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Waist-To-Hip Ratio and Serum Lipid Profile of Male 400-Level Students in Human Nutrition and Dietetics at Ambrose Alli University, Ekpoma

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ABSTRACT

Abnormal body fat distribution and dyslipidemia are recognized risk factors for cardiovascular and metabolic diseases, even among young adults who are presumed to be healthy. However, limited data exist on the waist-hip ratio and serum lipid profile of university students in Nigeria, particularly those studying nutrition-related disciplines. This study investigated the waist-hip ratio and serum lipid profile of male 400 level students in Human Nutrition and Dietetics in Ambrose Alli University, Ekpoma, Edo State. A total of twenty-four (24) apparently healthy adult male undergraduate students attending Ambrose Alli University, Ekpoma, were recruited for this study. The waist-hip ratio and serum lipid profile of the participants were determined using standard procedures. All data was subjected to statistical analysis using SPSS version 26. From the result, it can be seen that the waist-to-hip ratio, total cholesterol, triglycerides and Low-density lipoprotein cholesterol were 0.82 ± 0.11 , 68.67 ± 16.72 mg/dl, 79.40 ± 43.91 mg/dl and 52.77 ± 17.97 mg/dl. Majority of the participants were of normal weight (83.35) while the prevalence of overweight and obesity amongst the participants were 8.3% and 8.3% respectively. All participants had desirable/optimal total cholesterol and LDL-cholesterol while the majority of the participants (83.3%) had optimal triglycerides.

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There was no significant ($p > 0.05$) relationship between waist-hip ratio and serum lipid profile. It can be concluded that majority of the participants were healthy, well-nourished and at low risk of developing health complications. Nonetheless, maintaining healthy lifestyle and dietary practices is recommended, while individuals with abnormal waist-hip ratio or lipid profile should adopt appropriate dietary and lifestyle modifications to ensure optimal health outcomes.

Keywords: Waist-hip ratio, Serum lipid profile, University students, Cardiovascular risk, Nutritional status, Dyslipidemia.

1. INTRODUCTION

1.1. Background and Review

The waist-to-hip ratio (WHR) is a measure of body composition that has been extensively used in public health research as a predictor of chronic disease risk, particularly cardiovascular disease (Balkau et al., 2007; Geng et al., 2018). The ratio is calculated by dividing the waist circumference by the hip circumference. The higher the ratio, the more likely an individual is to have excess abdominal fat, which is associated with an increased risk of metabolic syndrome, type 2 diabetes, cardiovascular disease, and other chronic conditions.

Serum lipid profile, on the other hand, is a set of laboratory measurements that assess the levels of cholesterol, triglycerides, and other lipids in the blood. Elevated levels of these lipids have been linked to an increased risk of cardiovascular disease (Nordestgaard et al., 2010). Serum lipid profile is another important aspect of metabolic health.

Nutrition plays a key role in the prevention and management of chronic diseases, particularly cardiovascular disease (Tyrovola et al., 2023). A healthy diet that is low in saturated and trans fats and rich in whole grains, fruits, vegetables, and lean protein sources can help to reduce serum lipid levels and improve cardiovascular health (Cena and Calder, 2020; Feingold, 2021). Additionally, regular physical activity can help to reduce body fat, particularly abdominal fat, which can in turn reduce serum lipid levels and improve cardiovascular health (Paley and Johnson, 2018).

This project will provide important insights into the relationship between waist-to-hip ratio and serum lipid profile in young adult males. Certain dietary factors, such as saturated and trans fats, have been shown to increase serum lipid levels, while others, such as dietary fiber, have been shown to lower serum lipid levels (Mozaffarian et al., 2004; Jenkins et al., 2011). By examining the dietary habits of the study participants, we may be able to identify specific dietary factors that are associated with differences in WHR and serum lipid profile. This information can be used to inform dietary and lifestyle interventions aimed at reducing the risk of chronic disease and promoting overall health and well-being.

The research recruited a cohort of males between the ages of 18 and 30 years and measure their waist and hip circumferences as well as their serum lipid profile. We will then analyze the data to determine whether there is a correlation between these two variables.

The findings from the study contributed to the existing literature on the relationship between body composition and cardiovascular health. Additionally, this study informed public health strategies aimed at reducing the risk of chronic disease in young adult males. By identifying modifiable risk factors, such as waist-to-hip ratio, interventions can be targeted to promote healthy lifestyle behaviors and reduce the burden of chronic disease.

Studying the waist-hip ratio and serum lipid profile of male adults serves as a useful parameter in understanding the risk of developing several diseases such as cardiovascular diseases and diabetes mellitus in the study population (Seidell et al., 2001). This study will provide adequate data on the waist-hip ratio and serum lipid profile of male adults within Ambrose Alli University.

1.2. Novelty and Objective

Dyslipidemia, characterized by abnormal levels of serum lipids, is a significant risk factor for cardiovascular disease (Hedayatnia et al., 2020). Waist-to-hip ratio (WHR), a measure of body fat distribution, has been suggested as a potential indicator of lipid abnormalities and cardiovascular risk. However, limited research has focused specifically on the relationship between WHR and serum lipid profile in young male adults, a population vulnerable to early-onset cardiovascular disease. Therefore, there is a need to investigate the association between WHR and serum lipid profile in this population to better understand the potential role of WHR as a predictor and screening tool for lipid abnormalities and cardiovascular disease risk. By addressing this research gap, the findings will contribute to the development of targeted interventions and preventive strategies aimed at reducing cardiovascular disease burden in young male adults.

Despite the growing recognition of the importance of waist-to-hip ratio (WHR) as an indicator of central obesity, there is a lack of research exploring the relationship between WHR and serum lipid profile specifically in young male adults, a population at risk for early-onset dyslipidemia and cardiovascular disease. This gap in literature is what the present study seeks to address. Hence, the study aimed to evaluate the waist-to-hip ratio (WHR) and serum lipid profile of young male adults in Ambrose Alli University, Ekpoma, Edo State.

The specific objectives of the study include:

- To measure the waist-hip ratio and serum lipid profile (total cholesterol, LDL cholesterol, and triglycerides) of young adult males.
- To determine the prevalence of normal weight, overweight and obesity among the male participants based on waist-hip ratio.
- To determine the prevalence of dyslipidemia/abnormal lipid profile among the male participants.
- To evaluate the relationship between serum lipid profile parameters and WHR.

2. MATERIALS AND METHODS

2.1. Materials

2.1.1. Equipment/Apparatus

Auto-pipette, disposable pipette, sample bottles, disposable cuvettes, bottle cuvettes, pipette tips, syringe, centrifuge, photoelectric colorimeter, weight scale, stadiometer, accu-check strip, accu-check machine, lancets, cotton wool, methylated spirit, disposable gloves, Omron and Adron blood pressure machine, 1000ml and 100ml pipette, spectrophotometer.

2.1.2. Reagents/Non-reagents

Cholesterol kits (Randox CHOL R1), triglyceride kits (Randox TRIGS R1a), HCL-Cholesterol kit (Randox CHOL CAL) (Randox Laboratories Limited, United Kingdom).

2.2. Study Design and Participants

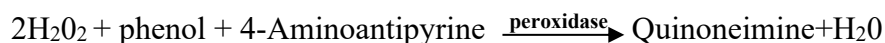
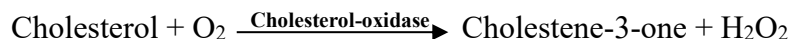
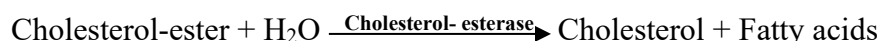
This study employed a cross-sectional research study design. A total of twenty-four (24) apparently healthy adult male undergraduate students attending Ambrose Alli University, Ekpoma, were recruited for this study without bias. The participants were briefed on the nature of the study and informed consent was obtained from the participants before taking part in this study. The participants were examined to ensure they were healthy and not on any form of medication or having any underlying illness.

2.3. Methods

2.3.1. Determination of total Cholesterol

Principle

The cholesterol is determined after enzymatic hydrolysis and oxidation. The indicator, quinoneimine is formed from hydrogen peroxide and 4-aminoantipyrine in the presence of phenol and peroxidase.



Procedure:

The method described by Roeschlau *et al.* (1974) was adopted for this study. About 10 μl of supernatant was measured into a plain container. 1000 μl of cholesterol reagent was added to it, mixed thoroughly and labelled "sample". Into another container, 1000 μl of reagent is measured. About 10 μl of standard was added to it, mixed thoroughly and labelled "standard". About 1000 μl of reagent blank was measured into the third plain container and was labelled "blank". It was mixed thoroughly also, incubated for 5 minutes at 37 °C. The absorbance of the sample and standard were measured with a spectrophotometer at 500 nm against the reagent blank within 60 seconds.

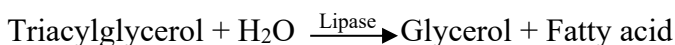
Calculation:

$$TC \text{ (mg/dL)} = \frac{\text{change in absorbance of sample}}{\text{change in absorbance of standard}} \times \text{concentration of standard}$$

2.3.2. Determination of serum triacylglycerol

Principle:

Serum triglyceride is determined after the enzymatic hydrolysis with lipases. The indicator is a quinoneimine formed from hydrogen peroxides, 4-aminophenazone and 4- chlorophenol under the catalytic influence of peroxidase.



Procedure:

The method described by Bucolo and David (1973) was adopted for this study. About 10 µl of distilled water was pipette into reagent blank test tube, 10 µl of the standard was also pipette into standard test tube. Sample of about 10 µl was pipette into sample test tube, while p- Chlorophenol (2 mmol/l) and Pipes Buffer (50 mmol/l, pH 7.2) reagent of 1000 µl each was pipette into reagent blank, standard and sample test tubes respectively. Mixture was incubated for about 5 minutes at 37 °C. Insert into the RX Monza flow cell holder and read within 60 seconds. The absorbance was read at 500 nm.

Calculation:

$$TG \text{ (mg/dL)} = \frac{\text{absorbance of sample}}{\text{absorbance of standard}} \times \text{concentration of standard}$$

2.3.3. Determination of serum low density lipoprotein cholesterol (LDL-C)

The LDL-C content of serum is determined using the Friedwald formula (Friedewald *et al*, 1972).

$$LDL\text{-C (mg/dL)} = \text{Total Cholesterol} - \text{HDL-C} - (\text{Triglycerides}/5)$$

2.4. Statistical Analysis

Data were subjected to analysis using IBM Statistical Package for Social Sciences (SPSS) Version 26. Categorical variables were presented as frequencies and percentages while continuous variables were presented as mean and standard deviation. Pearson correlation analysis was used to investigate the relationship between waist-to-hip ratio and lipid profile of the participants in this study with statistical significance flag when $p < 0.05$.

3. RESULT

Objective Addressed: To measure the waist-hip ratio and serum lipid profile (total cholesterol, LDL cholesterol, and triglycerides) of young adult males.

Anthropometric characteristics and serum lipid profile of male undergraduate students is presented in table 1. The mean waist-to-hip ratio and lipid profile of the male participants in Table 2 revealed a total cholesterol, triglycerides and Low-density lipoprotein cholesterol were 0.82 ± 0.11 , 68.67 ± 16.72 mg/dl, 79.40 ± 43.91 mg/dl and 52.77 ± 17.97 mg/dl. Data is presented as mean \pm standard deviation. LDL-C: Low-Density Lipoprotein Cholesterol.

Table 1. Anthropometric characteristics and serum lipid profile of male undergraduate students.

S/No	Waist (cm)	Hip (cm)	Waist/hip ratio	Total Cholesterol (mg/dl)	Triglyceride (mg/dl)	LDL-Cholesterol mg/dl
1.	76	98	0.78	59.81	77.39	44.33
2.	77	95	0.81	46.52	55.28	35.46
3.	67	83	0.81	66.45	55.28	55.39
4.	78	101	0.77	39.87	77.39	24.39
5.	98	93	1.05	ABS	ABS	ABS
6.	80	132	0.61	46.52	55.28	35.46
7.	114	108	1.06	59.81	55.28	48.75
8.	84	86	0.98	86.39	132.67	59.86
9.	74	82	0.90	86.39	88.44	68.70
10.	72	100	0.72	79.74	66.33	66.47
11.	84	106	0.79	59.81	33.17	53.18
12.	95	119	0.80	66.45	44.22	57.61
13.	93	118	0.79	59.81	44.22	50.97
14.	77	101	0.76	66.45	55.28	55.39
15.	63	80	0.79	73.10	66.33	59.83
16.	74	76	0.97	79.74	77.39	64.26
17.	71	90	0.79	112.97	88.44	95.28
18.	73	101	0.72	86.39	77.39	70.91
19.	79	94	0.84	ABS	77.39	ABS
20.	66	87	0.76	66.45	66.33	53.18
21.	62	84	0.74	73.10	55.28	62.04
22.	57	82	0.70	ABS	ABS	ABS

23.	75	88	0.85	53.16	210.06	11.15
24.	69	88	0.78	73.10	187.94	35.51

Source: Author's computation (2025)

Table 2. Waist-to-hip ratio and lipid profile of male participants.

Parameters	Value
Waist-to-hip ratio	0.82 ± 0.11
Total cholesterol (mg/dl)	68.67 ± 16.72
Triglycerides (mg/dl)	79.40 ± 43.91
LDL-C (mg/dl)	52.77 ± 17.97

Source: Author's computation (2025)

Objective Addressed: To determine the prevalence of normal weight, overweight and obesity among the male participants based on waist-hip ratio.

The distribution of the male participants is presented in Table 3. From the result, the majority of the participants were of normal weight (83.35) while the prevalence of overweight and obesity amongst the participants were 8.3% and 8.3% respectively.

Table 3. Distribution of male participants based on waist-to-hip ratio.

Category	Frequency (N)	Percentages (%)
Normal weight	20	83.3
Overweight	2	8.3
Obese	2	8.3

Source: Author's computation (2025)

Objective Addressed: To determine the prevalence of dyslipidemia/abnormal lipid profile among the male participants.

The distribution of male participants based on lipid profile is as seen in Table 4. All participants had desirable/optimal total cholesterol and LDL-cholesterol while the majority of the participants (83.3%) had optimal triglycerides.

Table 4. Distribution of male participants based on lipid profile.

Lipid Profile Parameters	Category	Frequency (N)	Percentages (%)
Total Cholesterol	Desirable	21	87.5
Triglycerides	Optimal	20	83.3
	Borderline High	1	4.2
	High	1	4.2
LDL-C	Optimal	21	87.5

Source: Author's computation (2025)

Objective Addressed: To evaluate the relationship between serum lipid profile parameters and WHR.

The result of the correlation between waist-to-hip ratio and serum lipid profile of male participants is presented in Table 5, from the result it is observed that there is a significant ($p < 0.05$) positive relationship between serum total cholesterol and low-density lipoprotein cholesterol. There was no significant ($p > 0.05$) relationship between other variables.

Table 5. Correlation between waist-to-hip ratio and serum lipid profile of male participants.

	Waist-to-hip ratio	Total cholesterol	Triglycerides	LDL-C
Waist-to-hip ratio		0.180	0.193	0.070
Total cholesterol	0.180		0.125	0.868**
Triglycerides	0.193	.125		-0.384
LDL-C	0.070	0.868**	-0.384	

Source: Author's computation (2025)

The distribution of the male participants is presented in Table 6. From the result, the majority of the participants were of normal weight (83.35) while the prevalence of overweight and obesity amongst the participants were 8.3% and 8.3% respectively.

Table 6. Distribution of male participants based on waist-to-hip ratio.

Category	Frequency (N)	Percentages (%)
Normal weight	20	83.3
Overweight	2	8.3
Obese	2	8.3

Source: Author's computation (2025)

The distribution of male participants based on lipid profile is as seen in Table 7. All participants had desirable/optimal total cholesterol and LDL-cholesterol while the majority of the participants (83.3%) had optimal triglycerides.

Table 7. Distribution of male participants based on lipid profile.

Lipid Profile Parameters	Category	Frequency (N)	Percentages (%)
Total Cholesterol	Desirable	21	87.5
Triglycerides	Optimal	20	83.3
	Borderline High	1	4.2
	High	1	4.2
LDL-C	Optimal	21	87.5

Source: Author’s computation (2025)

The result of the correlation between waist-to-hip ratio and serum lipid profile of male participants is presented in Table 8. From the result, it is observed that there is a significant ($p < 0.05$) positive relationship between serum total cholesterol and low-density lipoprotein cholesterol. There was no significant ($p > 0.05$) relationship between other variables.

Table 8. Correlation between waist-to-hip ratio and serum lipid profile of male participants.

	Waist-to-hip ratio	Total cholesterol	Triglycerides	LDL-C
Waist-to-hip ratio		0.180	0.193	0.070
Total cholesterol	0.180		0.125	0.868**
Triglycerides	0.193	.125		-0.384
LDL-C	0.070	0.868**	-0.384	

Source: Author’s computation (2025)

4. DISCUSSION

This study investigated the waist-hip ratio and serum lipid profile of male undergraduate students in Ambrose Alli University, Ekpoma, Edo State. The result on the waist-hip ratio and serum lipid profile reveals that the mean values for these parameters were within the normal ranges. Olabisi *et al.* (2018) had earlier reported that poor nutritional status was associated with abnormal serum lipid profile (high total cholesterol and low-density lipoprotein cholesterol levels). In another study, Bilgili *et al.* (2009) reports that serum lipid profile of children was significantly correlated with body composition. The result from this present study indicates that these participants are considerably healthy and well nourished.

Further analysis revealed that the majority of the participants were of normal weight and had normal serum lipid profiles. These findings further validate the initial results and suggestions that the participants in this study can be perceived as being adequately nourished. The waist-hip ratio and serum lipid profile are often considered as good indicators of health risk especially with regards to developing cardiovascular diseases and obesity (Bacopoulou *et al.*, 2015; Shabana and Sarwar, 2020; Habanova *et al.*, 2022; Singh *et al.*, 2022).

The result of the correlational analysis revealed that the waist-hip ratio had no significant relationship with any of the serum lipid parameters. This result, despite agreeing with some studies, contradicts those of some other authors. In one study by Reddy *et al.* (2014), it was reported that waist-hip ratio had no significant ($p > 0.05$) relationship with serum lipid profile. On the other end of the spectrum, studies by Sandhu *et al.* (2008), Mallick *et al.* (2018) and Tsai *et al.* (2019) all report that serum lipid profile was significantly ($p < 0.05$) related with waist-hip ratio. The result of this present study is indicative to the fact that the serum lipid profile and waist-hip ratio of the participants may be influenced by several other factors not covered within this study.

5. CONCLUSION AND RECOMMENDATION

Based on the findings of this study, it can be concluded that the majority of the participants were healthy, well-nourished, and at low risk of developing health-related complications. Nevertheless, it is recommended that they maintain their current lifestyle and dietary practices in order to prevent adverse outcomes that could negatively affect their health status and overall quality of life.

- In accordance with the findings of this study, the following recommendations are made: Health workers should intensify public health outreach programs aimed at educating individuals on the importance of healthy living and appropriate dietary practices.
- Further studies involving a larger sample population are recommended to assess the prevalence of overweight, obesity, and dyslipidemia on a broader scale.

STATEMENTS AND DECLARATIONS

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Competing Interests

“The authors have no relevant financial or non-financial interests to disclose.”

Author Contributions

“The author contributed to the study conception and design. All material preparation, data collection and analysis were performed by Eunice Imotsekemhe Tendi.”

Ethics Approval: Ethical approval for this study was obtained from the Research Ethics Committee of Ambrose Alli University, Ekpoma, Edo State.

Consent to Participate: Written informed consent was obtained from all participants prior to the study.

Consent for Publication: All participants provided consent for the publication of anonymized data.

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