Original article

Factors associated with adolescent malnutrition among Nigerian students

Abdulkarim AA[1], Otuneye AT[2], Ahmed P[3], Shattima DR[4]

Abstract:

Objectives: The objective of this study was to determine the factors associated with malnutrition among adolescents. ***Design***: This was a cross-sectional study conducted among adolescents (10-19 years) in secondary schools. A multistage sampling technique was employed. ***Setting***: Senior secondary schools in The Abuja Municipal area council, Federal Capital Territory, Nigeria. ***Participants***: A total of 1700 students from 8 selected schools. All schools in the Abuja Municipal Area council (AMAC) were stratified into urban and rural schools. Eight schools were selected by balloting from a list of schools obtained from the Education centre. A school was selected from each of the four major districts of AMAC and four schools were selected from the rural making a total of 8 schools. Although the consent of the school authorities was obtained, individual subject also consented to the study before being enrolled. ***Study***: The study excluded those adolescents who were physically challenged thus limiting physical activity. Sociodemographic information was obtained using an interviewer administered questionnaire. Subject's height and weight was taken using the floor-type height (H) and weight (W) measuring scale model ZT-120 using Massachusetts Department of Public Health Protocol. ***Main outcome measure***: The nutritional status was determined using the formula: BMI= W/H^2, where W=weight (in kilograms) and H=height (in meters). The age and sex specific height and BMI percentile for each subject was determined using the 2007 WHO Height and BMI growth charts for age 5-19 years. The students were then classified into one of the following categories using previously used standards: normal, stunted, wasted, overweight or obese. Data was analyzed using SPSS version 17 statistical package. A regression analysis of all investigated factors was done to determine those with significant association to malnutrition. ***Results***: The mean age was 14.43±1.94 years; male 688, female 862, M:F ratio 1.1.3. Mean BMI, weight and height were 20.31±3.07kg/m^2, 51.07±10.80 kg, and 157.88±9.33 cm. The prevalence of overweight, stunting, obesity and wasting was documented as 13.2% (205/1550), 11.3% (175/1550), 2.6% (41/1550) and 1.7% (27/1550) respectively. Low social class, male gender, hawking after school and rural setting were associated with stunting ($p<0.05$) and female gender and watching Television for more than 3 hours daily were associated with overweight ($p<0.05$). Obesity occurred more in urban areas.

Keywords: adolescent; malnutrition; associated factors

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Introduction:

Malnutrition has been reported in epidemic proportions among adolescents in developing and developed countries[1, 2]. The prevalence and pattern of malnutrition- wasting, stunting, and overweight and obesity- however vary among countries and within regions in a country[3-6]. Global data is increasingly available on factors that are associated

1. AA Abdulkarim, Consultant and Senior lecturer, Department of Paediatrics, University of Ilorin Teaching Hospital.
2. AT Otuneye,
3. P Ahmed,
4. DR Shattima,

Consultant, Department of Paediatrics, National Hospital, Abuja.

Corresponds to: Dr. AA Abdulkarim, Department of Paediatrics, University of Ilorin Teaching Hospital, PMB 1459, Ilorin, Kwara State. **E-mail:** aishaakarim@yahoo.com

with the nutritional status of adolescents, and rural/ urban differences in the type and prevalence of malnutrition have been documented.[5-8] Furthermore, socioeconomic status, lifestyles including alcohol and tobacco consumption, eating habits and level of physical activity in an individual have been found to be associated with malnutrition among adolescents[5, 7-10]. Adolescent over-nutrition is associated with non-communicable diseases such as hypertension, diabetes mellitus and sleep apnoea among others. In adulthood, there is a higher burden of Type II Diabetes Mellitus (DM), hypertensive heart diseases, coronary heart diseases, colonic cancers and other disorders in obese and overweight individuals[11, 12]. Under-nutrition affects the final physical height, body weight and cognitive ability of an adolescent[2, 6, 11, 12]. Malnutrition in childhood through adolescence may progress to adult life. In addition, there may be factors that influence malnutrition that start in childhood or adolescence and persist into adulthood, thus the potential to increase the burden of non-communicable diseases (NCDs) among the population.

The importance of understanding the factors associated with the epidemic of malnutrition in any population is important in order to institute measures to reduce and/or reverse the trend. Different countries and regions have a wide variation of factors associated with malnutrition. Also, there are many changing factors in our society. These include proliferation of fast food outlets, the technological advancements and increasing use of blackberry and video games by children and adolescent thus increasing sedentary lifestyles; the global economic recession, and the increasing number of families with working mothers which can affect the nutritional status of an adolescent. Few studies and data are available for Nigeria and many of these studies are in the Southern part of the country. This study explored some factors associated with malnutrition among Nigerian adolescents in secondary schools in the Federal capital territory.

Materials and methods:

This was a cross-sectional study conducted among adolescents in secondary schools in the Abuja Municipal area council in the Federal capital territory of Nigeria. A multistage sampling technique was employed. All schools in the Abuja Municipal Area council (AMAC) were stratified into urban and rural schools then eight schools were selected by balloting from a list. A school was selected from each of the four major districts of AMAC and four schools were selected from the rural area. Students' ages were verified (using school records and/or birth certificate) and only those between the ages of 10 and 19 years were selected. Informed consent was obtained from individual subject as well as the school authorities. The study excluded those adolescents who were physically challenged thus limiting physical activity.

Sample size determination used the approach described by Araoye et al[13], and assumed a prevalence of 50% among adolescents in the population. Eight hundred and fifty students were selected from the four urban schools and an equal number were selected from the rural schools. The total number subjects enrolled were 1,700.

Random sampling was employed for the selection of students in each school. Information was obtained via the use of questionnaires that were administered by trained personnel. Subject's height and weight was taken in the presence of a chaperon assigned by the school. The floor-type height (H) and weight (W) measuring scale model ZT-120 was used for measurement using Massachusetts department of public health protocol. The nutritional status was determined using the formula: $BMI = W/H^2$, where W =weight (in kilograms) and H= height (in meters). The age and sex specific height and BMI percentile for each subject was determined using the 2007 WHO Height and BMI growth charts for age 5-19years. The subjects were then classified into one of the following categories using previously used standards: normal, stunted, wasted, overweight or obese. The socioeconomic status of the students was determined as described by Olusanya et al[14]. Data was analyzed using SPSS version 17 statistical package. The study was ethically approved by the ethical committee of University of Ilorin.

Results:

Sociodemographic parameters

Only 1550 (91.2%) of the 1700 questionnaires were analyzed because of withdrawal of consent in 150 (8.8%). There were 688 (44.4%) males and 862 (55.6%) females and the Male: Female of 1:1.3. The mean age was 14.43 ± 1.94 years. Seven hundred and eighty (50.3%) were from urban schools while the 49.7% were selected from rural schools. The upper social class represented 708 (45.7%) of the study population; 542 (35.0%) were in the middle class and 300 (19.3%) in the lower class. In the urban area, 502 (64.4%) belong

in the upper class and 68 (8.7%) in the lower class. In the rural area 206 (26.8%) and 232 (30.1%) belong in upper and lower class respectively ($p < .05$). The educational level of mothers was also documented thus: 615(39.7%) tertiary education; 654 (42.2%) secondary education; 188 (12.1%) primary education and 93 (6.0%) had no formal education. A total of 1515 adolescents volunteered information with respect to family size and number of children in the household. The mean family size of the study population was 6.86±2.22 (6.60±2.09 in urban schools versus 7.11±2.30 in rural schools; p=0.000) and mean number of children in household 4.11±2.00 (3.77±1.81 in urban schools versus 4.45±2.05 in rural schools; p=0.000).

The mean weight, height and BMI of the adolescents are 51.07±10.80 kg, 157.88±9.33 cm, 20.30±3.07 kg/m^2. Table 1 below shows the distribution of the anthropometry among the study population.

The pattern of some physical activities was documented for the study population. These activities include hawking after school hours, participation in school sport, watching television for more than 3 hours/day, and playing computer for more than 3 hours/day. The finding in the population is documented in table 2 below. More males, 533 (77.6%) participated in school sports compared to 606 (70.4%) females (p=0.001). Hawking was found in 23.7% of those in the lower social class; 15.2% of those in middle and 6.3% of those from upper class. (p=0.000)

The overall prevalence of any type of malnutrition in the sample population was 28.8% (48/1550). The types of malnutrition found was distributed as follows: 205 (13.2%) had overweight, 175(11.3%) were stunted, 41(2.6%) obese, 27(1.7%) had

Table 1: Distribution of mean weight, height and bmi for the study population

Age (years)	No	Mean weight (kg)	Mean Height (cm)	Mean BMI (kg/m^2)
10	23	34.87±5.05	143.00±7.72	16.97±1.36
11	83	40.35±8.31	147±7.78	18.34±2.74
12	170	42.82±8.22	150.64±7.15	18.70±2.64
13	224	47.55±9.56	155.10±7.93	19.62±2.84
14	290	50.26±10.23	156.94±7.98	20.30±3.12
15	287	53.76±9.21	160.56±7.45	20.81±2.90
16	241	56.18±9.53	163.00±8.37	21.09±2.87
17	138	57.65±7.89	163.05±8.22	21.71±2.97
18	84	59.52±8.81	164.29±7.82	21.95±2.86
19	10	57.60±6.42	163.70±5.24	21.73±1.87
Total	1550	51.07±10.80	157.88±9.33	20.31±3.07

Table 2: Pattern of physical activities in the study population

Activity	Yes No (%)	No No (%)	Total No (%)
Hawking	197 (12.7)	1353 (87.3)	1550 (100.0)
School sport	1194 (77.0)	356 (23.0)	1550 (100.0)
Watch TV >3hour/day	635 (41.0)	915 (59.0)	1550 (100.0)
Play computer >3 hours/day	185 (11.9)	1365 (88.1)	1550 (100.0)

Table 3: Types of malnutrition by school setting

Type of malnutrition	School setting No.(%) Urban	rural	Odds ratio	df	X^2	p-value
Stunting	35 (4.5)	140 (18.2)	0.211	1	72.557	0.000*
Wasting	11 (1.4)	16 (2.1)	0.674	1	1.009	0.315
Overweight	120 (15.4)	85 (11.0)	1.465	1	6.376	0.012*
Obesity	28 (3.6)	13 (1.7)	2.168	1	5.440	0.020*

Table 4: Types of malnutrition by socioeconomic status of the family

Type of malnutrition	Socioeconomic status of family No (%) Upper	middle	Lower	X2	df	p-value
Stunting	50 (7.1)	70 (12.9)	55 (18.3)	28.924	2	0.000*
Wasting	13 (1.8)	8 (1.5)	6 (2.0)	0.370	2	0.831
Overweight	101 (14.3)	76 (14.0)	28 (9.3)	4.927	2	0.085
Obesity	22 (3.1)	15 (2.8)	4 (1.3)	2.616	2	0.270

Table 5: Relationship between malnutrition and physical activity

Activity	Response	Type of Malnutrition No (%) Stunting	Wasting	Overweight	Obesity
Hawking	Yes	44 (22.2)	3 (1.5)	22 (11.1)	6 (3.0)
	No	131 (9.7)	2.4 (1.8)	183 (13.5)	35 (2.6)
X^2		27.037	0.069	0.891	0.130
df	1	1	1	1	1
p value		0.000*	0.540	0.250	0.429
School sport	Yes	141 (12.4)	17 (1.5)	148 (13.0)	36 (3.2)
	No	34 (8.4)	10 (2.4)	56 (13.7)	5 (1.2)
X^2		4.963	1.593	0.128	4.384
df		1	1	1	1
p value		0.026*	0.149	0.389	0.022*
Use computer	Yes	6 (3.2)	4 (2.2)	23 (12.4)	3 (1.6)
	No	169 (12.4)	23 (1.7)	182 (13.3)	38 (2.8)
X^2					
df		13.582	0.217	0.115	0.855
p value		1	1	1	1
		0.000*	0.406	0.420	0.259
Watch TV	Yes	63 (9.9)	19 (3.0)	103 (16.2)	18 (2.8)
	No	112 (12.2)	8 (0.9)	102 (11.1)	23 (2.5)
X^2		2.013	9.823	8.406	0.150
df		1	1	1	1
p value		0.090	0.002*	0.003*	0.407

wasting. The mean BMI, weight and height for males were 19.60±2.71 kg/m^2, 50.81±11.85kg and 160±11.14 cm respectively. The mean BMI, weight and height in females were 20.89±3.22 kg/ m^2, 51.28±9.87 kg, 156.19±7.16 cm respectively (p value 0.000).

Table 3 below shows the difference in the prevalence of overweight, stunting, wasting and obesity in the studied population. Stunting was found in 35 urban and 140 rural adolescents; overweight in 120 urban and 85 rural adolescents; obesity in 28 urban and 13 rural students. These differences were statistically significant with p values < 0.05.

The types of malnutrition found among the adolescents were disaggregated by socioeconomic status (SES). Stunting was seen in 7.1% of the upper class, 12.9% in the middle class and 18.3% of those from lower SES. This was statistically significant with a p value=0.000.

The relationship between the types of malnutrition with respect to physical activities was explored. Stunting was a significant finding among those who engaged in hawking after school hours (22.2% versus 9.7% and p value=0.000). Obesity and stunting was also found more in those who engaged in school sport ($p<0.05$). Overweight and wasting was significant among those who watched TV for more than 3 hours/day ($p<0.05$).

A regression analysis of the factors explored showed that gender, and watching TV for >3 hours/day remained significant factors with respect to overweight while school sport and setting were

significant for obesity. School setting, sex and socioeconomic class as well as hawking after school hours were statistically significant for stunting.

Discussion:

Severe forms of malnutrition contribute significantly to a higher morbidity and mortality in childhood[2,15]. The association of over-nutrition with non-communicable diseases (NCDs) has long been established[11,12]. The effect of malnutrition in adolescents has been less studied compared to the effects in childhood, but reports from various parts of the world have started to emerge showing the association of overweight and obesity with non-communicable diseases (NCDs) such as diabetes mellitus and hypertension[5,12,16]. Health promotion and prevention of malnutrition and related disorders rely on an understanding of factors associated with these disorders. These factors vary between and within regions of the world. This study therefore investigated some of the factors associated with adolescent malnutrition in the FCT of Nigeria.

This study documented a higher prevalence of overweight and obesity among females when compared to males. This finding is consistent with earlier findings from other parts of Nigeria and elsewhere[3, 6, 17-19]. These findings may be due to the fact that females are likely to lay down more fat due to the effect of oestrogens. In our culture, females also engage in cooking family meals and therefore have more access than males to larger portions though this was not investigated in this study. Also, females are less likely to engage in school sports compared to males but they engage more in household chores. It is however different from what has been found among adolescents in some developed countries particularly in USA and some developing countries where more males were documented to have overnutrition[4, 5, 20-22]. The finding that fewer females are overweight or obese in USA and some other developed countries may be related to the societal and media promotion/ approval of thinness among females in such cultures. Perhaps, more females in the developed countries may also have eating disorders that leave them thin.

Those from upper socioeconomic class and urban schools had higher prevalence of overweight and obesity. This agrees with the findings of other workers from Nigeria[3,8,18]. The socioeconomic class appears to reflect the access to food by the adolescents in our environment. The urban schools had more adolescents in the upper social class. In contrast, Gearhart et al found that those females from low socioeconomic class in the USA had a higher prevalence of obesity and overweight[22]. He attributed his findings to less opportunities being available for those in the lower class to make appropriate food choices and their exposure to high calorie cheap food. Furthermore, less opportunity for physical activity was also alluded to among those from low social class in USA[22].

This study also showed that those who engaged in sedentary activity- watch TV for long duration- also had higher prevalence of overweight. This is understandable as energy is not expended as it is consumed hence conversion to fat which then accumulates. Obesity was found to be significant among those who engaged in physical activity. This may be strategy for weight reduction in these adolescents rather than a routine.

Stunting was more prevalent among males and this may reflect the effect of chronic malnutrition. Physiologically, males have a greater growth velocity and for a longer duration compared to female adolescents. Hence, the height of the male adolescent may suffer more from the effect of chronic malnutrition. Furthermore, the other factors associated with stunting in the study population namely rural setting, low social economic class and hawking could contribute to chronic under-nutrition. On the other hand wasting is associated with the male gender and watching TV. These findings are not thought to be significant as wasting reflects more of an acute malnutrition in the adolescent. Moreover, this study did not document episodes of illnesses that could be associated with wasting.

Our findings suggest a rural-urban dichotomy in social class and malnutrition. The rural adolescents are affected by stunting while the urban adolescents have a high prevalence of overweight and obesity. It also showed that females are affected more by over-nutrition while males are affected more by under-nutrition.

Limited data on physical activity was collected in this study- only related to school sports. There was no objective measurement of hours of activity or calories expended in the activities. The difficulties of obtaining information with respect to diet and the limited fund for this study precluded data collection on this aspect.

This study has no doubt been able to document some factors associated with malnutrition among adolescents that can be used in planning health promotion and prevention programmes. It also

shows the need for wider collection of data on factors associated with malnutrition in our environment as variations clearly occur.

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Conflict of interest: None declared.

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