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Assessment of Dietary Practices and the Dual Burden of Malnutrition among Out-of-School Adolescents in Makurdi, Benue State: A Cross-Sectional Study

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ABSTRACT

Background: Adolescence is a critical window for growth and development, yet out-of-school adolescents remain nutritionally vulnerable to the dual burden of malnutrition due to socioeconomic constraints and limited access to health information. This study assessed the dietary practices and nutritional status among out-of-school adolescents in Makurdi, Benue State.

Methods: This cross-sectional study consisted of 200 out-of-school adolescents (Boys/girls) selected using multi-stage sampling technique. Dietary Practice was assessed using dietary practice questionnaire and food frequency questionnaire while anthropometric measurement such as weight and height were measured using a weighing balance and stadiometer. Data were analysed using statistical package for social sciences (SPSS) software and W.H.O anthroPlus software (version 1.0.4). Descriptive and inferential statistics with significance level set at $p<0.05$ were used to present data.

Results: The findings revealed dual burden of malnutrition (54% overweight/obesity, 38% stunting/underweight) and poor dietary practices (34%) characterized by irregular meal patterns and frequent consumption of energy-dense staples; cereals (44.0%), roots/tubers (50.5%) and fat/oils (52.5%) more than five (5) times a week. Gender was significantly associated with nutritional status ($p = 0.038$); Obesity was more prevalent among males (28.0%) and females had higher proportion of normal weight (49.5%). Dietary practice was not significantly associated with nutritional status ($p>0.05$).

Conclusion: The coexistence of overweight/obesity and stunting/underweight among out-of-school adolescents in Makurdi indicates a substantial dual burden of malnutrition in among out-of-school adolescents in the study area. Community-based nutrition programmes including nutritional screening, physical activity promotion etc should be integrated into vocational training to reduce the burden of malnutrition.

Keywords: Nutritional status, Out-of-school adolescents, Dietary Practices, Benue State

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INTRODUCTION

Adolescence is a transitional developmental phase between childhood and adulthood (10-19). It is characterized by early adolescence (10-13 years), middle adolescence (14-16 years) and late teens (17-19 years)[1]. This life stage is unique (second window of opportunity) and poses rapid physical, cognitive and psychosocial changes and as such adequate nutrition is paramount (Devine et al., 2022)[2].Inadequate nutrition can result to delayed sexual maturation and retarded growth, cognitive impairment, mental health problems and reduced immunity whereas over-nutrition can lead to overweight/obesity causing low self-esteem, distorted body image and higher risk of developing non-communicable diseases[3]. Globally, adolescents bear a significant burden of malnutrition particularly in low and middle-income countries. About 23.1% and 8% of adolescent girls are overweight/obese and underweight respectively. Among boys, 27.0% and 26.6% were overweight/obese and underweight respectively[4,5]. In Sub-Saharan Africa, rapid nutrition transition has led to an emerging dual burden of malnutrition, where under-nutrition persists alongside overweight and obesity[6].Stunting and obesity is estimated at 30.3% and 10.3%[7]. In Nigeria, the prevalence of undernutrition among older adolescents was 6.8% and about 12.4% overweight/obesity[7] and factors such as socio-economic disparities, food insecurity and poor dietary habits exacerbate the problem[8].

Dietary habits established during adolescence are likely to persist into adulthood[9]. Studies have shown that adolescents have poor dietary practices such as excessive consumption of energy-dense processed foods, skipping meals and consuming meals at irregular or late hours [10-12]. They also exhibit unhealthy lifestyle behaviors such as smoking, drinking and lack of physical activity[13]. All these factors predispose them to obesity and obesity increases the risk of cardiovascular diseases, type 2 diabetes mellitus and mental disorders (depression, anxiety, low self-esteem and eating disorders)[14]. Malnutrition especially in girls can create a vicious intergenerational cycle of malnutrition later in life as she can grow up into a malnourished adult and give birth to a malnourished child[6,15]. It poses the risk of obstructed labor, intrauterine growth restriction, low birth weight, preterm delivery, infant mortality and poor child outcomes[16].

Adolescence represents a critical period of growth and development. However, most existing evidence on adolescent nutrition is derived from school based-based studies[17-18]. Similarly, nutrition intervention targeting adolescent are school-based, utilizing schools as platforms for nutrition education and health promotion while limited attention is given to out-of-school adolescents who constitute a high-risk and underserved group due to greater socio-economic vulnerability, poorer access to health information and increased nutritional risk[19-20]. Consequently, there is insufficient evidence to guide the development of inclusion nutritional programmes that address the needs of adolescent outside the school system. This study therefore aimed to assess the dietary practices and nutritional status of out of school adolescents in Makurdi.

SOCIO-DEMOGRAPHIC FACTORS (Age, gender, parental education and occupation, living Arrangement)

▼

DIETARY PRACTICES (Meal frequency, type of meals skipped, consumption of carbonated drinks, consumption of fruits and vegetables, snacking) and Food consumption pattern

▼

NUTRITIONAL STATUS (BMI-for-age (Underweight, Normal, Overweight), Height for age)

Figure 1: Conceptual Framework illustrating the relationship between socio-demographic characteristics, dietary practice and nutritional status among out-of-school adolescents

METHODS

***Study Area*:** The capital of Benue State "Makurdi" was where the study was conducted. Makurdi was created in 1970 and is situated in the middle-belt of Nigeria. Makurdi also referred to as the "Food Basket of the Nation" is the highest producer of food staples in Nigeria and has eleven (11) council wards

***Study Design*:** This study employed a cross-sectional community-based design to assess dietary practices and nutritional status among out-of-school adolescents in Makurdi, Benue State. The study design allows for the estimation of prevalence and examination of associations between variables at a single point in time. However, it is important to note that the cross-sectional nature of the study limits causal inference between dietary practices and nutritional outcomes.

Study Period: The study was conducted between February and June, 2025

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Study Population: The study population comprised of out-of-school adolescents aged 10–19 years residing in Makurdi. Out-of-school adolescents include individuals not currently enrolled in formal secondary education but engaged in vocational training, apprenticeships, or informal economic activities.

Study Setting: The study was conducted in Makurdi, an urban semiurban setting with a mix of informal labour, apprenticeship activities and community-based adolescent populations

Sample Size Determination: The sample size was calculated using Fisher (1991) formula $n = \frac{Z^2 \times P\,(1-P)}{d^2}$ where Z=1.96 (Statistical constant), p=prevalence (13.8%) of malnutrition [21], d=0.05 (5% marginal error)

$$n = \frac{1.96^2 \times 0.138\,(1 - 0.138)}{0.05^2}$$

$$n = \frac{3.8416 \times 0.138 \times 0.862}{0.0025}$$

n = 183. In order to account for the multistage sampling techniques and clustering effect arising from the selection of two communities, a modest effect of 1.2 was applied due to limited number of clusters: Deff(1.2) = 183 × 1.2 = 219. A 10% non-response rate was added to account for possible attrition; 219/0.9 =244.

Sampling Technique: Multi-stage sampling technique involving three stages was used to select 200 adolescents. In the first stage, a simple random sampling technique by balloting without replacement was used to select four (4) wards from the list of all wards in Makurdi. Within each selected ward, two (2) communities were selected, yielding a total of eight (8) communities. Thirdly, households and vocational centres (Tailoring shops, hairdressing and barbing salons, mechanics and welding workshops, carpentry workshops, phone repair centers, food vending/processing clusters) were selected using systematic random sampling. Within each selected household and vocation centre, eligible out-of-school adolescents were identified and recruited. If a selected household or vocational centre had no eligible adolescent or declined participation, the next immediate household or vocational centre was approached.

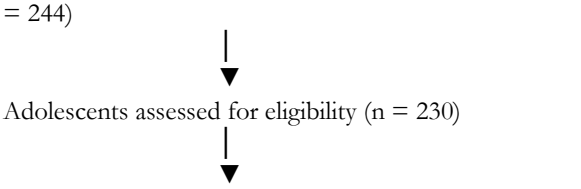

Figure 2: Flow chart showing enrolment and analysis of out-of school adolescents in the study

Variables of the Study

Dependent Variable: Nutritional Status

Independent Variables: Socio-demographic Factors, Dietary Practices**,** Food consumption pattern

Eligibility Criteria: Adolescents (boys and girls) aged 10-19 years who were not attending formal schools and who resided in the study area were included. Adolescents who were pregnant at the time of data collection were excluded due to the effect of pregnancy on anthropometric measurements. Participants with physical conditions that could affect accurate anthropometric measurement were also excluded.

Recruitment of Research Assistants: Two (2) research assistants, fluent in both English and Benue dialects were selected and trained on the techniques of data collection

Ethical Consideration: Ethical approval for the study was obtained from the Research Ethics Committee of Afe Babalola University, Ado-Ekiti (ABUADHREC/29/01/2025/788). Approval was also obtained from the Benue State Ministry of Education (NTD/REF04/01), school authorities, and community leaders. The study adhered to the principles of the declaration of Helsinki. Written informed consent was obtained from parents or guardians, while assent was obtained from participating adolescents before enrolment. Participation in the study was entirely voluntary and participants were informed of their right to decline participation or withdraw from the study at any stage without any consequences. To ensure confidentiality and privacy, no personal identifiers were recorded on study instruments and participants were assigned unique identification codes. All information

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collected were treated confidentially and used solely for research purposes, with access restricted to the research team.

Data Collection Instruments and Methods: A well-structured interviewer administered questionnaire consisting of sections of socio-demographic characteristics (Age, gender, parental education and occupation, living arrangement), dietary practices (Meal frequency, type of meals skipped, consumption of carbonated drinks, consumption of fruits and vegetables, snacking) and food consumption pattern was used to obtain information from the respondents

Assessment of Dietary Practices: Dietary practices were assessed using a dietary habits questionnaire which consisted of eight (8) dietary habit questions. Participants were scored one (1) if they correctly answered a question favorable or healthy for dietary practice but assigned zero (0) if they did not correctly answer the question, favorable or healthy for dietary practice. The sum of points earned were graded into good dietary practice (≥75%) and poor dietary practices (<75%) [22]. The questionnaire was pre-tested in a similar population outside the study area, and necessary adjustments were made for clarity and cultural appropriateness. Internal consistency reliability was assessed using Cronbach's alpha=0.81, indicating good internal consistency among the dietary practice items.

Assessment of Food Consumption Pattern: Habitual food intake was derived using a 7-day food frequency questionnaire (FFQ) of selected foods from different food groups. The food frequency questionnaire (FFQ) comprise of a list of commonly consumed foods in the locale. The pattern of food consumption was computed based on meal frequency for each day in a week. Food consumption frequency was established to be poor if frequency is <5 times per week and good if frequency is ≥5 times per week[23].

Assessment of Nutritional Status: Anthropometric measures of weight were obtained using a digital scale and standing height measured using a non-stretchable measuring tape affixed to a vertical wall surface (stadiometer equivalent). World Health Organization (W.H.O) AnthroPlus (version 1.0.4) was used to calculate height for age Z-scores (Stunting <−2) and Body mass index for age BMIAZ (thinness <-2.0, overweight >1.0 and obesity >2.0)[9].

Data Analysis: Data were analyzed using statistical package for social sciences (SPSS version 27.0). Descriptive statistics (Frequencies, percentages) were used to present the data while inferential statistics (Chi-square) with accompanying effect sizes (Cramér's V) was used to establish associations between variables at a significance level of $p < 0.05$. Anthropometric measurement data were analysed using W.H.O AnthroPlus software (version 1.0.4) to obtain B.M.I for age[15]. Missing data were assessed and cases with incomplete key variables were excluded from analysis. No imputation was performed due to the low proportion of missing values.

RESULT

Socio-demographic Characteristics of Out-of-school Adolescents

Table 1 shows the socio-demographic characteristics of Out-school Adolescents. Majority of the adolescents were aged 16-18 years (65.5%), followed by those aged 13-15 years (30.0%), while only 4.5% were below 12 years. Slightly more females (53.5%) participated compared to males (46.5%). Most respondents were Tiv (62.5%), followed by Idoma (24.5%) while very few belonged to Igede (7.5%), Yoruba (3.5%) and Igbo (2.0%) ethnic groups. The study population was overwhelmingly rural, with 97.0% residing in rural areas and only 3.0% in urban settings. Parental education levels were generally low; among mothers, 44.0% had primary education, 40.0% had no formal education and only 5.0% attained post-secondary education. Similarly, fathers' education showed that 46% had no formal education, 37.0% had primary education while only 5.0% reached post-secondary level. Mothers were predominantly farmers (31.0%) and traders (30.5%) while fathers were mainly engaged in trading (32.5%), artisan work (26.5%) and farming (24.5%). Furthermore, 49.5% lived with both parents, 30.5% with relatives or friends, 16.5% lived alone and 3.5% lived with a single parent.

Table1: Socio-demographic Characteristics of Out-of-school Adolescents

Variable	Frequency 200)	Percentage (100)
Age (years)		
Less than 12	9	4.5
13-15	60	30.0
16-18	131	65.5
Gender		
Male	93	46.5
Female	107	53.5
Ethnicity		

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Variable	Frequency 200)	Percentage (100)
Tiv	125	62.5
Idoma	49	24.5
Igede	15	7.5
Yoruba	7	3.5
Igbo	4	2.0
Hausa	0	0.0
Type of Residence		
Rural	194	97.0
Urban	6	3.0
Educational Level of Mother		
None	80	40.0
Primary	88	44.0
Secondary	22	11.0
Post-Secondary	10	5.0
Educational Level of Father		
None	74	37.0
Primary	92	46.0
Secondary	24	12.0
Post-Secondary	10	5.0
Occupation of Mother		
None	46	23.0
Business/trading	61	30.5
Civil servant	4	2.0
Teacher	1	0.5
Artisan	26	13.0
Farmer	62	31.0
Occupation of Father		
None	27	13.5
Business/trading	65	32.5
Civil servant	4	2.0
Teacher	2	1.0
Artisan	53	26.5
Farmer	49	24.5
Living Arrangement		
Both Parents	99	49.5
Single Parent	7	3.5
Relative/Friend	61	30.5
Alone	33	16.5

Dietary Practices of Out-of-school Adolescents

Table 2 shows the dietary practices of Out-of-school Adolescents. More than half (52.5%) of the adolescents consumed meals more than three times daily while 29.0% consumed three meals and 18.5% consumed less than three meals per day. Breakfast was the most commonly skipped meal (26.0%), followed by lunch (14.5%) and dinner (7.5%), although 52.0% reported not skipping meals. A majority (63.0%) consumed snacks, with varying frequencies; 27.5% snacked 3-4 times weekly and 18.0% snacked ≥5 times per week. Carbonated drink consumption was relatively moderate, with 45.5% reporting no consumption while 43.0% consumed them less than three times per week. Similarly, fast or processed food intake was generally low, with 60.0% reporting no consumption.57.5% consumed vegetables in the last 24 hours whereas 44.5% consumed fruits, indicating lower fruit intake compared to vegetables. Furthermore, figure 3 revealed that 34% had poor dietary practice score while 66% had good dietary practice score.

Table 2: Dietary Practices of Out-of-school Adolescents

Variables	Frequency (200)	Percentage (100)
Meal Frequency		
<3x/day	37	18.5
3x/day	58	29.0
>3x/day	105	52.5
Type of meal skipped		
Breakfast	52	26.0
Lunch	29	14.5
Dinner	15	7.5
None	104	52.0
Consumption of snacks		
Yes	126	63.0
No	74	37.0
Snacking frequency		
None	74	37.0
<3x/wk	35	17.5
3-4x/wk	55	27.5
≥5x/wk	36	18.0
Carbonated drinks frequency of consumption		
<3x/wk	86	43.0
3-4x/wk	22	11.0
≥5x/wk	1	0.5
Never	91	45.5
Frequency of consumption of fast/processed food		
<3x/wk	70	35.5
3-4x/wk	8	4.0
≥5x/wk	2	1.0
Never	120	60.0
Consumption of vegetable in the last 24 hours		
Yes	115	57.5
No	85	42.5
Consumption of fruits in the last 24 hours		
Yes	89	44.5
No	111	55.5

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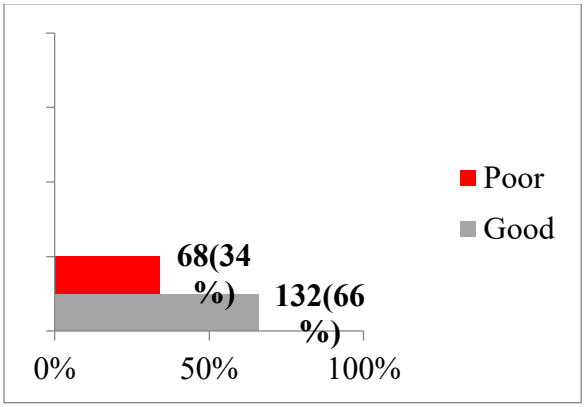

Figure 3: Dietary Practice Score of the Adolescents

Food Consumption Pattern of Adolescents

Table 3 shows the food consumption pattern of adolescents. Cereals, roots/tubers and fats/oils were the most frequently consumed food groups, with 44.0%, 50.5% and 52.5% consuming them more than five times per week respectively. Moderate consumption patterns were seen for fruits, vegetables, animal protein sources such as meat and eggs while milk and dairy products had relatively lower consumption, with 18% never consuming them.

Table 3: Food Consumption Pattern of Adolescents

Food and Products	Never Freq (%)	<3times times/week Freq (%)	3-4 times/week Freq (%)	>5 times/week Freq (%)
Cereals	0(0.0)	26(13.0)	86(43.0)	88(44.0)
Meat	3(1.5)	66(33.0)	73(36.5)	58(29.0)
Egg	12(6.0)	63(31.5)	74(37.0)	51(25.5)
Roots and Tubers	2(1.0)	14(7.0)	83(41.5)	101(50.5)
Milk and products	36(18)	67(33.5)	57(28.5)	40(20.0)
Legumes and products	24(12.0)	50(25.0)	87(43.5)	39(19.5)
Fat and Oils	6(3.0)	19(9.5)	70(35.0)	105(52.5)
Nuts and Seeds	20(10.0)	53(26.5)	69(34.5)	58(29.0)
Fruits	5(2.5)	32(16.0)	86(43.0)	77(38.5)
Vegetables	0(0.0)	36(18.0)	87(43.5)	77(38.5)

Nutritional Status of Adolescents

Figure 4 shows the nutritional status of adolescents using BMI-for-age Z-scores (BMIAZ). 45.0% of adolescents were in the normal category while significant proportions were either overweight (34.0%) or obese (20.0%) and only 1.0% were underweight. Height-for-age Z-scores (HAZ) showed that 37.0% of adolescents were stunted while 63.0% had normal height-for-age.

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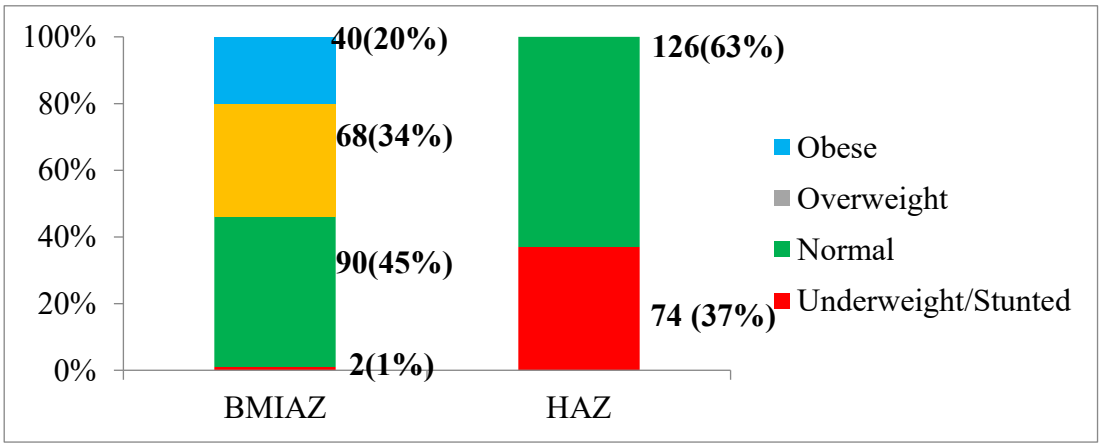

Figure 4: Nutritional Status of the Adolescents

Association between Socio-demographic Characteristics and Nutritional Status of Out-of-School Adolescents

Table 4 shows the association between socio-demographic characteristics and nutritional status among out-of-school adolescents was assessed using the Chi-square test and Cramér's V to determine both statistical significance and effect size. The results showed that gender was the only socio-demographic variable significantly associated with nutritional status ($\chi^2 = 8.447$, $p = 0.038$), although the strength of association was weak (Cramér's $V = 0.206$), indicating a small effect size. All other socio-demographic variables, including age ($\chi^2 = 10.944$, $p = 0.085$; $V = 0.165$), type of residence ($\chi^2 = 0.800$, $p = 0.850$; $V = 0.063$), maternal education ($\chi^2 = 6.532$, $p = 0.686$; $V = 0.104$), paternal education ($\chi^2 = 10.525$, $p = 0.310$; $V = 0.132$), maternal occupation ($\chi^2 = 17.741$, $p = 0.277$; $V = 0.172$), paternal occupation ($\chi^2 = 4.381$, $p = 0.996$; $V = 0.086$), and living arrangement ($\chi^2 = 10.653$, $p = 0.300$; $V = 0.133$), were not statistically significant predictors of nutritional status ($p > 0.05$). However, most variables showed small effect sizes (Cramér's V ranging from 0.063 to 0.172).

Table 4: Association between Socio-demographic Characteristics and Nutritional Status of Out-of-School Adolescents

Characteristics	Underweight No (%)	Normal No (%)	Overweight No (%)	Obese No (%)	X^2	p-value	Cramer's V
Age					**10.944**	**0.085**	**0.165**
Less than 12	0(0.0)	4(44.4)	3(33.3)	2(22.7)			
13-15	1(1.7)	24(40.0)	15(25.0)	20(33.3)			
16-18	1(0.8)	62(47.3)	50(38.2)	18(13.7)			
Gender					**8.447**	**0.038***	**0.206**
Male	0(0.0)	37(39.8)	30(32.3)	26(28.0)			
Female	2(1.9)	53(49.5)	38(35.5)	14(13.1)			
Type of Residence					**0.800**	**0.850**	**0.063**
Rural	2(1.0)	88(45.4)	66(34.0)	38(19.6)			
Urban	0(0.0)	2(33.3)	2(33.3)	2(33.3)			
Educational Level of Mother					**6.532**	**0.686**	**0.104**
None	1(1.2)	36(45.0)	25(31.2)	18(22.5)			
Primary	1(1.2)	43(48.9)	29(33.0)	15(17.0)			
Secondary	0(0.0)	8(36.4)	11(50.0)	3(13.6)			
Post-Secondary	0(0.0)	3(30.0)	3(30.0)	4(40.0)			
Educational Level of Father					**10.525**	**0.310**	**0.132**
None	1(1.4)	32(43.2)	23(31.1)	18(24.3)			
Primary	1(1.1)	48(53.2)	29(31.5)	14(15.2)			
Secondary	0(0.0)	7(29.2)	13(54.2)	4(16.7)			
Post-Secondary	0(0.0)	3(30.0)	3(30.0)	4(40.0)			
Occupation of Mother					**17.741**	**0.277**	**0.172**
None	0(0.0)	27(58.7)	14(30.4)	5(10.9)			
Business/trading	0(0.0)	28(45.9)	20(32.8)	13(21.3)			

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Characteristics	Underweight No (%)	Normal No (%)	Overweight No (%)	Obese No (%)	X^2	p-value	Cramer's V
Civil servant	0(0.0)	0(0.0)	2(50.0)	2(50.0)			
Teacher	0(0.0)	0(0.0)	1(100.0)	0(0.0)			
Artisan	1(3.8)	14(53.8)	6(23.1)	5(19.2)			
Farmer	1(1.6)	21(33.9)	25(40.3)	15(24.2)			
Occupation of Father					**4.381**	**0.996**	**0.086**
None	0(0.0)	14(51.9)	9(33.3)	4(14.8)			
Business/trading	0(0.0)	29(44.6)	22(33.8)	14(21.5)			
Civil servant	0(0.0)	2(50.0)	1(25.0)	1(25.0)			
Teacher	0(0.0)	1(50.0)	1(50.0)	0(0.0)			
Artisan	1(1.9)	24(45.3)	16(30.2)	12(22.6)			
Farmer	1(2.0)	20(40.8)	19(38.8)	9(18.4)			
Living Arrangement					**10.653**	**0.300**	**0.133**
Both Parents	0(0.0)	48(48.5)	35(35.4)	16(16.2)			
Single Parent	0(0.0)	1(14.3)	2(28.6)	4(57.1)			
Relative/Friend	1(1.6)	27(44.3)	19(31.1)	14(23.0)			
Alone	1(3.0)	14(42.4)	12(36.4)	6(18.2)			

*significance level=p<0.05

Association between Dietary Practice and Nutritional Status of Out-of-school Adolescents

Table 5 shows the association between dietary practice and nutritional status of Out-of-school adolescent. There was no statistically significant association between dietary practices and nutritional status for both BMI-for-age (p = 0.737) and height-for-age (p = 0.472). Although a higher proportion of adolescents with good dietary practices fell within normal and overweight categories, these differences were not statistically significant. The strength of association between nutritional status and dietary practice was further assessed using Cramér's V. The analysis revealed a very weak association between BMI-for-age z-score (BMIAZ) and dietary practice (V = 0.080), as well as between height-for-age z-score (HAZ) and dietary practice (V = 0.087).

Table 5: Association between Dietary Practice and Nutritional Status of Out-of-school Adolescents

	Dietary Practice				
BMIAZ	**Poor N (%)**	**Good N (%)**	**X^2**	**P-value**	**Cramer V**
Underweight (<-2SD)	0(0.0)	2(100)	**1.267**	**0.737**	**0.080**
Normal (>-2SD and <+1SD)	30(33.3)	60(66.7)			
Overweight(>+1SD and +2SD)	23(33.8)	45(66.2)			
Obesity (>+2SD)	15(37.5)	25(62.5)			
HAZ			**1.502**	**0.472**	**0.087**
Stunting (<-2SD)	25(40.0)	49(60.0)			
Normal (>-2SD)	43(34.1)	83(65.9)			

BMIAZ (Body mass Index for age Z-score); HAZ (Height for age Z-score) *significance level=p<0.05

DISCUSSION

The study assessed the dietary practices and nutritional status of Out-of-school Adolescent in Makurdi, Benue State. Educational exclusion is largely driven by structural inequalities rather than individual choice. The predominance of adolescents aged 16-18 years (65.5%) indicates that school dropout is a cumulative process that peaks in late adolescence. Transition points from lower to upper secondary education represent critical periods of vulnerability due to increased direct and

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indirect schooling costs[24]. At this stage, adolescents in low-resource settings are more likely to engage in income-generating activities, thereby prioritizing economic survival over continued education. The finding conforms to reports of a study in Lagos [Olatona et al., 2023][20] where majority of participants where in the late adolescence stage. It is also consistent with findings by [Sy et al., 2024] and [Asaolu et al., 2024] [25, 26]. Only slightly half of respondents were females in this study. This is consistent with findings from a study in Ibadan, Nigeria[27]. Girls are increasingly at risk of being uneducated due to persistent socio-cultural barriers such as early marriage, care giving responsibilities and gender norms that undervalue female education [24]. Furthermore, the relatively narrow gender gap found in this study suggests that pervasive poverty and structural deprivation may exert a more uniform effect across genders, supporting findings that economic hardship can diminish traditional gender differentials in school participation[24]. The predominance of Tiv adolescents (62.5%), largely mirrors the demographic composition of the study area. Also, rural residence was prevalent. Rural settings are characterized by inadequate educational infrastructure, limited availability of qualified teachers and long distances to schools, all of which contribute to poor school attendance and retention[29]. Adolescents living in rural areas are more likely to be out of school compared to their urban counterparts, highlighting persistent spatial inequalities in access to education. Parental education emerged as a significant determinant of adolescents being out-of-school with a high proportion of both mothers (40.0%) and fathers (37.0%) lacking formal education. Educated parents are more likely to value education, provide academic support and navigate institutional systems effectively [30]. The occupational distribution of parents further reflects the economic vulnerability of households. The majority were engaged in informal sector activities such as farming, trading, and artisanal work, which are often characterized by low and unstable incomes. Such economic conditions frequently compel adolescents to participate in labor activities, thereby limiting their ability to attend school. This finding is consistent with reports of [Lou et al., 2024] [31]. Living arrangements also play a crucial role in shaping educational outcomes. Although nearly half of the adolescents lived with both parents (49.5%), a significant proportion resided with relatives or friends (30.5%) or lived alone (16.5%). This finding is consistent with empirical research [28]. These non-traditional living arrangements are often associated with reduced supervision, emotional support and financial stability. Adolescents living outside nuclear family structures are at increased risk of school discontinuation due to neglect, exploitation or limited access to resources[32]. The relatively high proportion living alone is particularly indicative of severe socio-economic hardship and social dislocation.

Adolescents are increasingly exposed to a transitional dietary pattern, defined as a shift from traditional diets (typically high in fibre and minimally processed staple foods) toward more westernized dietary patterns characterized by increased consumption of energy-dense, ultra-processed foods, refined sugars, and saturated fats. The dietary practices observed in this study reflect a transitional dietary pattern. While over half of the adolescents consumed more than three meals daily, unhealthy behaviours such as breakfast skipping and frequent snacking were also prevalent. Breakfast skipping (26.0%) is particularly concerning, as it has been linked to increased risk of overweight and poor metabolic outcomes in adolescents[33]. Additionally, the high prevalence of snacking (63.0%) suggests increased consumption of energy-dense foods which may contribute to excess caloric intake. This finding is consistent with evidence reported by [Conrad et al., 2024] and [Sosanya et al., 2021] [30, 31]. Although the meal frequency was adequate, the meal quality is questionable. The foods consumed were mainly energy-dense starchy staples (cereals, roots, tubers and fats) with low consumption of nutrient-dense foods. This suggests that increased meal frequency does not necessarily translate into improved nutritional quality which could be the reason for the high incidence of overweight and obesity noted in this study. This finding is consistent with evidence reported by [Adepoju et al., 2021][32].

The nutritional status assessment of the adolescents revealed a coexistence of undernutrition and overnutrition, reflecting the growing burden of the double burden of malnutrition among adolescents. The prevalence of overweight and obesity found in this study is higher than values reported by [Adesina et al., 2012] and [Abdulkarim et al., 2016] [37, 38]. Rapid urbanization, increased consumption of energy-dense processed foods and reduced physical activity have contributed significantly to rising rates of adolescent overweight and obesity. Furthermore, 37% of respondents were stunted, which is higher than the reports of 11.3% in Ile-Ife,

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Nigeria[39]. Surprisingly, the prevalence of underweight in this study is very low when compared to a study[40]. The coexistence of stunting with overweight and obesity in this study have important public health implications because overweight and obese adolescents are at increased risk of developing non-communicable diseases later in life, while stunted adolescents may experience impaired physical growth, reduced cognitive performance, lower academic achievement, and decreased economic productivity in adulthood[41]. Furthermore, this finding suggests that current nutrition interventions targeting adolescents should move beyond conventional nutrition education to include routine nutritional assessment, dietary counselling, physical activity promotion, and early management of nutrition-related disorders. Given that out-of-school adolescents are often excluded from school-based health and nutrition programmes, community-based interventions should be developed to reach this vulnerable population. Vocational training centres, apprenticeship workshops, youth centres, markets, religious institutions, and other informal settings where adolescents congregate can serve as platforms for delivering nutrition services. Such services should include periodic anthropometric screening using BMI-for-age and height-for-age indices, growth monitoring, nutrition counselling, and referral of at-risk adolescents to primary healthcare facilities for appropriate management. This approach is consistent with the National Policy on the Health and Development of Adolescents and Young People in Nigeria, which advocates equitable access to health and nutrition services for all adolescents, irrespective of school attendance status[41]. Community-based programmes should promote healthy eating practices through practical nutrition education focusing on the reduction of sugar-sweetened beverages, energy-dense snacks, and highly processed foods while encouraging increased consumption of fruits, vegetables, legumes, and other nutrient-dense foods. In addition, structured physical activity programmes, including organized sports, recreational activities, and active lifestyle campaigns, should be incorporated into adolescent development programmes [42]. Programmes should incorporate micronutrient interventions, particularly iron and folic acid supplementation for adolescent girls, nutrition counselling on dietary diversity, and routine screening for anaemia and other nutrition-related conditions. Community outreach services should also provide deworming and health education to reduce the effects of infections that may contribute to poor growth and nutritional outcomes.

Among the socio-demographic variables examined, only gender showed a statistically significant association with nutritional status ($p=0.038$). Males had a higher prevalence of obesity while females were more likely to have normal weight. This implies that male adolescents may be more exposed to unhealthy dietary behaviors such as higher consumption of energy-dense foods, leading to greater energy imbalance and fat accumulation. Lifestyle and activity level may also be causal factors[43]. The observed finding in this study is consistent with a research conducted by [Adeloye et al., 2021] and [Abubakar et al., 2025][44,45], where the proportion of obesity was higher in boys than females. Furthermore, the significant association between gender and nutritional status suggests that nutrition interventions should be gender-sensitive. Female adolescents may require additional support related to menstruation, reproductive health, iron requirements, and nutritional needs during periods of rapid growth. Consequently, programme planners should design interventions that respond to the unique nutritional vulnerabilities of both male and female adolescents. Gender-disaggregated monitoring and evaluation indicators should also be incorporated into nutrition programmes to facilitate effective targeting and assessment of outcomes. These actions fit the National Strategic Plan of Action for Nutrition [2021–2025][46].

The absence of a statistically significant association between dietary practices and nutritional status ($p >0.05$) in this study emphasizes the multifactorial nature of nutritional outcomes. Socioeconomic conditions, food security, physical activity, disease burden, household characteristics, and environmental influences may collectively exert greater effects on adolescent growth and body composition than dietary practices measured at a single point in time[47]. Adolescents who report good dietary practices may still consume excessive calories from energy-dense foods or engage in low levels of physical activity, thereby increasing the risk of overweight and obesity. Conversely, some adolescents with poor dietary practices may maintain normal body weight due to higher energy expenditure associated with manual labour and active lifestyles. The absence of a significant association between dietary practices and nutritional status may be explained by several interrelated factors. Nutritional status indicators such as BMI-for-age and height-for-age reflect the cumulative

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effects of long-term dietary intake, health status and environmental exposures, rather than current or recent dietary behaviors alone[48]. The cross-sectional design of the study limits causal inference, as dietary practices and nutritional status were assessed at a single point in time, making it impossible to establish temporal relationships. The use of food frequency questionnaire (FFQ) may have contributed to potential recall bias, where respondents may inaccurately report their usual intake, and a limited food list that may not fully capture dietary diversity or portion sizes. The findings demonstrate the need to strengthen nutritional surveillance systems for adolescents, particularly those outside the formal education system. Regular nutritional assessments conducted through primary healthcare centres, community outreach programmes, and youth-focused organizations would facilitate early detection of malnutrition and enable timely interventions. Such measures support the objectives of the National Strategic Plan of Action for Nutrition (2021-2025), which emphasizes improving nutritional outcomes through multisectoral collaboration and enhanced monitoring systems[46].

Potential Sources of Bias

Potential sources of bias included recall bias and social desirability bias due to the use of a self-reported Food Frequency Questionnaire. Selection bias was minimized using a multi-stage sampling technique. However, residual confounding may still exist due to unmeasured variables such as physical activity and household food security.

Study Strengths and Limitation

This study provides valuable evidence on the dietary practices and nutritional status of an often-neglected population group and offers important insights for the development of adolescent nutrition interventions and policies. However, the cross-sectional design limits causal inference. Dietary data were self-reported and subject to recall and social desirability bias. The absence of biochemical markers limits the ability to detect micronutrient deficiencies. In addition, dietary intake may vary by season, which was not accounted for in this study.

CONCLUSION

This study revealed a substantial dual burden of malnutrition among out-of-school adolescents in Makurdi, Benue State. More than half of the adolescents were either overweight (34.0%) or obese (20.0%), while 37.0% were stunted, indicating the coexistence of overnutrition and chronic undernutrition within the same population. Although a majority of respondents reported good dietary practices, dietary practice was not significantly associated with nutritional status as measured by BMI-for-age ($p = 0.737$) and height-for-age ($p = 0.472$). In contrast, gender emerged as a significant determinant of nutritional status ($p=0.038$). These findings highlight the need to recognize out-of-school adolescents as a nutritionally vulnerable population that has received limited attention in existing health and nutrition programmes. The coexistence of overweight, obesity, and stunting suggests that interventions should address both forms of malnutrition simultaneously rather than focusing exclusively on undernutrition. Community-based nutrition programmes targeting out-of-school adolescents should incorporate routine nutritional screening, dietary counselling, physical activity promotion, micronutrient interventions, and gender-responsive strategies. Such interventions should be integrated into vocational training centres, apprenticeship settings, youth development programmes, and primary healthcare outreach services in line with Nigeria's National Policy on the Health and Development of Adolescents and Young People and the National Strategic Plan of Action for Nutrition. Future studies should therefore adopt longitudinal or prospective designs to better understand causal pathways and should investigate additional determinants such as household food security, physical activity, socioeconomic status, and health conditions. Furthermore, biochemical assessment of micronutrient status, including indicators of iron, vitamin A, and other nutrient deficiencies, would provide a more comprehensive understanding of adolescent nutritional health and help identify hidden forms of malnutrition that may not be detected through anthropometric assessment alone.

Declarations

Authors' Contribution: GPM: Conceptualized the entire study, collected and analyzed the data and drafted the manuscript. **DIO:** Supervised the study from conceptualization to the drafting of the manuscript, reviewed and edited the manuscript. **TYJ:** Reviewed and edited the manuscript. **OUCN:** Assisted in data collection, methodology, review of the manuscript. **AEO:** Assisted with data entry, proofreading and final manuscript formatting. All authors have read and

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approved the revised version of the manuscript and agree to be accountable for all aspects of the work.

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