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**Research Article,**

# Prevalence of Overweight and Obesity among Secondary Schools Adolescents in Onitsha, Anambra State Nigeria

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## Abstract:

**Background:** The prevalence of obesity is increasing worldwide, both in developed and developing countries. In Nigeria, obesity is emerging as an important public health problem. Childhood and adolescent obesity results in adult obesity with the resultant morbidities.

**Objectives:** This study determines the prevalence of overweight and obesity in apparently healthy secondary school adolescents.

**Methods:** This study was a cross-sectional study of secondary school adolescents aged 10-19 years randomly selected from two public schools and three private schools. The weights and heights of the study subjects were measured using standard equipment. BMI was computed using the standard formula weight (kg) / height2 (m). Using the WHO; 2007 age and sex-specific BMI percentile cut-offs, the subjects were classified as underweight (3rd to <15th percentile), normal (15th to <85th percentile), overweight (85th to <97th percentile) or obese ≥97th percentile.

**Results:** Data were initially collected from 1250 participants, but 52 were excluded from improperly completed questionnaires. Thus, 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 an F: M ratio of approximately 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 males and females in the distribution of age groups (p=0.12). The mean BMI was 21.51±3.57kg/m2 for females and 20.22±3.16kg/m2 for males. The BMI was significantly higher in females in all age groups (p<0.001) except for those aged 10-<12 years (p=0.13). The prevalence rates of overweight and obesity were 14.4% and 5.1%, respectively. The prevalence rates of overweight and obesity were significantly 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<12yrs; p= 0.04).

**Conclusion:** Prevalence of overweight and obesity is high among secondary school adolescents in Onitsha, Anambra state. There is a need for regular monitoring of weight and height as an early measure to prevent and control overweight and obesity.

**Keywords:** Bmi, Prevalence of Overweight and Obesity, Adolescents.

## Introduction:

Childhood and Adolescent obesity have attained epidemic levels in the United States, with millions of lives affected. In the past three decades, the prevalence of childhood obesity has more than doubled in children and tripled in adolescents.1 the Latest data from National Health and Nutrition Examination Survey shows that the prevalence of obesity among children and adolescents in the US was 18.5% in 2015-2016. Overall, the prevalence of obesity among adolescents 12-19 years was

higher than among school-aged children.1According to Ahmad et al. 80% of adolescents aged 10-14 years, 25% of children younger 5 years, and 50% of children aged 6 to 9 years with obesity are at risk of growing into an adult with obesity.2 Among Nigerian adolescents, the prevalence of obesity is up to 18%.3, 4 Several factors contribute to the increasing prevalence of overweight and obesity in adolescents. These include increased consumption of energy-dense diets, high in fat, high sugar, high salt, low nutrient quality and without proportionate energy expenditure due to sedentary lifestyle.5 Parental influence on the feeding habits of children and dietary intake is significant.6 Previous studies have shown a relationship between child body mass index (BMI) and maternal behaviours such as restrictive feeding practices, eating pressure, and weight concerns.6,7 Obesity can affect all areas of the adolescent's life, including psychological, emotional, cardiovascular and entire physical health. Also, the relationship between obesity and morbid outcomes makes it a public health issue. It is associated with hypertension, hyperlipidaemia, diabetes, sleep apnea, poor self-esteem, and severe depression. The children that attained adult life with obesity end up with cardiovascular and digestive diseases. Some obese adolescents are at increased risk of cancers, such as breast, colon, oesophagal, kidney and pancreatic cancers, due to increased body fat. Moreover, obesity is associated with social isolation, 12, 13, 14 increased mortality in later life, and economic losses due to reduced productivity and premature deaths.15, 16The impact of the latter is likely to be greater in developing countries owing to extant inadequacy of resources and meagre budgets for health care. Therefore, emphasis should be placed on strategies aimed at preventing adolescent overweight and obesity through weight monitoring and reduction. There are many studies on the prevalence of overweight and obesity among adolescents in Nigerian, but only a few, particularly from the South East, have evaluated its associated factors. Therefore, understanding how to intervene effectively to prevent overweight and obesity during adolescence requires more knowledge and awareness about these disorders in Nigeria. Therefore, the aim of this study was to determine the prevalence of overweight and obesity among secondary school adolescents aged 10-19 years in Onitsha and to identify the socio-demographic factors contributing to them. Furthermore, the findings of this research could add to the existing body of knowledge on overweight and obesity.

## Subjects and Methods:

### *Study Area*

This was a cross-sectional survey conducted among secondary school adolescents 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 centre in Anambra State and is the gateway to Eastern Nigeria.17 the ONLGA has 41 secondary schools comprising 17 public and 24 private secondary schools.

### *Study Participant and Recruitment*

The 1250 students apparently healthy adolescents aged 10-19 years whose ages were verified using the school register were selected in the same ratio of 2:3, that is, 500 students from public schools and 750 students from private schools. Subjects were recruited by multi-stage sampling technique. Students with history or features suggesting a chronic medical condition such as chronic renal failure, heart disease, sickle cell disease, students with a physical impairment such as a lumbar or spinal abnormality and those on drugs known to cause overweight or obesity such as steroids and poorly completed questionnaires were excluded from the study.

### *Data collection*

Stage1. All the registered secondary schools in ONLGA were stratified into public and private schools. The public schools were 17 and the private schools 24.

Stage 2. Using simple random sampling, by balloting from the numbered schools, a total of five schools, two public and three private schools, were selected given a ratio of 2:3. The calculated sample size of 250 was applied to each school; 18 thus, 1250 students were selected.

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 categories in the school), while 14 students represented each arm of three arms. There were more than three arms per class; three were selected through random sampling. The 14 students were chosen systematically using the class register as the sample frame, and the students were

set at an interval of 2, with the first randomly selected. For the private schools, 750 students represented the 3 private schools. Again, 250 students were chosen 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 a systematic sampling technique.

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

### *Ethical Approval and Consent*

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

## Methodology:

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, the stadiometer and positioning of the students to avoid errors in measurement of weights and heights. At first contact, the students were introduced to the research team. Next, the purpose and nature of the study were explained in detail, and reassurances were given to them that the research activity would not harm the participants. This was followed by a request for verbal assent of the students and written informed consent from the parents. Finally, data were collected using a semi-structured questionnaire.

The following information was collected -students' personal data, parents' occupation and level of education, family and medical history. The students who were boarders and someday 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. They are 10-<12years, 12-<14years, 14-<16years, 16-<18years, and 18-<19years.

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

The weight was measured with a mechanical floor scale (SECA model 761, UK) that can measure to the nearest 0.1 kilograms (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 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) / height2 (m2). Using the WHO; 2007 age and sex-specific BMI percentile cut-offs (Appendix VII), the subjects were classified as normal (15th to <85th percentile), underweight (3rd to <15th percentile), overweight, (85th to <97th percentile) or obese (97th percentile and above).20

The students' families were classified into socio-economic classes using Oyedeji's method.21

### *Data Analysis*

Data were entered into MS Excel version 2010 spreadsheet. Data analysis was carried 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 association tests were made using the chi-square test. Analysis of variance (ANOVA) and student's t-test was used to compare the means of continuous variables. A p-value of <0.05 was considered statistically significant.

## Results:

Data were initially collected from 1250 participants, but 52 were excluded from improperly completed questionnaires. Thus, 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, providing an 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 males and females in the distribution of age groups (p=0.12).

Over half of the students (53.0%) were from high socio-economic class families. The prevalence of high socioeconomic class families was significantly higher among male students (59.1% vs 47.3%, x2= 18.3, p = <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%; x2 = 56.4, p<0.001). There was no significant difference between male and female students in the type of school and prevalence of a family history of non-communicable diseases.

**Table I: General characteristics of the study population**

| **Characteristic**<br>**Age (in years)** | **Male**<br>**(n=577)(%)** | **Female**<br>**(n=621) (%)** | **Total**<br>**(N=1198) (%)** | **$t/\chi^2$** | ***P* value** |
|---|---|---|---|---|---|
| 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 | |
| FamilyHistoryof 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 |

## Anthropometric measurements of the study population

Table II shows the mean weight of the students by age and gender. The mean weight of females (57.6±11.7kg) was higher than that of males (56.8±13.5 kilograms). Compared to males, the mean weight of females was higher up to the age of 14 -<16years. However, the difference in mean weight between sexes was not statistically significant (t=1.01, p=0.31).

**Table II: Meanweight (kg) of students by age and gender**

| **Age(in years)** | **Males(n)** | **Mean ±SD** | **Females(n)** | **Mean ±SD** | **T** | ***P* value** | |
|---|---|---|---|---|---|---|---|
| 10-<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 | | | |

***t*=1.01, *p*=0.31**

**Table III shows the mean height of the students by age and gender. The overall mean height of the males (1.67±0.11 m) was significantly higher than that of females (1.63±0.08m) (t=6.21, p<0.001). Furthermore, there was a gradual increase in height with age except at 18 -< 19 years in both sexes.**

**Table III: Mean height (m) of students by age and gender**

| Age (in years) | Males (n) | Mean ±SD | Females(n) | Mean ±SD | T | *P* value | |
|---|---|---|---|---|---|---|---|
| 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 | | | |

$t$=6.21, $p$<0.001

**Table IV shows the students' mean BMI distribution by age and gender.**
**The mean BMI increased steadily with age in both sexes, except at 18-<19 years in males.**
**The mean BMI for females (21.51±3.57kg/m2) was significantly higher than that of the males (20.22±3.16kg/m2) (t=6.64, p<0.001).**

**Table IV: Mean (kg/m$^2$) BMI of students by age and gender.**

| Age (years) | Males (n) | Mean ±SD | Females (n) | Mean ±SD | T | *P* value |
|---|---|---|---|---|---|---|
| 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 |

## Prevalence of overweight and obesity in the study population

**Figure I** shows the distribution of BMI status by gender. 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 BMI distribution by gender (p<0.001).

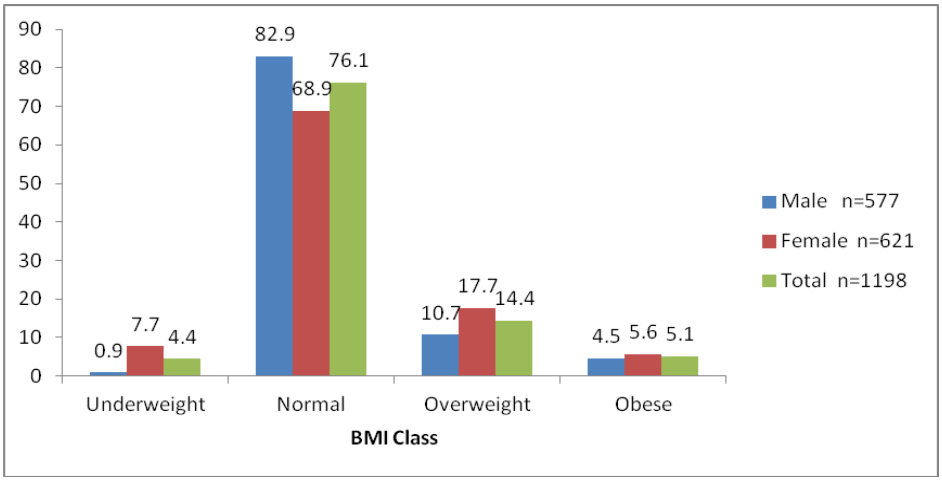


Figure I: Distribution of Students by BMI Class and by Gender.

The association between overweight and obesity and socioeconomic class is shown in Table V. Prevalence of overweight was highest among adolescents from the middle socioeconomic class (16.2%) compared to the high (13.0%) and low (11.4%) socioeconomic classes. Obesity prevalence was highest among students from the high socioeconomic class (5.3%) compared to the middle (5.1%) and low (0.0%) socioeconomic classes. However, these differences were insignificant ($\chi 2$=5.12, df=6, p=0.52).

**Table V: 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 |

## Discussion:

This study showed that females had a significantly higher mean BMI than males. This is consistent with the results of previous Nigerian studies.3, 22, 23-25 but contradicts that of Yusufet al., 26who reported no significant difference between mean BMI across gender. The prevalence rates of overweight and obesity among the adolescents in this study were 14.4% and 5.1%, respectively. The combined prevalence was 19.5% and indicated a high prevalence of overweight and obesity in the study area. This is consistent with some previous studies.27, 28However, the 5.1% prevalence of obesity is higher than the 0.3%-1.8% reported from other Nigerian studies 18, 26 and lower than the 9.8% and 18% reported in Ife4 andNnewi.29In the Ife study, there was no distinction between overweight and obese subjects. The higher prevalence of obesity in this study compared to previous studies 29,30could be due to differences in geographical locations of the populations of these studies, with distinct genetic, environmental and socio-cultural backgrounds. The previous Nigerian studies were carried out in the South-Western29 and North-Central,30 Nigeria instead of the South-Eastern base of this present study. The highest prevalence rates of overweight and obesity were in the age group of 10-12 years. This finding is consistent with Odo et al.31, who studied adolescents in urban and rural areas nearby Enugu State. The lower prevalence of overweight among older adolescents in this study is also consistent with the findings from previous studies.3,32 and could be attributed to the fact that older adolescents are conscious of weight gain and physical appearance and thus try to maintain healthy weights. However, the results contrast to those of Akesode et al. 22and Yusuf et al. 26who 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 the previous studies.22,33,34 However, differ from the findings from most developed countries in which there is a male preponderance of overweight and obesity3, 35, 36 The preponderance of overweight and obesity among females in developing countries may be attributed partly to the hormonal changes during adolescence37, 38and partly to the behavioural differences between males and females, the former being more physically active.39 In addition, concerns about body image among adolescent girls, in particular, may lead to problematic eating behaviours such as irregular meal patterns which may result in increased weight gain.40In developed countries, dietary intake rather than or in addition to physical activity drive the gender disparities in overweight, and obesity.41Males in developed countries have a greater preference for meat-based products and thus consume more of protein-based diet than females. Increased energy intake from protein results in increased weight gain 42The predisposition of female adolescents to overweight or obesity could put them at a greater risk of health issues resulting from overweight and obesity.43, 44,45 The higher prevalence rates of overweight and obesity among adolescents of the upper and middle-class families in this study agree with Alkali et al.'s study46 in Gombe State, Nigeria. It is not surprising since affluent parents can freely provide their adolescent children with energy-dense snacks, thus contributing to excessive weight gain.47 The observation is in contrast with the results of studies from developed countries, 3,35,48 where overweight and obesity are more prevalent among adolescents from the lower socioeconomic class. A few studies3, 29from developing countries and the present study report no significant association between socioeconomic status and the prevalence of overweight and obesity.

## Conclusion:

The prevalence rates of overweight and obesity were high among adolescents in ONLGA, and the mean Body Mass Index (BMI) is higher in adolescent females than males.

**Recommendations:**

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

**Study Limitations:**

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

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