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# Nutrition and Health Status of Adolescents in a Private Secondary School in Port Harcourt

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## Abstract

**Background:** Adolescents health status is a cumulative effect of the health and nutritional problems occurring during early childhood as well those originating in period of adolescence.

**Objectives:** To determine nutrition and health status of adolescents using body mass index, dental caries and visual acuity and the relationship between BMI, gender, age and period of adolescence.

**Methods:** In 2009, 182 adolescents aged 10-16 years in armed force secondary school in Port Harcourt were selected in the junior secondary schools. Weight, height were measured, BMI estimated, their visual acuity and dental status were also assessed.

**Results:** The prevalence of underweight, overweight and stunting were 46.2%, 6.6% and 36.3% respectively. Twenty three percent had refractive error and prevalence of dental caries was 24.2%. There was a significant difference in the mean BMI by gender and period of adolescence. The prevalence of underweight was higher in early adolescence and male gender while the prevalence of stunting was higher in the early adolescence.($x^{2=}$ 5.32, p=0.02) There was a significant association between low BMI and gender (($x^2$=14.3, p=0.0001); low BMI and period of adolescence ($x^2$=13.1, p=0.014).

Gender and period of adolescence is a contributory factor in BMI of the adolescents. Periodic assessment of adolescents in schools and communities is essential in order to design a life course approach preventive efforts to address their health and nutritional problems.

**Keywords:** Nutrition, Body Mass Index, Adolescent Health

## Introduction

Adolescence is a period of transition of physical, psychological and social maturation from childhood to adulthood. An estimated 20% of the total world population are adolescents. Achievement of optimum growth during this period is of utmost importance in maintaining good health thereafter. Poor nutrition among adolescents resulting in short stature and low lean body mass is associated with many concurrent and future adverse health outcomes [1]. The nutritional status of adolescents contributes significantly to the health status of the community in which they reside. One of the major global health problems faced by developing countries today is under nutrition [2]. Adolescent malnutrition (underweight or overweight) impacts future adult physique and sense of self-esteem, it also affects future metabolic and cardiovascular outcomes [3]. A previous study carried out amongst secondary students in Kaduna metropolis showed that energy and protein intake by the students were inadequate to adequately support their health status otherwise majority of them would not have been underweight or slightly obese. Most times, the body mass index of adolescents were categorised into overweight, obesity, and thinness according to the International Obesity Task Force cut off points for children and adolescents. In Nigeria, the prevalence of thinness (grades 2 and 3) has been reported to be as high as 10.2% among school children in Markudi [4]. A study carried out among urban school aged children and

adolescent in southern Nigeria showed a prevalence rates of thinness of 13% , more in children than adolescent and affected by location and income levels [5]. Similarly, a study amongst adolescent in rural and urban areas in Enugu reported a prevalence rate of thinness of 13.9% [6]. However, a study conducted among adolescents in Kano reported an overall prevalence of thinness of 60.6%, with a higher prevalence among boys (63.0%) compared with girls (58.7%) [7]. A study amongst adolescents in Umahia, south eastern part of Nigeria reported 24.2% of boys and 19.2% of girls were thin% [8]. The higher prevalence of thinness in boys compared with girls could be explained by the engagement of the boys in more physically demanding activities than girls including walking to school irrespective of the distance and partaking in rigorous sport activities. The anthropometric measurements of adolescent in developing countries are lower than global reference [7]. This has been ascribed to delayed growth in Africans during early adolescence. Overweight and obesity are increasing in high-income countries and in low- and middle income countries, with increased risk of diabetes and cardiovascular disease [9]. Reports from studies in four urban towns in southern Nigeria reported prevalence rate of 11.4% and 2.8% of overweight and obesity respectively [5]. A study in Niger Delta, southern Nigeria found 22% overweight and 49.3% were obese [10]. A prevalence of overweight of 8.1% in males , 8.1% in females and prevalence of obesity of 2.7% in males and 1.9% in females was reported in Shagamu, south west Nigeria [11]. In Abia, south east Nigeria , prevalence of overweight/obesity was 28.4% , contrast to this is the report of prevalence of obesity of 6%, a community based study in Benue reported overweight of 9.7% and obesity 1.8% [12-14]. The reason may be due to socioeconomic differences in sub population studied.

Research have reported that the important morbidities found among school children are malnourishment, communicable diseases, ailments of skin, eye and ear and dental problems [15]. Vision is an important equipment of learning and communication. Optimal vision is essential for learning, health and education needs. Previous studies have shown that ocular morbidity is a public health problem. In a study carried amongst school children who attend municipal and private schools in Pune, India, overall, 43.06 % of students with refractory error were underweight; the underweight students were having more refractory error followed by normal and overweight with 27.78% each respectively. In the municipal school, refractory error was more in over weight (51.61%) followed by underweight and normal students who have refractive error 35.48% and 12.90% respectively. On the other hand in private school the refractory error was more in underweight (48.78%) followed by normal (39.02 %). There was no association found between nutritional status of student and refractory error [16]. Several studies have looked into nutritional status in children, few on non communicable diseases such as malnutrition, over nutrition and other morbidities in adolescents. The study aims to provide information that will be used to design a life course approach to preventive measures addressing non communicable diseases and its risks amongst adolescents with a view to improve adolescent health.

# Methodology

## Study location

The study was conducted in a private secondary school in Port Harcourt metropolis in 2009 during Harmattan season. Port Harcourt is the capital city of Rivers State, located along bonny river in Niger Delta with estimated population by 2006 census 1,383,592. The Port Harcourt metropolis is made up of Port Harcourt city and parts of the Obio/Akpor Local Government Areas. It is highly congested as it is the only major city. The city is a major industrial centre as it has a large number of multinational firms as well as other industrial areas particularly related to petroleum industry. It is the chief oil refining city in Nigeria. The city is about 360 km, has lengthy and heavy rainy seasons and very short dry seasons. The natives are majority Ikwerres and minority Okrikas.

Air force secondary school is located along Aba road, Rumuomasi, 97 special operations group NAF within the air force base. The school is 300 meters from the main gate at the right side of the road leading to group headquarters. It had two blocks of junior and senior sections, the junior section has two blocks of classroom within which are counselling office and staff room are located. The administrative blocks, three science laboratories and blocks of classrooms are located in the senior section. The school is headed by commandants assisted by vice principal academics and administration, administrative officers, about 40 teachers to attend to students of officers and few civilians.

## Study population

The cross sectional survey was carried out to determine the health and nutritional status of adolescents (boys and girls) aged 10-16 years attending air force secondary school, Port Harcourt. It is a private school that Shell Petroleum Development Company PLC partners with and use as practice area for school health programmes. All the students in the junior secondary schools whose parents consented and are not ill at time of the survey or chronically ill were eligible for the study.

## Sampling technique

A two stage sampling technique was employed. The first stage involves selection of students in the junior secondary schools from a list retrieved from the head teacher and this was the sampling frame. Students were selected from the JSS1 -3 classes' propionate to the estimated number of students in the classrooms. Finally, males and females students in the arms of the junior secondary school were selected using the simple random sampling method.

## Data collection

One hundred and eighty two pupils within age 10 to 16 years in the junior secondary school were examined by a team comprising of doctor, nurse and school teachers after thorough explanation and written informed consent from the commandant and parents.

Body weight was measured to the nearest 0.5kg with the pupils standing motionless and erect on the weighing scale. Height was measured (to the nearest 0.5cm) with the pupil standing erect

against a vertical scale with head well positioned. Nutritional status was estimated using weight for height squared (underweight, normal and overweight) and height for age (stunting) according to WHO criteria. Thinness is defined as BMI for age below minus 2 standard deviation, overweight is BMI for age between 1 and 2 standard deviation and obesity is above 2 standard deviation from the relative median value of WHO growth reference. Stunting was defined as height for age (z score), below 2 standard deviation from the relative median value of WHO growth reference [17].

Oral examination and visual acuity of all pupils were carried out using Snellen's chart. Where oral and visual problem were identified, the teachers were notified and guided on further course of action.

### Data analysis

Data collected were entered and analysed using SPSS version 14 package. Association between variables were identified using chi square test and multivariate logistic regression. Low BMI for age was regarded as thinness/ underweight and high BMI for age was considered overweight. The association between variables were carried out using statistical test; student t test was used to determine significant difference in the means by gender, chi square test used to determine association between dependent and independent variables and multivariate logistic regression to determine predictors of underweight/ low BMI for age.

### Ethical consideration

Permission was obtained from the commandant of the schools. Informed consent was also sought obtained from each participant's parent/ guardian before being enrolled.

## Limitations

The study was carried in one school so it may not be representative of the schools in River state. Because of the peculiarity of the time of the survey (examination was ongoing), the senior secondary school section could not be part of the study and the junior secondary students could also not be selected using the probability sampling method. However, the findings can assist the school to improve their school health programme.

## Results

A total of 182 pupils participated in the study, 81(44.5%) were boys, 101(55.5%). Mean age for female was 12.6 ± 0.11, male 12.5± 0.14. Mean weight for female was 46.4 ± 0.98, male 43.6 ± 1.34, mean height for female was 1.55 ± 0.01, males 1.56 ± 0.01. Mean BMI for female was 19.1 ± 0.31, male 17.7 ± 0.40. Prevalence for dental caries was 24.2% with proportion of males with dental carries (27%) and females (22%). Prevalence of refractive error was 23.1%, with proportion of males (16%) and females (29%) (**Table 1**). Forty seven percent had normal weight, 46.2% were underweight and 6.6% were overweight. Early adolescent were at risk of underweight, they were significantly more 51.8% as compared to mid adolescents 25.6% (**Table 2**). Males were at high risk of being underweight as they significantly more 61.7% as compared to females 33.7% ($p<0.05$) (**Tables 3 and 4**).

There was a significant difference in the mean BMI of males and females by the period of adolescence. The mean BMI of females was significantly higher than the males during the early and mid-adolescence ($p<0.05$). Similarly the early adolescents were at risk of stunting, they were significantly more (87.9%) as compared to 12.1% % of mid adolescents.

The other disorders observed among the adolescents are in Table 6, 23.1% had refractive error and 24.2% had dental caries. The refractive error occurred significantly more in the overweight adolescents. The result of the multivariate analysis showed that period of adolescence and gender are significant predictors of underweight in adolescents.

## Discussion

The mean height of 15.5 m and mean weight of 45.2 kg was similar to the mean height of 1.57 m and weight of 45 kg reported in a study in Kano state. The mean BMI of 18.5 kg/m$^2$ in the present study was slightly higher than BMI 17.8 kg/m$^2$ in the Kano study [7]. The mean height and weight of adolescents in the present study was lower than the median values of NCHS standards. This was similar to the report of the study carried out amongst adolescents in a peri urban area in Warda India [1]. The mean BMI of the females and males in the present study was lower than what was reported in previous study amongst adolescents in selected schools in Port Harcourt. The findings of BMI for

**Table 1** Biodata of the Adolescents.

| Variable | Boys | Girls |
|---|---|---|
| **Mean age** | 12.5 ± 0.14 | 12.6 ± 0.11 |
| **Mean weight** | 43.6 ± 1.34 | 46.4 ± 0.98 |
| **Mean height** | 1.56 ± 0.01 | 1.55 ± 0.01 |
| **Mean BMI** | 17.7 ± 0.40 | 19.1 ± 0.31 |

**Table 2** Nutritional status of the Adolescent (BMI).

| Variable | Nutritional status | | |
|---|---|---|---|
| **Sex** | **Underweight** | **Normal** | **Overweight** |
| **Male** | 50(61.7) | 27(33.3) | 4(5.0) |
| **Female** | 34(33.7) | 59(58.4) | 8(7.9) |
| $X^2$= 14.3, p value=0.001 (significant) | | | |
| **Period of adolescence** | | | |
| **Early** | 74(51.8) | 60(41.9) | 9(6.3) |
| **Mid** | 10(25.6) | 26(66.7) | 3(7.7) |
| **Total** | 84(46.2) | 86(47.2) | 12(6.6) |
| $X^2$= 8.57, p=0.014(significant) | | | |

**Table 3** Nutritional status of adolescents (stunting).

| Variable | Nutritional status | |
|---|---|---|
| **Sex** | stunted | Normal |
| **Male** | 31(38.3) | 50(61.7) |
| **Female** | 35(34.7) | 66(65.3) |
| $X^2$= 0.25, p=0.61(not significant) | | |
| **Period of adolescence** | | |
| **Early** | 58(87.9) | 85(73.3) |
| **Mid** | 8(12.1) | 31(26.7) |
| **Total** | 66(100.0) | 116(100.0) |
| $X^2$= 5.32, p=0.02( significant) | | |

**Table 4** Mean BMI by gender and period of adolescence.

| Period of adolescence | Male | Female | T test | P value |
|---|---|---|---|---|
| Early | 17.6 ± 0.48 | 18.7 ± 0.34 | -16.02 | 0.0001 |
| Mid | 18.2 ± 0.41 | 20.9 ± 0.69 | -14.53 | 0.0001 |

**Table 5** Morbidity pattern in the adolescents.

| Diseases | Male (n=81) | Female(n=101) | Total (n=182) |
|---|---|---|---|
| Refractive error | 13(16.0) | 29(28.7) | 42(23.1) |
| Dental caries | 22(27.2) | 22(21.8) | 44(24.2) |

**Table 6** Result of the logistic regression on significant predictors of underweight (low BMI) .

| Variable | Odds ratio | SE | P value | 95%CI |
|---|---|---|---|---|
| Early adolescence | 0.28 | 0.12 | 0.003 | 0.12-0.63 |
| Mid adolescence | 3.45 | 1.12 | 0.0001 | 1.83-6.53 |

females been significantly higher than that of males support this previous report. The difference may be due to increased fat mass in females and increased physical activity in males.

The prevalence of stunting in this study was 36.3% was much higher than the report of overall prevalence of 17.7% amongst school children and adolescent in Abeokuta south west Nigeria [18] and prevalence of 12.5% amongst government school children of adolescent age group in Parkdesh [19]. But was similar to 34.5% reported in a study carried out amongst adolescents in Warda India [1]. The prevalence was much higher than 5.4% reported in a study amongst adolescent in selected secondary schools in Port Harcourt. The prevalence of stunting was higher in the early period of adolescence in the present study was in contrast to the report that stunting occurred more in mid adolescence than early or late adolescence. Similarly, the non-significant difference in the prevalence of stunting by gender was in contrast with report of more boys stunted as compared to girls in a study carried out amongst adolescents in selected schools in Port Harcourt. The difference might be due to the time when the studies were carried out and location in the Port Harcourt city [20].

Damhere et al. reported 48.3% of the adolescents were normal weight, none was overweight and obese and 51.7% were underweight. The present study reported 47.2% of the adolescents were normal weight, 6.6% were overweight, none obese and 46.2% were underweight. The higher proportion of normal weight (85%) and lower proportion of underweight in a study conducted in a selected school in Port Harcourt contrast the above report [20]. The difference might be due to the use of NCHS reference population and large sample size. The prevalence of 46.2% of underweight in the present study is much lower than the prevalence of 60.6% reported in Kano study, this could be due to differences in BMI cut off points. The high prevalence of thinness in boys compared with girls demonstrated in Kano study was in keeping with the report of the present study of proportion of males that are underweight are significantly higher than the proportion of females [7]. The prevalence of 6.6 % overweight in the present study was similar to the report of 6.3% in a study in port Harcourt [20]. The prevalence was much lower than reports from previous studies in Niger Delta, south eastern part of Nigeria but similar to the findings in Markudi, Benue state [13,14]. The differences are due to the socioeconomic differences in the sub groups. The proportion of females that are overweight are more but not significant. This was in contrast with the findings of prevalence of overweight more in females than males in the study in the study carried out amongst adolescent in selected schools in Port Harcourt [20]. There are no obese adolescents in the present study , this was in contrast with the prevalence of 1.5% reported in the port Harcourt study but in agreement in Ukeagbu study amongst adolescent in Umahia which reported no obese adolescents was found. This difference might be due to small sample size. The multivariate logistic regression analysis, the early adolescents and male gender were significant predictors of underweight. This was in contrast with the report of high prevalence of underweight in mid and late adolescents amongst boarding students in Umahia [21-23]. and the report of older age significantly associated with thinness in the Kano study [7].

About a quarter of the adolescents had dental caries in the present study, this was lower than 35.3% adolescent reported having dental caries in Wardha, India. But similar to the report of a quarter children with dental caries in a study carried out amongst rural school children in Puducherry India. The prevalence of refractive error, 23.1% was higher than 13.8% reported in the study carried out amongst adolescent in Wardah, India [1] but similar to the 22.5% prevalence recorded on a retrospective review of pattern of refractive error amongst children attending eye clinic of Niger Delta University Teaching Hospital in Balyesa state, Nigeria. The finding was similar to the report of one fifth of the school children in rural Puducherry having refractive error at the time of study [15]. There was a lack of significant difference in the proportion of students with refractive error that are stunted or normal. The present study supported the above finding as there was no significant difference in the proportion of adolescents with normal weight and adolescents who were either underweight or overweight adolescents. This was consistent with the report of no significant association between nutritional status and refractive error in a study carried out among school children in Pune in India [16].

## Conclusion

Being overweight during early adolescence as assessed by their nutritional status is an indicator of non-communicable disease and other health problems identified are stunting, dental caries and refractive error. This should be of great concerns for health care providers. The mean BMI in females was significantly higher than mean BMI of males and the early adolescents were more stunted than the mid adolescents. Early adolescence and male gender are significant predictors of underweight. A life course approach to preventive measures for addressing the occurrence of non-communicable diseases and its risk factors in adolescent will go a long way to improve adolescent health.

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