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# Socio-Demographic Factors Associated with Obesity among Adolescents in Secondary School in Onitsha, South East Nigeria

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## Abstract

**Background:** The prevalence of obesity among adolescent has been on the increase worldwide. This is probably a result of increase in the sedentary life style and the increasing shift to western diet. Obesity in children and adolescents has adverse consequences. These include increase in the rate of Diabetes Mellitus, hypertension, dyslipidemia, cardiovascular diseases, etc with resultant increase in premature deaths. **Objectives:** To determine the socio-demographic and behavioral factors associated with overweight and obesity in apparently healthy secondary school adolescents. **Methods:** This was a cross-sectional study of secondary school adolescents aged 10 - 19 years randomly selected from two public schools and three private schools. The weight and heights of study subjects were measured using standard equipment. Body mass index (BMI) was appropriately calculated and the WHO growth reference standard for age and gender, specific percentile for BMI was used to define overweight 85$^{th}$ to 97$^{th}$ and obese (97$^{th}$ percentile and above). **Results:** Data were initially collected from 1250 participants, but 52 were excluded due to improperly completed questionnaires. Thus, a total of 1198 students were ultimately included in the study, giving a response rate of 95.8%. These included 621 females (51.8%) and 577 males (48.2%) aged 10 - 19 years giving a F:M ratio of 1:0.9. The mean age of the students was 15.07 ± 1.96 years overall, 15.13 ± 2.08 years for males and 15.03 ± 1.83 years for females. There was no statistically significant difference between male and female in the distribution of age groups ($p$ = 0.12). The mean BMI was 21.51 ± 3.57 kg/m$^2$ for fe-

males and 20.22 ± 3.16 kg/m$^2$ for males. The BMI was significantly higher in females in all age groups ($p < 0.001$) except those aged 10 - <12 years ($p = 0.13$). The prevalence rates of overweight and obesity were higher in females than males (17.7% vs 10.7%, 5.6% vs 4.5% respectively; $p < 0.001$) and most prevalent among the early adolescence (10 ≤ 12 yrs; $p = 0.04$). The frequent consumption of sugar based beverages ($p < 0.001$), sedentary lifestyles ($p < 0.001$), non participation in school based sports ($p = 0.03$) were significantly associated with both overweight and obesity ($p < 0.001$). Also commuting to school by car/bus ($p < 0.001$) and lack of engagement in household chores ($p < 0.001$) were also significantly associated with obesity. **Conclusion:** Socio-odemographic factors such as gender, socioeconomic status and behavioral patterns were major contributors to obesity. Behavioral interventions including regulating the intake of sugar based beverages and reducing the time spent on sedentary activities could be useful strategies in reducing the high prevalence of overweight and obesity among adolescents.

## Keywords

Adolescent, Obesity, Socio-Demographic, Behavioral Factors

## 1. Introduction

Over the past decades, overweight and obesity are becoming increasingly prevalent among adolescents in both developed and developing countries.

The prevalence of childhood obesity has been on the rise, affecting all socioeconomic groups in both developed and developing countries regardless of age, sex or ethnicity [1]. The worldwide prevalence of childhood overweight and obesity increased from 4.2% in 1990 to 6.7% in 2010 and the prevalence is expected to be about 9.1% in 2020 [2].

The 2013 Demographic Health Survey in Nigeria, reported a combined prevalence of overweight and obesity of 6% among 15 - 19-year female adolescents [3].

In Anambra State, South East, Nigeria, a study of children and adolescents aged 2 - 18 years, found the prevalence rates of overweight and obesity to be 5.1% and 0.3% respectively [4].

A study in Kano by Yusuf *et al.* [5] which employed IOTF standard, reported prevalence rates of overweight and obesity among adolescent students aged 13 - 18 years to be 1.98% and 0.84%, respectively. Musa *et al.* [6] in Benue State in North Central Nigeria, reported prevalence rates of overweight and obesity to be 9.7% and 1.8% respectively. In Cross River State, South-South Nigeria, a study by Ansa *et al.* [7] showed a 4% prevalence of obesity in children aged 13 - 15 years and 3% in those aged 16 - 18 years, with the prevalence higher in females.

In Lahore, Pakistan, the prevalence rates of overweight and obesity among school-going children defined using the 2007 WHO standard were 21.8% and 11.9%, respectively [8]. A recent study among adolescents in Kuwait reported a

very high prevalence of overweight (girls 32.1% and boys 29.3%) and obesity (girls 14.2% and boys 14.9%) [9].

Due to its serious health consequences, it is now considered a public health problem [1]. The increasing public health concerns are connected with the health risks posed by obesity. Previous studies have shown that obesity is linked with non communicable disorders which include hypertension, type 2 diabetes mellitus, stroke, arthritis, coronary heart disease, breast and prostate cancers etc. [10] [11] [12] [13]. Obviously, adolescent obesity increases the risk of experiencing a lot of adverse health problems, such as metabolic syndrome, obstructive sleep apnea, dyslipidaemia diabetes type II, hypertension, and a greater risk of social isolation [14].

A number of factors are contributory to the increasing prevalence of overweight and obesity in adolescents. These include increased consumption of energy-dense diets and food high in fat without proportionate energy expenditure due to sedentary lifestyle [14]. Few studies are done in overweight/obesity and related factors among adolescents particularly in the South East, Nigeria. This was a cross-sectional descriptive study carried out to determine the relationship between the myriad of these socio-demographic factors and overweight/obesity among secondary school adolescents aged 10 - 19 years in Onitsha Hence the research questions "What are the prevalence rate of overweight/obesity in apparently healthy adolescents and its socio-demographic determinants in Onitsha local Government". The findings of this study may help in interventions to reduce the burden of this malady.

## 2. Subjects and Methods

### 2.1. Study Area

This was a cross-sectional survey conducted among secondary school adolescent in Onitsha North Local Government Area (ONLGA), one of the two Local Government Areas in Onitsha metropolis and one of the 21 Local Government Areas in Anambra State. Onitsha is the largest urban center in Anambra State and has been described as the gateway to Eastern Nigeria [15]. The ONLGA has a total of 41 secondary schools comprising 17 public and 24 private secondary schools.

### 2.2. Sample Size Determination

The minimum sample size for the study was calculated using the formula:

$$N = Z^2PQ/d^2 \text{ [16]}$$

where, $N$ = minimum sample size.

$Z$ = confidence interval (1.96);

$P$ = estimated or known prevalence from a previous study. In this study, 18%, which is the highest prevalence of obesity reported from Nigeria [17], was used;

$d$ = standard error (5% or 0.05);

$Q = 1 - P$.

Thus,

$$N = \frac{1.96 \times 1.96 \times 0.18(1-0.18)}{0.05^2}$$
$$= \frac{3.8416 \times 0.18(0.82)}{0.0025}$$
$$= \frac{3.8416 \times 0.1476}{0.0025}$$
$$= \frac{0.5670}{0.0025}$$
$$= 227$$

To allow for possible attrition, 10% of the calculated sample size was added. Thus the minimum sample size was 250.

## 2.3. Sampling Method

A multi-stage sampling technique was used to select the secondary schools and study subjects.

Stage 1. All the registered secondary schools in ONLGA were stratified into public and private schools. The public schools were 17 and the private schools 24, giving a public to private school ratio of approximately 2:3.

Stage 2. Using simple random sampling, by balloting from the numbered schools, a total of five schools, two public and three private, were selected. The calculated sample size of 250 was applied to each school, thus 1250 students were selected. This was to increase the power of the study.

Stage 3: The 1250 students were selected in the same ratio of 2:3 *i.e.* 500 students from public schools and 750 students from private schools. For the public schools, 250 students represented each school and 42 students represented each class (250 divided by the six classes in the school) while 14 students represented each arm of three arms. Where there were more than three arms per class, three of the arms were selected through random sampling. The 14 students were systematically selected using the class register as the sample frame and the students selected at an interval of 2, with the first randomly selected. For the private schools, a total of 750 students represented the 3 private schools. 250 students were selected from each school, 42 students from each and 14 students from each arm. The 14 students were selected as described above for the public schools using systematic sampling technique.

All the selected students who met the inclusion criteria were recruited.

## 2.4. Ethical Approval and Consent

Ethical approval for the study was obtained from the Ethics Committee of the NAUTH and informed consent/assent from the parents/guardians and the participants, respectively. Permission was also obtained from Anambra State Post Primary School Service Commission as well as from the principals of the selected schools.

## 3. Procedure

The study was carried out over three months, January-March 2015. Four Research Assistants who were house-officers in the Department of Paediatrics were trained on how to adjust the weighing scale and the stadiometer, position the students to avoid errors and take accurate measurement of weight and height.

At the first contact, the students were introduced to the research team. The purpose and nature of the study were explained in detail and reassurance was given to the effect that the research activity will not result in any harm to the participants. This was followed by the request for verbal assent of the students and written informed consent from the parents. A semi-structured questionnaire was also distributed and self-administered by the students. Pretesting of the questionnaire was carried out in a secondary school not selected for the study three weeks before commencement of the study.

The information sought using the questionnaire included the students' personal data, parents' occupation and level of education, and family medical history. The nutritional history comprised of the number of bottles of carbonated/sugar sweetened drinks such as coca-cola, fruit juices and other soft drinks taken per day, the number of bottles of alcohol (beer) taken daily, the number of meals consumed in a day, frequency of eating outside the homes in restaurants or fast-food joints and the frequency of consumption of snacks such as meat pie, cake, buns or biscuits.

The level of physical activity was assessed from the response to questions on the number of hours per day spent on watching television, playing computer games, video games or browsing the internet. Questions were also asked regarding participation in organized sports in school, means of commuting to school as well as involvement in household chores such as cooking, washing plates, fetching water, laundry etc.

For ease of analysis, responses on the number of bottles of sugar-based drinks and beer consumed in a day were grouped into 3 categories (none, 1, 2 or more) [18]. Responses on the number of meals per day were categorized into 3 (2 per day, 3 per day, >3 per day) while that of the number of food eaten outside home and number of snacks consumed per day were categorized into 4 (none, 1, 2, 3 or more) [18]. Time spent on sedentary activities was recorded into 5 categories (nil, <1 hour, >1 - 2 hours, >2 - 3 hours and 3 hours or more per day). Responses on number of organized sports and household chores involved in were categorized into 0 - 3 and 0 - 4 respectively [18]. For uniformity, the dates of birth of the participants supplied in the questionnaire were verified from the school register, which contains the names and dates of birth of the students, as the boarders and some day students could not present their birth certificates. An adolescent according to WHO, is an individual within the 10 - 19 years age bracket [19]. For the purpose of convenience in data analysis, the adolescents in this study were grouped into five age groups of 10 - <12 years, 12 - <14 years, 14 - <16 years, 16 - <18 years, and 18 - <19 years.

During the second contact, the consent forms and questionnaires were retrieved. A general clinical examination of the participants for features which are indications of chronic diseases, cushingoid facies or physical impairment was then conducted and measurements of weight and height of each participant taken.

The weight was measured with a mechanical floor scale (SECA model 761, UK) that can measure to the nearest 0.1 kilogram (kg) with the subjects lightly dressed in their school uniforms with all pockets emptied out and without shoes, stockings, caps, sweater or cardigan. The weighing scales were corrected for zero error after every measurement and standardized after every ten measurements.

Height was measured using Leicester height meter with the subject standing erect against the wall on a horizontal floor without shoes, and with the two legs together, fully extended. The heels, buttocks, shoulder blades and occiput were placed in firm contact with the stadiometer, with the student looking straight ahead such that the lower borders of the eye sockets were in the same horizontal plane as the external auditory meatus. The readings were recorded to the nearest 0.1centimeter (cm).

BMI was computed using the standard formula weight (kg)/height$^2$ (m). Using the WHO; 2007 age and sex specific BMI percentile cut-offs, the subjects were classified as normal (15$^{th}$ to <85$^{th}$ percentile), underweight (3$^{rd}$ to <15$^{th}$ percentile), overweight (85$^{th}$ to <97$^{th}$ percentile) or obese (97$^{th}$ percentile and above) [20].

The families of the students were classified into socio-economic classes using the method of Oyedeji [21]. Each family was assigned a socio-economic index score based on the occupation and educational attainment of the parents or guardians. For occupation, class 1 was allocated to senior public servants, professionals, managers, large scale traders, businessmen and contractors. Class 2 was assigned to intermediate grade public servants and senior school teachers. Class 3 to junior school teachers, drivers and artisans, class 4 to petty traders, laborers, messengers and similar grades, class 5 was assigned to unemployed, full term house wives, students and subsistence farmers. For the educational scale, class 1 was assigned to university graduates or its equivalent, class 2 to school certificate holders, O'Level General Certificate on Education (GCE) with teaching or other professional trainings. Class 3 was assigned to O' Level GCE, West African Examination Council (WAEC) school certificate or grade II teachers certificate holder or its equivalent. Class 4 to modern 3 and primary 6 certificate holders and class 5 to those with no formal education/illiterates. The mean of the four scores (two for the father and two for the mother) approximated to the nearest whole number, determined the social class. Social classes 1 and 2 were further classified as high socio-economic status, class 3 middle and classes 4 and 5 low [21].

## 4. Data Analysis

Data was entered into MS Excel version 2010 spreadsheet. Data analysis was car-

ried out using SPSS (Statistical Package for Social Sciences) version 21. Numerical variables were summarized using means and standard deviations while categorical variables were described by frequency distributions, proportions and percentages. The comparison of categorical variables and tests for association were done by means of chi-square test. Analysis of variance (ANOVA) and Student's t-test were used for comparison of the means of continuous variables. A *p*-value of <0.05 was considered statistically significant.

## 5. Results

Data were initially collected from 1250 participants, but 52 were excluded due to improperly completed questionnaires. Thus, a total of 1198 students were ultimately included in the study, giving a response rate of 95.8%. These included 621 females (51.8%) and 577 males (48.2%) aged 10 - 19 years giving a F:M ratio of 1:0.9. The mean age of the students was 15.07 ± 1.96 years overall, 15.13 ± 2.08 years for males and 15.03 ± 1.83 years for females.

The other general characteristics of the participants are summarized in Table 1.

Table 1. General characteristics of the study population.

| Characteristic | Male (n = 577) (%) | Female (n = 621) (%) | Total (N = 1198) (%) | t/$\chi^2$ | *P* value |
|---|---|---|---|---|---|
| **Age (in years)** | | | | | |
| 10 - <12 | 37 (6.4) | 30 (4.8) | 67 (5.6) | | |
| 12 - <14 | 142 (24.6) | 158 (25.4) | 300 (25.0) | | |
| 14 - <16 | 185 (32.1) | 237 (38.2) | 422 (35.2) | **7.25** | **0.12** |
| 16 - <18 | 174 (30.2) | 163 (26.2) | 337 (28.1) | **df = 4** | |
| 18 - ≤19 | 39 (6.8) | 33 (5..3) | 72 (6.0) | | |
| **Socioeconomic class** | | | | | |
| High | 341(59.1) | 294(47.3) | 635 (53.0) | 18.30 | < 0.001 |
| Middle | 217(37.6) | 309(49.8) | 526 (43.9) | df = 2 | |
| Low | 19(3.3) | 18(2.9) | 37(3.1) | | |
| **School type** | | | | | |
| Public | 247(42.8) | 248(39.9) | 495(41.3) | 1.01 | 0.31 |
| Private | 330(57.2) | 373(60.1) | 703(58.7) | df = 1 | |
| **Student type** | | | | | |
| Boarding Student | 66 (11.4) | 180 (29.0) | 246 (20.5) | 56.44 | < 0.001 |
| Day Student | 511 (88.6) | 441 (71.0) | 952 (79.5) | df = 1 | |
| **Family History of NCDs** | | | | | |
| Hypertension | 62 (10.7) | 64 (10.3) | 126 (10.5) | 0.06 | 0.80 |
| Diabetes | 58 (10.1) | 62 (10.0) | 120 (10.0) | 0.00 | 0.97 |
| Body Swelling | 13 (2.4) | 14 (2.3) | 27 (2.3) | 0.66 | 0.42 |

NCD-non communicable diseases.

The age group with the highest number of participants was 14 - <16 years (35.2%). There was no statistically significant difference between male and female in the distribution of age groups ($p = 0.12$).

Over half of the students (53.0%) were of the high socio-economic class families. The prevalence of high socioeconomic class families was significantly higher among male students (59.1% vs 47.3%, $x^2 = 18.3$, $p \leq 0.001$). The overall ratio of day to boarding students was about 3.9:1. The proportion of day students was significantly higher among males (88.6% vs 71%; $x^2 = 56.4$, $p < 0.001$). There were no significant difference between male and female students in the type of school, and prevalence of a family history of non-communicable diseases.

High percentage of the students (82.3%) consumed sugar-based drinks at least once per day. Males were more likely to be heavy consumers of sugar-based drinks per day ($\chi^2 = 14.47$, $p < 0.001$). More than 50% of the students (53.2%) consumed beer. Males (57.9%) had a significantly higher intake of at least 1 bottle of beer daily ($\chi^2 = 9.62$, $p = 0.01$). Females were more likely to eat up to three times daily compared to males (56.8% vs 48.5%, $\chi^2 = 8.38$, $p = 0.02$) while males (42.6%) were more likely to eat outside homes compared to females (34.8%). However, this difference was not statistically significant ($\chi^2 = 8.01$, $p = 0.05$). More males (69.8%) than females (59.9%) consumed snacks at least once a day and this difference was statistically significant ($\chi^2 = 15.86$, $p < 0.001$). Most students (45.1%) were engaged in sedentary activities that lasted for more than 3 hours a day. A significantly higher proportion of males than females were engaged in sedentary activity for longer period of time ($\chi^2 = 16.89$, $p < 0.01$). A significantly higher proportion of the females (65.5%) were engaged in at least four household chores than the males (47.0%) ($\chi^2 = 42.61$, $p < 0.001$) as shown in Table 2.

More males (43.5%) were engaged in at least 3 sporting activities in school compared to only 12.1% of females and this difference was statistically significant ($\chi^2 = 214.49$, $p < 0.001$) as shown in Figure 1.

Figure 2 shows the means of commuting to school by gender. A significantly higher percentage of the females (45.6%) attend school by car/bus compared to males (40.9%) ($\chi^2 = 13.39$, $p < 0.001$).

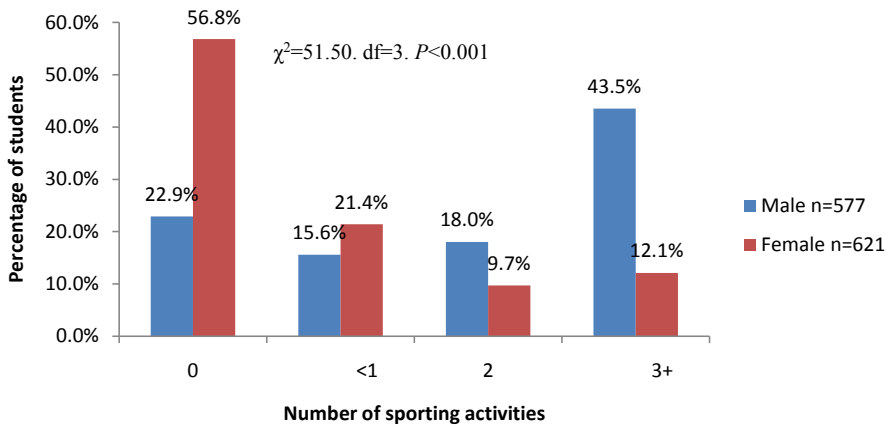


Figure 1. Participation in sporting activity in school by gender.

**Table 2.** Drinking pattern, eating pattern, sedentary lifestyle and physical activity pattern of the study population.

| Characteristics | Male | Female | Total | *p*-value |
|---|---|---|---|---|
| **Number of 60 cl bottles of sugar-based drinks consumed per day** | | | | |
| <1 | 77 (13.3) | 135 (21.7) | 212 (17.7) | |
| 1 | 246 (42.6) | 238 (38.3) | 484 (40.4) | <0.001 |
| 2+ | 254 (44.0) | 248 (39.9) | 502 (41.9) | |
| **Number of 75 cl bottles of beer consumed per day** | | | | |
| 0 | 243 (42.1) | 317 (51.0) | 560 (46.8) | |
| ≤1 | 234 (40.6) | 211 (34.0) | 445 (37.1) | <0.01 |
| 2+ | 100 (17.3) | 93 (15.0) | 193 (16.1) | |
| **Frequency of meals per day** | | | | |
| 2 | 293 (50.9) | 265 (42.7) | 558 (46.6) | |
| 3 | 280 (48.5) | 353 (56.8) | 633 (52.8) | 0.02 |
| 4+ | 4 (0.7) | 3 (0.5) | 7 (0.6) | |
| 1 | 174 (30.2) | 249 (40.1) | 423 (35.3) | |
| **Number of meals eaten out per week** | | | | |
| None | 331 (57.4) | 405 (65.2) | 736 (61.4) | |
| 1 | 96 (16.6) | 89 (14.3) | 185 (15.4) | 0.05 |
| 2 | 92 (15.9) | 78 (12.6) | 170 (14.2) | |
| 3+ | 58 (10.1) | 49 (7.9) | 107 (8.9) | |
| **Number of snacks Consumed per day** | | | | |
| 1 | 231 (40.0) | 230 (37.0) | 461 (38.5) | |
| 2 | 141 (24.4) | 109 (17.6) | 250 (20.9) | <0.001 |
| 3+ | 31 (5.4) | 33 (5.3) | 64 (5.3) | |
| **No. of hours/day (sedentary activity)** | | | | |
| None | 42 (7.3) | 68 (11.0) | 110 (9.2) | |
| ≤1 | 60 (10.4) | 89 (14.3) | 149 (12.4) | |
| >1 - 2 | 85 (14.7) | 107 (17.2) | 192 (16.0) | <0.001 |
| >2 - 3 | 98 (17.0) | 109 (17.6) | 207 (17.3) | |
| >3 | 292 (50.6) | 248 (39.9) | 540 (45.1) | |
| **Number of household chores involved in per day** | | | | |
| 0 | 31 (5.4) | 21 (3.4) | 52 (4.3) | |
| 1 | 56 (9.7) | 44 (7.1) | 100 (8.3) | |
| 2 | 67 (11.6) | 49 (7.9) | 116 (9.7) | <0.001 |
| 3 | 152 (26.3) | 100 (16.1) | 252 (21.0) | |
| 4+ | 271 (47.0) | 407 (65.5) | 678 (56.6) | |

The mean weight of females (57.6 ± 11.7 kg) was higher than the mean weight of male (56.8 ± 13.5 kg). Compared to males, the mean weight of females was higher up to the age of 14 - <16 years. The difference in mean weight between sexes was not statistically significant (t = 1.01, $p = 0.31$). The overall mean height of the males (1.67 ± 0.11 m) was significantly higher than that of females (1.63 ± 0.08 m) (t = 6.21, $p < 0.001$). There was a gradual increase in height with age except at 18 - <19 years in both sexes. The mean BMI was observed to increase

steadily with age in both sexes, except at 18 - <19 years in males. The mean BMI for females (21.51 ± 3.57 kg/m$^2$) was significantly higher than that of the males (20.22 ± 3.16 kg/m$^2$) (t = 6.64, $p < 0.001$) as shown in Table 3.

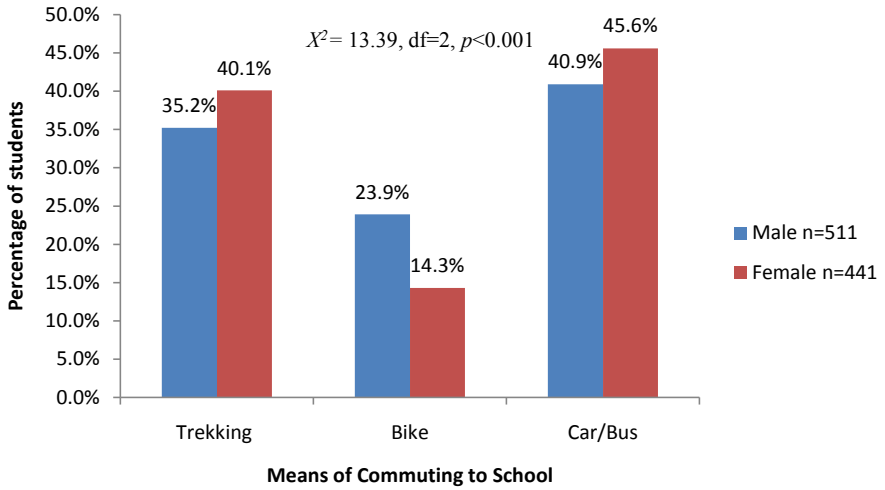


Figure 2. Means of commuting to school by gender.

Table 3. Mean weight (kg), mean height in cm and BMI of students by age and gender.

| Age(in years) | Males(n) | Mean ± SD | Females(n) | Mean ± SD | T | *P* value |
|---|---|---|---|---|---|---|
| **Mean weight** | | | | | | |
| 0 - <12 | 37 | 42.93 ± 9.62 | 30 | 47.17 ± 12.34 | 1.58 | 0.12 |
| 12 - <14 | 142 | 47.18 ± 11.32 | 158 | 52.93 ± 11.89 | 4.28 | <0.001 |
| 14 - <16 | 185 | 58.29 ± 11.71 | 237 | 58.56 ± 10.10 | 0.25 | 0.80 |
| 16 - <18 | 174 | 65.18 ± 11.65 | 163 | 61.70 ± 11.39 | 2.78 | 0.01 |
| 18 - ≤19 | 39 | 61.73 ± 7.31 | 33 | 62.68 ± 10.05 | 0.46 | 0.64 |
| Total | 577 | 56.88 ± 13.57 | 621 | 57.62 ± 11.74 | | |
| **Mean height** | | | | | | |
| 10 - <12 | 37 | 1.53 ± 0.10 | 30 | 1.56 ± 0.09 | 1.01 | 0.31 |
| 12 - <14 | 142 | 1.58 ± 0.10 | 158 | 1.60 ± 0.08 | 2.66 | <0.01 |
| 14 - <16 | 185 | 1.68 ± 0.09 | 237 | 1.63 ± 0.07 | 5.97 | <0.001 |
| 16 - <18 | 174 | 1.74 ± 0.07 | 163 | 1.66 ± 0.07 | 9.66 | <0.001 |
| 18-≤19 | 39 | 1.73 ± 0.06 | 33 | 1.66 ± 0.07 | 4.46 | <0.001 |
| Total | 577 | 1.67 ± 0.11 | 621 | 1.63 ± 0.08 | | |
| **Mean BMI** | | | | | | |
| 10 - <12 | 37 | 18.04 ± 2.51 | 30 | 19.27 ± 4.03 | 1.53 | 0.13 |
| 12 - <14 | 142 | 18.77 ± 2.81 | 158 | 20.43 ± 2.57 | 4.45 | <0.001 |
| 14 - <16 | 185 | 20.49 ± 3.23 | 237 | 21.81 ± 3.25 | 4.16 | <0.001 |
| 16 - <18 | 174 | 21.48 ± 3.07 | 163 | 22.28 ± 3.61 | 2.20 | 0.03 |
| 18 - ≤19 | 39 | 20.66 ± 1.72 | 33 | 22.84 ± 3.10 | 3.74 | <0.001 |
| Total | 577 | 20.22 ± 3.16 | 621 | 21.51 ± 3.57 | 6.64 | <0.001 |

t = 1.01, $p = 0.31$.

Overall, 76.1% of the students had a normal BMI, 4.4% were underweight, 14.4% overweight, and 5.1% obese. The prevalence of overweight was 10.7% in males and 17.7% in females ($p < 0.001$). The prevalence of obesity was 4.5% in males and 5.6% in females. There was a statistically significant difference in the distribution of BMI by gender ($p < 0.001$) as shown in Table 3 and Figure 3.

Peak prevalence rates of overweight (19.4%) and obesity (9.0%) were among age group 10 - <12 years and least for age group 16 - <18 years and 18 - <19 years respectively. Significant association was observed between prevalence of overweight and obesity and age ($\chi^2 = 22.27$, df = 12, $p = 0.04$). Those aged 10 - <12 years had significant highest proportion of overweight ($\chi^2 = 11.41$, df = 4, $p = 0.02$) as shown in Table 4.

Prevalence of overweight was highest among adolescents from the middle socio-economic class (16.2%) compared to the high (13.0%) and low (11.4%) socio-economic classes. Prevalence of obesity was highest among students from the high socio-economic class (5.3%) compared to the middle (5.1%) and low (0.0%) socio-economic classes. However, these differences were not significant ($\chi^2 = 5.12$, df = 6, $p = 0.52$) as shown in Table 5.

Consumption of at least two bottles of sugar-based/sweetened drinks per day was significantly associated with higher prevalence rates of overweight and obesity ($\chi^2 = 14.09$, $p < 0.001$). Subjects who consumed 2 or more bottles of beer per day were more likely to be overweight (17.1%) or obese (6.7%). However, this difference was not statistically significant ($\chi^2 = 0.58$, $p = 0.75$) as in Table 6.

Overweight and obesity were more prevalent among study subjects who ate more than three meals per day, ate outside home three or more times per week and consumed mostly snacks. No significant association was observed between eating pattern and overweight and obesity as shown in Table 7.

The prevalence rates of overweight (17.7%) and obesity (7.1%) were significantly higher among those who engaged in sedentary activity for longer than 3 hours ($\chi^2 = 53.71$, df = 8, $p < 0.001$). Students who participated in fewer school-based sports were more likely to be overweight or obese ($\chi^2 = 18.84$, df = 9, $p = 0.03$) as in Table 8.

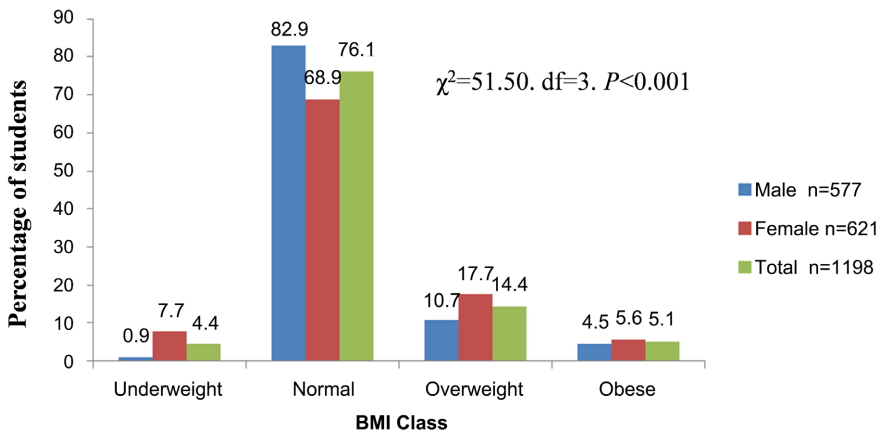


Figure 3. Distribution of students by BMI class and by gender.

**Table 4.** Distribution of BMI status in relation to age.

| Age (in years) | Underweight N (%) | Normal N (%) | Overweight N (%) | Obese N (%) | $\chi^2$ | *P* value |
|---|---|---|---|---|---|---|
| 10 - <12 | 3 (4.5) | 45 (67.2) | 13 (19.4) | 6 (9.0) | | |
| 12 - <14 | 19 (6.3) | 216 (72.0) | 50 (16.7) | 15 (5.0) | 22.27 | 0.04 |
| 14 - <16 | 19 (4.5) | 313 (74.2) | 70 (16.6) | 20 (4.7) | df = 12 | |
| 16 - <18 | 11 (3.3) | 276 (81.9) | 32 (9.5) | 18 (5.3) | | |
| 18 - ≤19 | 1 (1.4) | 62 (86.1) | 7 (9.7) | 2 (2.8) | | |

$\chi^2 = 3.47$, df = 2, $\chi^2 = 16.79$, df = 4, $\chi^2 = 11.41$, df = 4, $\chi^2 = 2.22$, df = 3, $p = 0.18$, $p = 0.002$, $p = 0.02$, $p = 0.53$.

**Table 5.** Association between overweight and obesity and socio-economic class.

| Social class | Underweight (n = 53) N (%) | Normal (n = 912) N (%) | Overweight (n = 172) N (%) | Obese (n = 61) N (%) | $\chi^2$ | *P* value |
|---|---|---|---|---|---|---|
| High | 26 (4.1) | 494 (77.6) | 83 (13.0) | 34 (5.3) | 2.55, df = 3 | 0.47 |
| Middle | 25 (4.8) | 389 (74.0) | 85 (16.2) | 27 (5.1) | 2.94, df = 3 | 0.40 |
| Low | 2 (5.7) | 29 (82.9) | 4 (11.4) | 0 (0.0) | 1.54, df = 2 | 0.46 |

$\chi^2 = 5.12$, df = 6, $p = 0.52$.

**Table 6.** Association between drinking pattern and overweight and obesity.

| Drinking Pattern | Underweight (n = 53) N (%) | Normal (n = 912) N (%) | Overweight (n = 172) N (%) | Obese (n = 61) N (%) | $\chi^2$ | *P* value |
|---|---|---|---|---|---|---|
| **Number of sugar-based drinks/day** | | | | | | |
| 0 | 9 (4.2) | 173 (81.6) | 24 (11.3) | 6 (2.8) | | |
| 1 | 24 (5.0) | 380 (78.5) | 64 (13.2) | 16 (3.3) | 14.09 | <0.001 |
| 2+ | 20 (4.0) | 359 (71.5) | 84 (16.7) | 39 (7.8) | df = 8 | |
| **Number of bottles of beer taken/day** | | | | | | |
| 0 | 31 (5.5) | 428 (76.5) | 75 (13.4) | 26 (4.6) | | |
| 1 | 18 (4.0) | 341 (76.7) | 64 (14.4) | 22 (4.9) | 0.58 | 0.75 |
| 2+ | 4 (2.1) | 143 (74.1) | 33 (17.1) | 13 (6.7) | df = 8 | |

**Table 7.** Association between eating pattern and overweight and obesity.

| Eating Pattern | Underweight (n = 53) N (%) | Normal (n = 912) N (%) | Overweight (n = 172) N (%) | Obese (n = 61) N (%) | $\chi^2$ | *P* value |
|---|---|---|---|---|---|---|
| **Number of meals eaten/day** | | | | | | |
| 2 | 25 (4.5) | 427 (76.5) | 76 (13.6) | 30 (5.4) | 0.59 | 0.89 |
| 3 | 28 (4.5) | 481 (76.0) | 94 (14.8) | 30 (4.7) | df = 3 | |
| >3 | 0 (0.0) | 4 (57.1) | 2 (28.6) | 1 (14.3) | | |

Continued

| | | | | | | |
|---|---|---|---|---|---|---|
| **Number of meals eaten out/week** | | | | | | |
| None | 36 (4.9) | 568 (77.1) | 99 (13.5) | 33 (4.5) | | |
| 1 | 10 (5.4) | 136 (73.5) | 29 (15.7) | 10 (5.4) | 11.81 | 0.22 |
| 2 | 5 (2.9) | 128 (75.3) | 27 (15.9) | 10 (5.9) | df = 9 | |
| 3+ | 2 (1.9) | 80 (74.7) | 17 (15.9) | 8 (7.5) | | |
| **Number of Snacks/day** | | | | | | |
| None | 21 (5.0) | 320 (75.7) | 61 (14.4) | 21 (5.0) | | |
| 1 | 21 (4.6) | 353 (76.6) | 65 (14.1) | 22 (4.8) | 6.51 | 0.68 |
| 2 | 9 (3.6) | 192 (76.8) | 36 (14.4) | 13 (5.2) | df = 9 | |
| 3+ | 2 (3.1) | 47 (73.4) | 10 (15.6) | 5 (7.8) | | |

**Table 8.** Association between BMI status and engagement in physical activities.

| Duration of activity | Underweight (n = 53) N (%) | Normal (n = 912) N (%) | Overweight (n = 172) N (%) | Obese (n = 61) N (%) | $\chi^2$ | *P* value |
|---|---|---|---|---|---|---|
| **Duration of involvement in sedentary activities in hours/day** | | | | | | |
| None | 11 (9.5) | 90 (77.6) | 12 (10.3) | 3 (2.6) | | |
| ≤1 | 17 (10.7) | 122 (76.8) | 15 (9.4) | 5 (3.1) | 53.71 | <0.001 |
| >1 - 2 | 12 (6.1) | 153 (78.1) | 24 (12.2) | 7 (3.6) | df = 8 | |
| >2 - 3 | 9 (4.3) | 160 (77.3) | 29 (14.1) | 9 (4.3) | | |
| >3 | 4 (0.8) | 387(74.4) | 92 (17.7) | 37 (7.1) | | |
| **Participation in school based sports/week** | | | | | | |
| None | 32 (6.6) | 345 (71.1) | 77 (15.9) | 31 (6.4) | | |
| ≤1 | 6 (2.7) | 173 (77.6) | 32 (14.3) | 12 (5.4) | 18.84 | 0.03 |
| 2 | 7 (4.3) | 131 (79.9) | 18 (11.0) | 8 (4.9) | df = 9 | |
| 3+ | 8 (2.5) | 263 (80.7) | 45 (13.8) | 10 (3.1) | | |

**Table 9.** Association between overweight/obesity and engagement in household chores and means of commuting to school.

| Variable | Underweight (n = 53) N (%) | Normal (n = 912) N (%) | Overweight (n = 172) N (%) | Obese (n = 61) N (%) | $\chi^2$ | *P* value |
|---|---|---|---|---|---|---|
| **Involvement in household chores** | | | | | | |
| None | 1 (1.9) | 28 (53.8) | 15 (28.8) | 8 (15.5) | 26.54 | <0.001 |
| 1 - 2 | 19 (8.4) | 152 (67.3) | 41 (18.1) | 14 (6.2) | df = 3 | |
| 3+ | 33 (3.6) | 732 (79.6) | 116 (12.6) | 39 (4.2) | | |
| **Means of commuting to school** | **Underweight n = 55 (%)** | **Normal n = 739 (%)** | **Overweight n = 113 (%)** | **Obese 45 (%)** | | |
| Trekking | 35 (9.9) | 277 (78.2) | 33 ( 9.3) | 8 (2.3) | 32.07 | <0.001 |
| Motorbike | 10 (5.2) | 152 (79.6) | 20 (10.4) | 9 (4.7) | df = 6 | |
| Car/Bus | 10 (2.5) | 310 (76.2) | 60 (14.7) | 28 (6.8) | | |

Students who did not engage in household chores were most overweight (28.8%) or obese (15.5%) ($\chi^2 = 26.54$, df = 3, $p < 0.001$). Also, students who commute to school by car/bus were most overweight (14.7%) or obese (6.8%) ($\chi^2 = 32.07$, df = 6, $p < 0.001$) as in **Table 9**.

## 6. Discussion

The highest prevalence rates of overweight and obesity was in the age group of 10 - 12 years. This finding is consistent with the findings in the study done by Odo *et al.* [22] among adolescents in urban and rural areas in nearby Enugu State. The lower prevalence of overweight among older adolescents in this study is also consistent with the findings from previous studies [7] [23], and could be attributed to the fact that older adolescents are conscious of their physical appearance and thus try to maintain healthy weights. However, the results are in contrast to those of Akesode *et al.* [24] and Yusuf *et al.* [5] who reported a higher prevalence of overweight among older adolescents.

The finding of higher prevalence rates of overweight and obesity among female adolescents in this study, is consistent with other previous studies [24] [25] [26], but differ with the findings from most developed countries in which there is a male preponderance of overweight and obesity [27] [28] [29]. The preponderance of overweight and obesity among females in developing countries may be attributed partly to the hormonal changes during adolescence [30] [31], and partly to the behavioral differences between males and females, the former being more physically active [32]. In addition, concerns about body image among adolescent girls in particular may lead to problematic eating behaviors such as irregular meal patterns which may result in increased weight gain [33]. In developed countries, dietary intake rather than or in addition to physical activity drive the gender disparities in overweight and obesity [34]. Males in developed countries have greater preference for meat-based products and thus consume more of protein-based diet than females. Increased energy intake from protein, results to increased weight gain [35]. The predisposition of female adolescents to overweight or obesity could put them at a greater risk of health issues resulting from overweight and obesity [36] [37] [38].

The higher prevalence rates of overweight and obesity among adolescents of the upper and middle class families in this study is in agreement with results of Alkali *et al.*'s study [39] in Gombe State, Nigeria. It is not surprising since affluent parents are known to freely provide their adolescent children with energy dense snacks thus contributing to excessive weight gain [40]. The observation is however, in contrast with the results of studies from developed countries [27] [28] [41], where overweight and obesity are more prevalent among adolescents from the lower socio-economic class. A few studies [7] [42] from developing countries as well as the present study, report that there is no significant association between socio-economic status and the prevalence of overweight and obesity. This was probably because the population was more or less homogenous with

a loose classification into the social classes; this finding was consistent with previous studies in Nigeria [43] [44] [45]. In high income countries, food insecurity results in obesity and overweight in children as poorer families tends to go for cheaper , energy dense processed foods. While some other studies opine that children of more affluent tends to be more obese [46] [47] [48] due to availability of large quantities of food. In many low and middle income countries low socioeconomic class is rather associated with the opposite-a decrease in obesity and an increase in stunting and under nutrition [49]. Other reasons could be due to other health-risk behaviors' that could influence energy metabolism such as drinking pattern, feeding pattern, involvement in physical activities.

The prevalence rates of overweight and obesity were higher among adolescents who consumed at least two bottles of sugar–based drinks per day. This finding is consistent with those of Ludwig *et al.* [50]. These drinks have a high sugar content, low satiety, and incomplete compensation for total energy thus contributing to the development of overweight and obesity.

There is no consensus on the relationship between obesity and the intake of alcohol [51]. Alcohol consumption amongst adolescents in this study was not significantly associated with overweight and obesity. This supports the findings of Peltzer *et al.* [52] in Ghana. In contrast, Mandal *et al.* [53] in India reported that alcohol consumption is a risk factor for adolescence overweight. Also, Vagstrand *et al.* [54] reported that alcohol intake was positively associated with increased body fat in female but not in male adolescents. Furthermore, a strong positive association between beer consumption and overweight and obesity was reported by Mozafarrian *et al.* [55]. A possible explanation for the inconsistency between reports could be related to the differences in the amount of alcoholic drinks consumed or cultural variations in the drinking patterns of the different areas studied.

The highest prevalence rates of overweight and obesity were among adolescents who ate more than 3 times per day. Female adolescents were more likely to eat up to three times daily and this would have been the reason for the higher prevalence rates of overweight and obesity found in females in this study. However, no significant association was found between the number of meals per day and prevalence of overweight and obesity. This is consistent with findings by Nicklas *et al.* [56]. In contrast, Toschke *et al.* [57] reported an inverse association between meal frequency and childhood overweight and obesity.

Snacks promote weight gain by contributing extra calories. Snacks also accentuate hunger, thereby resulting in a higher intake of food at meals [58]. Those who consumed most snacks in this study were more likely to be overweight or obese. However, there was no significant association between consumption of snacks [59] [60] have demonstrated an inverse association between increased snacking and weight gain.

The present study showed that most adolescents spent more than 3 hours per day watching television, playing games or computer which is far above the rec-

ommended "screen time" of ≤2 hours per day for children 2 - 18 years old [61]. These results also confirmed the previous findings on the association between lifestyle and overweight and obesity [62].

Female adolescents in this study were less likely to engage in organized school sports and this might have contributed to the higher prevalence rates of overweight and obesity among them. The lower rate of participation of female adolescents in school-based sports may be due to socio-cultural and religious restrictions [63].

The prevalence rates of overweight and obesity were higher among respondents who did not participate in any form of organized sports in school. This agrees with previous studies [64] [65].

This study also observed that the prevalence rates of overweight and obesity were lower among adolescents who engaged in at least 3 household chores. This supports the fact that involvement in household chores is a good form of physical activity and is consistent with the findings from the study by Laxmaiah *et al.* [66].

The results of this study also showed higher prevalence rates of overweight and obesity among those driven to school and is agreement with other previous studies [67] [68]. This observation emphasizes the need for the provision of safe walkways for students to use while commuting to and from school as a way of promoting a more active life style among adolescents.

## 7. Conclusions

1) Mean Body Mass Index (BMI) is higher in adolescent females than in males.

2) Overweight and obesity among adolescents in ONLGA are directly associated with consumption of sugar-based beverages and sedentary life style.

## Recommendations

1) The findings of this study call attention to the need to address the problem of Overweight/Obesity among secondary school adolescent by incorporation of health education on nutrition and exercise in the school curriculum.

2) The Federal Government of Nigeria should regulate the intake of sugar-based beverages in adolescents either through taxation or an outright ban from school canteens.

3) The reduction of sedentary lifestyle among adolescents could be an effective measure against adolescent overweight and obesity. Adolescents should be encouraged to be involved in sports and household chores.

## Study Limitations

1) The ages of the participants were verified using the school register as it was difficult to assess the students' birth certificates.

2) The assessment of food intake and physical activity was subjective and this

might have affected the information on the accurate calories from food intake and actual duration and intensity of physical activity.

3) The questionnaires were self reported and some respondents might have given incorrect information to protect their ego, this could have influenced the conclusions drawn from the results.

4) The types of snacks consumed by adolescents and their potential impact on overweight and obesity were not part of this study.

## Further Studies

The different types of snacks and their specific effects on overweight and obesity should be considered.

## Conflicts of Interest

The authors declare that they have no conflict of interest.

## Disclosure

This research did not receive any specific grant from funding agencies. The authors bore all the cost incurred during the course of this research.

## Ethical Approval and Consent

Ethical approval was obtained from the institutional ethical committee of Nnamdi Azikiwe University Teaching Hospital. Permission was also obtained from Anambra State Post Primary School Service Commission. Consent of the participating school principals, parents/guardians, tutorial staff and students were duly obtained.

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