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Regional and socio-demographic predictors of dietary proficiency of adolescent girls in Nigeria

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ABSTRACT

Background: Dietary behaviors of female adolescents are of increasing concern due to their critical role in determining long-term health outcomes. **Aims:** This study aimed at investigating dietary proficiency of adolescent girls aged 10 – 19. **Methods:** A descriptive cross-sectional study was conducted with 2261 in-school female adolescents aged 10 – 19 years. Participants were selected using a multistage stratified random sampling procedure was used to select participants from three geopolitical zones in Nigeria. Two states were selected from three geopolitical zones in Nigeria: North-Central (Kogi and Niger States), South-East (Abia and Imo States), and South-West (Osun and Ondo States). A validated questionnaire was employed to collect data on sociodemographic variables, Dietary Diversity (DD), Nutrition Knowledge (NK), and Dietary Behavior (DB). These variables were combined to define Dietary Proficiency. Data were analyzed using SPSS version 27. Chi-square test assessed regional associations, while logistic regression analysis was used to identify predictors of dietary proficiency (DP). Statistical significance was set at $p < 0.05$. **Results:** Significant regional variations were observed in DD ($\chi2 = 36.069$), NK ($\chi2 = 56.895$), DB ($\chi2 = 176.52$), and DP ($\chi2 = 40.551$). Older girls residing in peri-urban location, from Igbo ethnic group, and moderately large household predicted a likelihood of higher DD with odd ratios exceeding 1. Larger household size (OR = 1.056, 95% CI = 0.813 – 1.373) predicted higher NK. Residing in South-East region (OR = 2.030, 95% CI = 1.640 – 2.513) and being in the mid-adolescent age group (14 – 16 years) (OR = 2.093, 95%CI = 1.589 – 2.756) doubled the likelihood of high DB. Predictors of higher DP included older age (OR = 1.160, 95% CI = 0.923 –1.457) and residence in the South-East region (OR = 1.148, 95% CI = 0.883–1.49). **Conclusion:** Regional and sociodemographic differences significantly influenced dietary proficiency among adolescent girls. Addressing these disparities through targeted nutrition education and awareness programs is crucial for promoting healthier dietary behaviors and improving overall dietary proficiency in this population.

Keywords: Dietary Factors, School Adolescent Female, Food Choices, Food Intake, Nigeria.

ARTICLE INFORMATION

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1 Introduction

Adolescence represents a distinct and critical phase of life characterized by significant physical, psycho-social, and cognitive development. During this period, there is an increased demand for calories and protein to maintain optimal growth and maturation. Recognizing health requirements of adolescents, researchers have emphasized the crucial role of adequate nutrition during this life stage as a cornerstone for achieving optimal health and development (Salam et al., 2016). Emerging scientific evidence highlight various dietary factors associated with the consumption of

poor-quality diets among adolescents. These includes excessive intake of sugary beverages and unhealthy fast foods, low intake of vegetables, frequent meal skipping, and a tendency toward unhealthy snacking behaviors (Evans, 2020; Musaiger et al., 2011).

A study conducted among adolescents in Kolkata, India, revealed that a significant proportion of adolescent exhibited poor eating habits (Kumar et al., 2017). Factors contributing to these behaviors included insufficient knowledge and poor perception of cardiovascular disease-related risk and the importance of preventive measures (Kumar et al., 2017). Similarly, suboptimal nutritional intakes and unhealthy meal patterns were associated with poor diet quality, as reported by a study among adolescents in Alberta, Canada, which emphasized the need to address health behaviors to enhance diet quality health outcomes and overall wellness (Storey et al., 2009).

In Nigeria, the 2021 National Food Consumption and Micronutrient Survey, (FGoN, 2024) reported concerning nutritional indicators among adolescents: 3% were overweight, 15.4% experienced underweight/thin, 21.7% were stunted, and were 1.1% obese. Additionally, approximately, 20.3% of adolescent girls presented some form of anemia, while only 11.3% used iron or folic acid supplements. Despite the limitations of Nigeria's healthcare system, which restrict access to essential health commodities and medicines in Nigeria, low-cost, proven interventions are available to prevent anemia. These include weekly iron and folic acid supplementation, nutrition education, and large-scale food fortification initiatives (WHO, 2017). Addressing adolescent nutrition is crucial for public health, as it lays the foundation for a healthy adulthood and contributes to reducing maternal and perinatal morbidity and mortality.

Malnutrition occurs when there is an imbalance between food intake and the energy expended or nutrients required, leading to undernutrition or overnutrition. These conditions can coexist and are often exacerbated by inappropriate or unhealthy dietary behavior. Adolescents in developing countries face significant nutritional challenges, rendering them vulnerable to poor learning outcomes, reduced productivity, elevated morbidity, and mortality rates. Cases of non-communicable diseases (NCDs) are being recorded among adolescents (Biswas et al., 2022). However, limited attention is directed toward ensuring a healthy lifestyle and adequate nutritional intake in preparation for adulthood. Intervention programs are usually focused on infants, children under five, school-aged children, and pregnant women, with minimal emphasis on adolescents, despite their classification as a vulnerable group. The dietary behaviors of female adolescents play a critical role in determining nutrient stores, preventing NCDs and enhancing immunity (Norris et al., 2022). Early adoption of unhealthy dietary behaviors is a major contributory factor to the development of diseases later in life.

Despite repeated calls to action, adolescent health remains a neglected area. There is a growing recognition of the potential of promoting a healthy start to life for future generations by addressing health and nutritional risks in adolescents before pregnancy and parenthood (Patton et al., 2016). Adolescence, therefore, has been identified as a critical window of opportunity to disrupt the intergenerational cycle of malnutrition. This period provides opportunity to reduce the incidence of health challenges associated with nutritional imbalances by positively influencing the dietary behaviors among female adolescents.

The transformative shift toward sustainable development involves ensuring that female adolescents have access to quality nutrition, equipping them for both productive and reproductive phases of life.

There is a paucity of data to inform decisions taken regarding potential intervention among adolescents in Nigeria. Hence, the aim of this study was to investigate the dietary proficiency of female adolescents in Nigeria. The null hypotheses tested were: (1) there is no significant difference in the dietary proficiency of in-school adolescent girls across regions, and (2) there is no significant association between sociodemographic characteristics and dietary proficiency among in-school adolescent girls in Nigeria.

2 Methods

2.1 Study design

This study employed a descriptive cross-sectional design targeting in-school female adolescents aged 10 – 19 years. Three geopolitical zones were selected from the six geopolitical zones in Nigeria. Two states each were selected from each of the selected zones, namely North Central (Kogi and Niger States), South East (Abia and Imo States) and South West (Osun and Ondo States).

2.2 Sample size

The sample size was determined using the Research Advisor, (2006) guidelines, based on 95% confidence level and 5% margin of error. As parameters were determined in each of the six selected states, each state was treated as a distinct population. According to the Research Advisor's table, a sample of 355 is adequate for rational estimation in each state, regardless of population size. A proportionate sampling size distribution method was utilized to allocate the sample size across the states. Assuming a non-response rate of 5%, the adjusted sample size for each state was increased to 372, resulting in a total minimum sample size of 2,232 across the six states. Schools operating boarding systems, pregnant and

lactating adolescents, and privately owned schools were excluded from the study.

2.3 Sampling procedure

A multistage stratified random sampling procedure was employed to select both schools and students for this study. In the first stage, six states were selected from three geopolitical zones in Nigeria. In the second stage, the local government areas (LGAs) within each selected state were stratified based on their urbanization status (urban, peri-urban, or rural). Subsequently, two predominantly peri-urban LGAs and two predominantly urban LGAs were purposively selected from each state. In the third stage, lists of secondary schools within the selected LGAs were obtained from the respective Local Education Authorities. From these lists, two schools were randomly selected from each LGAs using a ballot method. Within the designated schools, 25 students were randomly selected from junior and senior arms.

To ensure a systematic and unbiased selection of participants, school registers were employed as the sampling framework. A systematic sampling technique with a *Kth* interval was applied, starting with a randomly selected starting point to identify the participants (Olumakaiye et al 2024).

2.4 Data collection procedure

Four research assistants were recruited and trained to facilitate data collection in each state. The training, conducted over two days, focused on the use of Open Data Kit (ODK), the digital tool employed for data collection. To reduce interpersonal bias, the research assistants worked in pairs. Data collection was carried out concurrently across all states over a two-week period in April 2023 to prevent potential seasonality bias in food availability.

2.5 Measurement of variables

A validated socioeconomic questionnaire was utilized to elicit information on personal, social and demographic variables. Nutrition Knowledge Questionnaire (NKQ) was used to assess the adolescents' understanding of nutrition. The questionnaire included 15 predefined questions aimed at evaluating nutritional knowledge with a score of one (1) point for correct response while incorrect responses were assigned zero (0). The total nutrition knowledge score was calculated by summing the responses, with a maximum score of 15 points. Dietary Diversity was assessed using a food intake checklist and 24-hour dietary recall. Each adolescent was asked to describe all foods and drinks consumed during the previous 24 hours. Two recalls (one weekday and one weekend day, excluding party days) were conducted for each participant. Individual Dietary Diversity (IDD) scores were calculated using the Dietary Diversity Questionnaire (DDQ). The most varied diet corresponded to a maximum score of 15. Knowledge and IDD scales were categorized into three levels using the overall mean and standard deviation (SD). Scores exceeding the sum of the mean and SD were classified as high, those below the mean minus SD were considered low, and scores between these thresholds were categorized as moderate (Olumakaiye, 2013).

Dietary Behavior (DB) was evaluated 17 questions, nine of which were included in the DB score calculation. The DB scale was categorized by calculating the overall mean and SD scores. The score obtained by adding the mean and SD was classified as high, the value obtained by subtracting the SD from the mean was considered low while the value in-between high and low scores was classified as moderate.

Dietary proficiency was conceptualized as a composite measure encompassing nutritional knowledge, dietary diversity, and dietary behavior. The Dietary Proficiency Score was calculated by the summation of IDD, NK, and DB scores. This composite score was subsequently dichotomized into two categories: Healthy Dietary Proficiency (HDP) and Unhealthy Dietary Proficiency (UDP). HDP was defined as a score exceeding the sum of the mean and SD of the total score, while UDB was defined as below this threshold.

2.6 Data analysis

Data Cleaning was performed to exclude incomplete entries and outliers. A total of 2,261 verified entries were analyzed using IBM SPSS Statistics, Version 27. Both descriptive and inferential statistical methods were employed. Descriptive statistics employed included mean, SD, frequency distribution, and percentages were utilized. To assess associations between variables Chi-square tests were employed for continuous variables, while logistic regression was applied to categorical variables to identify predictors of dietary proficiency. Statistical significance was set to a p-value of less than 0.05. The outputs were presented using tables and figures to provide a clear and structured depiction of the findings.

3 Results

Demographic characteristics: Table 1 provides a summary of the demographic characteristics of adolescent girls in Nigeria. The participants ranged in age from 10 – 19 years, with the majority 58.2% falling within the 14 – 16 years age group. Slightly more respondents resided in urban (51.7%) compared to peri-urban areas (48.3%). The sample was proportionately distributed across the three geopolitical zones investigated; North Central (28.5%), South East (32.8%), and South West (38.7%). Most respondents identified as Christians (77.7%), and the mean household size was 6.12 ± 2.58 members. Additionally, 45.2% of the adolescents were from moderately large household.

Table 1. Socio-demographic variables of adolescent girls n = 2261

Variables	n	%
Age (year)		
- 10 – 13	529	23.4
- 14 – 16	1315	58.2
- 17 – 19	417	18.4
Mean ± SD = 14.86 ± 1.78		
Residence		
- Peri-urban	1091	48.3
- Urban	1170	51.7
Region		
- North Central	645	28.5
- South East	742	32.8
- South West	874	38.7
Ethnic group		
- Hausa	48	2.1
- Igbo	800	35.4
- Yoruba	1014	44.8
- Ebira	138	6.1
- Nupe	120	5.3
- Tiv	10	0.4
- Others	131	5.8
Religion		
- Christianity	1756	77.7
- Islam	501	22.1
- Traditional	2	0.1
- Others	2	0.1
Household size		
- Small (<5)	953	42.1
- Moderately Large (5-8)	1021	45.2
- Large (>8)	287	12.7
Mean ± SD = 6.12 ± 2.58		

12.3% of the adolescents demonstrated high NK and 16.3% exhibited low levels of NK. The majority of adolescents demonstrated awareness of key nutritional concepts, including:

- The role of water in digestion (96.1%),
- The importance of physical exercise in preventing obesity (87.0%),
- Milk and meat as sources of protein (85.4%),
- The role of vitamins and minerals in disease prevention (85.1%).

Conversely, some misconceptions were noted regarding specific food groups, such as fiber-rich foods, nuts and pulses, as well as vegetables and fruits, indicating gaps in nutrition knowledge among the participants.

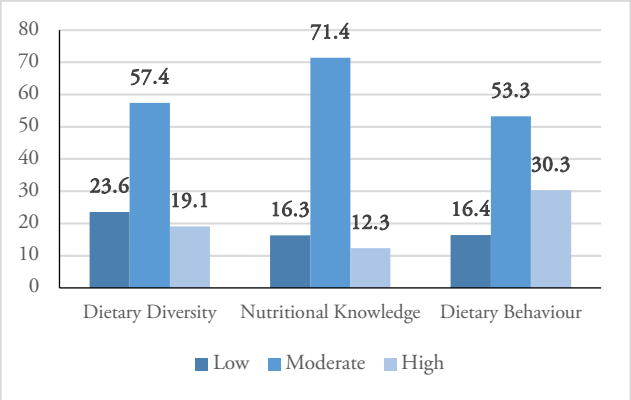

Figure 1. Level of dietary diversity, nutritional knowledge and dietary behavior of adolescent girls in Nigeria

Table 2. Nutrition knowledge of the adolescent girls n = 2261

S/N	Statements	Correct Answer		Rank
		n	%	
1.	Vitamins and minerals protect our body from diseases	1924	85.1	4th
2.	Proteins repair worn-out tissues	1777	78.6	7th
3.	Rice, bread and noodles do not contain the same nutrient	668	29.5	12th
4.	Vegetables and fruits are rich sources of fat and oil	655	29.0	13th
5.	Animal protein can be eaten in place of plant proteins	1493	66.0	9th
6.	Fish cannot be replaced with nut/pulse	642	28.4	14th
7.	Milk and meat are protein sources	1931	85.4	3rd
8.	Physical exercise helps to prevent obesity	1967	87.0	2nd
9.	Iron helps to make blood cell	1385	61.3	10th
10.	Anemia, which is shortage of blood can be prevented by eating fat	720	31.8	11th
11.	Milk and milk products provide Calcium and vitamin D in the body	1800	79.6	5th
12.	Fiber rich foods cause constipation	561	24.8	15th
13.	Water is required for the digestion of food	2173	96.1	1st
14.	Carbohydrates and fat produce energy in the body	1795	79.4	6th
15.	Too much of carbohydrate foods can lead to obesity	1602	70.9	8th

Mean ± SD = 9.33 ± 2.15

Nutrition Knowledge (NK): The nutritional knowledge of the adolescent girls is summarized in Table 2 and in Figure 1. The mean nutrition knowledge score was 9.33 ± 2.15. Only

Dietary behavior (DB): The dietary behaviours of the in-school adolescent girls across the three geopolitical zones are presented in Table 3. A majority respondents (86.8%)

Table 3. Dietary behavior of adolescent girls n = 2261

Dietary Behavior	n	%
Frequency of meals per day		
- Once	11	0.5
- Twice	288	12.7
- Thrice and above	1962	86.8
Sometimes skipping meal #		
- Yes	762	33.7
- No	1499	66.3
Meals sometimes skipped		
- Breakfast	243	31.9
- Lunch	427	56.0
- Dinner	92	12.1
Breakfast consumed #		
- Yes	2018	89.3
- No	243	10.7
Lunch consumed		
- Yes	1834	81.1
- No	427	18.9
Dinner consumed		
- Yes	2169	95.9
- No	92	4.1
Timing of Breakfast when consumed #		
- Before 11:00 am	1900	94.2
- After 11:00 am	118	5.8
Timing of Lunch #		
- 1:00 pm – 3:00 pm	1385	75.5
- After 3:00 pm	449	24.5
Timing of Dinner #		
- 6.00pm – 8.00pm	1471	67.8
- After 8.00pm	698	32.2
Snack consumption #		
- Yes	2148	95.0
- No	113	5.0
Frequency of snacks consumption #		
- Sometimes	1355	63.1
- Everyday	720	33.5
- Rarely	73	3.4
Replacing main meal with snacks #		
- Yes	1102	51.3
- No	1046	48.7
Meal replaced with snacks		
- Breakfast	251	22.8
- Lunch	738	67.0
- Dinner	113	10.2
Buy from vendors		
- Yes	766	33.9
- No	1495	66.1
Consume Soft Drinks		
- Yes	2162	95.6
- No	99	4.4
Frequency of soft drink consumption		
- Everyday	1878	86.9
- Rarely	135	6.2
- Sometimes	149	6.9
Consume Alcohol #		
- Yes	216	9.6
- No	2045	90.4

Included in Dietary Behaviour Score; Mean ± SD = 11.31 ± 1.80

reported consuming meals three or more times daily. However, meal-skipping was common, with one-third (33.7%) of participants admitting to skipping meals. Lunch was the most frequently skipped meal at times (56.0%), whereas dinner was the most consistently consumed meal (95.9%). Breakfast was regularly consumed by 90% of the participants, with 94.2% adhering to the recommended time frame for breakfast. Likewise, 81.1% regularly consumed lunch, and 95.9% consumed dinner; however, 24,5% and 32.2%, respectively, did not consume these meals within the recommended time frame. Snack consumption was prevalent among the adolescents, with 95.0% reporting regular snack intake, and 51.3% replacing main meals with snacks. Additionally, 33.9% of the respondents purchased meals from food vendors, and 95.6% reported consuming soft drinks.

Food group consumption: Table 4 outlines the variety of food groups consumed by the respondents. The most frequently consumed food group was oils and fats, with approximately 96% of participants reporting regular consumption. These are often incorporated into most mixed dishes in Nigeria. Cereals constituted the second most consumed food group, with nearly 94% of adolescents of adolescents consuming cereal-based meals, followed by other vegetables, such as tomatoes and pepper, which were consumed by 88% of the respondents. Certain nutrient-rich food groups were less frequently consumed. These included vitamin A-rich vegetables and tubers (18.0%), other fruits (26.7%), and eggs (31.0%).

Dietary diversity (DD): As presented in Figure 1, 24% of the adolescents exhibited low DD, 57.4% displayed moderate DD, and only 19.1% revealed high DD. Additionally, low scores were recorded for DD (23.6%), NK (16.3%), and DB (16.4%) among the adolescent girls (Figure 1).

Dietary proficiency (DP): The summary of the dietary proficiency of the adolescent girls, which is the summation of DD, NK and DB is presented in Table 5, which indicates that 17.5% were classified as having unhealthy dietary behavior. There were significant variations in DD, NK, DB, and DP by Region, as presented in Table 5. Compared to other regions, the South-East region displayed the highest proportions of adolescent girls with low DD (28.4%), NK (22.1%), and DB (22.0%). In the South-East region, 24.8% of adolescents were categorized as exhibiting unhealthy dietary proficiency (Table 5). Analysis using a binary logistics regression model revealed adolescents aged 17 – 19 group (OR = 1.070, 95% CI = 0.856 – 1.338), those residing in a peri-urban area (OR = 1.177, 95%CI = 0.995 – 1.391), those from Igbo extraction (OR = 1.023, 95%CI = 0.571 – 1.833) and moderately large households (5 – 8 members) (OR = 1.366, 95% CI = 1.042 – 1.789) presented a higher likelihood of having high dietary diversity compared to the reference categories. The mid-age adolescent girls (OR = 2.093, 95% CI = 1.589 – 2.756), those from South-East (OR = 2. 030, 95%CI = 1.640 – 2.513) and from Igbo extraction (OR = 2.023, 95% CI = 1.057 – 3.869) were twice more likely to possess better DB. Adolescent girls aged 17 – 19 years (OR = 1.160, 95% CI = 0.923 – 1.457) and those residing in the South-East (OR = 1.148, 95% CI = 0.883 – 1.491) are more likely to have healthy DP. Those from larger household sizes (OR = 1.066, 95%CI = 0.819 – 1.389) had the likelihood of having high nutritional knowledge.

Table 4. Dietary diversity of the adolescent girls (n= 2261)

S/N	Food Groups	Example	Yes		Rank
			n	%	
1	**Cereals**	Rice, Maize, Wheat, Sorghum, Millet, Bread, Yam Porridge, Tuwo masara, Tuwo shinkarfa, Oat, Pap, Noodles, Masa, Pasta (Spaghetti, Macaroni), Semovita, Popcorn	2120	93.8	2nd
2	**Roots, tubers and plantain**	Potatoes (Irish or sweet), yam, cassava, starch, Plantain	1465	64.8	5th
3	**Vitamin A rich Vegetables and tubers**	Carrot, Pumpkin, sweet potato,	410	18.0	15th
4	**Other vegetables**	Amaranth, cassava leave, and spinach	1998	88.4	3rd
5	**Vitamin A rich fruits**	Cabbage, Lettuce, Garlic, Cucumber, Onion, eggplant, Tomato, Red pepper, Mushroom, Green beans, Green, Mango, Pawpaw, Apple and Watermelon Pepper	780	34.5	11th
6	**Other Fruits**	Banana, Lemon, Berries, Strawberries, Yellow Cherry, Grapefruit, Pineapple	604	26.7	14th
7	**Flesh foods and organ meat**	Liver, Kidney, Heart, Beef, Pork, Lamb, Goat, Rabbit, Chicken, Duck, Edible Insects, Lungs, Spleen, Mutton, Turkey, Corn beef	1140	50.4	8th
8	**Eggs**	Egg from Hen, duck and Turkey	700	31.0	13th
9	**Fish and Sea food**	Fresh or Dried Fish, Can fish, smoked fish, crab stick, crayfish	1247	55.2	7th
10	**Nuts and seeds**	Sesame seed, Pumpkin seed, Walnut, Peanut, Locust beans,	729	32.2	12th
11	**Beans and Peas**	Beans, Red beans, White beans,	1118	49.4	9th
12	**Milk and milk products**	Milk, Cheese, Yoghurt, Ice cream, Condensed milk, Skimmed milk,	835	36.9	10th
13	**Oil and fats**	Vegetable oil, Palm oil, Butter, added to food or used in cooking, Mayonnaise, Margarine	2164	95.7	1st
14	**Sweets**	Sugar, Honey, Sweetened Soda, Juice, Drinks, Chocolates, Candies, Cookies, Biscuits, Pie and Cakes	1437	63.6	6th
15	**Spices, condiments and beverages**	Black pepper, Soy sauce, Herbs, Seasoning cubes, Ketchup, coffee, Coriander, Mint, Bayleaf, Rosemary, Lipton Tea, Alcoholic beverages, Wines, Milo, Bornvita	2002	88.5	4th

Mean ± SD = 8.47 ± 2.93

Table 5. Level of Dietary Diversity, Nutritional Knowledge, Dietary Behavior and Dietary Proficiency by region (n= 2261)

Dietary Factors	North Central (n=645) n (%)	South East (n=742) n (%)	South West (n=874) n (%)	Total (n=2261) n (%)	Mean ± SD	χ2	P-value
Dietary Diversity							
- Low	159 (24.7%)	211(28.4%)	163 (18.6%)	533 (23.6)			
- Moderate	375 (58.1%)	367 (49.5%)	555 (63.5%)	1297 (57.4)	8.47 ± 2.93	36.069	0.000
- High	111 (17.2%)	164 (22.1%)	156 (17.8%)	431 (19.1)			
Nutritional Knowledge							
- Low	107 (16.6%)	164 (22.1%)	98 (11.2%)	369 (16.3)			
- Moderate	491 (76.1%)	484 (65.2%)	639 (73.1%)	1614 (71.4)	9.33 ± 2.15	56.895	< 0.001
- High	47 (7.3%)	94 (12.7%)	137 (15.7%)	278 (12.3)			
Dietary Behavior							
- Low	67 (10.7)	163 (22.0)	139 (15.9)	371 (16.4)			
- Moderate	257 (39.8)	445 (60.0)	502 (57.4)	1204 (53.3)	11.32 ± 1.80	176.52	< 0.001
- High	319 (49.5)	134 (18.0)	233 (26.7)	686 (30.3)			
Dietary Proficiency							
- Unhealthy Dietary Proficiency	94 (14.6)	184 (24.8)	118 (13.5)	396 (17.5)	29.12 ± 4.12	40.551	< 0.001
- Healthy Dietary Proficiency	551 (85.4)	558 (75.2)	756 (86.5)	1865 (82.5)			

Table 6. Binary logistic regression analysis showing the odds of dietary diversity, nutritional knowledge, dietary behavior and dietary proficiency and selected socio-demographic variables (n= 2261)

Variables	B	OR	95% CI for Exp (B)	P-value
Dietary Diversity				
Age (years)				
- 10 – 13 (RC)				
- 14 – 16	- 0.212	0.812	0.624 – 1.056	0.120
- 17 – 19	0.053	1.070	0.856 – 1.338	0.554
Region				
- North Central (RC)				
- South East	- 0.306	0.773	0.629 – 0.951	0.015**
- South West	- 0.265	0.767	0.636 – 0.946	0.012**
Residence				
- Urban (RC)				
- Peri-Urban	0.200	1.177	0.995 – 1.391	0.057
Ethnic group				
- Hausa (RC)				
- Igbo	0.023	1.023	0.571 – 1.833	0.940
- Yoruba	- 0.132	0.877	0.726 – 1.058	0.171
- Others	- 0.244	0.784	0.618 – 0.994	0.045**
Household Size				
- Small (<5) (RC)				
- Moderately Large (5-8)	0.312	1.366	1.042 – 1.789	0.024**
- Large (>8)	- 0.012	0.989	0.755 – 0.933	0.933
Nutritional Knowledge				
Age (years)				
- 10 – 13 (RC)				
- 14 – 16	- 0.441	0.589	0.455 – 0.765	0.001**
- 17 – 19	- 0.048	0.915	0.732 – 1.143	0.432
Region				
- North Central (RC)				
- South East	-0.193	0.842	0.685 – 1.035	0.103
- South West	-0.686	0.483	0.396 – 0.589	0.001**
Residence				
- Urban (RC)				
- Peri-Urban	-0.089	0.883	0.748 – 1.042	0.140
Ethnic group				
- Hausa (RC)				
- Igbo	-0.596	0.551	0.308 – 0.986	0.045**
- Yoruba	-0.654	0.520		0.001**
- Others	-0.303	0.739	0.585 – 0.933	0.011**
Household Size				
- Small (<5) (RC)				
- Moderately Large (5-8)	0.064	1.066	0.819 – 1.389	0.634
Large (>8)	0.055	1.056	0.813 – 1.373	0.682
Dietary Behavior				
Age (years)				
- 10 -13 (RC)				
- 14 – 16	0.738	2.093	1.589 – 2.756	0.002**
- 17 – 19	0.311	1.365	1.083 – 1.721	0.008**
Region				
- North Central (RC)				
- South East	0.781	2.030	1.640 – 2.513	0.001**
- South West	-0.405	0.711	0.584 – 0.866	0.001**
Residence				
- Urban (RC)				
- Peri-Urban	0.012	1.028	0.872 – 1.214	0.740
Ethnic group				
- Hausa (RC)				
- Igbo	0.704	2.023	1.057 – 3.869	0.033**
- Yoruba	-0.461	0.630	0.523 – 0.760	0.001**
- Others	0.210	1.234	0.973 – 1.565	0.083
Household Size				
- Small (<5) (RC)				
- Moderately Large (5-8)	-0.048	0.839	0.643 – 1.096	0.117
- Large (>8)	-0.028	0.855	0.656 – 1.113	0.244

Table 6. (continued)

	Dietary Proficiency			
Age (years)				
- 10 – 13 (RC)				
- 14 – 16	-0.84	0.920	0.704 – 1.202	0.54
- 17 – 19	0.148	1.160	0.923 – 1.457	0.20
Region				
- North Central (RC)				
- South East	0.138	1.148	0.883 – 1.491	0.30
- South West	-0.505	0.604	0.416 – 0.877	< 0.05
Residence				
- Urban (RC)				
- Peri-Urban	-0.019	0.981	0.826 – 1.165	0.83
Ethnic group				
- Hausa (RC)				
- Igbo	-0.219	0.803	0.433 – 1.491	0.49
- Yoruba	-0.090	0.914	0.634 – 1.319	0.63
- Others	-0.353	0.703	0.526 – 0.938	< 0.05
Household Size				
- Small (< 5) (RC)				
- Moderately Large (5 – 8)	-0.010	0.990	0.747 – 1.311	0.94
- Large (> 8)	-0.101	0.904	0.689 – 1.187	0.47

** Significant @ < 0.05, RC=Reference Category

4 Discussion

Food Consumption

Adequate nutrition is vital for the growth, development, and health of adolescent girls. This study found that the participants predominantly consumed energy-dense foods, with nutrient-dense foods being the least consumed. An identical trend was observed in a study conducted in Iran (Naeeni et al., 2014). The high intake of fats and oils can largely be attributed to traditional Nigerian food preparation methods, where oil is a frequent ingredient used in mixed dishes. Similarly, staple Nigerian meals are predominantly cereal-based, providing affordable carbohydrate-rich energy sources; however, these meals often lack dietary diversity. Excessive consumption of fats, oils, cereals, and root, and tubers poses long-term health risks, including obesity and cardiovascular diseases. While, the limited consumption of nutrient-dense foods, which are rich in vitamin A and iron, undermines optimal adolescent health. Some foods are fortified with vitamin A in Nigeria (Friesen et al., 2020; Ogunmoyela et al., 2013; Ohanenye et al., 2021), and biofortified tubers, such as orange-fleshed sweet potatoes (Nkhata et al., 2020), biofortified cassava (Ayinde et al., 2017; Afolami et al., 2021; Ilona et al., 2017) and maize (Manjeru et al., 2019; Ahmed et al., 1997), are available. However, the consumption remains low. The limited consumption of iron-rich foods partly explains the persistently high prevalence of iron deficiency anemia in Nigeria (FGoN and IITA, 2024). Iron deficiency anemia continues to be a leading global cause of years lost to death and disability among adolescent girls. (Evans, 2020). The negative health impact of anemia if it transcends to adulthood can lead to higher risks of maternal mortality and poor pregnancy outcomes among girls. The low consumption of micronutrients -rich foods observed in this study aligns with findings from various regions, including South-Asia (Alami et al., 2019), Iran (Kheirouri & Alizadeh 2014), Indonesia (Knijff et al., 2021), Ethiopia, Kenya, Nigeria, and South Africa (Harika et al., 2017), as well as young adults and women of reproductive age in Nigeria (Olumakaiye et al., 2010) and Mumbai (Nunn et al., 2019).

Nutrition Knowledge

Knowledge is a critical determinant in facilitating changes in dietary habits (Harika et al., 2017). In the present study, the proportion of adolescent girls with a high level of nutritional knowledge was low, mirroring findings from a similar study in Iran (Naeeni et al., 2014). This contrasts with higher levels of nutritional knowledge reported in studies conducted Europe (Sichert-Hellert et al., 2011) and Croatia (Milosavljević et al., 2015). Poor nutrition knowledge predisposes individuals to unhealthy food choices and dietary practices, such as excessive consumption of processed foods, sugary drinks, or foods high in saturated fats. It also reduces the likelihood of consuming a balanced and varied diet, potentially leading to adverse health outcomes (FGoN and IITA 2024; Olumakaiye et al., 2010). Low nutrition knowledge increases the risk of nutrient deficiencies, as individuals may lack awareness of the nutritional values of various foods and the importance of obtaining diverse nutrients in their diet. Poor nutritional knowledge can have long-term consequences for health, potentially contributing to the development of chronic health conditions such as obesity, cardiovascular diseases, and deficiencies in essential micronutrients (Biswas et al., 2022).

Dietary Behavior

The findings highlight positive dietary behavior among the adolescent girls, such as regular meal consumption and adherence to the recommended timing for breakfast intake. However, concerns emerged regarding the timing of lunch and dinner consumption. Similar findings have been reported in studies conducted in Australia and England (Mullan et al., 2014), as well as in literature reviews (Blondin et al., 2016), and Lagos, Nigeria (Olatona et al., 2022). A significant proportion of participants frequently skipped lunch, and when consumed, it was often replaced with snacks. Snack and soft drink consumption may increase sugar intake and potential health concerns for adolescents. While snacking is not fundamentally detrimental for adolescents, the quality of snacks consumed is crucial. Promoting healthy snacks with low fat, sugar, and sodium content, but high in fibers and micronutrients, could alleviate these concerns (Olumakaiye et al., 2010; Tripicchio et al., 2019; Bucher et al., 2016). Additionally, the findings raise issues regarding the nutritional quality and hygiene of snacks and foods commonly sourced from street or school vendors (Sanlier et al., 2018; Steyn et al., 2014; Alimi, 2016).

5 Conclusions

Significant variations in dietary proficiency–comprising dietary diversity, nutrition knowledge, and dietary behavior–were observed based to the location and sociodemographic characteristics of the adolescent girls. Specifically, the inadequate intake of two critical micronutrients, vitamin A and iron, as well as gaps dietary diversity, nutrition knowledge gap and dietary behavior highlights the need for targeted nutrition education and awareness campaigns to promote healthier dietary proficiency among adolescent girls in Nigeria.

Recommendations

Evidence suggests that nutrition education is a highly effective tool for improving dietary habits. Collaboration with schools to integrate nutrition education into the school curriculum is strongly recommended. This could include targeted programs such as the establishment of school nutrition clubs that focus on locally available food options, seasonal food alternatives, practical sessions on meal planning and preparation, and the promotion of healthy dietary behavior and overall dietary proficiency. Furthermore, leveraging digital technologies, such as mobile applications and social media platforms could enhance engagement and provide interactive content to encourage positive dietary behavior.

These efforts are expected to contribute significantly to improved health outcomes among adolescents.

Implication for Research and Practice

The findings of this study provide empirical data on key dietary indicators among adolescent girls offering valuable insights for public health policy formulation. This study also serves as a foundational reference for future research in adolescent nutrition enabling further exploration and the development of targeted interventions to address nutritional deficiencies and promote healthier dietary practices.

Limitations of the study

This study focused exclusively on female adolescents enrolled in public secondary schools, thereby excluding those in private secondary schools and higher institutions. Additionally, the school-based sampling approach omitted out-of-school adolescents, a population that may be at heightened risk of unhealthy dietary proficiency. The reliance on self-reported data in this study, particularly food dietary intake, which is susceptible to recall and reporting bias. Such biases could compromise the accuracy and precision of the findings, thereby affecting the generalizability and applicability of the conclusions to the broader adolescent population in Nigeria.

Ethical Approval

Approval for the study was obtained from the Health Research and Ethics Committee of the Institute of Public Health, Obafemi Awolowo University, Ile-Ife (IPHOAU/12/2205). Permission was also obtained from the Education and Development Research Committee in the Ministry of Education. Approval for the selected states was given by the Executive Secretary of each Local Government, Local Inspectors of Education (LIEs) and principals of the selected schools. Consent was obtained from participants with assurance of confidentiality.

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