Original Research Article

AN ASSESSMENT OF THE NUTRITIONAL STATUS AND EATING HABITSOF IN-SCHOOL ADOLESCENTS IN SOKOTO, NORTH-WESTERN NIGERIA

ABSTRACT

Background: The period of adolescence has been characterized by poor dietary practices that may lead to health problems such as under nutrition and obesity.

Objectives: To assess the nutritional status and eating habits of in-school adolescents within Sokoto metropolis.

Methods: A cross-sectional survey of adolescents selected through multistage random sampling. Data was obtained using pre-tested semi-structured interviewer administered questionnaire. Subjects' body mass index (BMI) was determined using Centre for Disease Control BMI percentiles.Data was analyzed using IBM® SPSS version 25.

Results: A total of 389 subjects were recruited with a mean age of 15.46 ± 1.67 SD and more than half of them 231(59.4%) were females. The BMI was normal among 276(71.0%) of the respondents, 93(23.9%) were underweight, while 4(1.0%) were obese. Most of the respondents 318(81.7%) reported taking at least 3 meals per day, 257(66.0%) reported breakfast as their heaviest meal. The frequency of skipping meals was 300(77.1%). The main reason for meal skipping was non-availability of food as at meal time by 99(33.0%) of them. Frequent snacking occurred amongst 330(84.8%) subjects. The independent predictors of BMI were age category (p=0.015), gender (p=0.012), tribe (p=0.031), father's education status (p=0.002), mother's education status (p=0.003), number of people in the household (p=0.004), social class (p<0.001), and frequent snacking (p=0.034)

Conclusion: Two-third of the respondents had normal BMI for age while about a quarter of them were underweight. Ahigh proportion of them engaged in meal skipping and snacking. The BMI was associated with socio-demographics and frequent snacking.

Keywords: Body Mass Index, Eating habits,adolescents, Sokoto, Nigeria

Introduction

Adolescence refers to a transitional phase of growth and development between childhood and adulthood.[1] This period is characterized by poor dietary practices such as eating meals which contain low fruits and vegetables content, low meal frequency, high consumption of sweetened beverages, increased consumption of energy-dense foods, increased consumption of foods away from home with peers and skipping meals, particularly breakfast, consumption of high-dense fatty, sugary fast foods as the main meals of the day.[2]Adolescence is a vulnerable stage of life characterized by rapid growth and development and increased nutrients requirement.[3] Adequate nutrition is crucial for achieving full growth potential, and failure to achieve optimal nutrition may lead to delayed and stunted linear growth and impaired organ remodeling.[4]The dietary practice of adolescent is influenced by factors such as the period spent outside of the house, attitudes, socio-demographic characteristics, behavioral, physical appearance, In addition, the factors above are persuaded by personal preferences, parents education, economic status and culture.[5]

Unhealthy eating practices of adolescents may lead to health problems such as iron deficiency, eating disorders, obesity, under-nutrition and dental caries.[6] In developing countries, there is double burden of malnutrition among the adolescents. The global burden of moderate or severe underweight remains higher than that of overweight and obesity. However, the prevalence of

overweight and obesity has increased globally leading to a nutrition and epidemiological transition in recent times.[7,8] Previous reports indicated widespread malnutrition among Nigerian adolescents and increasing incidence of micronutrient deficiencies, overweight and obesity among children and adolescents.[9,10]Overweight in adolescents which persist to adulthood is associated with a high risk of heart diseases, and low intake of calcium is associated with osteoporosis in old age.[11] As for girls, poor nutrition during adolescence can affect the survival, health, and well-being of their children.[12]

Addressing nutrition issues for adolescents is relevant for current, future and intergenerational health in order to reduce the triple burden of malnutrition and non-communicable diseases later in life.[13]A recent report on multidimensional povertyindex survey has placed the study location as the poorest in Nigeria with an index of 90.5% thus indicating that people from the location are at risk of health conditions such as malnutrition, compounded by low literacy level and its attendant consequences such as unhealthy eating and dietary practices.[14]Previous studies conducted in the study area either focused on over nutrition or was based on a single community and did not explore factors such as the eating habits of the subjectsas well as other relevant socio-demographics apart from age, gender and social status.[15,16]This study sought to assess the nutritional status and the relationship with the eating habits and socio-demographics of the adolescents in the study location. Information on the nutritional status and eating habit of the respondents was to be brought to fore to assist the adolescents and their caregivers through their schools'management identify gaps and improve on their practices. It was also hoped that schools will use the research findings in designing interventions that would address unhealthy eating practices as well as nutrition and nutrition-related health issues in adolescents in the study area.

Materials and Methods

The study was a cross-sectional survey conducted in Sokoto metropolis from 08th June to 25th August 2023 among assenting in-school adolescents aged 10-20 years whose parents or guardians consented to the study. Adolescents attending non-coeducational schools and those that were ill during the course of the study as well as the physically challenged were excluded.[17]Also excluded were those with features suggestive of chronic illnesses such as sickle cell disease, malignancies and tuberculosis.[16]Farming is the predominant occupation of people in the state. Crops such as rice, maize, millet, guinea corn, ground nuts, beans, cassava and sweet potatoes are produced for subsistence while vegetables, wheat, cotton, and tobacco are produced as cash crops. Fish farming is also being engaged by individuals living around the river basin as another economic venture.[18-20] There are 47 (28 public and 19 private) secondary schools in the metropolis. The population of adolescents in Sokoto metropolis was 136,900 in 2006, projected at 226,274 for 2023.[21,22]

Sample Size Determination

The minimum sample size was determined using the following formula for cross-sectional studies[23] $n = \frac{Z^2pq}{d^2}$

Where:

n = minimum sample size needed for meaningful statistical analysis

Z = standard normal deviation, usually standard value set at 1.96, which corresponds to the 95% confidence interval

p = the proportion in the target population estimated to have a particular characteristic. In the absence of a reasonable estimate, 50% (0.5) is used.

q = 1-p

d = the degree of accuracy desired, usually set at 0.05.

In the study, p= 0.5 was used for the estimated prevalence of poor eating habits among adolescents in the study area. This was because of the absence of a reasonable estimate of the proportion in the target population in the study location, to the best of the investigators' knowledge.

Therefore, $n= (1.96)^2(0.5)\ (0.5)/\ (0.05)^2 = 384$

The minimum sample size that was considered in this study was 384.

To account for non-response or attrition of subjects which occurred as a result of dropped cases following subjects' inconsistent responses to the questions as well as voluntary withdrawal of subjects during the course of the study, a response rate of 90% was anticipated.

Using the formula $n_s = n/ 0.9$ [23]

Where n_s = the sample size to be selected

n= originally calculated size

0.9 = anticipated response rate

$n_s = 384/0.9= 426.$

However, 400 questionnaires were distributed to the participants.

Sampling Technique

A multistage sampling technique was used to select respondents for the study. Three Local Government Areas (LGAs) were selected out of the five LGAs in Sokoto metropolis through simple random sampling by balloting. They included Sokoto North, Sokoto South, and part of Wamakko LGAs. Two (2) secondary schools were selected from each of the three selected

LGAs using simple random sampling by balloting (therefore, 6 secondary schools were selected they included; Brilliant footsteps Academy (Private),Government Day SecSch. Kofar Marke (Public), Blue Crescent School, Mabera, Sokoto (Private), Government Day Secondary. School Minannata (Public),Government Day Secondary School Arkilla (Public) and Alheri School Sokoto (private).Proportionate allocation was done based on the number of students in each of the selected schools. It was also done based on the number of students in each class. Stratified sampling technique was done to select males and females in each class. Proportionate Allocation of Sample Size based on number of males and female was done in each of the selected class. Simple random sampling was used to select study participants based on the number of sample allocated in each stratum.

Data Collection Technique

A structured interviewer – administered questionnaireadapted from a previous[4]was used to collect data from the study participants via Open Data Kit (ODK) software installed on all the data collectors' smart phones via Google play store to collect data on eating habits. The questionnaire consisted of sections on Socio-demographic characteristics of the respondents, their eating habits, and anthropometric measurement. Their socio-economic status was assessed using Ibadin's classification of Socio-economic Index Score.[24] The section on dietary habits included questions on meal frequency, meal considered as the heaviest, snacking, meal skipping and frequency of meal skipping, reasons for skipping meals, preferred method of food preparation, application of concept of balanced diet, water intake per day and locations were main meals were mostly eaten.

The materials that were used for the anthropometric measurement included floor type weighing scale with stadiometer C202MWunder®, Italy. Subjects were weighed in light clothing and bare-footed. The weight was measured to the nearest 0.1kg after the scale was adjusted for zero error.

The height was measured with the subjects' bare-footed, and heels and back in contact with the stadiometer back support. The head was stabilized such that subjects looked straight ahead with the lower border of the eye sockets in the same horizontal plane as the external auditory meatus. The measurement was done to the nearest 0.1 cm. to assess precision of measurements taken, the subjects were randomly selected to be measured a second time. A difference of 1cm or less between two measurements was defined as acceptable level of precision for height.[25] The nutritional status was determined using the formula: Body mass index (BMI) = W/H^2, where W =weight (in kilograms) and H= height (in meters), to the nearest 0.1kg, for weight and 0.1cm for height. The age and sex specific height and BMI percentile for each subject was determined using the 2022 CDC BMI percentiles for age 2-20 years.[26]

The students were then classified into one of the following categories based on the percentile of their BMI on the age-and-sex-specific CDC growth chart as follows: underweight (less than 5th percentile), normal (5th to < 85th percentile), overweight (85th to <95th percentile) and obese (≥ 95th percentile).[26]Subjects identified to be malnourished were notified and counseled on appropriate dietary intake and nutritional supplements that are likely to improve their nutritional status. Some were referred to health facilities in the state for further evaluation, intervention, and monitoring.

Data Analysis

Data were cleaned from the ODK by checking for completeness and errors. This was then followed by data export to IBM® SPSSversion 25. Descriptive statistics of all variables was done to provide general characteristics of the data. Quantitative data was explored to check for outliers. This was done by running frequencies, means and cross tabulation. Continuous variables were expressed as frequencies and percentage are used, means, and standard deviation. Pearson's Chi-square and Fisher's exact tests were performed to assess for existence of

association between categorical variables. Level of significance was set at $\alpha = 0.05$ (i.e., 95% confidence interval). Therefore, any statistical test with $p < 0.05$ was considered to be statistically significant.

RESULTS

A total of four hundred (400) questionnaires were administered among the in-school adolescents, 389 were fully completed and considered suitable for analysis. The response rate was therefore ninety seven percent (97.0%).

Sociodemographic characteristics of the respondents

The mean age of the respondents was 15.46 ± 1.67 SD and more than half of them 231(59.4%), were females. A large proportion 300 (77.1%) of the participants were Hausa by tribe and 350(90%) were Muslims. Two hundred and seventy-eight (71.5%) were from the senior class. The majority of the fathers 376(96.4%) were the heads of the family, about a half of them 198 (50.9%), had tertiary education, 177 (44.7%) were civil servants. More than half 230 (59.1%) of the mothers had secondary school education and 233 (59.9%) were unemployed. One hundred and sixty-seven (42.9%) of the students had a family size of ≤4, majority 360 (92.5%) resided in urban areas, and 147(37.8%) were of middle social class. (Tables 1a &1b)

Table 1a: Sociodemographic characteristics of the respondents

Variable	Frequency (*n* = 389)	Percent (%)
Age (years)		
10 – 15	212	54.5
16 – 20	177	45.5
Mean age=15.46 ± 1.67 SD		
Gender		
Female	231	59.4

Male	158	40.6
Tribe		
Hausa	300	77.1
Igbo	21	5.4
Yoruba	57	14.7
Others*	11	2.8
Religion		
Islam	350	90.0
Christianity	39	10.0
Class in School		
Senior secondary	278	71.5
Junior secondary	111	28.5
Head of family		
Father	376	96.7
Mother	12	3.1
Other**	1	0.3
Household number		
≤ 4	167	42.9
5-7	163	41.9
≥8	59	15.2

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Table 1b: Sociodemographic characteristics of the respondents

Variable	Frequency (*n* = 389)	Percent (%)
Father's education		
None/Quranic	7	1.8
Primary	12	3.1
Secondary	172	44.2
Tertiary	198	50.9
Mother's education		

None/Quranic	21	5.4
Primary	36	9.3
Secondary	230	59.1
Tertiary	102	26.2
Father's occupation		
Senior public servant	174	44.7
Intermediate grade professional	59	15.2
Primary school teachers/Artisan	50	12.9
Petty trader/ labourer	100	25.7
Unemployed/ subsistence farmer	6	1.5
Mother's occupation		
Senior public servant	38	9.8
Intermediate grade professional	55	14.1
Primary school teachers/Artisan	9	2.3
Petty trader/labourer	54	13.9
Unemployed/Housewife	233	59.9
Social status		
Upper	137	35.2
Middle	147	37.8
Lower	105	27.0
Place of Residence		
Urban	360	92.5
Rural	27	6.9
Urban Slum	2	0.5

Nutritional status of the subjects

The classification of the BMI of the subjects based on the percentile as shown in Table 2 revealed that the majority 276(71.0%) were within the normal BMI category, 93(23.9%) were underweight, while 4(1.0%) were obese. (Table 2)

Table 2:Nutritional status of in-school adolescents in Sokoto

BMI (Percentile)	Frequency	Percent (%)
Underweight	93	23.9
Normal	276	71.0
Overweight	16	4.1

Obese	4	1.0
Total	**389**	**100.0**

Eating habits of the respondents

Majority of the respondents 318(81.7%) consumed three meals per day while 15(3.9%) of them ate greater than three meals per day. Two hundred and fifty-seven (66.1%) of the subjects considered breakfast to be their heaviest meal in a day while 300(77.1%) of the respondents reported skipping at least a meal per day. Of those that skipped meals, 212(70.7%), 201(67.0%), and 190(63.3%) skipped breakfast, lunch, and dinner 1-2 times per week, respectively. Most of the respondents 357(91.8%) took their meals at home with family members, 333(85.6%) applied the concept of balance diet to the choice of their meals and 317(81.5%) preferred boiled food than any other method of food preparation. The main reason for meal skipping was non-availability of food as at meal time by 99(33.0%) of the subjects. (Tables 3&4)

Table 3a: Eating habits of the respondents

Variable	Frequency (n=389)	Percent (%)
Meal per day		
1 per day	17	4.4
2 per day	39	10.0
3 per day	318	81.7

More than 3 per day	15	3.9
Heaviest meal of the day		
Breakfast	257	66.1
Lunch	103	26.5
Dinner	29	7.5
Do you skip meals		
Yes	300	77.1
No	89	22.9
Frequency of meal skipping per skipped meal (Breakfast)		
Everyday	56	18.7
1 - 2 per week	212	70.7
3 - 6 per week	32	10.6
Frequency of meal skipping per skipped meal (Lunch)		
Everyday	47	15.7
1 - 2 per week	201	67.0
3 - 6 per week	52	17.3
Frequency of meal skipping per skipped meal (Dinner)		
Everyday	72	24.0
1 - 2 per week	190	63.3
3 - 6 per week	38	12.7

Table 3b: Eating habits of the respondents

Variable	Frequency (n= 389)	Percent (%)
Where do you usually take your meals?		
At home with family member	357	91.8
Outside home alone	31	8.0

Outside home with peers	1	.3
Do you take snacks?		
Yes	330	84.8
No	59	15.2
Preferred food based on the preparation method		
Boiled	317	81.5
Fried	60	15.4
Baked	10	2.6
Steamed	2	.5
Application of balanced diet concept to choice of food		
Yes	333	85.6
No	56	14.4
Water intake in liter		
1 litre	10	2.6
2 litres	181	46.5
3 liters	175	45.0
> 3 liters	23	5.9

Table 4: Reason for skipping meal(s) among respondents

Variable	Frequency (n=300)	Percentage (%)
Food not available as at meal time	99	33.0
Did not like available food	91	30.3

Lack of appetite	49	16.3
Fasting for religious reasons	48	16.0
Perceived impact of available food on health	6	2.0
Concern for body image	4	1.3
Peer influence	3	1.0

Relationship between respondents Sociodemographic factors and BMI

Age category (p=0.001), gender (p=0.005), tribe (p<0.001), religion (p=0.009), father's education status (p<0.001), mother education status (p=0.004), number of people in the household (p=0.002) and social class (p=0.010) were significantly associated with body mass index of the subjects. (Table 5)

Table 5a: Association between socio-demographic factors and BMI status of the subjects

Variable	Body mass index (n=389)				Test statistic p-value
	Underweight n (%)	Normal n (%)	Overweight n (%)	Obese n (%)	

Age (years)					
<15 years	36(38.7)	162(58.7)	13(81.2)	2(50.0)	$\chi^2 = 15.965$
≥15 years	57(61.3)	114(41.3)	32(18.8)	2(50.0)	**p = 0.001**
Gender					
Male	52 (55.9)	101(36.6)	4 (25.0)	1(25.0)	$\chi^2 = 12.897$
Female	41 (44.1)	175(63.4)	12(75.0)	3(75.0)	**p = 0.005**
Tribe					
Hausa	86(92.5)	204(73.9)	9(56.2)	1(25.0)	
Igbo	1(1.1)	19(6.9)	1(6.2)	0(0.0)	$\chi^2 = 42.124$
Yoruba	4(4.3)	47(17.0)	3(18.8)	3(75.0)	**p < 0.001**
Others*	2(2.2)	6(2.2)	3(18.8)	0(0.0)	
Religion					
Islam	92(98.9)	241(87.3)	14(87.5)	3(75.0)	$\chi^2 = 11.520$
Christianity	1(1.1)	35(12.7)	2(12.5)	1(25.0)	**p = 0.009**
Class in School					
Senior	34(36.6)	73(26.4)	4(25.0)	0(0.0)	$\chi^2 = 5.220$
Junior	59(63.4)	203(73.6)	12(75.0)	4(100.)	p = 0.156
Head of family					
Father	91(97.8)	266(96.4)	15(93.8)	4(100)	$\chi^2 = 1.378$
Mother	2(2.2)	9(3.3)	1(6.2)	0(0.0)	p = 0.967
Other**	0(0.0)	1(0.3)	0(0.0)	0(0.0)	
Household number					
≤ 4	39(41.9)	116(42.0)	11(66.8)	1(25.0)	$\chi^2 = 20.738$
5-7	29(31.2)	126(45.7)	5(31.2)	3(75.0)	**p = 0.002**
≥8	25(26.9)	43(12.3)	0(0.0)	0(0.0)	
Setting					
Urban	87(93.5)	254(92.0)	15(93.8)	4(100)	$\chi^2 = 1.635$
Rural	5(5.4)	21(7.6)	1(6.2)	0(0.0)	p = 0.950
Urban Slum	1(1.1)	1(0.4)	0(0.0)	0(0.0)	

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Table 5b: Association between socio-demographic factors and BMI status of the subjects

Variable	Body mass index (n=389)				Test statistic p-value
	Underweight	Normal	Overweight	Obese	

	n (%)	n (%)	n (%)	n (%)	
Father's education					
None/Quranic	4(4.3)	3(1.1)	0(0.0)	0(0.0)	
Primary	8(8.6)	4(1.4)	0(0.0)	0(0.0)	$\chi^2 = 30.565$
Secondary	52(55.9)	113(40.9)	5(31.2)	2(50.0)	**p < 0.001**
Tertiary	29(31.2)	156(56.5)	11(68.8)	2(50.0)	
Mother's education					
None/Quranic	12(12.9)	8(2.9)	1(6.2)	0(0.0)	
Primary	12(12.9)	24(8.7)	0(0.0)	0(0.0)	$\chi^2 = 24.146$
Secondary	56(60.2)	162(58.7)	10(62.5)	2(50.0)	**p =0.004**
Tertiary	13(14.0)	82(29.7)	5(31.2)	2(50.0)	
Father's occupation					
Senior public servant	31(33.3)	135(48.9)	7(43.8)	1(25.0)	
Intermediate grade professional	12(12.9)	42(15.2)	4(25.0)	1(25.0)	$\chi^2 = 20.829$
Primary school teachers/Artisan	12(12.9)	38(13.8)	0(0.0)	0(0.0)	p < 0.053
Petty trader/ Labourer	36(38.7)	58(21.0)	4(25.0)	2(50.0)	
Unemployed/ Subsistence farmer	2(2.2)	3(1.1)	1(6.2)	0(0.0)	
Mother's occupation					
Senior public servant	10(10.8)	26(9.4)	2(12.5)	0(0.0)	
Intermediate grade professional	10(10.8)	43(15.6)	0(0.0)	2(50.0)	$\chi^2 = 18.752$
Primary school teachers/Artisan	0(0.0)	7(2.5)	2(12.5)	0(0.0)	p < 0.095
Petty trader/Labourer	14(15.1)	37(13.4)	2(12.5)	1(25.0)	
Unemployed/Housewife	59(63.4)	163(59.1)	10(62.5)	1(25.0)	
Social status					
Upper	19(20.4)	110(39.9)	7(43.8)	1(25.0)	$\chi^2 = 16.727$
Middle	38(40.9)	104(37.7)	4(25.0)	1(25.0)	**p < 0.010**
Lower	36(38.7)	62(22.5)	5(31.2)	2(50.0)	

Relationship between respondents eating habits and BMI

Whereas there was no significant statistical association between number of meals per day (p=0.274), the heaviest meal of the day (p = 0.528) and meal skipping (p=0.734) with respondents' BMI, it was however observed that Snacking (p=0.004), concept of balanced diet (p=0.028), and preferred method of food preparation (p=0.048) were statistically significantly associated with body mass index. (Table 6)

Table 6: Association between eating habits and BMI status of the respondents

Variable	Body mass index (n=389)				Test statistic p-value
	Underweight n (%)	Normal n (%)	Overweight n (%)	Obese n (%)	
Meals per day					
1 per day	5 (5.4)	11 (4.0)	0 (0.0)	1(25.0)	
2 per day	9 (9.7)	25(9.1)	4(25.0)	1(25.0)	$\chi^2 = 11.020$
3 per day	76 (81.7)	229(83.0)	11(68.8)	2(50.0)	p = 0.274
≥ 4 per day	3 (3.2)	11(4.0)	1(6.3)	0(0.0)	
Heaviest meal of the day					
Breakfast	61(65.6)	185(67.0)	9(56.3)	2(50.0)	$\chi^2 = 5.121$
Lunch	22(23.7)	74(26.8)	6(37.5)	1(25.0)	p = 0.528
Dinner	10(10.8)	17(6.2)	1(6.3)	1(25.0)	
Meal skipping					
Yes	69(74.2)	214(77.5)	13(81.2)	4(100.0)	$\chi^2 = 3.571$
No	24(25.8)	62(22.5)	3(18.8)	0(0.0)	p = 0.734
Frequent snacking					
Yes	69(74.2)	241(87.3)	16(100.0)	4(100.0)	$\chi^2 = 13.083$
No	24(25.8)	35(12.7)	0(0.0)	0(0.0)	**p = 0.004**
Application of balanced diet					
Yes	72(77.4)	241(87.3)	16(100.0)	4(100.0)	$\chi^2 = 9.077$
No	21(22.6)	35(12.7)	0(0.0)	0(0.0)	**p = 0.028**
Preferred preparation					
Boiled	82(88.2)	220(79.7)	14(87.5)	1(25.0)	
Fried	10(10.8)	46(16.7)	2(12.5)	2(50.0)	$\chi^2 = 17.018$

Baked	1(1.1)	8(2.9)	0(0.0)	1(25.0)	**p = 0.048**
Steamed	0(0.0)	2(0.7)	0(0.0)	0(0.0)	
Common location of food intake					
At home with family member	87(93.5)	252(91.3)	14(87.5)	4(100.0)	$\chi^2 = 4.981$
Outside home alone	5(5.4)	24(8.7)	2(12.5)	0(0.0)	p = 0.546
Outside home with peers	1(1.1)	0(0.0)	0(0.0)	0(0.0)	

Independent predictors of BMI

On logistic regression analysis, age category (p=0.015), gender (p=0.012), tribe (p=0.031), religion (p=0.011), father's education status (p=0.002), mother's education status (p=0.003), number of people in the household (p=0.004), social class (p<0.001), frequent snacking (p=0.034), were found to remain the independent predictors of BMI. (Table 7)

Subjects in the age category of ≥15 yearswere 0.1 time less likely to have normal BMI than those in the age category of <15 years. Males were 1.7 times more likely to have normal BMI than their female counterparts. Subjects of Igbo tribe were 0.8 times less likely to have normal BMI than those of other tribes. Respondents whose fathers and mothers were educated were 6 and 7 times respectively more likely to have normal BMI than those whose parents were not educated. Adolescents from a larger household were 0.3 times less likely to have normal BMI. Subjects who were of upper social class were 0.3 times less likely to have normal BMI than those from the lower class. Subjects engaged in frequent snacking were 0.2 times less likely to have normal BMI than those not into frequent intake of snacks. (Table 7)

Table 7: Predictors of BMI status of the subjects

Variables	aOR	95% CI		p-value
		lower	Upper	
Age category (<15years vs ≥15 years *)	0.579	0.372	0.900	**0.015**
Gender (Male vs female*)	1.764	1.133	2.746	**0.012**
Tribe (Hausa vs Others*)	0.565	0.168	1.896	0.355
Tribe (Igbo vs Others*)	0.126	0.019	0.827	**0.031**
Tribe (Yoruba vs Others*)	0.255	0.065	1.004	0.051
Household number (≤4 vs ≥8*)	0.399	0.212	0.752	**0.004**
Household number (5-7 vs ≥8*)	0.598	0.324	1.103	0.100
Father educated (Yes vs No*)	7.429	2.133	3.084	**0.002**
Mother educated (Yes vs No*)	6.662	2.433	3.243	**0.003**
Socioeconomic class (Upper class vs Lower class*)	0.354	0.200	0.628	**<0.001**
Socioeconomic class (Middle class vs Lower class*)	0.596	0.352	1.010	0.054

Frequent intake of snacks (Yes vs No*)	0.539	0.303	0.956	**0.034**
Concept of balanced diet (Yes vs No*)	0.636	0.352	1.150	0.134

aOR = Adjusted Odds Ratio **CI** = Confidence Interval *** = Reference** group

Discussion

This study has assessed the nutritional status of In-school adolescents in Sokoto, North-western Nigeria, and its relationship with Sociodemographic and eating habits of the respondents. Although majority of the subjects in this study had a normal weight status, about a quarter of them were underweight. The prevalence of underweight in this study is comparable to the 23.3% and 26.1% reported in studies among adolescents in Indonesia and Ghana respectively.[27,28] This finding is in contrast to report from Bauchi, North-east Nigeria where 54.4% had normal weight and a higher prevalence (36.0%) of underweight was reported.[29] The finding of this study also contrasts with report from Lagos, South-west Nigeria where the prevalence of underweight was lower (5.4%) than that reported in this study.[30] The prevalence of overweight and obesity in the Lagos study were however, higher than those reported in this study. Similarly, overweight and obesity were much higher in the Tanzanian study than reported in this study.[31] This contrasting pattern of nutritional status could be linked to a variation in the socio-cultural and economic set-up of people living in the aforementioned locations in Nigeria and elsewhere.[27-31] Bauchi and the study area are located in different zones in the North, with each of the inhabitants experiencing peculiar socio-economic and security challenges.[14] North Sumatera in Indonesia and Northern

Ghana where the aforementioned studies were conducted are similar to the study location in terms of occurrence of high poverty level and malnutrition.[27,32] The educational and economic status of people in Lagos is however, better compared to those of people living in the study location. The employment status and entrepreneurship opportunities for women in Lagos are also higher.[33] Although most of the parents of the respondents in this study had at least secondary school education, almost 60.0% of the mothers were not employed thus eliminating the possibility of spousal support, which is a factor that could've improved the economic situation of the families and by extension translate to better weight status than reported in this study. Culturally, women from the study location are hardly encouraged to engage in civil service or business ventures outside their home environment,[34] further limiting their roles in decision making concerning feeding and other health related matters. The occurrence of obesity and overweight has remained almost same as reported in a study conducted over a decade ago among adolescents in Sokoto.[15] The finding of obesity and overweight being commoner among respondents in the Lagos study could be related to higher social status with access to and intake of highly processed foods which can be high in saturated fat, sugar and sodium and low in essential nutrients and fibreand can result to over nutrition.[3] A higher prevalence of overweight and obesity among subjects in the Tanzanian study could be related to the fact that the subjects were boarding school students with diet reported to be monotonous containing carbohydrates and fat above the recommended daily allowances.[31]

The finding of most of the subjects eating at least three main meals per day is comparable to reports from previous studies.[28,30,31,35,36]This finding implies that the meal frequency of adolescents in this study was appropriate but whether the meals were diverse enough to reflect on their nutritional status or not, was not sought for in this study. The practice of meal skipping by respondents in this study corroborated reports from other studies.[28,30,35] The majority of

respondents skipping at least one meal is an indication that although they ate at least thrice per day, the duration between meals were unlikely to have been even. This is supported by the fact that the main reason for skipping meals by the subjects was non-availability of food as at meal time. Dislike for available food and lack of appetite as reasons for skipping meals by the respondents was as reported in earlier conducted studies where the reasons included little time for meal preparation, ill health, lack of appetite, or disliking the food served.[28,30] Adolescents are said to usually have the habit of skipping meals especially breakfast, irrespective of their geographical location.[30] Irregular intake of meals however, increases the risk of malnutrition and its attendantnegative consequences on growth and development, as well as increasing the chances of communicable and non-communicable diseases.

The lack of association between numbers of meals per day with the nutritional status of the subjects observed in this study was in consonance with the report from a previous study.[30] Adequate meal intake goes beyond frequency to include diversity and acceptability such that, the desired impact on individual's nutritional status can be achieved.[37] Frequent intake of snacks as reported in this study was comparable to reports from other studies.[28,30,35]Subjects engaged in frequent snacking being less likely to have normal weight status in this study further confirms the possible effect of such practice on the health status of the adolescents in the study area and the need to intervene to forestall future consequences. The school food environment has been documented to promote the consumption of unhealthy foods often sold to children in school cafeterias or at convenience stores and street stalls outside schools.[3] In addition, advertisements for sugar-sweetened beverages, pastries and sweets, many featuring gifts or special promotions, remain common outside schools, particularly state schools, and can influence food and drink choices among children.[38] There is increasing concern about the impact of these diets on human health. Much of the focus is on rising overweight and obesity, but modern diets are also

implicated in under-nutrition andare now believed to be the single biggest risk factor for the global burden of disease.[3,39]

Similar to report from a previous study, younger adolescents in this study were more likely to have normal weight status.[30] Striving towards independence in terms of decision making and engaging in more risky practices are behaviours usually engaged by mid-late adolescents.[40] These factors could reflect in their choices of food, eating habits, and unhealthy practices that could be detrimental to their nutritional status, thus increasing their risks of developing malnutrition and its complications. Gender has long been identified as a factor that plays a role in the nutritional status of adolescents.[41] The observation of males' being more likely to have normal nutritional status than females in this study is in agreement with report from a previous study.[30] Apart from nutritional factors, hormonal, environmental and socio-cultural factors have been implicated as possible aetiologies.[3] Respondents with educated parents had normal nutritional status compared to those with uneducated parents. This finding is comparable to report from a previous study.[42] Education has been shown to greatly influence the family health and socioeconomic status while Social class has been known to influence human behaviours in areas of food choices, number and types of meals taken, including the use of snacks and the quality and quantity of diets available to adolescents.[3,17] The adolescents whose parents were from Upper social class in this study were more prone to malnutrition, especially overweight and obesity. This could be due to the adolescents' ability to bear the cost of unhealthy diets as well as more accessibility compared to those of lower social class. Children from affluent families have also been reported to be more prone to over nutrition because of factors such as sedentary life-style, lack of regular physical activities and more exposure to the marketing of ultra-processed foods which can influence food choices.[3]

Conclusion

Two-third of the respondents had normal BMI for age while about a quarter of them were underweight. A high proportion of them engaged in meal skipping and snacking. The BMI was associated with socio-demographics and frequent snacking. Nutrition and health-related programs organized by schools in collaboration with stakeholders in the state ministries of education and health targeting adolescents in the study area as well as their parents are likely to improve the eating habits and reduce the prevalence of underweight among adolescents.

Ethical Consideration

Ethical approval was sought from Sokoto State Ministry of Health Ethics Committee. Permission was sought from theSokoto State Ministry for Basic and Secondary Education, permission to carry out the study was also sought from authorities in each of the selected secondary school, then written informed consent and assent was obtained from the selected parents/guardians/ students respectively before proceeding with the study.

Study Limitations

The limitation included self-reporting of practices, which might have led to social desirability bias, in that some subjects, recognizing that they are part of a study, may have reported on the ideal eating habits rather than their actual practices. Recall bias cannot be excluded as some information' were based on past practices. To reduce these limitations, respondents were counseled on the importance of factual information on the research. They were also routinely asked questions for a second or third time to ascertain consistency of their earlier responses.

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