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ORIGINAL ARTICLE

Adolescent Obesity and its Association with Socio-Demographic Profile, Lifestyle Factors, Dietary and Physical Activity Patterns; Findings from Southwestern Nigeria

L'Obésité chez les Adolescents et son Association avec le Profil sociodémographique, les Facteurs de Style de Vie, les Habitudes Alimentaires et l'Activité Physique; Résultats du sud-ouest du Nigeria

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ABSTRACT

BACKGROUND: The prevalence of adolescent obesity is rising in all parts of the world, but only very few studies have considered factors influencing obesity among Nigerian adolescents. Therefore, this study aimed to determine the prevalence of obesity and its association with socio-demographic profile, lifestyle factors, dietary patterns, and physical activity patterns among in-school adolescents in Southwest Nigeria.

METHODS: A total sample size of 400 in-school adolescents were selected through a multi-stage sampling technique from secondary schools in Ile-Ife. The dietary patterns were assessed using a 92-item FFQ, while the activity patterns were assessed using the physical activity questionnaire for older children and adolescents. Data were analyzed using IBM SPSS.

RESULTS: There were 211 (52.8%) males and 189 (47.3%) females, with mean ages of 14.8 ± 2.1 and 14.4 ± 1.9 years, respectively. The prevalence of overweight/obesity was 12.8%. The associated factors were age, sex, class, the number of children in the family, birth orders and the dietary pattern dominated by starchy foods, roots and tubers ($p<0.05$).

CONCLUSION: The prevalence of overweight/obesity was relatively high among the respondents. It was associated with age, the number of children in the family, and adolescents' birth order. **WAJM 2022; 39(2): 119–126.**

Keywords: Adolescent obesity, Dietary pattern, physical activity pattern, Lifestyle factors, Nigeria.

RÉSUMÉ

CONTEXTE: La prévalence de l'obésité chez les adolescents augmente dans toutes les régions du monde, mais très peu d'études ont facteurs considérés comme influençant l'obésité chez les adolescents Nigérians. Par conséquent, cette étude visait à déterminer le prévalence de l'obésité et son association avec le profil sociodémographique, les facteurs de style de vie, les habitudes alimentaires et les habitudes d'activité physique chez les adolescents scolarisés dans Sud-ouest du Nigeria.

MÉTHODES: Un échantillon total de 400 adolescents scolarisés ont été sélectionnés par une technique d'échantillonnage en plusieurs étapes à partir de écoles secondaires d'Ile-Ife. Les habitudes alimentaires ont été évaluées à l'aide d'un questionnaire FFQ de 92 items, tandis que les habitudes d'activité ont été évaluées à l'aide du questionnaire sur l'activité physique pour les enfants plus âgés et les adolescents. Les données ont été analysées à l'aide d'IBM SPSS.

RÉSULTATS: Il y avait 211 hommes (52.8 %) et 189 hommes (47.3 %) femelles, avec des âges moyens de 14.8 ± 2.1 et 14.4 ± 1.9 ans, respectivement. La prévalence du surpoids / obésité était de 12.8%. Les facteurs associés étaient l'âge, le sexe, la classe, le nombre de enfants dans la famille, ordres de naissance et régime alimentaire dominé par les féculents, les racines et les tubercules ($p <0.05$).

CONCLUSION: La prévalence du surpoids / de l'obésité était relativement élevé parmi les répondants. Il était associé à l'âge, le nombre d'enfants dans la famille et l'ordre de naissance des adolescents. **WAJM 2022; 39(2): 119–126.**

Mots-clés: Obésité chez les adolescents, Régime alimentaire, modèle d'activité physique, Facteurs de style de vie, Nigeria.

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Abbreviations: BMI, Body Mass Index; **CI,** Confidence Interval; **FFQ,** Food Frequency Questionnaire; **KMO,** Kaiser-Meyer-Olkin; **LGA,** Local Government Area; **LIE,** Local Inspector of Education; **OR,** Odds Ratio; **PCA,** Principal Component Analysis; **QFFQ,** Quantitative Food Frequency Questionnaire; **SPSS,** Statistical Package and service solutions; **WHO,** World Health Organisation.

INTRODUCTION

Obesity is a public health problem resulting from a long-term imbalance between food intake and energy expenditure.[1,2] It is a global problem that affects 50 million girls and 74 million boys worldwide. Also, 213 million children and adolescents and 1.3 billion adults were overweight worldwide.[3] What was once considered a disease of the high-income countries is now a potential health problem in low- and middle-income countries.[4–6] In 2016, more than 70 % of overweight/obese people lived in low and middle-income countries.[7,8] In Sub-Saharan Africa, the prevalence of overweight and obesity increased by almost a third between 1992 and 2005.[6] Unlike childhood obesity that has plateaued in many high-income countries,[9–11] adolescent obesity has increased substantially around the world.[12,13] The prevalence rates are as high as 15.6% for overweight and 4.9% for obesity among adolescents in European countries.[14] In Sub-Saharan Africa, the prevalence of 10.6% and 2.5% for overweight and obesity have been documented.[15] In Nigeria, overweight and obesity among adolescents ranges from 1.0%–8.6% and 0.0%–3.0%, respectively.[16,17]

While genetic factors are estimated to cause more than 40% variation in Body Mass Index (BMI),[18,19] environmental factors contribute immensely to the obesity epidemic.[20] Studies have shown that socio-demographic variables such as age, sex, education level, wealth and marital status are determinants of obesity.[21–25] Also, unhealthy dietary intake, such as a high intake of refined carbohydrate foods, saturated fats, sugar, and low dietary fibre intake,[26–29] are factors associated with increased rates of overweight and obesity. Evidence has also shown that sedentary lifestyles, smoking and alcohol could be risk factors for obesity.[30,31]

In Nigeria, most studies on obesity focused on women and children. It is important to study obesity in adolescents because of its health implications. Obesity in adolescence is associated with several adverse health consequences for the entire life course. It is associated with a higher risk and earlier onset of chronic diseases such as type 2 diabetes, cardiovascular diseases and cancer.[30,32–35] Also, it has adverse psychosocial consequences and lowers educational attainment.[36,37]

The few studies on adolescent obesity in Nigeria focused mainly on the prevalence, with little or nothing on the determinants.[38–41] More studies are required to elaborate on the influence of different factors on adolescent obesity as this will inform effective prevention and intervention programs. Therefore, this study aimed to determine the prevalence of obesity and its association with socio-demographic profile, lifestyle factors, dietary patterns, and physical activity patterns among in-school adolescents in Southwest Nigeria.

SUBJECTS, MATERIALS AND METHODS

Study Location and Study Population

The study was carried out among in-school adolescents (10 to 19 years old) in Ile-Ife, a semi-urban town in the southwestern part of Nigeria. Adolescents who were acutely ill, had chronic illnesses that could affect their weight (like sickle cell anaemia) were excluded. Those with disabilities that made them unable to stand were also excluded from the study.

Sample Size and Sampling Technique

The sample size was calculated to get an absolute precision of ± 5% using STATCALC on the Epi-Info software. The proportion of expected outcome was taken as 37.2%, which was the proportion of in-school adolescents with obesity from a previous study in Ile-Ife, with an acceptable margin of error of 5%. The calculated sample size was 359 but was adjusted for an anticipated non-response of 10%, giving a sample size of 400. Therefore, four hundred adolescents were recruited from 6 secondary schools in Ile-Ife using a multi-stage sampling technique. The two Local Government Areas (LGAs) in Ile-Ife were included in the study. At the first stage, three schools each were selected from the list of schools in the two LGAs. The number of respondents to be selected in each school was determined using proportional allocation. At the second and final stage, the respondents were selected using stratified random sampling technique, with stratification along the line of the different classes.

Research Instruments and Data Collection Methods

A pre-tested structured questionnaire was used for data collection using the assisted self-administered method. The dietary patterns were assessed using a 92-item Quantitative Food Frequency Questionnaire (QFFQ), adapted from the validated FFQ used among school-aged children in Ghana,[42] and further modified after pre-testing the research instrument. The activity patterns were assessed using the physical activity questionnaire for older children and adolescents by Kowalski, *et al,*[43] validated and used among similar age groups in Nigeria.[44] The instruments for anthropometric measurements were the Seca® electronic bathroom weighing scale (SECA GmbH & Co, Germany) for measuring weight in 0.1 kilograms (kg). Height was measured to the nearest 0.1 meters using the stadiometer (Leicester® Height Measure, Seca, UK). The anthropometric measurements were done according to standard protocols recommended by the International Society for the Advancement of Kinanthropometry.[45]

Data Management

Data were analyzed using IBM SPSS version 23. Descriptive analysis of all the variables measured was first done, and the categorical variables were reported as frequencies and proportions/percentages. The continuous variables were reported as means ± standard deviation. At the bivariate level, cross-tabulations were done to test for associations between the different categorical variables (in line with the study's objective) using the chi-square test. Fisher's exact test was used when an expected value was less than 5. T-test for two independent samples was used to compare the means of the continuous variables between the two categories of the dependent variable (Obese/Not obese). Logistic regression was used to control for confounders and to identify the predictors of obesity out of the independent variables that were

significantly associated with obesity at the bivariate level.

Overweight and Obesity were determined using BMI-for-age Z-scores from the WHO reference charts > +1 to +2 and obese > +2, respectively, and the two groups represented obesity in this study.

The responses to the questions on activity patterns were scored, and each section was scored over 5. Afterwards, all the scores from the different sections were scored over 5. The scores were then categorized into < 2, 2.00 – 3.99 and ≥ 4 for low, moderate and high physical activity patterns respectively.[43]

Principal Component Analysis (PCA) was done to reduce the dimensions of dietary intake to a small number of dietary patterns. Factors were retained and interpreted for further analysis based on their natural interpretation, visual inflections of the scree-plot of eigenvalues construction, and the percentage of total variance explained. The reliability of the factor analysis was veriûed using the Kaiser-Meyer-Olkin (KMO) test with sampling adequacy of 0.9 and Bartlett's test of sphericity significant at $p < 0.001$.

Ethical Considerations

Ethical clearance was obtained from the Ethical Review Committee, Institute of Public Health, Obafemi Awolowo University, Ile-Ife. Permission for the study was obtained from the Local Inspector of Education (L.I.E.) of the selected local government and the Management of the selected schools. Written informed consent was obtained from parents and adolescents 18 years or above, while permission was obtained from respondents younger than 18 years. All information gathered was kept confidential, and participants were identified using only serial numbers.

Table 1: Relationship between Obesity and Socio-demographic profile of Respondents (N = 400)

Variables	Obesity Status (%)		Statistics
	Obese (n = 51)	Not Obese (n = 349)	
Age	13.6 ± 1.8	14.8 ± 2.0	t = 4.171
			P < 0.001*
Sex			
Male	20 (9.5)	191 (90.5)	χ^2 = 4.296
Female	31 (16.4)	158 (83.6)	p = 0.038*
Religion			
Christianity	36 (12.2)	258 (87.8)	LR = 1.179
Islam	15 (14.6)	88 (85.4)	p = 0.554
Traditional worshipper	0 (0.0)	3 (100.0)	
Class			
Junior Secondary 1	0 (0.0)	22 (100.0)	LR = 18.044
Junior Secondary 2	9 (23.1)	30 (76.9)	p = 0.003*
Junior Secondary 3	11 (20.0)	44 (80.0)	
Senior Secondary 1	18 (16.2)	93 (83.8)	
Senior Secondary 2	13 (7.7)	156 (92.3)	
Senior Secondary 3	0 (0.0)	4 (100.0)	
Number of Children in the Family			
1 – 2	2 (6.7)	28 (93.3)	χ^2 = 8.613
3 – 4	39 (17.0)	191 (83.0)	p = 0.013*
> 4	10 (7.1)	130 (92.9)	
Birth Order of the Child			
1 – 2	19 (8.4)	206 (91.6)	χ^2 = 9.918
3 – 4	27 (19.9)	109 (80.1)	
> 4	5 (12.8)	34 (87.2)	p = 0.007*
Fathers' Occupation			
Unemployed	4 (10.0)	36 (90.0)	LR = 2.247
[a]Skilled worker	33 (14.9)	188 (85.1)	p = 0.523
[b]Semi-skilled worker	13 (10.3)	113 (89.7)	
[c]Unskilled worker	1 (7.7)	12 (92.3)	
Fathers' Occupation			
Unemployed	0 (0.0)	19 (100.0)	LR = 6.100
[a]Skilled worker	22 (15.4)	121 (84.6)	p = 0.107
[b]Semi-skilled worker	27 (12.2)	194 (87.8)	
[c]Unskilled worker	2 (11.8)	15 (88.2)	
Family Setting			
Monogamous	45 (13.3)	294 (86.7)	χ^2 = 0.549
Polygamous	6 (9.8)	55 (90.2)	p = 0.594

** Statistically significant; χ, chi-square test used; LR, Likelihood ratio test used; t, 2 independent samples t-test used; a, professionals, e.g. doctors, lawyers etc.; b, Artisans, e.g. tailors, barbers etc.; c, manual/untrained workers, e.g. cleaners*

RESULTS

There were 211 (52.8%) males and 189 (47.3%) females. Most of them were of the Yoruba ethnicity (92.5%), were Christians (73.5%) by religion and were living with both of the parents (81.5%). As for the risky lifestyle of the adolescents, 28 (7.0%) had smoked before, 7 (1.8%) currently smoked, 66 (16.5%) had taken alcoholic beverages before, and 20 (5.0%) were currently taking alcoholic beverages. While the majority (93.0%) of the respondents did not know, 12 (3.0%) and 16 (4.0%) knew that their fathers and mothers had hypertension, respectively. Sixteen (4.0%) and 6 (1.5%) also reported a history of diabetes in their fathers and mothers, respectively.

After scoring the responses for the physical activity, the mean score was 21.5 ± 5.1, with a range of 10.0 to 39.6, out of a maximum score of 45. The respondents were then categorized into low, moderate and high using these scores, i.e. 110 (27.5%), 289 (72.3%) and 1 (0.3%), respectively. Using the WHO BMI-for-age references, 51 (12.8%) respondents were overweight or obese. (Figure 1).

The 92-dietary items on the FFQ were regrouped into 16 dietary groups, as seen in Table 2. Using PCA, three dietary patterns that explained about 52% of the total variance (total dietary variability) were retained. The first component (PCI), which accounted for 35.3%, had the largest positive loadings for fruits, vegetables, meat, poultry, eggs and products, fish and milk. The second component accounted for 9% and had the largest positive loadings for cereals and grain products, starchy fruits, roots and tubers, grain legumes, nuts and seeds. The third component accounted for 7.5% and had positive loadings for nuts and seeds, fats and oils and condiments and spices. (Table 2).

The relationship between obesity and socio-demographic profile is as shown in Table 1. Age ($p < 0.001$), sex ($p = 0.038$), class in the school ($p = 0.003$), number of children in the family ($p = 0.013$) and birth order of the child ($p = 0.007$) were the factors that were statistically significant. There was no statistically significant relationship between obesity and physical activity pattern ($\chi^2 = 0.107$, $p = 0.743$), and all the lifestyle factors ($p > 0.05$). The second component (PC2), dominated by high carbohydrate/starchy foods and legumes, was significantly associated with obesity ($P = 0.033$), while the others were not.

All independent variables that had a statistically significant relationship ($p < 0.05$) with obesity at the bivariate level were entered into a binary logistic model. (Table 4). Age ($p < 0.001$), number of children in the family ($p = 0.004$) and the birth order of the child ($p < 0.001$) were the factors that remained significantly associated with obesity afterwards.

Table 2: Component Matrix for three Components representing Major Dietary Patterns among Adolescents in Ile-Ife

	Components		
	PC1	PC2	PC3
Cereals and grain products	.051	.471	.056
Starchy fruits, roots and tubers	.057	.449	.071
Grain legumes and products	.386	.458	.298
Nuts and seeds	.049	.335	.346
Vegetables	.557	.191	.203
Fruits	.595	.169	–.274
Sugars and syrups	.247	–.167	.085
Meat	.503	–.047	–.174
Poultry	.426	.053	–.344
Eggs and products	.409	.066	–.278
Fish and products	.427	–.246	–.178
Milk and related products	.481	–.179	–.169
Fats and oils	.041	–.306	.512
Condiments and spices	.047	–.406	.536
Juice and sugar-sweetened drinks	.247	–.294	–.138
Desserts and snacks	.059	–.391	.002

Table 3: Relationship between Obesity and the Dietary Patterns (N – 400)

Variables	Obesity Status (%)		Statistics
	Obese (n = 51)	Not Obese (n = 349)	
PC1	–0.0942612 ± 0.95	0.137746 ± 1.01	t = –0.754
			P = 0.453
PC2	–0.2305216 ± 0.77	0.336865 ± 1.03	t = –2.175
			P = 0.033*
PC3	0.0654382 ± 0.97	–0.0095626 ± 1.01	t = 0.514
			P = 0.609

** Statistically significant;* *t – 2 Independent samples t-test used*

DISCUSSION

In this study, the combined prevalence of overweight and obesity is 12.8%, higher than what some authors had previously reported in Southwestern Nigeria.[46–48] Several other recent Nigerian studies have reported similar or even higher rates for overweight/obesity among Nigerian adolescents.[38,49–53] This rising prevalence of obesity among Nigerian adolescents should be a thing of concern to all stakeholders in adolescent health. Therefore, a quick response to stem this tide becomes necessary to prevent the associated health conditions resulting in lower quality of life in adulthood.

This study showed that obesity was significantly higher in the early adolescence period. This finding corroborates earlier studies that similarly observed higher prevalence rates of overweight and obesity in the lower adolescent age group.[48] The reason could be attributed to the increase in the hormonal secretion, which accompanied the growth spurt at this time and may be responsible for the excess fat deposition.[54] The present study also found that females were more likely to be obese than males. Similar findings have been documented previously in studies done among adolescents.[47,48] The differences in hormonal secretion,[54,55] lower involvement of females in rigorous physical activities and the cultural preference for girls[56] are some of the possible reasons different researchers have adduced. However, other studies showed a higher prevalence among males compared to females.[13,57] These differences may be due to age distribution or the culture of the different study areas.

The dietary component dominated by carbohydrate/ starchy foods and roots and tubers foods were significantly associated with adolescent obesity. Studies have shown that carbohydrate/ starchy foods consumption is associated with weight gain.[58,59] The high glycemic index of the food may play a vital role in weight gain. Conversely, higher

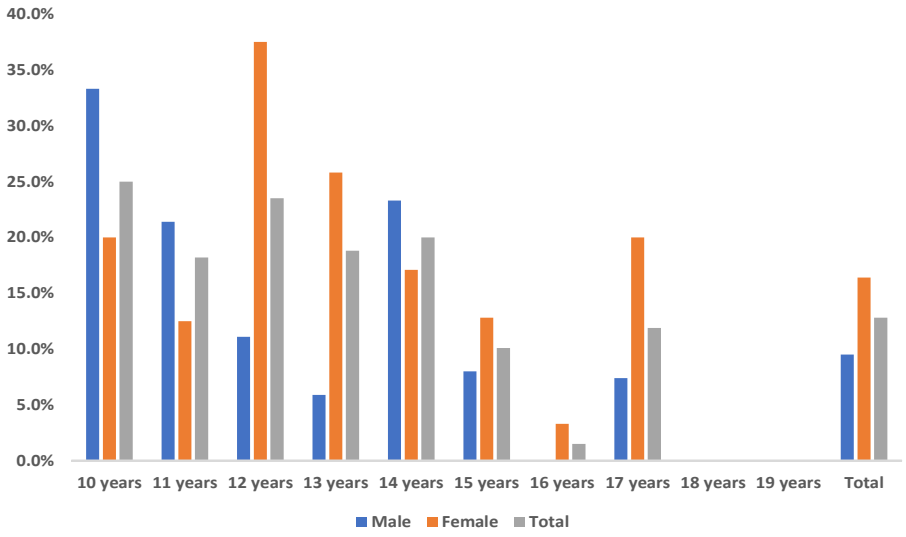

Fig. 1: Distribution of the Prevalence of Obesity among the Respondents according to Age and Sex.

Table 4: Predictors of Obesity using Binary Logistic Regression (N = 400)

Variables	p-value	Odds Ratio	Confidence Interval	
			Lower	Upper
Age in years	<0.001*	1.373	1.157	1.629
Gender				
Male (Reference Value)				
Female	0.099	0.577	0.300	1.109
Number of children in the family				
1 – 2 (Reference Value)	0.004*			
3 – 4	0.290	0.432	0.092	2.042
>4	0.374	2.288	0.369	14.187
Birth order of the child				
1 – 2	<0.001*			
3 – 4	0.005	8.576	1.940	37.924
> 4 (Reference Value)	0.232	2.313	0.586	9.135
PC2	0.178	1.263	0.899	1.773

** Statistically significant*

consumption of whole grains, legumes, nuts, fruits and vegetables has been associated with a lower risk of chronic non-communicable diseases and obesity.[60,61] Therefore, there is a need for nutritional education intervention programs for adolescents, especially within the school systems.

The number of children in the family remained significantly associated with adolescent obesity even after controlling for confounders in the present study. A similar finding showed that the lower the number of siblings, the higher the odds for overweight/obesity,[62] whereas the higher the number of siblings, the lower the risk for overweight.[63] A possible explanation for this finding is that additional siblings might increase the cost for food and general upkeep of the children, thereby limiting the average amount spent on food per child. Another probable explanation is that the increased number of children increases the involvement of each child in physical activities, which is protective against overweight and obesity. This study also shows that being the first or second child is associated with adolescent obesity. The first, second children have eight times the odds of being overweight/obese compared to those whose birth order is greater than 4. Studies have reported similar findings of a higher risk of being overweight with being an only child.[63,64] These findings suggest that family planning may play a role in controlling the obesity epidemic in Nigeria.

Studies have demonstrated a significant relationship between physical activity and body weight gain,[65–68] suggesting that a sedentary lifestyle plays a role in excessive weight gain. However, our result showed no significant relationship between physical activity patterns and body weight gain. This finding was in agreement with similar results reported by other researchers[69,70] who worked among adolescents. The discrepancy in these results may be attributable to the different sample sizes and the populations studied. It was, however, noted that only one respondent in the present study could be classified as having high physical activity, with nearly 3 out of 10 having low physical activity. This pattern of reduced physical activity among adolescents should be discouraged. All the stakeholders, including the government, school authorities and parents, should initiate measures to discourage sedentary lifestyles and encourage increased physical activity among adolescents.

This study is not without any limitations. Since the dietary habits of respondents were self-reported, it is prone to social desirability bias or recall bias. However, this was minimized by assuring the respondents of absolute confidentiality and requesting that they recall the information within the last 30 days. In addition, the study was descriptive cross-sectional in design and cannot be used to infer cause and effect.

CONCLUSION

This study found that the prevalence of overweight/obesity was relatively high among the respondents. Among the socio-demographic factors, age, gender, class, number of children and birth order were significantly associated

with obesity. The dietary pattern rich in starchy foods, roots and tubers was also significantly associated with obesity. Obesity had no significant association with the respondents' physical activity patterns and lifestyle factors. After controlling for confounders, age, the number of children in the family and the birth order of the children remained significantly associated with obesity. Effective nutrition education is needed to change dietary habits that are detrimental to adolescents. The school authority should also check the availability of unhealthy foods within the school environment. The findings of this study also indicate the possible usefulness of family planning to control the adolescent obesity epidemic in Nigeria.

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Competing Interests

The authors declare that they have no competing interests.

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