

ORIGINAL ARTICLE

Dietary Intakes, Physical Activity and Nutritional Status of Undergraduate Students at the University of Uyo, Nigeria

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DOI: [https://doi.org/10.70851/jfines.2025.2\(3\).146.154](https://doi.org/10.70851/jfines.2025.2(3).146.154)

Article history

Received;
23 May, 2025
Revised;
15 July, 2025
Accepted;
16 July, 2025

Keywords

Dietary intakes,
Physical Activity,
Metabolic equivalents,
Body mass index,
Abdominal obesity,
Undergraduate
students

ABSTRACT

Maintaining optimal nutrition and physical activity (PA) are often challenging for university students due to high academic demands and other factors. This descriptive cross-sectional study was conducted at the University of Uyo, to assess dietary intakes, PA and nutritional status among 427 undergraduate students. Nutrient intake values, obtained from a multi-pass 24-hr dietary recall assessment were compared with age- and sex-specific Recommended Dietary Allowance (RDA) values to assess adequacy. Information on weekly PA was collected using the short form of the International PA Questionnaire (IPAQ-SF), and analyzed to assess PA levels (PALs) measured in metabolic equivalents (METs). Body mass index (BMI) was determined from weight and height measurements; measurement of waist circumference was also taken. Descriptive and inferential statistics were performed, and statistical significance was established at $p < 0.05$. Percentage RDA met for energy and nutrients among males and females, respectively ranged as follows: energy (62.6%-63.1% and 76.7%-80.0%), protein (106.0%-94.5% and 103.9%-114.6), carbohydrate (206.2%- 178.9% and 174.7%-183.5%), dietary fibre (49.5%-51.1% and 72.3%-57.9%), vitamin A (42.1%-35.4% and 41.8%, 42.8%), calcium (32.9%-37.1% and 25.7% and 33.1%), and potassium (34.2%-38.4% and 49.7%-46.8%). Low, moderate and high PALs were 39.3%, 57.1% and 3.5%, respectively. Underweight, overweight, obesity and abdominal obesity were 1.4%, 33.0%, 25.1%, and 1.9%, respectively. There were significant, but negative correlation between PA scores and BMI ($\rho = -0.167$, $p = 0.001$). Excessive intakes of macronutrients alongside inadequate intakes of essential nutrients indicated poor dietary intakes among students. Furthermore, prevalent low PA coexisted with overweight and obesity in the same population. Modification of both physical and structural environments, in combination with peer group-based strategies can serve as effective strategies for promoting adequate dietary intakes and PA among students.

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Peer review under responsibility of Journal of Food Innovations, Nutrition, and Environmental Sciences.

A Publication of EcoScribe Publishers company Limited,
Uganda.

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1. INTRODUCTION

Optimal nutrition, when accompanied by regular physical activity (PA) constitute important components of health and development across life-stages. It is particularly important during the periods of early adulthood, where transitions in physical, emotional, and psychological states impact long term health and outcomes (Lawrence et al., 2017). This is because, healthy eating and active lifestyles adopted during this life stage can protect against non-communicable diseases, including obesity, diabetes, cardiovascular diseases while also supporting mental and social well-being (OECD, 2022).

Undergraduate university students often face unique dietary and lifestyle challenges that are driven by changes in eating habits associated with transition from home traditions to independent school life. Thus, meal skipping, increased snacking and fast-food consumption amidst minimal consumption of fruits and vegetables constitute common dietary abnormalities among students (Arisa et al., 2016; Ukegbu et al., 2017; Ani et al., 2018; Omega and Omuemu, 2018; Kayode and Alabi, 2020). Time constraints due to academic demands, coupled with limited access to recreational facilities further deny students the opportunity to engage in adequate PA (Silva et al., 2022).

The nutrition landscape in Nigeria is changing rapidly, resulting in double burden of malnutrition where undernutrition co-exist with overweight and obesity (Oladoyinbo et al., 2015). The changing food environment, marked by excessive availability of energy-dense nutrient-poor foods, coupled with increasing sedentary lifestyle all constitute contributory factors. Research on dietary intakes and PALs among undergraduate university students in Nigeria is limited, and often lacks regional specificity, with Akwa Ibom State being particularly underrepresented (Elejo et al., 2019; Chinyere et al., 2020; Kayode and Alabi, 2020; Adewumi et al., 2021). Fragmented evidence on the subject matter constrains institutions' ability to propose intervention policies that are informed by robust evidence base.

University of Uyo is located in Akwa Ibom State, South-South geopolitical zone in Nigeria. The institution offers a valuable platform to evaluate students' health and lifestyle behaviours, which may be influenced by traditional and cultural perspectives. Understanding students' intakes and PALs within regional contexts will enhance formulation and implementation of targeted interventions grounded in region-specific knowledge and resources. Despite this understanding, information on dietary intakes and PALs of university students in the region is lacking. This study, therefore, aimed to assess dietary intakes, PALs, and nutritional status of undergraduate students at the University of Uyo.

2. METHODOLOGY

2.1 Study design and setting

The study adopted a cross-sectional descriptive design to assess dietary intakes, PALs and nutritional status of undergraduate students at the University of Uyo, Nigeria. Uyo, the capital city of Akwa Ibom State, is located in the South-south geo-political zone of Nigeria. The University offers undergraduate academic programmes across three campuses. The main campus, situated along Nwaniba road is the largest, and serves as the primary administrative centre for the institution. Others include the Town and Annex campuses, both located along Ikpa road, within the city centre.

2.2 Study population and eligibility

The study population constituted of undergraduate students at the University of Uyo, Akwa Ibom State, Nigeria. Undergraduate students who gave informed consent, apparently healthy and without any physical disability were included in the study. Students on part-time programmes, pregnant and lactating females, as well as those with ill-health sufficient to affect usual food intake were excluded from the study.

2.3 Sample size determination

Minimum sample size was obtained using Yamane's formula (1967) for calculating sample size from finite populations.

Using the formula: $[n=N/1+N(e^2)]$

where:

n = required sample size

N = University total population = 41,958 (based on university enrollment data for 2022/2023 session)

Margin of error (e) =5%

$$= \frac{41,958}{1 + 41,958(0.05)^2}$$

Sample size calculated was 396. Adjusting to account for a 10% non-response rate, the minimum calculated sample size for the study was 436.

2.4 Sampling Technique

A multi-stage sampling technique was used to select participants for the study. Included faculties were selected using a simple random sampling. Furthermore, probability proportionate to size sampling technique was adopted to select departments and determine the required number of students from each selected department. Finally, simple random sampling was used to identify and interview students from respective departments included in the study.

2.5 Data Collection

2.5.1 Socio-demographic information

A semi-structured questionnaire was used to obtain information on age, sex, level of study, sponsor, marital status, religion, monthly stipend, father's and mother's education.

2.5.2 Dietary Intakes

Dietary intakes assessment was performed using a multi-pass 24-hour dietary recall technique (Gibson and Ferguson, 2008). Respondents were asked to list all foods, beverages, and mixed dishes consumed during the reference period. Items that were possibly forgotten during the initial listing were identified through further probing. Detailed descriptions, including brand names (where available), ingredients and recipes for each listed item were obtained. Portion sizes were estimated using simple household measures - spoons, measuring cups, plates, sales measures, and selected replica of food models. Dietary intake information was converted to specific nutrient intake values using the Total Dietary Assessment (TDA) Software (version 3.0.). Median intake values were compared with age- and sex-specific RDA values from the Institute of Medicine's Dietary Reference Intakes (2005) to calculate percentage RDA met.

2.5.3 Nutritional Status

Anthropometric measurements including weight, height, and waist circumference (WC) were taken to assess nutritional status using BMI and WC. All anthropometric measurements were taken with participants barefoot, wearing light and loose-fitting clothing, and maintaining proper posture. Measurements of body weight, height and WC were taken using a sensitive electronic bathroom scale (Seca 874, Germany), fabricated stadiometer and a non-stretchable measurement tape, respectively. Weight readings were recorded to the nearest 0.1 kg, while those of height and WC were each recorded to the nearest 0.1 cm. An average of two readings, taken at separate intervals were recorded for each measurement.

Information obtained from weight and height measurements were used to derive BMI values. Values corresponding to less than 18.5kg/m²; 18.5kg/m² to 24.99kg/m²; 25.00 kg/m² to 29.99kg/m², and 30kg/m² and above were classified as underweight, normal, overweight and obesity, respectively. Waist circumference readings greater than 102 cm for men and 88 cm for women were classified as abdominal obesity.

Physical activity was assessed using the IPAQ-SF (IPAQ, 2005). Information on the frequency and duration of vigorous-intensity, moderate-intensity and walking activities over the immediate past seven days period were obtained. Activity scores (number of days multiplied by the duration) obtained for each PA intensity was multiplied by respective METs values. Hence, vigorous-

intensity, moderate-intensity and walking PA were multiplied by 8.0, 4.0 and 3.3 METs, respectively. Total PA METs-minutes/week was calculated as the sum total of walking, moderate and vigorous intensity MET-minutes/week. Total PA METs-minutes/week scores "less than 600 METs-minutes/week", "600 to 1499 METs-minutes/week" and "1500 METs-minutes/week and above" were classified to correspond to low, moderate and high PALs, respectively.

2.6 Statistical Analyses

Statistical analysis was conducted using the IBM Statistical Package for Social Sciences, (SPSS), version 20. Descriptive statistics – mean, standard deviation (\pm SD), median, interquartile range (IQR), frequency and percentages were used to report findings. Independent-samples median test was conducted to report differences in median energy and nutrient intakes between two groups. The student's t-test was used to report differences in the mean values of continuous variables-age, BMI and WC between two groups. Chi-square test was conducted to report associations between categorical variables. Both student's t-test and Chi square test were employed to assess relationship between the same set of variables due to their ability to provide complementary insights and strengthen the overall analysis. Statistical significance was ascertained at $p < 0.05$.

3. RESULTS AND DISCUSSION

3.1 Socio-demographic characteristics of respondents

A total of nine questionnaires were excluded from the analyses due to incomplete vital data. The final sample thus comprised of 427 students (**Table 1**). Study population comprised of young adults (21.3 \pm 2.7 years), most of whom were in their first three years of university education, and sponsored primarily by their parents (94.8%). The demographics of participants in the present study compare well with those of similar studies (Mogre et al., 2015; Ukegbu et al., 2017; Omage and Omuemu, 2018; Kayode and Alabi, 2020), validating comparability of findings.

3.2 Dietary intakes adequacy

Findings on median intake levels for energy and nutrients are presented in **Table 2**. Energy intakes were generally below recommended levels among both males and females. Intake levels for protein and carbohydrates generally exceeded recommendations across groups, with the exception of protein intake among \geq 19 years old males, which was close to the recommended level at 94.5% RDA. With respect to carbohydrate intakes, our findings compare well with reports from earlier studies in Nigeria (Otemuyiwa et al., 2012; Ukegbu et al., 2015) where carbohydrate intakes of university students were high. Conversely, our study reported higher protein intakes when compared to findings from the other studies (Otemuyiwa et al., 2012; Ukegbu et al., 2015). Median intake levels for dietary

fibre, vitamin A, calcium and potassium, were generally low and below 50% RDA, with exception of fibre intake among females ≤ 18 years which was as high as 72.3%. In line with findings from the present study, all calcium, iron and fibre intakes were equally low among students in southwest Nigeria (Otemuyiwa et al., 2012). Excessive macronutrient intakes in the population suggests potential long-term risk of chronic diseases related to overnutrition, and necessitates timely intervention. The food environment within and around the university campus is characterized by non-traditional recipes dominating the available food options. Tight lecture schedules, in addition to other

constraints prevent students from taking healthy meals, causing them to patronize vendors who basically sell bread, biscuits, pastry products and minimal traditional cuisines. The full meal options consist primarily of riced-based dishes, occasionally served with boiled beans and assorted animal proteins - egg, beef, goat meat, fish and poultry. Few vegetable options (typically served as vegetable soups) and fruits are ever available. Presented with portion and pricing options, these foods are highly accessible to students. As a result, students usually purchase and consume meals that may not align with their family food culture.

Table 1: Socio-demographic factors of the respondents (n= 427)

Variable	Male (N = 197)	Female (N = 230)	Total (n = 427)
Age (years)			
Mean (\pm SD)	21.5 \pm 2.8	21.1 \pm 2.6	21.3 \pm 2.7
≤ 18 years	27 (13.7)	37 (16.1)	64 (15.0)
≥ 19 years	170 (86.3)	193 (83.9)	363 (85.0)
Level of study			
100	47 (23.9)	57 (24.8)	104 (24.4)
200	48 (24.4)	60 (26.1)	108 (25.3)
300	59 (29.9)	65 (28.3)	124 (29.0)
400	37 (18.8)	39 (17.0)	76 (17.8)
500	6 (3.0)	9 (3.9)	15 (3.5)
Sponsor			
Self	1 (0.5)	6 (2.6)	7 (1.6)
Parent	191 (97.0)	214 (93.0)	405 (94.8)
Scholarship	3 (1.5)	6 (2.6)	9 (2.1)
Others	2 (1.0)	4 (1.7)	6 (1.4)
Marital status			
Singles	195 (99.0)	227 (98.7)	422 (98.8)
Married	2 (1.0)	3 (1.3)	5 (1.2)
Religion			
Christianity	189 (95.)	227 (98.7)	416 (97.4)
Islam	3 (1.5)	2 (0.9)	5 (1.2)
Others	5 (2.5)	1 (0.4)	6 (1.4)
Monthly stipend (₦)			
$\leq 10,000$	12 (6.1)	26 (11.3)	38 (8.9)
11,000 - 29,000	81 (41.1)	90 (39.1)	171 (40.0)
30,000 – 49,00	92 (46.7)	104 (45.2)	196 (45.9)
50,000 – 99,000	11 (5.6)	8 (3.5)	19 (4.4)
$\geq 100,000$	1 (0.5)	2 (0.9)	3 (0.7)
Father's education			
Secondary or less	44 (22.3)	51 (22.2)	95 (22.3)
Tertiary education	153 (77.7)	179 (77.8)	332 (77.8)
Mother's education			
Secondary or less	43 (21.8)	61 (28.2)	104 (24.3)
Tertiary education	154 (78.2)	169 (73.5)	323 (75.6)

These scenarios probably explain the predominant excessive intakes of both carbohydrate and protein, with minimal intakes of micronutrients observed in the study. Obayelu et al. (2022) noted that consumption of beans, eggs, beef and goat meat was common among students in a Nigerian university. High protein intakes observed in the present study may be attributed to increased consumption of these items due to their accessibility.

The reasons for poor dietary intakes in student populations may be attributed to excessive snacking and reliance on energy dense meals (Arisa et al., 2016; Ukegbu et al., 2017; Ani et al., 2018; Omege and Omuemu, 2018; Kayode and Alabi, 2020). Of concern are the types of snacks often consumed and their contributions to intakes. The authors in southeast Nigeria (Ukegbu et al., 2015), noted that while pastries, cakes, biscuits were often consumed alongside carbonated drinks, these items made the greatest contributions to energy, protein and fat intakes. Conversely, consumption of fruits and vegetables are minimal among students (Mogre et al., 2015; Omege and Omuemu, 2018; Kayode and Alabi, 2020). Widespread dietary inadequacies often observed in students' populations have been blamed on time constraints, low financial power, proliferation of processed foods environments around university campuses and peer pressure; these collectively exert strong influence on students to patronize unhealthy food outlets (Menakaya and Menakaya, 2022; Oyekale et al., 2024).

3.3 Physical activity levels

Table 3 presents findings on PALs and prevalence of obesity in the study. The total median (IQR) PA score was 732.5 (532.5, 817.5) METs-minutes/week; indicating a likely prevalence of moderate PALs in the study population. However, the difference between the prevalence of moderate PA (57.1%) and low PA (39.3%) was not substantial enough to categorize the population as predominantly moderately active, thus characterizing it as largely low-to-moderately active. This observation deviates from the recommended moderate-to-high PA patterns, necessary for healthy living for all age groups (World Health Organization, 2020). Low PA prevalence rate obtained from our study compares well with 35.8% reported among undergraduate students in a university in southwest Nigeria (Kayode and Alabi, 2020). Though comparably lower than values obtained from the present study; low PA rates reported in other studies point to prevalent physical inactivity among university undergraduate students across diverse regions within and outside Nigeria (Mogre et al., 2015; Eleojo et al., 2019; Arisa et al., 2020; Oladejo et al., 2023). The trend has been blamed on challenges arising from all environmental, socioeconomic and demographic factors, although time constraint and lack of motivation often emerge the most commonly listed barriers to PA among university students (Silva et al., 2022).

3.4 Prevalence of Obesity

Mean BMI reported among students in this study was 26.4 ± 4.9 . This value falls outside the normal range, suggesting possible prevalent overweight and obesity in the study population. However, our findings revealed 1.4% of students were underweight, 40.5% had normal BMI, 33.0% were overweight and 25.1% had obesity, respectively. The rates reported in the present study compares well with 30.4% overweight and 27.1% obesity reported among students in southwest Nigeria (Ani et al., 2018). Conversely, rates obtained from other similar studies in Nigeria were comparatively lower (Omege and Omuemu, 2018; Eleojo et al., 2019; Arisa et al., 2020; Kayode and Alabi, 2020; Dada et al., 2024; Ndidi et al., 2024). A combined prevalence of 13.0% for overweight and obesity among students in Ghana was lower compared to the present study (Mogre et al., 2015).

Mean WC reported among students in the study was 76.8 ± 6.5 ; with 1.9% abdominal obesity. Abdominal obesity was notably low among students in the present study, aligning with the finding from an earlier study in the region (Opara et al., 2020). Conversely, higher rates were reported among students in universities in south east Nigeria (Ukegbu et al., 2017) and Ghana (Mogre et al., 2015). Differences in overweight and obesity rates observed between the present study and others, may be attributed to several factors including personal factors as well as cultural differences. Higher prevalence of overweight and obesity in our study may reflect the widespread physical inactivity in the study population. Moreover, our study revealed a significant inverse association between PA scores and BMI ($\rho = -0.167$, $p = 0.001$), indicating the significant influence of PA on body weight in the population. Coexistence of overweight/obesity with low PA within the same population underscores a potential rise in non-communicable diseases in the region; an early warning sign that warrants urgent attention.

3.5 Sex differences in Physical activity levels and Obesity

Findings also revealed sex differences in both PALs and obesity. Chi-square test showed borderline significant associations between PA and sex, $p = 0.047$. Low PA was higher among females, 43.9% compared to 34.0% among males. Conversely, males had higher prevalences of moderate (60.9%) and high (5.1%) PALs compared to 53.9% and 3.5% reported among females, respectively. Also, Student's t-test showed significant differences in mean BMI values between males and females, $p < 0.001$. Chi square test also showed significant association between BMI and sex, $p < 0.001$. Females had a higher mean BMI ($28.1 \pm 4.7 \text{ kgm}^2$), when compared to males ($24.4 \pm 4.1 \text{ kgm}^2$).

Table 2: Median Energy and Nutrients Intakes Levels

Energy and Nutrients	≤ 18 years		≥ 19 years		p-value
	RDA	Median (IQR)	EAR	Median (IQR)	
Males					
Energy (kcal)	2800	1754.1 (1361.0, 2177.5)	2500	1577.6 (1329.4, 1915.9)	0.658
Protein (g)	52	55.1 (45.9, 69.7)	56	52.9 (42.5, 69.7)	0.658
Carbohydrate (g)	130	268.1 (218.9, 272.5)	130	232.6 (199.3, 272.5)	0.184
Dietary Fibre (g)	38	18.8 (13.1, 26.8)	38	19.4 (12.6, 26.9)	0.424
Vitamin A (RAE)	900	378.6 (214.3, 530.3)	900	318.5 (191.0, 413.0)	0.081
Vitamin C (mg)	75	56.5 (48.9, 74.7)	90	56.6 (29.7, 78.4)	0.977
Thiamine (mg)	1.2	1.2 (0.9, 1.9)	1.2	1.2 (0.8, 1.6)	0.829
Riboflavin (mg)	1.3	0.9 (0.7, 1.5)	1.3	0.9 (0.6, 1.3)	0.977
Niacin (mg)	16	15.7 (11.4, 20.6)	14	14.4 (10.3, 20.1)	0.658
Vitamin B6 (mg)	1.3	1.1 (0.9, 1.4)	1.3	1.1 (0.8, 1.4)	0.932
Folate (µg)	400	339.2 (263.0, 458.6)	400	292.5 (208.8, 408.8)	0.658
Vitamin B12 (µg)	2.4	2.4 (1.5, 2.8)	2.4	2.7 (1.2, 3.5)	0.225
Calcium (mg)	1300	428.4 (259.9, 522.5)	1000	370.8 (262.3, 520.4)	0.204
Phosphorus (mg)	1250	838.5 (663.5, 1051.6)	700	870.4 (681.4, 1067.7)	0.700
Potassium (mg)	4700	1607.4 (1119.3, 2284.4)	4700	1813.8 (1317.8, 2261.6)	0.424
Sodium (mg)	1500	2610.6 (2117.0, 3529.4)	1500	2370.2 (1658.8, 3137.0)	0.361
Zinc (mg)	11	9.5 (8.4, 11.7)	11	8.9 (7.2, 11.2)	0.391
Iron (mg)	11	17.4 (11.8, 18.5)	8	14.3 (11.5, 17.0)	0.092
Magnesium (mg)	410	270.6 (205.6, 367.6)	400	280.9 (205.6, 367.6)	0.977
Females					
Energy (kcal)	2000	1535.3 (1244.2, 1884.2)	2000	1600.7 (1324.1, 1926.1)	0.308
Protein (g)	46	47.8 (33.9, 67.1)	46	52.7 (41.0, 72.7)	0.473
Carbohydrate (g)	130	227.2 (183.6, 267.5)	130	238.6 (190.0, 292.5)	0.282
Dietary Fibre (g)	26	18.8 (13.7, 26.5)	28	16.2 (9.8, 24.1)	0.282
Vitamin A (RAE)	700	292.5 (134.4, 405.1)	700	299.9 (181.9, 453.3)	0.720
Vitamin C (mg)	65	49.8 (28.9, 81.9)	75	51.5 (24.8, 80.6)	1.000
Thiamine (mg)	1.0	1.2 (0.9, 1.9)	1.1	1.2 (0.8, 1.7)	0.720
Riboflavin (mg)	1.0	0.9 (0.6, 1.4)	1.1	0.9 (0.6, 1.2)	1.000
Niacin (mg)	14	12.3 (9.2, 19.0)	14	14.0 (10.5, 18.2)	0.282
Vitamin B6 (mg)	1.2	1.0 (0.8, 1.5)	1.3	1.0 (0.8, 1.4)	0.808
Folate (µg)	400	381.9 (242.5, 515.9)	400	283.1 (192.2, 403.9)	0.031*
Vitamin B12 (µg)	2.4	2.0 (0.8, 3.4)	2.4	2.4 (1.3, 3.4)	0.720
Calcium (mg)	1300	333.5 (223.2, 436.9)	1000	331.0 (211.8, 497.0)	1.000
Phosphorus (mg)	1250	874.4 (621.1, 986.1)	700	783.4 (618.2, 993.4)	0.473
Potassium (mg)	4700	2337.1 (1201.1, 2982.6)	4700	2200.6 (1436.1, 3055.4)	0.720
Sodium (mg)	1500	1676.7 (1378.1, 2183.3)	1500	1638.3 (1131.5, 2089.2)	0.954
Zinc (mg)	9	7.7 (5.4, 11.2)	8	8.8 (7.0, 11.1)	0.720
Iron (mg)	15	12.4 (9.9, 18.3)	18	13.1 (10.7, 17.0)	0.720
Magnesium (mg)	360	258.6 (192.7, 315.4)	310	255.1 (178.5, 330.9)	1.000

*Differences between groups are statistically significant at p < 0.05

Table 3: Physical activity levels and prevalence of obesity

Variable	Male	Female	Total	p-value
Physical Activity				
Median (IQR) Mets-minutes/week	737.5 (572.5, 917.5)	697.5 (346.5, 787.5)	732.5 (532.5, 817.5)	0.047*
Low	67 (34.0)	101 (43.9)	168 (39.3)	0.047*
Moderate	120 (60.9)	124 (53.9)	244 (57.1)	
High	10 (5.1)	5 (2.2)	15 (3.5)	
Body mass Index				
Mean (\pm SD)	24.4 \pm 4.1	28.1 \pm 4.7	26.4 \pm 4.9	< 0.001*
Underweight	4 (2.0)	2 (0.9)	6 (1.4)	< 0.001*
Normal	115 (58.4)	58 (25.2)	173 (40.5)	
Overweight	58 (29.4)	83 (36.1)	141 (33.0)	
Obesity	20 (10.2)	87 (37.8)	107 (25.1)	
Waist Circumference				
Mean (\pm SD)	76.4 \pm 6.2	77.0 \pm 6.8	76.8 \pm 6.5	0.334
Normal	197 (100.0)	221 (96.5)	418 (98.1)	0.007*
Abdominal Obesity	0 (0.0)	8 (3.5)	8 (1.9)	

*Differences between groups are statistically significant at $p < 0.05$

Table 4: Correlations of Total METs-minutes/week with BMI and WC

Variables	Spearman's rho	95 Confidence interval		p-value
		Lower	Upper	
BMI	-0.167	-0.260	-0.070	0.001*
WC	-0.003	-0.100	0.095	0.955

*Differences between groups are statistically significant at $p < 0.05$

Furthermore, while a greater proportion of males had normal BMI (58.4% in males vs. 25.2% in females), both overweight (36.1% in females versus 29.4% in males) and obesity (37.8% in females vs. 10.2% in males) were more prevalent among females when compared to males, suggesting a higher tendency towards excess body weight among females when compared to their male counterparts. Since females are often less likely to engage in adequate PA (McCarthy and Warne, 2022); and are more predisposed to overweight and obesity (Muscogiuri et al., 2024), these findings highlight the need for targeted interventions aimed at promoting healthy lifestyle modifications and better health outcomes among females.

3.6 Association between physical activity and obesity

Spearman's correlation analysis (Table 4) revealed a significant inverse relationship between BMI and PA scores ($\rho = -0.167$, $p = 0.001$). Conversely, there was no significant association between WC and PA. The significant inverse association between PA

scores and BMI observed in our study implies that an effective PA intervention strategy will yield expected results for improved health outcomes both in the short and long terms bases.

The coexistence of suboptimal micronutrient intakes and excessive macronutrients consumption, alongside high prevalence of overweight and obesity constitutes a double burden of malnutrition, highlighting the presence of nutrition transition within the study setting. Nutrition transition, occurring as shifts from traditional diets to energy-dense intakes that are high in fats and sugars, has been widely implicated in the emergence of nutritional challenges where both undernutrition and overnutrition coexist within the same population. Often occupying national and regional relevance, the impact of nutrition transition is increasingly becoming evident across specific sub-groups, including university students. This reinforces the need for nutrition interventions at all population levels, including the academic environment.

CONCLUSION

Students exhibited excessive intakes of macronutrients alongside deficiencies in several key micronutrients, while overall energy intake was suboptimal, indicating poor dietary intake patterns. The coexistence of low PALs and a high prevalence of overweight and obesity in the study population further underscores the need for interventions that promote healthy lifestyles among students. Modifying the structural and physical environments alongside peer group-based programmes can serve as effective behavioural change models to improve both dietary and PA patterns among students.

ETHICAL APPROVAL STATEMENT

Ethical approval for the study was obtained from the Health Research Ethics Committee of the University of Uyo, (UU/CHS/IHREC/VOL.1/65). The research was conducted in line with the principles of the Declaration of Helsinki. Participants were duly informed on the purpose, procedures, potential risks and benefits of the study, after which written informed consent was obtained from each participant. Participation was entirely voluntary, and participants were assured of confidentiality of their responses.

ACKNOWLEDGMENTS

Authors wish to acknowledge the efforts of all data enumerators for investing their resources to ensure collection of quality data for this study.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest in this work.

DATA AVAILABILITY

The data used to support the findings of this study are available upon request from the corresponding author.

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