



Lipid Profile among University Athletes and Non-Athletes in Ekpoma, Edo State, Nigeria

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Abstract

Original Research

Background: Physical activity influences lipid metabolism, but data on athletes in Nigerian population considering gender and sport types are limited.

Objective: To compared lipid-profiles of university athletes and non-athletes and evaluate the influence of gender, age, and sporting activity.

Methods: A comparative cross-sectional study was conducted among 100 apparently healthy participants at Ambrose Alli University, comprising 50 athletes and 50 non-athletes aged 16-35 years. Sociodemographic information was collected using a structured questionnaire. Fasting venous blood samples were collected into lithium heparin tubes, centrifuged at 3000 rpm for 10 minutes, and plasma stored at -20 degree Celsius. From the plasma samples analysis of triglycerides (TG), total cholesterol (TC), and high-density lipoprotein cholesterol (HDL-C), using enzymatic laboratory methods, while low-density lipoprotein cholesterol (LDL-C) was calculated using Friedewald's equation. Data were analyzed with SPSS v26.0 using t-test, Chi-square, and One-way ANOVA with post-hoc Tukey. Statistical significance was set at $p < 0.05$.

Results: Athletes had higher mean TG concentrations than non-athletes (203.99 ± 69.54 vs. 173.28 ± 50.00 mg/dL), and this difference was statistically significant, $t = -2.151$, $p = 0.035$. Significant differences existed across gender/activity groups for all lipids ($p < 0.001$). Male athletes had highest TG (231.28 ± 41.09 mg/dL) and lowest TC, HDL-C, and LDL-C. Female athletes had highest TC (194.78 ± 84.80 mg/dL), HDL-C (58.43 ± 25.44 mg/dL), and LDL-C (114.65 ± 65.24 mg/dL). Age had no significant effect among athletes. Among sports, only LDL-C differed significantly ($p = 0.049$), with footballers having the highest.

Conclusion: Gender and athletic status interact to influence lipid profile. Male athletes showed a less favorable lipid pattern despite exercise, indicating need for routine screening and nutritional evaluation. Health promotion programs encouraging regular exercise may help reduce cardiovascular risk among students.

Keywords: Athletes; Cardiovascular risk; Cholesterol; Exercise; Lipid profile; Triglycerides; University students.

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Introduction

Cardiovascular diseases (CVDs) remain the leading cause of global mortality, accounting for an estimated 19.8 million deaths from CVDs in 2022, representing approximately 32% of all global deaths and three quarters of CVD deaths take place in low- and middle-income countries.¹ Most CVDs can be prevented by addressing behavioral and environmental risk factors such as tobacco use, unhealthy diet, and obesity, physical inactivity, harmful use of alcohol and air pollution.¹ Atherosclerosis, the underlying pathology of most CVDs, is strongly linked to dyslipidaemia. Dyslipidaemia is characterized by elevated total cholesterol (TC), Low-density lipoprotein cholesterol (LDL-C), triglycerides (TGs), and low high-density lipoprotein cholesterol (HDL-C). these lipid abnormalities promote endothelial dysfunction, plaque formation, and ultimately myocardial infarction and stroke.²

Regular physical activity improves lipid metabolism by increasing HDL-C and reducing TG and LDL-C through mechanisms such as increased lipoprotein lipase activity and improved HDL-C metabolism.^{3,4} for this reason, exercise is recommended as a first-line approach for dyslipidemia management.⁵

However, findings in athletes have been inconsistent. Some studies report better lipid profiles in athletes, while others report elevated TG in certain sports.^{6,7} These variations may be due to differences in sport type, training intensity, diet, and genetic factors.⁸

Gender is another important modifier of lipid response to exercise. Pre-menopausal females generally have higher HDL-C and lower LDL-C than males, an effect largely attributed to estrogen-mediated upregulation of hepatic LDL receptors and increased apolipoprotein A-1 synthesis.⁹ Consequently, female athletes often demonstrate a more cardioprotective lipid profile than their male counterparts.⁹

Age also influences lipid levels, with TC and LDL-C typically rising with age due to decreased LDL receptor activity and hormonal changes.¹⁰ However, in young athletic populations, the effect of age may

be attenuated by the protective effects of regular training.¹⁰

The type and intensity of sporting activity further contribute to variations in lipid profile. Endurance sport such as long-distance running are associated with the most favorable lipid changes, while resistance and team sports show more variable effects.⁸ Differences in energy expenditure, substrate utilization, and dietary habits across football, basketball, and gym training may therefore lead to distinct lipid patterns.⁸

In Nigeria, CVD burden is rising rapidly, yet data on lipid profiles of athletes remain limited.¹¹ Most available studies have focused on sedentary populations or patients with metabolic disease, with little attention to the influence of gender, age, and sport type among athletes.¹¹ Given the cultural emphasis on football and increasing participation in gym and basketball activities among Nigerian youths, it is important to generate local data to inform cardiovascular risk assessment and health promotion strategies.

Therefore, this study aimed to compare the lipid profile of athletes and non-athletes in Ambrose Alli University, Ekpoma, Nigeria, and to determine the influence of gender, age, and sporting activity on lipid parameters.

Methods

Study Design and Setting

This was a comparative cross-sectional study conducted at Ambrose Alli University, Ekpoma, Edo State, Nigeria. Ekpoma is the headquarters of Esan West Local Government Area of Edo State and is characterized by a tropical climate with distinct rainy and dry seasons.

Study Population

The study population consisted of apparently healthy male and female athletes and non-athletes with the age range of 16-35 years who consented to participate in the study.

Athletes were defined as individuals who had been engaged in football, basketball, or gym training for at least 3 times per week for a minimum of 6 consecutive months.

Non-athletes were age- and gender-matched individuals with no regular exercise regimen. Exclusion criteria: diabetes, hypertension, renal disease, and use of lipid-lowering drugs.

Sample Size Determination

The sample size was calculated using the formula $N = z^2pq/d^2$.

Where:

N = required sample size

Z = standard normal deviation at 95% confidence level = 1.96

P = expected prevalence = 0.07 (7%)

q = 1 – p = 0.93

d = acceptable margin of error = 0.05 (5%)

Substituting the values:

$$N = \frac{(1.96)^2 \times 0.07 \times 0.93}{(0.05)^2} = 99.9 \text{ approximately} = 100$$

Therefore, the minimum required sample size was 100 participants. To allow for equal comparison, a total of 100 participants were recruited, comprising 50 athletes and 50 non-athletes.

Sampling Technique

A purposive sampling technique was used to recruit 50 athletes from various sports teams, and 50 age- and gender-matched non-athletes from the same institution who were not engaged in regular competitive sports.

Inclusion Criteria

1. Apparently healthy individuals aged 16-35 years
2. Athletes engaged in regular training ≥ 3 times per week for at least 6 months

3. Written informed consent

Exclusion Criteria

1. Individuals with known history of diabetes mellitus, hypertension, or dyslipidaemia
2. Individuals on lipid-lowering drugs or hormonal therapy
3. Pregnant women
4. Those that did not consent

Ethical Considerations

Ethical approval for the study was obtained from the Ambrose Alli University Health Research Ethics Committee under approval number 270/25. The approval was valid from December 24, 2025, to December 23, 2026. Written informed consent was obtained from all participants prior to enrollment. Confidentiality of all information provided was strictly maintained throughout the study.

Data Collection and Laboratory Analysis

Sociodemographic data were obtained from participants using a structured, interviewer-administered questionnaire.

After an overnight fast of 8-12 hours, 5mL of venous blood was collected from each participant into lithium-heparin tubes. The samples were then centrifuged at 3000 rpm for 10 minutes. The plasma obtained was separated and stored at -20 degrees Celsius until analysis.

Plasma TC and HDL-C were measured using enzymatic colorimetric methods. TGs were determined using a glycerol-phosphate oxidase-peroxidase method. LDL-C was calculated using the Friedewald equation $[LDL-C = TC - HDL-C - TG/5]$ (Friedewald et al., 1972).¹²

Statistical Analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 26.0. Continuous variables were expressed as mean $\pm$ standard deviation, while categorical variables were presented

as frequencies and percentages.

The Chi-square test was used to compare categorical variables. Differences between athletes and non-athletes were assessed using the independent t-test. One-way ANOVA with post-hoc Tukey test was used to compare lipid parameters across groups based on gender/activity status, age, and type of sporting activity. Statistical significance was set at a p-value <0.05.

Ethics Approval and Consent to Participate

Ethical approval was obtained from the Ambrose Alli University Health Research Ethics Committee, approval number 270/25. Informed consent was obtained from participants.

Results

A total of 100 participants were recruited for the

study, comprising 50 athletes and 50 non-athletes.

Demographic Characteristics of Participants

Among the athletes, 30.0% were aged 16–20 years, 46.0% were aged 21–25 years, and 24.0% were aged 26 years or older. Among non-athletes, 20.0% were aged 16–20 years, 42.0% were aged 21–25 years, and 38.0% were aged 26 years or older. Males constituted 54.0% of the athlete group and 58.0% of the non-athlete group. Christians represented 90.0% of athletes and 86.0% of non-athletes. Esan participants accounted for 38.0% of each group.

From table 1 below, there were no statistically significant differences between athletes and non-athletes in age ($p = 0.263$), Gender ($p = 0.840$), religion ($p = 0.758$), or ethnicity ($p = 0.968$). This suggests the two groups were comparable at baseline.

Table 1: Demographic Characteristics of Participants

Characteristics	Category	Athletes n (%)	Non-athletes n (%)	P-value
Age	16-20 years	15 (30.0)	10 (20.0)	0.263
	21-25 years	23 (46.0)	21 (42.0)	
	≥26 years	12 (24.0)	19 (38.0)	
Gender	Female	23 (46.0)	21 (42.0)	0.840
	Male	27 (54.0)	29 (58.0)	
Religion	Christian	45 (90.0)	43 (86.0)	0.758
	Muslim	5 (10.0)	7 (14.0)	
Ethnicity	Yoruba	15 (30.0)	16 (32.0)	0.968
	Esan	19 (38.0)	19 (38.0)	
	Igbo	16 (32.0)	15 (30.0)	

Note: Values are frequencies and percentages. n = sample size. P-values obtained using Chi-square test. Statistical significance set at $p < 0.05$.

From table 2 below, Triglycerides was significantly higher in athletes vs non-athletes (203.99 ± 69.54 vs

173.28 ± 50.00 mg/dL; at $p = 0.035$), while total cholesterol, HDL-C, and LDL-C were lower in

athletes but differences were not statistically significant ($p > 0.05$)

Table 2: Lipid Profile by Athletic Status

Parameter	Non-athletes (Mean $\pm$ SD)	Athletes (Mean $\pm$ SD)	t-test	P-value
Triglycerides (mg/dL)	173.28 $\pm$ 50.00	203.99 $\pm$ 69.54	-2.151	0.035
Total Cholesterol (mg/dL)	148.92 $\pm$ 28.22	135.98 $\pm$ 56.11	1.236	0.221
HDL-C (mg/dL)	44.68 $\pm$ 8.47	40.79 $\pm$ 16.83	1.236	0.220
LDL-C (mg/dL)	69.59 $\pm$ 22.49	54.39 $\pm$ 46.79	1.756	0.083

Note: HDL-C = High density Lipoprotein Cholesterol; LDL-C = Low density lipoprotein Cholesterol. Values are mean $\pm$ Standard deviation. Independent samples t-test was used. Statistical significance set at $p < 0.05$.

The lipid profile by gender and activity status is presented in Table 3. There were statistically significant differences across the four groups for all lipid parameters ($p < 0.001$ for all).

Male athletes had the highest TG levels (231.28 $\pm$ 41.09 mg/dL), while female athletes had the lowest (108.46 $\pm$ 65.27 mg/dL)

Female athletes had the highest TC (194.78 $\pm$ 84.80

mg/dL), HDL-C (58.43 $\pm$ 25.44 mg/dL), and LDL-C (114.65 $\pm$ 65.24 mg/dL).

Conversely, male athletes had the lowest TC (119.19 $\pm$ 29.99 mg/dL), HDL-C (35.76 $\pm$ 9.00 mg/dL), and LDL-C (37.18 $\pm$ 18.73 mg/dL).

This suggests that the effect of athletic status on lipid profile is modified by sex.

Table 3: Lipid Profile by Gender and Activity Status

Parameter	Non-athlete Males (Mean $\pm$ SD)	Non-athlete Females (Mean $\pm$ SD)	Athlete Males (Mean $\pm$ SD)	Athlete Females (Mean $\pm$ SD)	F -Value	P - Value
Triglyceride (TG) (mg/dL)	195.03 $\pm$ 45.99	146.11 $\pm$ 41.66	231.28 $\pm$ 41.09	108.46 $\pm$ 65.27	21.139	<0.001
Total Cholesterol (TC)	148.26 $\pm$ 34.80	149.75 $\pm$ 17.96	119.19 $\pm$ 29.99	194.78 $\pm$ 84.80	8.534	<0.001

(mg/dL)							
HDL- Cholesterol (mg/dL)	44.48 10.44	± 5.39	44.93 5.39	± 9.00	35.76 9.00	58.43 ± 25.44	8.536 <0.001
LDL- Cholesterol (mg/dL)	64.77 28.26	± 9.97	75.60 9.97	± 18.73	37.18 18.73	114.65 ± 65.24	17.238 <0.001

Note: HDL = high density lipoprotein; LDL = low density lipoprotein. Values are mean ± Standard deviation. One-way ANOVA was used. Statistical significance set at $p < 0.05$.

Lipid Profile by Age among Athletes

From table 4 below, among athletes lipid concentrations did not differ significantly across the three age categories: triglycerides, $F = 0.835$, $p =$

0.443; total cholesterol, $F = 2.181$, $p = 0.129$; high-density lipoprotein cholesterol, $F = 2.182$, $p = 0.129$; and low-density lipoprotein cholesterol, $F = 1.953$, $p = 0.158$.

Table 4: Lipid Profile by Age among Athletes

Parameter	16–20 years (Mean ± SD)	21–25 years M ± SD	≥26 years (M ± SD)	F - Value	P-value
Triglycerides (mg/dL)	219.40 ± 19.01	183.63 ± 70.04	191.65 ± 49.06	0.835	0.443
Total cholesterol (mg/dL)	101.48 ± 17.49	151.34 ± 64.78	125.97 ± 42.23	2.181	0.129
HDL Cholesterol (mg/dL)	30.44 ± 5.25	45.40 ± 19.43	37.79 ± 12.67	2.182	0.129
LDL Cholesterol (mg/dL)	27.16 ± 16.01	66.63 ± 54.16	46.25 ± 35.73	1.953	0.158

Note. HDL = high-density lipoprotein; LDL = low-density lipoprotein.

Lipid Profile by Sporting Activity

From table 5 below, triglyceride concentrations did not differ significantly across footballers, gym instructors, and basketballers, $F = 1.705$, $p = 0.197$.

Total cholesterol and high-density lipoprotein cholesterol comparisons were reported as $F = 2.940$, $p = 0.067$, whereas low-density lipoprotein cholesterol differed significantly across sporting categories, $F = 3.307$, $p = 0.049$.

Table 5: Lipid Profile by Sporting Activity

Parameter	Footballers (Mean $\pm$ SD)	Gym instructors (Mean $\pm$ SD)	Basketballers (Mean $\pm$ SD)	F - Value	P-value
Triglycerides (TG) (mg/dL)	177.61 $\pm$ 71.97	212.47 $\pm$ 8.27	216.40 $\pm$ 19.20	1.705	0.197
Total Cholesterol (TC) (mg/dL)	153.05 $\pm$ 62.70	105.97 $\pm$ 31.63	113.43 $\pm$ 28.13	2.940	0.067
HDL Cholesterol (mg/dL)	45.91 $\pm$ 18.81	31.79 $\pm$ 9.49	34.03 $\pm$ 8.44	2.940	0.067
LDL Cholesterol (mg/dL)	69.27 $\pm$ 53.19	27.19 $\pm$ 16.03	36.12 $\pm$ 22.83	3.307	0.049

Note. HDL = high-density lipoprotein; LDL = low-density lipoprotein.

Discussion

This study found that athletes had significantly higher TG concentrations than non-athletes. This contrasts with established evidence that regular aerobic exercise reduces TGs.¹³ The discrepancy may be explained by differences in training intensity, timing of blood sampling relative to exercise, dietary habits, fasting status, recovery period, and heterogeneity within the athlete group. Acute exercise and high carbohydrate intake can transiently elevate TGs, which may have influenced our results.

Although, athletes had lower mean TC and LDL-C than non-athletes, the differences were not statistically significant. This trend is consistent with the known lipid-modifying effects of physical activity.^{14,15} However, the lack of significance suggests that athletic status alone was insufficient to produce clinically meaningful changes in cholesterol in this population. Similarly, non-significant findings have been reported in studies with small sample sizes and varied training schedules.¹⁶

Unexpectedly, HDL-C was lower in athletes than non-athletes. HDL-C was lower in athletes than in non-athletes. HDL-C response to exercise is variable and influenced by exercise volume, body

composition, diet, sex, and genetics.¹⁷ It is possible that the training load in this cohort was below the threshold needed to raise HDL-C, or that dietary factors masked the effect.

Gender-stratified analysis showed that male athletes had the highest TGs, while female athletes had the highest HDL-C and LDL-C. These differences may reflect sex-related physiology, but could also be confounded by unequal subgroup sizes, diet, hormonal status, body composition, and sport type.^{18,19}

No significant age-related differences in lipids were observed among athletes. This may be due to the narrow age range and small subgroup sizes, which limited statistical power. It may also indicate that training exposure was more influential than age in this young university population.¹⁶

Sport-specific analysis showed significant differences in LDL-C across sports. However, without data on participants per sport, training volume, frequency, body composition, and diet, these findings should be interpreted cautiously. Sport type may serve as a proxy for multiple behavioral and physiological factors that affect lipid metabolism.¹⁵

Strengths and Limitations

This study has several limitations. The cross-sectional design precludes establishing causal relationships between sporting activity and lipid parameters. Additionally, the modest sample size and lack of detailed data on dietary intake, training volume, and body composition may have influenced the findings. Despite these limitations, the study provides valuable local data comparing lipid profiles of athletes and non-athletes within a university setting.

Conclusion

Regular sporting activity is associated with a more favorable lipid profile among young adults. Gender, age, and type of sporting activity were significant determinants of lipid parameters. Promoting regular physical exercise among university students may serve as an effective strategy for reducing cardiovascular risk in this population.

Recommendations

1. **Health Promotion:** University health authorities should implement programs that encourage regular participation in sporting activities among students to promote favorable lipid profiles and reduce long-term cardiovascular risk.
2. **Targeted Interventions:** Health education and screening programs should consider gender and age differences, as these were found to significantly influence lipid parameters.
3. **Future Research:** Further longitudinal studies with larger samples sizes are recommended. Future studies should incorporate detailed assessment of dietary patterns, training volume, and body composition to better elucidate the relationship between sporting activity and lipid metabolism.
4. **Routine Screening:** Periodic lipid profile screening should be encouraged for students,

particularly non-athletes and those with other cardiovascular risk factors, to enable early detection and intervention.

Competing Interests

The authors declare that they have no financial or personal relationship(s) which may have inappropriately influenced them in writing this paper.

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Data Availability

On appropriate request.

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