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ORIGINAL ARTICLE

Factors Influencing the Nutritional Status of Adolescents in Selected Public Secondary Schools of Abakaliki, Ebonyi State, Nigeria

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Keywords

Socio-demographic;

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ABSTRACT

Background: Adolescence is a critical time for nutritional intervention to support growth, yet understanding of adolescent nutritional status is limited. This study examines the patterns and determinants of nutritional status among adolescents in Abakaliki, Ebonyi State, Nigeria.

Method: A cross-sectional study was conducted among 1073 public secondary school attending adolescents aged 10-19 years in Abakaliki. Sociodemographic data were collected using self-completed questionnaires, while weight and height were measured to derive Height for Age (HAZ) scores and Body Mass Index (BMI)-Z scores based on the 2007 WHO growth reference chart. Data analysis included univariate, bivariate, and multivariate methods using SPSS version 26. The ethics committee at the Federal Teaching Hospital Abakaliki approved the research.

Results: Of the 1,073 participants, 64.4% were female. Slightly over half (51.6%) were middle-aged adolescents, with 3.4% underweight, 8.8% overweight, 8.7% stunted, and 1.6% tall for their age. The BMI-Z score was associated with sex, class, and fathers' and mothers' education (p = 0.001; 0.04; 0.01; 0.001). The HAZ score was associated with age group (p = 0.00). Multivariate analysis revealed that sex and both parents' educational status strongly predicted BMI status, with females being about 16 times more likely (P = 0.00) to be overweight than males. Additionally, age, class, sex, and mother's education was predictive of height Z score.

Conclusion: Underweight and stunting are associated with early adolescence, male gender, and low parental education. Regular nutritional assessments can identify at-risk individuals for targeted interventions to improve adolescent nutrition, including educational programs for students and parents.

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INTRODUCTION

Adolescents are individuals between 10–19 years undergoing a critical period of growth and development. Adolescence is characterized by rapid physical, physiological, emotional and behavioural changes.[1] At this stage, there is an increased need for macro and micronutrients to support the growth spurt, as any imbalance in nutrition can negatively affect puberty. Consequently, it results in immediate and long-term effects on immunity, bone and muscle strength, cognition, psychology, and reproductive health, causing non-communicable diseases and morbidity.[2] The adolescent period is a window through which nutritional intervention may be targeted toward optimizing growth and development.

While underweight and stunting, which represent short-term and long-term suboptimal nutritional states, have been the prevalent form of infant and young child malnutrition in resource-limited nations like Nigeria, over-nutrition has become a rising condition in these nations, contributing to the global challenge of the double burden of malnutrition.[3-6] Studies have also established a range of biological, socio-demographic, family-related, dietary, political, economic, psychosocial, and cultural factors associated with malnutrition.[7,8]

More recently, malnutrition in adolescents has become recognized as a significant public health problem with a similar double burden of malnutrition pattern.[3,4] A UNICEF report revealed an increasing proportion of undernourishment among adolescent girls in Nigeria, from 5.6 million in 2018 to 7.3 million in 2021.[5] Same data showed a prevalence of thinness and overweight, 10% and 8%, respectively. Earlier studies conducted in Southeast Nigeria show adolescents' varied prevalence of under-nutrition and over-nutrition. Duru et al found 18.6% of underweight and 11.6% of overweight adolescents in Owerri, further revealing associated factors such as age, sex, religion, and class, but no relationship with the type of school attended.[9] Similarly, Adinma et al. in Nnewi found that more than a quarter (27.7%) of adolescent girls in secondary schools were underweight, 9.0% were overweight, and 1.3% were obese in Nnewi, Southeast Nigeria. Additionally, BMI significantly increased with age.[10]

Compared to infants and young children, these studies represent relatively limited epidemiological data on adolescent nutritional status. Adolescents are generally not sufficiently considered vulnerable to benefit from nutrition and health interventions, less so in southeast Nigeria, where lower rates of poverty and malnutrition have been reported.[5,9-11]

This study assesses nutritional status and describes the relationship between socio-demographic factors and nutritional status (body mass index [BMI] and height for age) of adolescents in public schools of Abakiliki, Ebonyi State, Nigeria.

METHODS AND MATERIALS

Study design: This is a descriptive cross-sectional study

Sample size determination: The sample size formula for an infinite population greater than 10,000 in cross-sectional studies was used = ($[Z_{1-\alpha}^2/2(P\ (1-P)]/d^2$)[12]

$Z_{1-\alpha/2}$= Standard normal variate at 5% type 1 error ($P < 0.05$) = 1.96

P = 2.6% based on studies from Akinlade et al[13]

d = 1% (0.01)

Applying these values, the sample size =973. Non-respondence rate (10% of 973) is 97.3

Total sample size (973+ 97) = 1080

Study protocol: A Multistage sampling technique was used, with a stratified random sampling method as the first stage because all the schools studied were narrowed down by geopolitical stratification into 7 public secondary schools in Abakaliki Metropolis of Ebonyi State. Five were selected for the study using simple random sampling.

The schools with large populations had more participants selected, after which participants were enrolled from JSS1- SSS 3. To prevent bias, an arm was selected from each class by balloting and assigned a number, from which participants who meet inclusion criteria will be recruited. Using the class attendance register, the first person selected in a class was done systematically (using the ratio of the number selected from the class to the total number in the class). The sampling interval for each school was determined by the population and the proportionate sample size.

Study population: From April to June 2022, adolescents aged 10-19 years at five public secondary schools in the Abakiliki metropolis of Ebonyi State, southeast Nigeria, participated in the study.

Selection criteria: Inclusion in this study were day secondary schools with all six class years- Junior and Senior classes. Students who did not give assent, the chronically ill, and those on special diets were excluded.

Study instruments: Information on demographic characteristics such as age, gender, class, and parents' highest educational level was obtained using an interviewer-administered questionnaire. Adolescents ages were classified into early adolescence (10 to 13 years), middle adolescence (14 to 17 years), and late adolescence/young adulthood (≥18 years).[1] Anthropometric measurements were collected following standardized procedures after administering the questionnaire. The weight recorded to the nearest 0.1kg of participants was measured by the subject standing with light inner cloth and no shoes on a digital scale with a stadiometer (Seccagmgh and Co kg, Hamburg Germany). Also, height was recorded to the nearest 0.1cm and BMI was derived from the height and weight (kg/m^2) and the 2005 WHO growth reference chart for children aged 5-19 years was used to classify participant's height-for-age Z-score (HAZ) and BMI-for-age Z-score (BAZ).[4] Stunting was defined as having a HAZ

of <−2SD and tall for age HAZ of >2SD. While Underweight is BAZ of <−2SD, overweight is>+1SD, and obesity is>+2SD. Data was collected using an interviewer-administered structured questionnaire, while research assistants were trained on ethics, confidentiality, and measurement steps and regularly monitored throughout the data collection period.

Univariate and bivariate analyses were conducted using SPSS (software for Windows version 26.0. Chicago. SPSS Inc).

Table 1: Socio-demographic characteristics and nutritional status of the study participants

Variable	Frequency (n=1073)	Percent (%)
Age (years)		
Mean-15.2 years		
Early Adolescent (10-13)	211	19.7
Middle Adolescent (14-17)	554	51.6
Late Adolescent (≥18)	308	28.7
Gender		
M:F ratio- 1:1.7		
Male	393	36.6
Female	680	63.4
Class		
Junior Class	490	45.7
Senior Class	583	54.3
Fathers Level of Education		
No Formal Education	54	5.0
Primary	138	12.9
Secondary	580	54.1
Tertiary	301	28.0
Mothers Level of Education		
No Formal Education	74	6.9
Primary	133	12.4
Secondary	553	51.5
Tertiary	313	29.2
Religion		
Christianity	1050	97.9
Others	23	2.1
Tribe		
Igbo	1024	95.4
Others	49	4.6
BMI for age		
underweight	36	3.4
Normal	941	87.7
Overweight	96	8.9
Height for age		
Stunted	93	8.7
Normal	963	89.7
Tall for age	17	1.6

Pearson's Chi-square and Fisher exact tests were used to test the association between categorical data groups. The P-value of < 0.05 was considered statistical significance. Multinomial logistic regression was used to identify independent predictors of nutritional status.

Ethical approval: The Research and Ethical Committee of the Federal Teaching Hospital Abakiliki, Ebonyi State (FETHA/REC/VOL/2/2018/007) approved the study. Permission was obtained from the Ebonyi State Secondary Education Board, the Ministry of Education, and each school selected. Written informed consent was sought from the adolescent's parents or legal guardian, while assent was obtained from the adolescents themselves. Participation was voluntary; each student could withdraw from the study anytime. Those who were found to be malnourished were counselled and referred to the adolescent clinic of Alex Ekwueme Federal University Teaching Hospital, Abakaliki.

RESULTS

Table 1 shows that more than half (51.6%) of the participants were middle adolescents, while more than half (54.1%) of both parents had secondary education. A vast majority of the students were Christians (97.9%), Igbo by tribe (95.4%) and fell in the normal range of both BMI Z-Score (87.7%) and height Z-Score (89.7%).

Table 2 shows that BMI-Z has no association with age group (P-0.75), but sex, class, fathers' education and mothers' education were associated with BMI status (P= 0.001; 0.04; 0.01; 0.001).

Table 3 illustrates the correlation between HAZ and age group. Early adolescents exhibited a greater percentage of being tall for their age compared to mid and late adolescents (4.7% vs. 0.5%, 1.3%; p=0.00). Additionally, a higher percentage of stunted adolescents was found among males compared to females (15.8% vs. 4.6%; p=0.00). Furthermore, the rate of stunted adolescents in Junior classes was twice that in Senior classes (12.0% vs. 5.8%; p=0.04). Parents with lower educational attainment (no formal education or primary education) did not have tall children for their age, unlike those with secondary or tertiary education.

Table 4 shows a multinomial logistic regression analysis of the relationships between age group, sex, class, and parental education with BMI and height categories (relative to being wasted and stunted, respectively). Sex and parents' educational status were strongly predictive of BMI status, with females about 16 (*P*=0.00) times more likely to be overweight than males. In contrast, age, class, sex, and mother's education predicted the height of adolescents. The floating-point overflows and extremely large values for some coefficients indicate potential issues like multicollinearity of independent variables like age and class.

Table 2: Relationship of Sociodemographic characteristic with BMI-Z score (BAZ) status (N=1073)

Characteristics	BAZ status			X^2	p-value
	Underweight	Normal	Overweight		
Age Group					
Early	6 (2.8)	185 (87.7)	20 (9.5)	1.94	0.75
Middle	19 (3.4)	481 (86.6)	54 (9.7)		
Late	11 (3.6)	275 (89.3)	22 (7.1)		
Sex					
Male	26 (6.6)	353 (89.8)	14 (3.6)	40.07	0.001*
Female	10 (1.5)	588 (86.5)	82 (12.1)		
Class					
Junior	18 (3.7)	413 (84.3)	59 (12.0)		
Senior	18 (3.1)	528 (90.6)	37 (6.3)		
Fathers Education					
No formal education	4 (7.4)	50 (92.6)	0 (0.0)	23.91	0.01*
Primary	5 (3.6)	129 (93.5)	4 (2.9)		
Secondary	13 (2.2)	498 (85.9)	69 (11.9)		
Tertiary	14 (4.7)	264 (87.7)	23 (7.6)		
Mothers education					
No formal education	0 (0.0)	69 (93.2)	5 (6.8)	26.61	0.0011*
Primary	9 (6.8)	119 (89.5)	5 (3.8)		
Secondary	18 (3.3)	495 (89.5)	40 (7.2)		
Tertiary	9 (2.9)	258 (82.4)	46 (14.7)		

* Significant at $p<0.05$

DISCUSSION

Our findings showed that most of the study participants were Christians and of the Igbo tribe, depicting the typical demography of southeastern Nigeria. Furthermore, the proportion of females almost doubles that of males, and, as it represents the general school population, may be linked to the out-of-school-boy phenomenon the southeast region of Nigeria, including Ebonyi state, has been grappling with over a few decades.[14]

In this study, we found a low prevalence (3.4%) of underweight, which is lower when compared to other studies that found a low prevalence of the same, such as the 6.6% underweight rate for adolescents in Ibadan, southwest Nigeria[15], and 6.4% among adolescents in Port Harcourt[16], south-south Nigeria. A much higher prevalence of under-nutrition has been reported in the same southeast region, with about 28% in adolescent girls in Nnewi town and 18.2 % in children aged between 6 and 15 years in Ede-Oballa, a rural community in Enugu State.[10,17] The use of different study sites and age groups in these separate studies could be responsible for the marked disparity between those studies and ours. However, in comparison with the 5.6 % under-nutrition rate earlier reported by Asiegbu et al. in school-aged children (6-12 years) in the same town of Abakiliki, this may suggest that under-nutrition is less prevalent in adolescents than younger children or that nutritional status improved over time.[11] From this, a case can be made to widen the scope of nutrition-related intervention to adolescents in the Abakiliki as residual or emerging under-nutrition has been noted.

Table 3: Relationship of Sociodemographic characteristic with Height for age status (HAZ)

Characteristics	Height for age status				
	Stunted	Normal	Tall	X^2	P-Value
Age Group					
Early	23(10.9)	178(84.4)	10(4.7)	22.62	0.00*
Middle	52(9.4)	499(90.1)	3(0.5)		
Late	18(5.8)	286(92.9)	4(1.3)		
Sex					
Male	62(15.8)	326(83.0)	5(1.3)	39.73	0.00*
Female	31(4.6)	637(93.7)	12(1.8)		
Class					
Junior	59(12.0)	414(84.5)	17(3.5)	11.12	0.04*
Senior	34(5.8)	549(94.2)	0(0)		
Father education					
No formal Education	4(7.4)	50(92.6)	0(0)	7. 92	0.24
Primary	10(7.2)	128(92.8)	0.(0)		
Secondary	58(10.0)	509(87.8)	13(2.2)		
Tertiary	21(7.0)	276(91.7)	4(1.3)		
Mothers Education					
No formal education	13(17.6)	61(82.4)	0(0)	35.99	0.00*
Primary	0(0)	133(100)	0(0)		
Secondary	63(11.4)	482(87.2)	8(1.4)		
Tertiary	17(5.4)	287(91.7)	9(2.9)		

Almost a tenth (8.9%) of our participants were found to be overweight, with none specifically obese. Comparative studies have consistently shown lower rates of obesity in public schools compared to private schools, attributed to lifestyle and socioeconomic disparities.[9,10,19] This may explain the absence of obese adolescents in our study, which was conducted solely among public school students.[17] This gives some direction for a targeted response regarding the prevalence and malnutrition pattern in different school settings.

We found age to be an independent predictor of nutritional status, as the early adolescent group had a significantly greater proportion of tall students for their age compared to middle and late adolescence (*P*=0.00). This may be explained by the growth spurt that occurs in the early adolescence period. The same reason underlies finding a greater proportion of subjects who were tall for age being in junior secondary than that found in senior secondary (3.5 vs. 0.0%) as early adolescents are likely to be in junior secondary classes. It is also important to note that the proportion of stunted subjects in junior classes was higher than that of senior secondary students (12.0% vs 5.8%). While it may seem paradoxical that junior classes had both the tallest and most stunted adolescents, this finding highlights the potential catch-up growth among stunted individuals. It also underscores the urgent need to identify and optimize nutrition during early adolescence.

Gender was identified as an independent predictor of BMI and height status of adolescents in our study. It is generally known that females have more subcutaneous fat and, consequently, a higher BMI and higher risk of being overweight than their male counterparts. This may underlie our observation that overweight is higher in girls than boys (12.1% vs .3.6%), with underweight and stunting more prevalent in boys, in agreement with earlier studies.[15,17,18]

Families with highly educated parents often have a higher socioeconomic status, which has been linked to better nutritional status in children.[16] Similarly, this study found a significantly higher prevalence of overweight and tall stature in adolescents whose mothers had tertiary education. Duru et al. also found significantly higher proportions of over-nourished adolescents in homes with parents who were professionals in comparison to artisans and farmers.[9] Maternal education is an important factor in having knowledge and ability to purchase nutrient-rich foods. Thus, it was not surprising that maternal education was an independent predictor of acute and chronic malnutrition. The same association may explain why adolescents with fathers who had no formal education experienced a higher rate of under-nutrition in this study, as a lack of education is linked to lower socioeconomic status.[9,19] Additionally, female empowerment and education have long been recognized as a child survival strategy fostering healthier families.[20] This aligns with the findings of this study, where maternal education emerged as a significant independent predictor of adolescent nutritional status, further underscoring its pivotal role in promoting better health outcomes.

One identified strength of this study is the large sample size, which we anticipated reduced margin of error. Another is the use of Z-score instead of BMI categorization, which standardizes comparisons across age groups and gender. However, a weakness of this study is the cross-sectional design, as the findings are not generalizable to other settings and have temporal limitations.

CONCLUSION

The findings indicated different malnutrition patterns (underweight, overweight, and stunting) were identified among adolescents attending public schools in Abakaliki. Sociodemographic factors associated with nutritional status included age group, gender, class, and parental education. We recommend optimizing adolescent nutrition by all stakeholders and incorporating periodic nutritional assessments in schools aimed at early identification of those at risk of malnutrition.

Implication for policy and practice:

Currently, there is no specific policy that recognizes and protects the nutritionally vulnerable adolescents in the state. This calls for policy formulation at different levels, such as the Ministry of Education, secondary school boards, and individual schools, to recognize and intervene on time. In addition, nutrition education should be integrated into public school health programs.

Table 4: Multinomial logistic regression of sociodemographic variables associated with BMI and Height status

BMI Category[#]		B	Odds ratio (OR)	P value	Height category @	B	Odds ratio (OR)	*P*-value
Normal	**Intercept**	2.44		0.00	**Normal**	2.92		0.000
Age Grp	**Early Adolescent**	0.53	1.69(0.54-5.36)	0.37		-0.51	0.60(0.28-1.28)	0.19
	Middle Adolescent	0.18	1.20(0.53-2.74)	0.67		-0.46	0.63(0.34-1.6)	0.14
	Older Adolescent	0[b]	.	.		0[b]	.	.
Sex	**Female**	1.47	4.36(2.047-9.27)	0.00*		1.62	5.044(3.16-8.06)	0.00*
	Male	0[b]	.	.		0[b]	.	.
Class	**Junior**	-0.50	0.60(0.28-1.32)	0.21		-0.81	0.45(0.26-0.75)	0.003*
	Senior	0[b]	.	.		0[b]	.	.
Fathers Education	**No Formal Education**	-0.08	0.93(0.24-3.60)	0.91		1.32	3.75(1.05-13.45)	0.04*
	Primary	1.17	3.20(0.80-12.89)	0.10		-0.43	.654(0.26-1.65)	0.37
	Secondary	1.30	3.66(1.41-9.51)	0.01*		-.0.07	0.926(0.50-1.72)	0..81
	Tertiary	0[b]	.	.		0[b]	.	.
Mother Education	**No Formal Education**	18.62	122547573.885(42359686.426-354533027.326)	0.00*		-1.50	0.22(0.08-0.56)	0.00*
	Primary	-1.52	0.22(0.06-0.81)	0.02*		18.61	120459530.24(0.00-.c)	0.99
	Secondary	-0.57	0.56(0.21-1.50)	0.25		-0.92	0.40(0.21-0.76)	0.01*
	Tertiary	0[b]	.	.		0[b]	.	.
Overweight	**Intercept**	-1.09		0.08*	**Tall for age**	-18.72		0.00*
Adolescent age grp	**Early**	0.12	1.12(0.29-4.31))	0.87		-0.74	0.48 (0.12-1.95)	0.30
	Middle	0.15	1.16 (0.43-3.12)	0.77		-2.28	0.10 (0.21-0.50)	0.01*
	Older	0[b]	.	.		0[b]	.	.
Sex	**Female**	2.78	16.08(6.21-41.66)	0.00*		2.23	9.32(2.75-31-51)	0.00*
	Male	0[b]	.	.		0[b]	.	
Class	**Junior**	0.26	1.30 (0.52-3.26)	0.58		18.62	121959628.77(121959628.77-121959628.77)	-
	Senior	0[b]	.	.		0[b]	.	.
Father Education	**No Formal Education**	-17.71	2.034E-8(0,00-.[c)]	1.00		-15.02	3.011E-7(0.00-.c)	0.10
	Primary	1.01	2.75(0.45-16.74)	.0.27		-17.04	3.995E-8(0.00-c)	0.10
	Secondary	2.60	13.43(4.40-40.99)	0.00*		0.78	2.19(0.55-866)	0.26
	Tertiary	0[b]	.	.		0[b]	.	.
Mothers Education	**No Formal Education**	17.910	60021639.792(60021639.792-60021639.792)	.		-20.233	1.633E-9(0.00-C)	0.99
	Primary	-2.956	.052(0.010-0.269)	0.00*		0.197	1.21(0.00-C)	1.00
	Secondary	-2.022	0.132(0.04-0.40)	0.00*		-2.489	0.08(0.02-0.33)	0.00*
	Tertiary	0[b]				0[b]	.	.

#. The reference category is: Wasted.; @ The reference category is Stunted; b. This parameter is set to zero because it is redundant; c. Floating point overflow occurred suggesting potential multicollinearity**.**

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