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EDITORIAL

The west African Journal of Physical and Health Education (WAJOPHE) is an interdisciplinary journal that publishes articles, findings and position papers on various issues in Physical and Health Education, Recreation, Sports and Dance, and other health related professionals contribute towards the full development of man and his environment especially with regards to the entire West African Sub-region.

In this era, it is vital that we continue to assemble interdisciplinary solutions that explore every horizon hence the volume 23 of this Journal features the many articles including:

- Effect of Solution Focused Brief Therapy on Resilience of Athletes in Lagos State
- The Positives and Negatives of Athletes' Social Media Use
- Administrative and Psycho-social Determinants of Students' Participation in Secondary School Sports in Ibarapa, Oyo State
- Smart Fitness Management Software for Improving Adherence and Safety among Gym Users in Nigeria
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- Perceived Effects of Increasing Football Organisation Performance through Effective Talent Recruitment Management
- Impact Assessment of Psychosocial Intervention on Academic Motivation and Engagement among Unintended Sports Science Students in South-West Universities, Nigeria
- Sports and Health Development Bank: Platform for Accelerating Sports and Allied Fields Growth
- Socioecological Barriers to Sustained Podium Performance among Programmed Athletes in Nigeria
- Exploring the Impact of Recreational Activities on Work Stress Coping Strategies and Well-being Among Female Non-academic Staff at The University of Benin.
- Influence of Sports Administrators' Inputs on Grassroots Sports Development in the Delta South Senatorial District of Delta State
- Predictors of Participation in Recreational Activities among Academic Staff in Public Universities in Southern Cross River State, Nigeria

I express my profound gratitude to all the contributors as well as various people that made the editorial transition smooth. I also appreciate their patience in making the publication of this volume possible and worthwhile. I also want to thank the efforts of Professor A.O Fadoju and the past heads of the Department of Human Kinetics, University of Ibadan towards the publication of previous editions

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NORM-REFERENCED COMPARISONS OF SELECTED PHYSICAL AND CARDIOVASCULAR MARKERS OF HEALTH AMONG STUDENTS IN A NIGERIAN UNIVERSITY

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Abstract

Regular assessment of physical and cardiovascular markers of health can provide useful information on the quality of life, overall health and well-being of university students. This study evaluated the physical and cardiovascular health markers of undergraduate at the University of Ilorin, Nigeria, through norm-referenced comparisons.

Utilising a cross-sectional design to select 500 participants, the study compared several key health markers; fasting blood glucose (FBG), blood pressure (BP), body fat percentage (%BF), cardiorespiratory fitness (VO_2Max), resting heart rate (RHR), and muscular strength (MS) against established norm values. Standardized instruments were used for all measurements, and the study adhered to ISAK and WHO protocols. Data were collected using glucometers (ACCU-CHEK, Germany) for FBG, an Omron digital sphygmomanometer (Omron-M6, China) for BP and RHR, Harpenden skinfold calipers (UK) for body fat percentage, and electronic hand dynamometer (Camry EH101, China) for muscular strength. VO_2Max was estimated using the UTH-Sørensen-Overgaard-Pedersen formula, based on heart rate data. All the data was normally distributed as indicated by Kolmogorov -Smirnov test ($p \geq .05$).

Findings revealed significant differences between the sample and norm reference values. Students exhibited elevated systolic and diastolic blood pressure (132.27 mmHg and 91.54 mmHg), classifying them as pre-hypertensive, and body fat percentages, especially among female students, exceeded recommended ranges (31.32% compared to 18–28%). Both male and female students' demonstrated suboptimal VO_2Max levels (37.81 ml/kg/min and 29.29 ml/kg/min, respectively), indicating poor cardiovascular fitness. Muscular strength was also found to be below the expected norms, with male students averaging 41.6 kg and female students 23.2 kg. However, FBG levels were normal (90.70 ± 6.65 mg/dL).

The study concludes that there are significant health concerns, particularly hypertension and excessive body fat in female students. Regular fitness assessments, promoting physical activity

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through campus-wide programmes, and addressing stress and lifestyle factors through targeted interventions is recommended. .

Keywords: Physical health, cardiovascular markers, university students, blood pressure, VO_2Max, body fat percentage, muscular strength, Nigeria.

Introduction

Cardiovascular health is an essential marker of overall health and wellbeing, particularly among young adults in higher education, where lifestyle behaviours often influence long-term health outcomes. Cardiorespiratory fitness, a strong predictor of cardiovascular health, reflects the ability of the circulatory and respiratory systems to supply oxygen during sustained physical activity (American College of Sports Medicine [ACSM], 2021). Norm-referenced values indicate that a healthy maximal oxygen uptake (VO_2Max) for university-aged males ranges between 42–46 mL/kg/min and for females between 35–40 mL/kg/min (Heyward and Gibson, 2019). The relationship between VO2max and disease prevention is well-established, with studies indicating that individuals with higher cardiorespiratory fitness levels, as indicated by VO2max, have better health outcomes and lower mortality rates (Ayenigbara, 2023). However, studies among Nigerian university students reveal suboptimal cardiorespiratory fitness levels, with many failing to meet these normative thresholds due to sedentary behaviour and reduced engagement in structured physical activity (Ene-Obong et al., 2021; Adedoyin et al., 2010).

Blood pressure (BP) is another critical cardiovascular marker. Blood pressure is a measure of the force of circulating blood on arterial walls, with sustained elevation constituting hypertension, a leading risk factor for cardiovascular disease. The norm-referenced standard for healthy adults is <120/80 mmHg, with values ≥130/85 mmHg classified as pre-hypertensive and ≥140/90 mmHg as hypertensive (World Health Organization [WHO], 2021). Empirical evidence among Nigerian university students indicates rising cases of pre-hypertension and hypertension, attributed to poor dietary patterns, stress, and physical inactivity (Chukwuonye et al., 2013; Oghagbon and Okesina, 2006). These findings suggest that blood pressure abnormalities are becoming increasingly prevalent in young adult populations, which traditionally were assumed to be at low risk.

Resting heart rate (RHR), a simple but informative cardiovascular marker, provides information on autonomic function and cardiovascular efficiency. It is defined as the number of times the heart beats in a minute and represented as beats per minute(bpm) The norm-referenced range for healthy young adults is 60–80 beats per minute, with lower values indicating better cardiovascular functioning (Shephard, 2016). Studies among Nigerian undergraduates have demonstrated that many exhibit resting heart rates above the recommended normative range, a situation linked to low fitness levels and stress-related lifestyle factors (Awotidebe et al., 2014). Higher resting heart rate has been reported in university students especially among female students (Ali, Kathak, Fariha,

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Taher, & Islam, 2023). Elevated resting heart rate in young adults may predispose them to cardiovascular risk later in life.

In addition, fasting blood sugar (FBS) levels also serve as a critical marker of cardiovascular and metabolic health. Fasting blood sugar (FBS), also known as fasting blood glucose, is the measurement of the amount of glucose present in the blood after an individual has abstained from eating or drinking (except water) for at least 8 hours. According to international standards, the norm-referenced fasting blood glucose range is 70–99 mg/dL, with 100–125 mg/dL indicating pre-diabetes and ≥126 mg/dL diagnostic of diabetes mellitus (American Diabetes Association [ADA], 2022). Recent findings among Nigerian university students have reported increasing prevalence of impaired fasting glucose, suggesting a growing risk of type 2 diabetes within this population (Sanya et al., 2016).

Body composition is a key marker of physical health and is defined as the relative proportion of fat and lean mass in the body, with the body mass index (BMI) serving as a widely used reference. Norm-referenced BMI values classify 18.5–24.9 kg/m² as normal, 25–29.9 kg/m² as overweight, and ≥30 kg/m² as obese (WHO, 2021). A ten-year retrospective review of medical records of students (undergraduate and post-graduate) admitted between 2009 and 2018 at the University of Ibadan (UI), Nigeria, established a higher prevalence of overweight and obesity than underweight among the participants (Oluwasanu, Akinyemi & Oluwasanu, 2023). Furthermore, high overweight and obesity prevalence was reported among undergraduates in Kano University students, Nigeria (Isyaku, Mabaruka, Nafisa & Salisu, 2020). Generally, overweight and obesity prevalence has been reported to range between 10% and 20% in Nigeria university students.

Similarly, body fat percentage (%BF) provides a more accurate indicator of adiposity than BMI. Normative values for young adult males are typically 10–20%, while for females the healthy range is 18–28% (ACSM, 2021). Evidence suggests that Nigerian university students often exhibit body fat percentages exceeding these recommended thresholds, placing them at increased risk of cardiometabolic disorders (Sanya et al., 2016).reflecting an emerging concern associated with physical inactivity and dietary transition (Desalu et al., 2008; Musa et al., 2012).

Muscular strength is another important physical marker of health, strongly associated with functional capacity and reduced risk of chronic disease. Muscular strength (MS) is defined as the amount of force that can be generated in a cross section of muscle fibre. Norm-referenced values suggest that for university-aged males, average handgrip strength ranges from 40–50 kg, while for females it ranges from 25–30 kg (Dodds et al., 2014). However, studies on Nigerian students reveal comparatively lower strength values, often linked to limited engagement in resistance training and sedentary lifestyles (Awotidebe et al., 2014). Reduced muscular strength at a young age may predispose individuals to functional limitations later in life.

Given these health concerns, the University of Ilorin, with an estimated population of over 49,000 students as at year 2025, represents a critical setting for health evaluation. Despite its size, empirical reports on physical and cardiovascular markers of health in Nigerian undergraduates,

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specifically, university of Ilorin are scanty. This gap has called for urgent need to generate empirical evidence that will inform targeted interventions aimed at mitigating emerging health risks in this population.

Objectives of the Study

This study seeks to compare the sample mean values of the physical and cardiovascular markers of health to norm-referenced values:

1. Cardiorespiratory fitness($V0_2Max$)
2. Blood Pressure(systolic and diastolic)
3. Resting Heart Rate(RHR)
4. Fasting Blood Glucose(FBG
5. Body composition((BMI and %BF)
6. Muscular Strength(MS)

Research Questions

1. What is the mean value of $V0_2Max$ of undergraduates in University of Ilorin?
2. What is the sample average Blood Pressure (systolic and diastolic
3. What is the sample mean Resting Heart Rate?
4. What is the sample mean fasting Blood Glucose?
5. What is the mean value of body composition (%BF and BMI)?
6. What is the mean value of muscular strength (MS)?

Hypotheses

1. There is no statistically significance difference in the mean $V0_2Max$ of the sample and norm-referenced value
2. There is no statistically significance difference in mean blood pressure of the sample and norm-referenced value
3. There is no statistically significance difference in the mean resting heart rate of the sample and norm-referenced value
4. There is no statistically significance difference in the mean fasting blood glucose of the sample and norm-referenced value
5. There is no statistically significant difference between the mean %BF of the sample and the norm-referenced value
6. There is no statistically significance difference in mean muscular strength of the sample and norm reference value

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Methodology

This study adopted a descriptive cross-sectional research design. This design was considered appropriate because it allows for the assessment of selected cardiovascular and physical health markers among university students at a single point in time, using norm-referenced comparisons as the basis for evaluation.

Population

The target population comprised undergraduate students of the University of Ilorin, Nigeria, with an estimated enrolment of approximately 50,000 students across different faculties and programmes (University of Ilorin, 2025).

Sample and Sampling Technique

The sample size for this study was determined using Krejcie and Morgan (1970) sample determination formula; $s = \frac{X^2.N.P\ (1-P)}{d^2\ (N-1) + X^2.P\ (1-P)}$

where; s = required sample size, X^2 = table value for Chi-square for 1 degree of freedom at the desired confidence level(3.841 for 0.95 confidence level), N = population size, P = population proportion(assumed to be 0.50 as this provides maximum sample size), d = degree of accuracy expressed as a proportion(usually,0.05).

Participants were selected using a multistage sampling procedure. At the first stage, faculties were stratified into three categories (Science-based, Arts-based, and Social Science-based). At the second stage, Departments within each category were randomly selected. At the final stage, proportionate stratified random sampling was employed to recruit participants by gender (male and female) and year of study. Based on the calculation, approximately 400 sample size was required. However, to enhance external validity, 500 participants were recruited for this study (250 males and, 250 females). Inclusion criteria were; (i) being a registered full-time undergraduate student (ii) aged 16 years above (iii) must not have registered in a gym at least 3 months prior to this study, (iv) must not be participating in any routine physical activity at least 3 months prior to recruitment for this study (v) must not be on medication or being treated for any medical condition prior to recruitment (vi) must sign informed consent form. All students who did not meet these inclusion criteria were excluded from participation in this study.

Procedure for Data Collection

- VO_2max was assessed using the UTH-SORENEN OVERGAARD- PEDERSEN estimation. Maximal heart rate divided by resting heart rate multiplied by 15.3; $VO_{2max} = HR_{max}/HR_{rest}$ X 15.3 (Uth, Sørensen, Overgaard & Pedersen, 2004). Maximal heart rate was obtained by subtracting age of the participant from 220 (Fox, Naughton and Haskell,

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1971). The values obtained was recorded in ml/kg/mins for each participant. The blood pressure and resting heart rate of the participants were measured using an Omron digital sphygmomanometer (Omron-M6, China). Prior to the measurement, each participant was instructed to remain seated quietly in a relaxed position for at least ten minutes to ensure stabilisation of cardiovascular responses. The participants were seated on a chair with their back supported and both feet placed flat on the floor, avoiding crossing of the legs. The non-dominant arm was positioned comfortably on a table at heart level with the palm facing upward. The appropriate cuff size was selected according to the participant's arm circumference, and the cuff was wrapped snugly around the upper arm, ensuring that it was not too tight or too loose. Participants were advised to avoid talking or moving during the procedure to prevent inaccurate readings. Once the device was activated, the Omron sphygmomanometer automatically inflated the cuff, measured the blood pressure and heart rate, and displayed the values on the digital screen. For accuracy, two readings were taken with an interval of two minutes, and the average was recorded as the participant's resting heart rate and blood pressure values to the nearest 0.1 bpm and mmHg respectively. To assess body composition, skinfold measurements were conducted at 3-sites using Harpenden skinfold caliper to estimate body fat percentage. Participants were asked to stand in a relaxed upright position, with minimal clothing to allow easy access to the measurement sites. Using the thumb and index finger, the researcher grasped a vertical fold of skin and subcutaneous fat, ensuring no muscle was included, and gently pulled it away from the underlying tissue. The caliper was then applied approximately 1 cm below the fingers, maintaining pressure while the reading was allowed to stabilise for 2–3 seconds before being recorded to the nearest 0.1 mm. In addition, BMI of the participant was calculated using their weight and height (kg/m). The weight was divided by the square of the height and recorded to nearest 0.1 kg/m^2. Norm-referenced BMI values classify 18.5–24.9 kg/m^2 as normal, 25–29.9 kg/m^2 as overweight, and ≥30 kg/m^2 as obese (WHO, 2021). For body fat percentage, normal value for young adults male ranges between 10-20%, while for females the healthy range is 18–28% (ACSM, 2021).

Fasting blood sugar was measured to assess the participants' glucose levels after an overnight fast of at least 8–10 hours. Participants were instructed not to eat or drink anything except water during the fasting period. On arrival at the testing venue in the morning, they were seated comfortably, and their hands were cleaned with an alcohol swab to maintain hygiene. A sterile lancet was then used to obtain a small drop of capillary blood from the fingertip, usually the index or middle finger. The first drop of blood was wiped away to ensure accuracy, and the second drop was placed on a glucose test strip already inserted into a calibrated glucometer (ACCU-CHEK, Germany). The device automatically analysed the sample, and the fasting blood sugar level was displayed in milligrams per decilitre (mg/dL) within a few seconds. The reading was recorded immediately for each participant. To ensure reliability, the glucometer was checked for proper functioning before use, and all procedures were conducted under sterile conditions to minimise risk of infection, normal reference value ranges between 75-100 mg/dL)

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To measure muscular strength (hand grip strength), electronic hand dynamometer (Camry EH101, China) was used. The participant was asked to sit comfortably or stand upright with their arm supported at heart level. They were instructed to squeeze the dynamometer as hard as possible for three to five seconds without moving the rest of the body. The test was repeated three times for each hand, with short rests (30 seconds) between trials. The average score was recorded and compared with reference values for age and sex to evaluate strength. Maximum grip strength was recorded in kilogrammes (kg). The mean values of all the variables assessed were compared to the norm reference values to make inference.

Procedure for Data Analysis

Percentage mean and standard deviation was used to describe the data demographic data, a one-sample t-test was used to compare the sample's mean with the midpoint of the norm-referenced value ranges (calculated as the average of the lower and upper limits of each range). These midpoints were used as the population (norm) values for the t-test. For each test, the degrees of freedom (dF) was calculated as dF =N−1, and the p-value was determined. A significance level of 0.05 was used to assess the results. If the p-value was below 0.05, the null hypothesis was rejected, indicating a significant difference between the sample mean and the midpoint of the norm-referenced value. If the p-value exceeded 0.05, the null hypothesis was not rejected, suggesting no significant difference.

Results

This study compared norm reference values of physical and cardiovascular markers of health in undergraduates of university of Ilorin. The table below shows the age distribution of the participants for this study

Table 1: Age and Gender Distribution of the Participants

Age Range (yrs.)	Frequency	Percentage	Gender	Frequency	Percentage
21-25	199	39.8	Male	250	50.0
26-30yrs	61	12.2	Female	250	50.0
31yrs above	39	7.8	**Total**	**500**	**100.0**
16-20	201	40.2			
Total	**500**	**100.0**			

Table 1 shows that most of the participants 201(40.0%) were aged between 16 to 20 years old and closely followed by the age bracket of 21-25(39.8%). In other age categories, 61(12.2%) aged between 26-30 and just 39(7.8%) were above 31 years old. It can be deduced that majority of the

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students were 16-25yrs old. This implies that undergraduates in university of Ilorin were young adults based on World Health Organisation classification (2017).

Table 2: Mean and Values for all the Selected Physical and Cardiovascular Markers of Health

Variable	N= 500	$\bar{x}$ ±S.D	Norm Reference value
FBG		90.70±6.65	75-100mg/dL
SDP		132.27±9.82	120mmHg
DBP		91.54±.26	80mmHg
%BF(Male)		18.45±2.03	10-20%
%BF(Female)		31.32.74±1.19	18-28%
$V0_2$Max(Male)		37.81±3.79	42-46ml/kg/min
$V0_2$Max(Male)		29.29±6.61	35-49ml/kg/min
RHR		79.17±5.82	60-100bpm
MS(Male)		41.6.31±6.712	45-50kg
MS(Female)		23.2.81±5.27	25-30kg
Total		**500**	

Key: FBG; Fasting Blood Glucose, **SDP;** Systolic Blood Pressure, **DBP;** Male)Diastolic Blood Pressure, **%BF(Male);** Body fat percent for male, **%BF(Female)**; Body fat percent for male, **$V0_2$Max(Male)**; Maximal Oxygen Volume for Male, **$V0_2$Max(Male)**; **RHR:** Resting Heart Rate, **MS(Male);** Muscular Strength for Male, **MS(Female);** Muscular Strength for Female

Answers to Research Questions

Table 2 shows that the participants' mean FBG levels (90.70 ± 6.65 mg/dL) fall within the normal reference range of 75–100 mg/dL. Systolic blood pressure (132.27 ± 9.82 mmHg) exceeds the normal reference of 120 mmHg, indicating a higher than typical reading. The diastolic blood pressure (91.54 ± 0.26 mmHg) also exceeds the normal reference value of 80 mmHg, suggesting a possible risk for cardiovascular health issues. Body fat percentage for male participants (18.45 ± 2.03%) falls within the recommended range of 10–20%, while the female participants (31.32 ± 2.74%) have values well above the recommended range of 18–28%. These findings suggest that female participants, on average, have higher body fat percentages compared to male participants. In terms of cardiorespiratory fitness, the mean VO_2 Max values for male participants (37.81 ± 3.79 ml/kg/min) are below the norm of 42–46 ml/kg/min, while female participants (29.29 ± 6.61 ml/kg/min) fall well below the expected range of 35–49 ml/kg/min, indicating suboptimal aerobic fitness in both groups. The resting heart rate (79.17 ± 5.82 bpm) is within the normal reference range of 60–100 bpm. However, maximal strength values for male participants (41.6 ± 6.31 kg) were slightly below the reference range of 45–50 kg, while female participants (23.2 ± 5.27 kg) also fall below the reference range of 25–30 kg, indicating weaker muscular strength among both groups compared to norms.

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Table 3: Results of all the Hypotheses(1-6)

Hypotheses	N = 500	t	dF	Sig.
H_{01}: VO_2 Max (Male)	500	-24.72	499	.00
H_{02}: VO_2 Max (Female)	500	-15.29	499	.00
H_{03}: Systolic Blood Pressure (SDP)	500	27.94	499	.00
H_{04}: Diastolic Blood Pressure (DBP)	500	24.45	499	.00
H_{05}: Resting Heart Rate (RHR)	500	-3.19	499	.002
H_{06}: Fasting Blood Glucose (FBG)	500	10.76	499	.00
H_{07}: Body Fat Percentage (Male)	500	38.0	499	.00
H_{08}: Body Fat Percentage (Female)	500	29.47	499	.00
H_{09}: Muscular Strength (Male)	500	-20.91	499	.00
H_{10}: Muscular Strength (Female)	500	-8.15	499	.00

The hypotheses tested whether there is statistically significant differences between the sample's mean values and the norm-referenced values for various physical and cardiovascular health markers, including VO_2 Max, blood pressure, resting heart rate, fasting blood glucose, body fat

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percentage, and muscular strength. The results showed significant difference in the variable assessed, particularly elevated blood pressure, higher body fat percentages, and lower muscular strength.

Discussion of Findings

This study compared the norm reference values of selected physical and cardiovascular markers of health in undergraduates of university of Ilorin. The results of this study demonstrated significant gender-specific differences in various cardiovascular parameters among the student population. The findings indicated distinct patterns in glucose metabolism, blood pressure, body composition, cardiovascular fitness, and muscular strength between males and females. The mean fasting blood glucose (FBG) level of 90.70 ± 6.65 mg/dL was within the normal reference range of 75–100 mg/dL.

This suggests that the students generally maintain healthy blood glucose levels, which aligns with findings from previous studies that reported normal glucose levels among university students (Aderibigbe & Ibekwe, 2020). However, rising cases of impaired fasting glucose and type 2 diabetes among Nigerian university students (Sanya et al., 2016) indicate that while glucose levels may be within normal limits for some, there is still a growing risk of metabolic disorders in the population, particularly in those with poor lifestyle habits. Elevated blood pressure readings observed in this study, with systolic blood pressure (132.27 ± 9.82 mmHg) and diastolic blood pressure (91.54 ± 0.26 mmHg) exceeding the reference values of <120 mmHg and <80 mmHg (WHO, 2021), reflect an increasing trend of hypertension in young adults.

These findings are consistent with previous studies that highlight rising blood pressure levels among Nigerian university students (Chukwuonye et al., 2013; Oghagbon & Okesina, 2006). Factors such as stress, sedentary behaviour, and poor diet may contribute to this rise, as reported in study by Akinbule, Ogunyinka and Adenusi (2025). The findings suggest that these factors play a significant role in the health status of students and emphasize the need for interventions targeting stress management and physical activity to combat the growing prevalence of hypertension in young adults.

Suboptimal cardiorespiratory fitness levels was observed in this study, with male students having a mean VO_2 Max of 37.81 ± 3.79 ml/kg/min (below the norm of 42–46 ml/kg/min) and female students having 29.29 ± 6.61 ml/kg/min (below the range of 35–49 ml/kg/min), are consistent with previous research that has found poor aerobic fitness levels among university students.

Studies by Adedoyin et al. (2010) and Ene-Obong et al. (2021) also reported low VO_2 Max values in Nigerian students, largely attributed to sedentary lifestyles and insufficient physical activity. This lack of physical engagement, compounded by academic pressures, suggests that university students are not meeting the minimum physical activity recommendations needed to maintain cardiovascular health (Ene-Obong et al., 2021). The current findings highlight the critical need for universities to promote physical activity and integrate aerobic exercises into students' daily

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routines to improve overall health outcomes. Resting heart rate (79.17 ± 5.82 bpm) was within the normal reference range of 60–100 bpm but was on the higher end, suggesting a potential issue with cardiovascular fitness. Higher resting heart rates are associated with lower fitness levels and increased stress, which is consistent with previous studies that have found elevated resting heart rates among university students, particularly females (Awotidebe et al., 2014; Ali et al., 2023). The higher resting heart rate observed in this study further supports the conclusion that stress and physical inactivity are major contributors to poorer cardiovascular health among students. These findings underscore the need for stress reduction programs and regular exercise to help students lower their resting heart rates and improve overall cardiovascular efficiency. The body fat percentage results, particularly for female students (31.32 ± 2.74%), which exceeded the norm of 18–28%, point to an emerging concern with overweight and obesity in this population.

The body fat percentage for male students (18.45 ± 2.03%) was within the recommended range of 10–20%, but female students exhibited significantly higher levels of adiposity. Previous studies, such as those by Sanya et al. (2016), have also reported higher body fat percentages among Nigerian university students, particularly females. Factors such as poor diet, sedentary lifestyles, and cultural expectations contribute to the higher body fat levels observed, particularly in women (Desalu et al., 2008; Musa et al., 2012). These findings are concerning, as excessive body fat is a risk factor for numerous health conditions, including cardiovascular disease, diabetes, and metabolic syndrome. Interventions to address weight management and encourage physical activity, particularly for female students, are critical in tackling this issue.

Muscular strength, an important determinant of overall physical health, was also found to be lower than expected, with male students averaging 41.6 ± 6.31 kg (below the norm of 45–50 kg) and female students averaging 23.2 ± 5.27 kg (below the norm of 25–30 kg). These findings align with studies by Awotidebe et al. (2014), who noted low muscular strength levels among Nigerian students, largely attributed to limited engagement in resistance training and sedentary behaviour. This deficiency in muscular strength may predispose students to functional limitations and increase their susceptibility to injury. As highlighted in previous literature, incorporating strength training into the university curriculum could significantly improve students' physical health and reduce the risks associated with poor muscular strength (Awotidebe et al., 2014; Dodds et al., 2014).

Conclusions

1. Cardiorespiratory fitness of the students was suboptimal compared to the norm-referenced value, with both male and female participants showing VO_2 Max values below the recommended ranges, suggesting insufficient aerobic fitness.
2. Elevated systolic and diastolic blood pressure were observed among the students, with mean values exceeding the norm-referenced values, suggesting a potential risk for hypertension and related cardiovascular diseases in the student population.

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3. Body fat percentage was found to be higher in female students, with their average body fat percentage exceeding the recommended range, indicating an increased risk for obesity-related health issues such as diabetes and cardiovascular disease.
4. Resting heart rate was on the higher end of the normal reference range, suggesting that while students' heart rates were not dangerously high, they may be experiencing suboptimal cardiovascular health.
5. Muscular strength was lower than the norm-referenced value for both male and female students.
6. Fasting blood glucose levels were within the normal reference range, indicating that, on average, students maintained healthy blood sugar levels, though the increasing prevalence of impaired glucose tolerance in this population suggests the need for routine monitoring.

Recommendations

1. Incorporate physical activity into daily campus Life. Encourage students to include physical activity in their routines through walking or cycling clubs, standing desks, recreational sports, and organized group walks led by qualified exercise and sports scientists
2. Integrate Routine Fitness Assessments to be conducted by exercise and sports scientists. Set up regular fitness assessments in the fitness center where students can voluntarily track their progress. Routine assessments can also motivate students to stay committed to improving their health over time.
3. Organising regular health and fitness awareness campaigns can play a vital role in promoting physical activity on campus. Physical educators and exercise scientists can collaborate with campus organisations to host fitness challenges, health seminars, and educational workshops that emphasise the importance of regular physical activity for both mental and physical health.

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