weight (kg) / Height² (m²)

Participants were categorized according to BMI as follows [11]:

- Underweight: <18.5 kg/m²
- Normal weight: 18.5–24.9 kg/m²
- Overweight: 25.0–29.9 kg/m²
- Obese: ≥30.0 kg/m²

WHR was calculated as:

WHR = Waist circumference / Hip circumference

For females, WHR was categorized as low (≤0.80), moderate (0.81–0.85), and high (≥0.86). For males, WHR was categorized as low (≤0.95), moderate (0.96–1.00), and high (≥1.00) [11].

Biochemical Analysis
Serum TC, HDL-C, and TG were determined using enzymatic colorimetric methods. TC was measured using the cholesterol oxidase–phenol aminophenazone (CHOD-PAP) method, while TG was determined using the glycerol phosphate oxidase–phenol aminophenazone (GPO-PAP) method. Commercial diagnostic kits obtained from Randox Laboratories Ltd., Crumlin, Antrim, United Kingdom, were used.

LDL-C was calculated using the Friedewald equation [12].

Dyslipidemia was defined according to the criteria stated in the original study as:

- TC >5.2 mmol/L
- HDL-C <1.4 mmol/L
- TG >1.7 mmol/L
- LDL-C >3.4 mmol/L

Statistical Analysis
Data were analyzed using Statistical Package for the Social Sciences (SPSS), version 22.0 (IBM Statistics, Chicago, IL, USA). Continuous variables were expressed as mean ± standard deviation (SD). Student's *t*-test was used for comparison of appropriate continuous variables, while one-way analysis of variance (ANOVA) was used to compare mean lipid concentrations across multiple groups. A p-value <0.05 was considered statistically significant.

Ethical Considerations
Ethical approval for the study was obtained from the Ethics and Research Committee of the Faculty of Health Sciences and Technology, Ebonyi State University. The study was conducted in accordance with the applicable ethical principles governing research involving human participants.

RESULTS

Overall Prevalence of Dyslipidemia
Among the 200 participants, 124 demonstrated at least one lipid abnormality, corresponding to an overall prevalence of **62%**.

Low HDL-C was the most frequently observed abnormality, occurring in 44 participants (22%), followed by elevated TC in 42 participants (21%). Elevated TG was observed in 22 participants (11%), while elevated LDL-C was observed in 16 participants (8%).

The mean TC, TG, HDL-C, and LDL-C concentrations among all participants were 4.56 ± 0.80, 1.17 ± 0.49, 1.76 ± 1.31, and 2.17 ± 1.65 mmol/L, respectively.

Table 1. Prevalence of individual lipid abnormalities among the study participants (n = 200)

Lipid parameter	Mean ± SD, all participants	Mean ± SD among participants with abnormality	Prevalence, n (%)
Total cholesterol	4.56 ± 0.80	5.53 ± 0.23	42 (21%)
Triglycerides	1.17 ± 0.49	2.22 ± 0.51	22 (11%)
HDL-C	1.76 ± 1.31	0.79 ± 0.32	44 (22%)
LDL-C	2.17 ± 1.65	4.11 ± 0.39	16 (8%)
Overall dyslipidemia	—	—	**124 (62%)**

Sex-Related Distribution of Dyslipidemia
The distribution of individual lipid abnormalities according to sex is presented in Table 2.

Elevated TC was observed in 22 males and 20 females, while elevated TG was observed in 18 males and 4 females. In contrast, low HDL-C was considerably more frequent among females than males, occurring in 34 females compared with 10 males.

The number of participants with elevated LDL-C was equal in both sexes, with 8 cases in each group.

The differences between males and females were not statistically significant for TC (p = 0.096), TG (p = 0.067), or HDL-C (p = 0.889). However, the difference in LDL-C was statistically significant (p = 0.022).

Table 2. Sex-related distribution of abnormal lipid parameters

Parameter	Male, n (%) / mean ± SD	Female, n (%) / mean ± SD	*p*-value
Total cholesterol	22 (5.61 ± 0.26)	20 (5.45 ± 0.18)	0.096

Triglycerides	18 (2.01 ± 0.24)	4 (3.14 ± 0.23)	0.067
HDL-C	10 (0.81 ± 0.16)	34 (0.78 ± 0.35)	0.889
LDL-C	8 (3.78 ± 0.15)	8 (4.44 ± 0.20)	0.022

Age-Related Differences in Serum Lipid Parameters

Participants aged 26–30 years had the highest mean TC concentration (4.81 ± 0.68 mmol/L) and HDL-C concentration (1.87 ± 1.04 mmol/L). The highest mean TG concentration was observed among participants aged 31–35 years (1.57 ± 0.93 mmol/L), whereas the highest mean LDL-C concentration was observed among those aged 16–20 years (2.34 ± 0.24 mmol/L).

However, none of the differences in TC, TG, HDL-C, or LDL-C across the age groups reached statistical significance, with *p*-values of 0.199, 0.511, 0.877, and 0.894, respectively.

Table 3. Age-related differences in serum lipid parameters

Parameter (mmol/L)	16–20 years (n=22)	21–25 years (n=116)	26–30 years (n=56)	31–35 years (n=6)	*p*-value
TC	4.60 ± 0.69	4.45 ± 0.86	4.81 ± 0.68	3.12 ± 0.70	0.199
TG	1.14 ± 0.63	1.18 ± 0.45	1.12 ± 0.47	1.57 ± 0.93	0.511
HDL-C	1.63 ± 0.90	1.76 ± 1.52	1.87 ± 1.04	1.28 ± 0.60	0.877
LDL-C	2.34 ± 0.24	2.07 ± 1.98	2.33 ± 1.24	2.01 ± 0.38	0.894

BMI-Related Differences in Serum Lipid Parameters

Serum TC and LDL-C demonstrated an increasing pattern across the higher BMI categories. Participants classified as obese had the highest mean TC (5.01 ± 0.51 mmol/L) and LDL-C (2.82 ± 1.54 mmol/L).

The highest mean TG concentration was observed among participants with normal BMI (1.22 ± 0.53 mmol/L), whereas the highest HDL-C concentration was observed among underweight participants (3.03 ± 2.81 mmol/L).

Differences in TC, HDL-C, and LDL-C across BMI categories were statistically significant (p = 0.017, 0.002, and 0.002, respectively). The difference in TG was not statistically significant (p = 0.617).

Table 4. BMI-related differences in serum lipid parameters

Parameter (mmol/L)	Underweight (n=6)	Normal (n=108)	Overweight (n=60)	Obese (n=26)	*p*-value
TC	4.03 ± 1.36	4.53 ± 0.62	4.81 ± 0.69	5.01 ± 0.51	0.017
TG	1.03 ± 0.31	1.22 ± 0.53	1.18 ± 0.49	1.03 ± 0.39	0.617
HDL-C	3.03 ± 2.81	1.51 ± 0.69	1.66 ± 0.91	1.66 ± 1.10	0.002
LDL-C	0.58 ± 3.67	2.34 ± 0.72	2.49 ± 1.12	2.82 ± 1.54	0.002

WHR-Related Differences in Serum Lipid Parameters

Among female participants, those with high WHR had the highest mean TC (4.58 ± 0.49 mmol/L) and LDL-C (2.52 ± 0.89 mmol/L), while those with low WHR had the highest TG concentration (1.18 ± 0.60 mmol/L). HDL-C was lowest among females with high WHR (1.09 ± 0.56 mmol/L).

The difference in TC across female WHR categories was statistically significant (p = 0.021), whereas differences in TG, HDL-C, and LDL-C were not statistically significant.

Among male participants, those with high WHR had the highest mean TC (4.75 ± 0.86 mmol/L), TG (1.33 ± 0.81 mmol/L), and LDL-C (2.61 ± 0.29 mmol/L), together with the lowest HDL-C (1.40 ± 0.73 mmol/L). None of the differences across male WHR categories were statistically significant.

Table 5. WHR-related differences in serum lipid parameters according to sex

Sex	Parameter (mmol/L)	Low WHR	Moderate WHR	High WHR	*p*-value
Female	TC	3.68 ± 0.49	4.57 ± 0.73	4.58 ± 0.49	0.021
Female	TG	1.18 ± 0.60	1.13 ± 0.16	0.84 ± 0.23	0.373
Female	HDL-C	1.38 ± 0.70	1.44 ± 0.36	1.09 ± 0.56	0.535
Female	LDL-C	2.10 ± 0.23	2.49 ± 0.63	2.52 ± 0.89	0.547
Male	TC	4.65 ± 0.93	4.47 ± 0.61	4.75 ± 0.86	0.886
Male	TG	1.20 ± 0.47	1.25 ± 0.53	1.33 ± 0.81	0.871
Male	HDL-C	2.29 ± 1.78	1.56 ± 1.02	1.40 ± 0.73	0.445
Male	LDL-C	1.76 ± 2.33	2.21 ± 1.46	2.61 ± 0.29	0.718

DISCUSSION

The present study identified a substantial prevalence of dyslipidemia among students, with 62% of participants demonstrating at least one abnormal lipid parameter. Low HDL-C was the most common lipid abnormality, accounting for 22% of participants, followed by elevated TC (21%), elevated TG (11%), and elevated LDL-C (8%).

The observed prevalence is broadly comparable with findings reported in some previous studies. Gama et al. reported a prevalence of approximately 64%, while Homma et al. reported a prevalence of 72% in their respective study populations [13,14]. Crisieli et al. also reported variation in the prevalence of dyslipidemia depending on the diagnostic criteria applied [15]. Other studies have reported lower prevalence estimates, demonstrating that the observed frequency of dyslipidemia may vary according to population characteristics, age distribution, diagnostic thresholds, and study methodology [16,17].

The predominance of low HDL-C and elevated TC in the present study is consistent with previous observations of lipid abnormalities among younger populations [18–20]. Differences between studies may be related to variations in dietary patterns, physical activity, body composition, genetic factors, and the criteria used to define dyslipidemia.

With respect to sex, elevated TC and TG were more frequently observed among males, whereas low HDL-C was substantially more common among females. The difference in LDL-C between the two sexes was statistically significant. Similar sex-related differences have been reported in previous studies [21], although contrasting findings have also been described [17]. Such differences may reflect variation in body composition, dietary practices, physical activity, and other metabolic or hormonal factors.

No statistically significant differences were observed in serum TC, TG, HDL-C, or LDL-C across the different age categories. This finding is consistent with the observations of Tamunopriye and Iroro [22], although other investigators have reported significant associations between age and dyslipidemia [23]. The relatively narrow age distribution and the unequal number of participants in some age categories may have contributed to the absence of statistically significant differences in the present study.

BMI demonstrated a significant relationship with several lipid parameters. Participants classified as obese had the highest mean TC and LDL-C concentrations, while the differences in TC, HDL-C, and LDL-C across BMI categories were statistically significant. In contrast, TG did not differ significantly across BMI groups. These findings are consistent with the established association between excess adiposity and adverse lipid profiles.

WHR provided an additional measure of body fat distribution. Among females, TC differed significantly across WHR categories, with the highest concentration observed among those with high WHR. Although the differences in TG, HDL-C, and LDL-C among females were not statistically significant, the observed pattern suggests a relationship between abdominal adiposity and lipid metabolism. Among males, none of the lipid parameters differed significantly across WHR categories.

Overall, the findings suggest that abnormal lipid profiles can be identified even among apparently healthy students. Early recognition of these abnormalities may provide an opportunity for preventive interventions focused on healthy dietary practices, regular physical activity, and maintenance of appropriate body weight.

Study Limitation

One limitation of the study was that the investigators could not independently verify adherence to the required overnight fasting period. Consequently, the possibility of minor variation related to fasting compliance cannot be completely excluded.

CONCLUSION

The study demonstrated a **62% prevalence of dyslipidemia** among the participating students. Low HDL-C and elevated TC were the most frequently observed lipid abnormalities, followed by elevated TG and LDL-C.

Sex-related differences were observed, with low HDL-C occurring more frequently among females and elevated TC and TG occurring more frequently among males. Although lipid concentrations did not differ significantly across age groups, significant differences were observed across BMI categories for TC, HDL-C, and LDL-C. Among females, TC also differed significantly across WHR categories.

These findings indicate the presence of lipid abnormalities among young adults and support the importance of promoting healthy dietary practices, regular physical activity, and maintenance of healthy BMI and WHR from an early age.

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