EAS Journal of Nutrition and Food Sciences
Abbreviated Key Title: EAS J Nutr Food Sci
ISSN: 2663-1873 (Print) & ISSN: 2663-7308 (Online)
Published By East African Scholars Publisher, Kenya

OPEN ACCESS

Volume-8 | Issue-4 | Nov-Dec; 2026 | DOI: https://doi.org/10.36349/easjnfs.2026.v08i04.001

Original Research Article

Assessment of Dietary Diversity and Nutritional Status among School-Aged Adolescents of Johnsonville Township, Liberia

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Article History
Received: 04.06.2026
Accepted: 25.07.2026
Published: 17.11.2026

Journal homepage:
https://www.easpublisher.com

Quick Response Code

Abstract: ***Background*:** Adolescence is a critical developmental period characterized by rapid growth and increased nutritional requirements. However, limited evidence exists on dietary diversity and nutritional status among adolescents in Liberia, particularly in peri-urban settings. ***Objective*:** This study assessed dietary diversity, nutritional status, and associated socio-demographic factors among in-school adolescents in Johnsonville Township, Montserrado County, Liberia. ***Methods*:** A school-based cross-sectional study was conducted among 230 adolescents aged 12–19 years selected from five randomly chosen schools. Data were collected using structured questionnaires adapted from FAO dietary diversity guidelines and WHO anthropometric and hemoglobin assessment protocols. ***Results*:** Dietary diversity analysis showed that 11.3% of adolescents had low dietary diversity, 53.9% had moderate diversity, and 34.8% had high diversity. Cereals, roots, and tubers were the most frequently consumed foods (94.8%). Nutritional assessment revealed that 11.3% were underweight, 71.7% had normal weight, and 16.9% were overweight or obese. Hemoglobin analysis conducted among a subsample (n=30) indicated that 13.3% were anemic. ***Conclusion*:** Dietary diversity among adolescents in Johnsonville Township remains suboptimal and reflects a dual burden of malnutrition. The findings provide baseline evidence to support nutrition-sensitive policies and school-based interventions in Liberia.

Keyword: Adolescents, Dietary Diversity, Nutritional Status, Anemia, Liberia.

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1. INTRODUCTION

Adolescence usually understood as the age group of 10-19 years, is one of the most significant stages of the human growth and development. Adolescents make up around 20 percent of the world population of approximately 1.9 billion, of which an almost equal number are in developing countries *(AA-HA,* 2017). It is a development phase that is characterized by a rapid physical, cognitive, and reproductive maturation and which significantly increases nutritional demands. As a result, energy-intensive physiological needs necessitate that proper nutrition is followed by consuming a balanced and nutrient-rich diet (EFSA, 2017). However, although the nutrient requirements during this stage are high, sometimes even higher than in adults, the theme of the adolescent population, especially nutritional conditions has traditionally been a less significant issue in the world health agenda (Patton *et al.,* 2016).

The Lancet Commission defined adolescent nutrition as a hidden epidemic, including the consequences that a poor diet at this stage of life has all the way through life. Adverse health outcomes in the later stages of life, such as metabolic syndrome, depression, and obesity in adulthood have been linked to poor nutritional practices in adolescents (Patton *et al.,* 2016). The assessment of nutritional intake among adolescents is thus important in determining and tracking the nutritional status of adolescents. Nonetheless, those tests can be quite difficult because of various behavioral, developmental, and environmental issues affecting the eating habits at various adolescent stages (Sagbo & Kpodji, 2023). Researchers have more and more in the last few years started to highlight the significance of studying the general trends in the type of diets eaten, as opposed to focusing on specific nutrients, as this mode of study offers a more detailed insight into the

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connection between food consumption and the onset of chronic illnesses (Viner *et al.,* 2015).

The available research evidence in Malaysia indicates that a number of socio-demographic factors, such as ethnicity, religious group, household income, and parent education level, have strong influences on dietary habits of adolescents (Abdullah *et al.,* 2016). Equally, the youth residing in socioeconomically challenged populations, including Johnsonville, Liberia, frequently face significant difficulties in accessing various and nutritious meals, which might also be a cause of poor dietary habits (UNICEF, 2022). Discussing the nutritional requirements of adolescents thus needs multi-faceted and context-oriented intervention, which can consider the other socio-economic and cultural factors that precondition food preferences (Best & Ban, 2021).

2. METHODS

2.1 Study Design

A school-based cross-sectional study was conducted among adolescents in selected secondary schools in Johnsonville Township, Liberia.

2.2 Sample Size Determination

The sample size was calculated using the Cochran formula with a 95% confidence level and a 10% attrition rate.

Calculation

Sample size was calculated using the Cochran Formula (Cochran, 1977), at 10% attrition rate.

$$n_0 = \frac{Z^2.p.q}{d^2}$$

Where:

$n_{0=}$ Minimum required sample size

Z = standard normal deviate at 95% confidence level = 1.96

p = estimated prevalence = 0.16

q = 1 − p = 0.84

d = desired precision = 0.05

$$n_0 = \frac{(1.96)^2.0.16.084}{(0.05)^2} = 207$$

10% attrition rate:

$$n = n_0 + (0.10.n_0) = 207 + 21 \approx 230$$

$$\therefore n = 230$$

2.3 Sampling Technique

A stratified random sampling technique was used. Adolescents were stratified by school age group (12-14, 15-17, and ≥18 years). Participants were randomly selected from registers within each stratum.

2.4 Anthropometric Measurements

Body weight was measured using a calibrated digital scale and recorded to the nearest 0.1 kg. Height was measured using a Seca 213 stadiometer following standardized procedures. Body Mass Index (BMI) was calculated as:

$$BMI = \frac{Weight(kg)}{Hight(m)^2}$$

2.5 Hemoglobin Measurement

Hemoglobin levels were measured using a portable HemoCue 301 analyzer using capillary blood samples obtained from finger pricks.

Data Analysis

Data were analyzed using SPSS version 27. Descriptive statistics including frequencies and percentages were used to summarize the data. Multilevel regression analysis was performed to identify factors associated with dietary diversity, with statistical significance set at p<0.05.

3. RESULTS

Table 1: Presents Frequency Distribution of Demographic information Characteristics Data (n=230)

VARIABLES	N	(%)
Gender		
Male	144	67.10
Female	116	32.90
Self-Assessed Poverty		
Poor	74	32.20
Non-Poor	156	67.80
Guardian Employed		
Employed	85	37.00
Unemployed	145	63.00
Had Weekly Pocket Money		
Yes	79	34.30
No	151	65.70
Residence Density		
High density	72	31.30
Medium density	44	19.10
Low density	144	49.60

Table 2: Shows the Distribution of Respondents Based On Consumption of Different Food Groups (N=230)

Food Group	Yes (n)	Yes (%)	No (n)	No (%)	Total (n)	Total (%)
Cereals, roots, tubers & products	218	94.80	12	5.20	230	100
Legumes, seeds & nuts	98	42.6	132	57.40	230	100
Milk & milk products	94	40.9	136	59.10	230	100
Eggs & egg products	94	40.9	136	59.10	230	100
Fish, shellfish & products	160	69.6	70	30.40	230	100
Meat & meat products	112	48.7	118	51.30	230	100
Vegetables & products	13	5.7	217	94.30	230	100
Fats, oils & fruits	124	53.9	106	46.10	230	100
Sweets & sugars	147	63.9	83	36.10	230	100
Beverages	197	85.7	33	14.30	230	100

Table 3: Presents the Distribution of Dietary Diversity Score (N=230)

Dietary Diversity Score	Frequency	(%)
1	1	.40
2	5	2.20
3	20	8.70
4	63	27.40
5	32	13.90
6	29	12.60
7	45	19.60
8	30	13.00
9	5	2.20
Total	**230**	**100.00**

Table 4: presents the Body Mass Index Distribution of participants according to BMI (N=230)

BMI Range (kg/m²)	N	(%)
Underweight (<18.5)	26	11.30
Normal weight (18.5–24.9)	165	71.70
Over weight (25.0–29.9)	32	13.90
Obese (≥30.0)	7	3.00
Total	**230**	**100**

Table 5: Presents the Hemoglobin Level of the Respondents (N=30)

HB Range	N	(%)
Normal (≥12 g/dL for females, ≥13 g/dL for males)	26	86.7%
Mild Anemia (10–11.9 g/dL)	3	10.0%
Moderate Anemia (7–9.9 g/dL)	1	3.3%
Total	30	100.0%

4. DISCUSSION

4.1 Socio-Demographic Characteristics

The study population consisted of 230 adolescents, with a relatively balanced gender distribution and a predominance of older adolescents and senior high school students. A significant percentage of participants or guardians reported they were unemployed. These results highlight the presence of serious socioeconomic challenges within the study population. The socioeconomic status has been repeatedly reported to be a significant influence on dietary habits and nutritional effects among adolescents in low- and middle-income nations (WHO, 2022). Limited financial resources often restrict access to diverse and nutrient-rich foods, thereby increasing the risk of poor dietary quality and malnutrition.

4.2 Dietary Diversity

Dietary diversity is a critical indicator of diet quality and micronutrient adequacy, particularly in adolescence when nutritional demands are high (FAO, 2016). More than half of the adolescents shown moderate dietary diversity, implying that they had access to a variety of food groups. However, nearly half of the participants did not obtain adequate dietary diversity, indicating persistent nutritional vulnerability.

This finding aligns with reports from other sub-Saharan African settings, where a significant proportion of adolescents fail to meet recommended dietary diversity thresholds (Fadare *et al.,* 2019). Comparatively, the proportion of adolescents with adequate dietary diversity in this study appears slightly higher than that reported in parts of Ghana (Amugsi *et al.,* 2017). These differences may reflect variations in socioeconomic

conditions, household food security, and levels of urbanization.

Although the overall dietary diversity is moderate, major gaps in the consumption of nutrient-dense foods remain evident. Adolescents with poor dietary diversity are at increased risk of micronutrient deficiencies, including iron deficiency, which may contribute to anemia, impaired growth, and weakened immunity (WHO, 2022).

4.3 Food Frequency Patterns

The food consumption patterns observed in this study reflect typical dietary trends across West Africa. Cereals, roots, and tubers, formed the basis of diets are cheap and available sources of energy. Similar patterns have been reported among adolescents in Ghana, Nigeria, and Sierra Leone (Turay, 2022). Although these foods are important sources of calories, this preeminence in the diet can restrict the consumption of other important micronutrients unless they are supplemented with other food groups. The relatively frequent consumption of fish and legumes indicates some access to protein sources, consistent with findings from coastal West African populations (FAO, 2016). Nevertheless, the consumption of vegetables, especially ones rich in micronutrients was quite low, which is an essential shortcoming in the quality of diet. Poor intake of vegetables has been extensively reported as one of the leading causes of micronutrient deficiencies in developing nations (FAO and WHO, 2019). An emerging concern identified in this study is the increasing consumption of processed and convenience foods, including snacks and refined carbohydrate products. This trend reflects a broader nutrition transition occurring in many urban and peri-urban African settings (Popkin *et al.,* 2012; Prentice, 2006). A change in the consumption of energy dense but nutrient deficient foods has been linked to increased prevalence of overweight, obesity and non-communicable diseases in adolescents.

4.4 Nutritional Status (BMI)

Majority of adolescents in this study had normal body mass index shows that they had a stable nutritional status. This pattern is consistent with findings from other sub-Saharan African countries, where most adolescents fall within the normal BMI range despite underlying dietary challenges (Manyanga *et al.,* 2014; Ofori-Asenso *et al*., 2016).

However, the coexistence of underweight and overweight individuals highlights the presence of the double burden of malnutrition**,** a phenomenon increasingly observed in low- and middle-income countries undergoing nutrition transition (Popkin, 2012). While undernutrition remains a concern, the rising prevalence of overweight and obesity reflects changing dietary patterns, reduced physical activity, and increased consumption of processed foods.

4.5 Hemoglobin Status

The prevalence of anemia observed in this study was relatively low compared to reports from other African settings. Most adolescents had normal hemoglobin levels, which may be partly attributed to moderate consumption of iron-rich foods such as fish and legumes. However, the presence of anemia among a subset of participants indicates ongoing micronutrient deficiencies.

Globally, anemia remains a significant public health concern among adolescents, particularly in low- and middle-income countries (Stevens *et al.,* 2013). Even mild anemia can negatively affect cognitive development, academic performance, and overall well-being. Therefore, improving dietary diversity and increasing access to iron-rich foods remain critical interventions.

5. CONCLUSION

This paper finds out that, although the majority of the adolescents in Johnsonville Township, Monrovia, Liberia have medium dietary diversity, typical body mass index, and an overall sufficient level of hemoglobin content, a significant percent of them are in jeopardy of developing nutritional disorders and diet-related complications. Other factors like low socioeconomic status, poor pocket money, excessive dependence on staple foods that are high in carbohydrates are also contributory factors to poor dietary patterns.

Underweight and overweight adolescents co-occur which also presents the new duality burden of malnutrition in semi-urban settings.

These findings may be used as a critical baseline of future studies because they are the first study in Liberia to specifically focus on the nutrition of adolescents. They also emphasize the necessity of specific interventions, such as nutrition education at schools, diversification programs, and approaches toward preventing not only undernutrition but also the growing numbers of overweight and obese. In addition, the findings highlight the significance of the incorporation of nutrition-sensitive policies into adolescent health programs and request further longitudinal and countrywide investigations to enhance the evidence base, facilitate long-term and sustainable interventions, as well as enhance the health outcomes of the adolescents.

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Cite This Article: Mulbah, A., Dangambo, M. A., Atiku, M. K., Souleymane, R. I., Andrew, E., & Make, Y. G. (2026). Assessment of Dietary Diversity and Nutritional Status among School-Aged Adolescents of Johnsonville Township, Liberia. *EAS J Nutr Food Sci, 8*(4), 111-115. https://doi.org/10.36349/easjnfs.2026.v08i04.001