Nutritional Knowledge, Dietary Practices and Consumption Pattern of Fruits and Vegetables among In-school Adolescents in LAUTECH International College, Ogbomoso, Oyo State, Nigeria

ABSTRACT

Background: Micronutrient deficiencies remain a significant public health concern in Nigeria, particularly among young adolescents. These deficiencies can lead to adverse health outcomes, including osteoporosis, osteomalacia, thyroid dysfunction, colorectal cancer, and cardiovascular disorders. This study assessed the nutritional knowledge, dietary practices, and consumption patterns of fruits and vegetables among in-school adolescents attending LAUTECH International College, Ogbomoso, Oyo State, Nigeria.
Methodology: This study was descriptive cross-sectional in design. Two hundred and sixteen (216) students of LAUTECH International College, Ogbomoso, Oyo State, Nigeria were selected using stratified random sampling techniques. A semi-structured questionnaire was used to collect the data from the respondents. Descriptive and inferential statistics such as chi-square test was used for the data analysis.
Results: The study revealed that the mean age of the students were 13.33 ± 1.69 years, 55.6% of the students demonstrated good knowledge, though there were areas where understanding was high, in spite of this, 58% dietary practices of fruits and vegetables. 34.3% showed preference for fruits and vegetables during break time in school.Price (36.6%), availability (29.3%) and quality (21.8%) prevented the students from eating fruits and vegetables. From the chi-square test, the study showed that there was no statistical association between nutritional knowledge and dietary practices of fruits and vegetables consumption of the students ($x^2 = 0.309$, $p = 0.579>0.05$).
Conclusion: The study revealed a disparity between nutritional knowledge and dietary practices, with relatively good dietary practices observed despite poor knowledge. Daily consumption of fruits and vegetables was found to be moderate.

Keywords: [nutritional knowledge, dietary practices, consumption pattern, fruits and vegetables, in-school adolescents}

1. INTRODUCTION

Due to increased nutritional needs, adolescents are more vulnerable to nutritional problems, but the quality of the diets they eat frequently declines dramatically during this time (Aoibhin and Breige, 2023). However, adolescent diets are often characterized by high-energy-density foods and low intake of fruits and vegetables (Beal *et al.,* 2019). Adolescents are particularly vulnerable to malnutrition because of the increased physiological need for nutrients (Hadiza *et al.,* 2024).

Micronutrient deficiency, often referred to as “hidden hunger,” is a form of undernutrition that occurs when the body lacks sufficient vitamins and minerals to sustain optimal physical and cognitive function, as well as overall health and development (Ibeanu*et al.,* 2020). It remains one of the most prevalent forms of malnutrition, affecting over two billion people globally (WHO, 2007). In Nigeria, micronutrient deficiencies are a significant public health concern, particularly among young adolescents (Ibeanu*et al.,* 2020). For instance, insufficient fruit consumption is often linked to vitamin C deficiency, which can impair immune function and slow wound healing (WHO, 2020). Similarly, potassium deficiencies—commonly observed in individuals with low fruit and vegetable intake—can increase the risk of cardiovascular diseases, such as hypertension (Garcia-Alonso *et al.,* 2017).

Increasing daily fruit and vegetable consumption is a critical component of a healthy diet, essential for preventing malnutrition and adult non-communicable diseases (Rohin *et al.,* 2021). Fruits and vegetables are rich in essential minerals, phytochemicals, and dietary fiber, which offer additional health benefits (Mozaffarian, 2016). Studies have demonstrated that fruit and vegetable intake significantly contributes to the intake of key nutrients, including 91% vitamin C, 48% vitamin A, 30% folate, 27% vitamin B6, 17% thiamine, 15% niacin, 16% magnesium, 19% iron, and 9% of total caloric intake (United States Department of Agriculture, 2000). These nutrients collectively combat oxidative stress (Kashi *et al.,* 2019), modulate immunity, reduce inflammation, inhibit fat tissue formation, lower blood pressure, and prevent thrombosis (Sun*et al.,* 2021). Increased fruit and vegetable consumption has also been strongly associated with a reduction in cardiovascular risk factors, including blood pressure, cholesterol, and triglycerides (Adebawo*et al.,* 2006). Due to their high water and fiber content, fruits and vegetables are low in energy density, promoting satiety and supporting healthy weight maintenance (Tohill *et al.,* 2004).

Adolescents are a nutritionally vulnerable group due to high nutritional demands for growth, reproductive maturity, and cognitive changes (Tulchinsky, 2010). However, most adolescents lack sufficient awareness of their health, nutritional needs, and development (Black *et al.,* 2013). Societal perceptions often overlook adolescents as a nutritionally at-risk group (Ibeanu *et al.,* 2020). In developing countries such as Nigeria, micronutrient deficiencies and malnutrition are increasing due to inadequate fruit and vegetable intake (Ruta, 2011).

Globally, adolescent diets—whether in developed or developing nations—are often characterized by high consumption of sugary foods, soft drinks, and sodium-rich products, alongside low intake of dairy, fruits, vegetables, protein, and iron (Rache *et al.,* 2014; WHO, 2005). Low fruit and vegetable consumption has been linked to chronic conditions such as high blood pressure, osteoporosis, chronic obstructive pulmonary diseases (COPD), mental health disorders, certain cancers, and cardiovascular diseases (Adebawo et al., 2006). According to the World Health Organization (WHO), inadequate fruit and vegetable consumption accounted for approximately 5.2 million deaths globally in 2013, making it the sixth leading risk factor for mortality (WHO, 2015). The increasing prevalence of cardiovascular diseases (CVDs) and cancers—the two leading causes of death worldwide—has been strongly associated with low fruit and vegetable consumption (WHO, 2015).

Lack of awareness about the nutritional benefits of fruits and vegetables remains a significant barrier to their consumption (Obayelu*et al.,* 2018). In Nigeria, insufficient knowledge about fruit consumption contributes to the country’s nutritional challenges (Obayelu*et al.,* 2018). Despite the availability of abundant tropical fruits such as pineapple, mango, and papaya in Oyo State, low fruit consumption persists. Many residents fail to meet

the recommended daily intake of 500 grams, leading to vitamin deficiencies (Adebayo *et al.,* 2020).

Fruits and vegetables provide essential micronutrients that facilitate metabolic processes, enabling the body to utilize energy from macronutrients like fats and carbohydrates, which are critical for optimal body function (Ayankogbe*et al.,* 2018). Consumption of fruits and vegetables is not only a preventive measure against chronic diseases but also serves as an indicator of overall diet quality (Pomeleau*et al.,* 2006). Adolescents benefit significantly from fruits and vegetables, as these foods support digestive health, promote bone growth, enhance vision, and aid in the development of brain cells and neurons (Glori, 2018). Furthermore, establishing healthy eating habits during adolescence increases the likelihood of maintaining those habits into adulthood.

To effectively promote fruit and vegetable consumption among adolescents, it is essential to understand the factors influencing their intake (Ilesanmi *et al.,* 2018). Therefore, this study assessed the nutritional knowledge and practices of fruit and vegetable consumption among in-school adolescents.

2. METHODOLOGY

This study was cross-sectional in design; participants were adolescents attending LAUTECH International College, Ogbomoso, Oyo state, Nigeria.
The sample size was determined using Cochran's method $n = z^2(p)(q)/d^2$ which gave 198, (**z** (constant) is 1.96, **p** (prevalence of poor nutritional knowledge of fruits and vegetables for adolescents was 14.99% (Silvia et al. 2017), q (1 - p) is 0.85,**d** (precision) is 0.05), 10% non-responsive rate was added to give 216; therefore, the total sample size was 216. The school was visited during school hours; students who volunteered to participate were selected using stratified random sampling. (Proportionate method was used to calculate the number of respondents to be selected from each class).

Using proportionate method;
Sample size = $\frac{Number\ of\ students\ in\ each\ class}{Population\ size}$ x Total sample size

Population Size = 344 Students

Sample Size = 216 Students

Numbers of Students in each class were as follows; JSS 1 (59), JSS 2 (67), JSS 3 (68), SS 1 (80), SS 2 (70).
Using Proportionate method, number selected from each class were: JSS 1 (37), JSS 2 (42), JSS 3 (43), SS 1 (50), SS 2 (44)
A semi-structured questionnaire was used for collection of data; the questionnaire was developed based on the objectives of the study, and was administered to each student that was sampled in the study area.
Descriptive statistics such as frequency, percentage and mean was used to analyze socio-demographic characteristics, nutritional knowledge, dietary practicesand consumption pattern of the respondents. SPSS (Statistical Product and Service Solution) version 27 was used to analyze all the data analysis.

3. RESULTS

3.1 STUDY POPULATION

Table 1 described the socio-demographic characteristics of the respondents. Majority (73.6%) were within the early adolescent age group (10–14 years), while 26.4% were late adolescents aged 15–19, the mean age was 13.33±1.69 years.48.1% of the respondents were male, while 51.9% were female.The majority of respondents were of Yoruba ethnicity (91.7%). The largest group of respondents were in SSS 1 (23.1%)while JSS 1 had the lowest respondents(17.1%). Also, a significant percentage of fathers (53.2%) and mothers (50.5%) had postgraduate degrees, while 3.7% of the father and mother had no formal education. Daily allowances varied, with 24.5%of respondents received more than 500 naira while 35.2% received 200 naira or less.

Table 1. Socio-demographic characteristics of the respondents

Variables	Frequency	Percentage	Mean±SD
Age (Years)			
10 – 14 (Early Adolescent)	159	73.6	
15 – 19 (Late Adolescent)	57	26.4	13.33±1.69
Gender			
Male	104	48.1	
Female	112	51.9	
Ethnicity			
Yoruba	198	91.7	
Igbo	13	6.0	
Others	5	2.3	
Class			
JSS 1	37	17.1	
JSS 2	42	19.4	
JSS 3	43	19.9	
SSS 1	50	23.1	
SSS 2	44	20.4	
Father's educational status			

No formal	8	3.7
Primary	10	4.6
Secondary	27	12.5
Tertiary	56	25.9
Postgraduate	115	53.2
Mother's educational status		
No formal	8	3.7
Primary	5	2.3
Secondary	31	14.4
Tertiary	63	29.2
Postgraduate	109	50.5
Daily Allowance		
Less than or equals to 200 naira	76	35.2
210 – 300 naira	20	9.3
300 – 500 naira	41	19.0
> 500	53	24.5
None	26	12.0

**Total population is 216, and total percentage is 100%*
JSS 1: Junior Secondary School 1
JSS 2: Junior Secondary School 2
JSS 3: Junior Secondary School 3
SSS 1: Senior Secondary School 1
SSS 1: Senior Secondary School 1

3.2 Nutritional Knowledge of Fruits and Vegetables Consumption of the Respondents

The nutritional knowledge of the respondentswas described in table 2. slightly above average (55.6%) had a poor nutritional knowledge while 44.4% had a good knowledge on fruits and vegetables consumption respectively.

Table 2. Nutritional Knowledge of fruits and vegetables consumption of the respondents

Nutritional Knowledge	**Frequency**	**Percentage**

Fruits and vegetables are important for the optimal functioning of the Gastrointestinal tract		
True	202	93.5
False	2	0.9
No Idea	12	5.6
Fruits and vegetables protect against diseases and illness such as cancer, diabetes		
True	192	88.9
False	16	7.4
No Idea	8	3.7
Fruits and vegetables can prevent constipation		
True	172	79.6
False	19	8.8
No Idea	25	11.6
Fruits are rich with		
Vitamins	176	81.5
Proteins	24	11.1
Fats	8	3.7
No Idea	8	3.7
Vegetables are rich with		
Carbohydrates	47	21.8
Proteins	67	31.0
Minerals	71	32.9
No Idea	31	14.4
Type of non-nutrient found in fruits and vegetables		
DHA	27	12.5

Carotene	21	9.7
Tanin	35	16.2
No Idea	133	61.6
Vitamin A is present in fruits and vegetables in what form		
Beta-carotene	33	15.3
Lutein	31	14.4
Tannin	39	18.1
No Idea	113	52.3
Fruits and vegetables contains vitamins and what		
Protein	93	43.1
Fibre	58	26.9
Cholesterol	17	7.9
No Idea	48	22.2
How many portions of fruits should be eaten daily by an individual		
2 portions	65	30.1
3 portions	100	46.3
4 portions	34	15.7
No Idea	17	7.9
What component in the food makes you full		
Protein	86	39.8
Fibre	44	20.4
Cholesterol	32	14.8
No Idea	54	25.0
Does eating fruits and vegetables make us healthy		

True	178	82.4
False	23	10.6
No Idea	15	6.9
Fruits and vegetables do not boost the immune system		
True	78	36.1
False	108	50.0
No Idea	30	13.9
What colour of fruits are high in Vitamin C		
Yellow	119	55.1
Purple	22	10.2
Green	39	18.1
No Idea	36	16.7
Regular consumption of fruits and vegetables reduce the risk of being overweight and obese		
True	137	63.4
False	34	15.7
No Idea	45	20.8
Which of these groups should not eat fruits and vegetables		
Pregnant women	33	15.3
Adolescents	33	15.3
Children	20	9.3
None of the above	130	60.2
What is the recommended daily intake of fruits		
200 grams	67	31.0

500 grams	38	17.6
400 grams	13	6.0
No Idea	98	45.4
Consumption of Fruits and Vegetables cannot prevent the risk of cancer, Diabetes		
True	73	33.8
False	102	47.2
No Idea	41	19.0
Fruits are what?		
Fleshly part of a plant that contains the seeds	61	37.5
Long stem part of the plant	38	17.6
Greenish part of a plant that encloses a seed	50	23.1
No Idea	47	21.8
Vegetables could be categorized as		
Dark and brown vegetables	33	15.3
Green leafy and non-leafy vegetables	137	63.4
Dark and root vegetables	18	8.3
No Idea	28	13.0
An individual cannot get complete nutrient by eating only one type of fruit		
True	125	57.9
False	53	24.5
Poor Knowledge(1 – 10)	120	55.6
Good Knowledge (11 – 20)	96	44.4
Total	**216**	**100.0**

3.3 Dietary Practices of the respondents on fruits and vegetables consumption

This is presented in table 3. 58.3% had good dietary practices while 41.7% had poor dietary practices of fruits and vegetable consumption.

Table 3: Dietary Practices of the respondents on fruits and vegetables consumption

Dietary Practices	Frequency	Percentage
Do you like fruits and vegetables		
Yes	213	98.6
No	3	1.4
Your preference for consumption during break time in school		
Fruits or Vegetables	74	34.3
Pastries	86	39.8
Soft drinks	41	19.0
Nothing	15	6.9
What prevents you from eating fruits and vegetables		
Price	79	36.6
Unavailability	63	29.2
Quality	47	21.8
Others	27	12.5
Did you specifically purchase fruits in the last 1 week		
Yes	134	62.0
No	82	38.0
How often you consume fruits and vegetables		
Daily	101	46.8
Weekly	71	32.9
Monthly	40	18.5
Never	4	1.9

Do you prefer to eat your vegetables raw		
Yes	149	69.0
No	67	31.0
Do you have to process your fruits and vegetables before you eat them		
Yes	68	31.5
No	148	68.5
Poor Practice (0 – 3)	90	41.7
Good Practice (4 – 8)	126	58.3
Total	**216**	**100.0**

3.4 Association between Nutritional Knowledge and Dietary Practices on Fruits and Vegetables

This is presented in table 4. There was no significant association (*P*>.05) between the students' nutritional knowledge and dietary practices on consumption of fruits and vegetables.

Table 4: Association between the nutritional knowledge and dietary practice of fruit and vegetable consumption of the respondents

Knowledge	Practice F (%)			X2	p-value
	Poor	**Good**	**Total**		
Poor	52 (57.8)	68 (54.0)	120 (55.6)	.309	.579
Good	38 (42.2)	58 (46.0)	96 (44.4)		
Total	**90 (100.0)**	**126 (100.0)**	**216 (100.0)**		

P>.05

3.6 Consumption Pattern of Fruits and Vegetables

This is presented in table 5. The fruits and vegetables consumption pattern of the respondents showed high daily consumption of tomatoes, peppers, and onions (80.6%).

Watermelon was mostly consumed daily(42.6%) while 12.0% respondents consumed avocado daily.

Table 5: Fruit and Vegetable Consumption Pattern of the respondents

Type	Daily F (%)	4-6 times /weeks F (%)	1-3 times /weeks F (%)	Never F (%)
Apple	45 (20.8)	48 (22.2)	90 (41.7)	33 (15.3)
Banana	58 (26.9)	70 (32.4)	74 (34.3)	14 (6.5)
Mango	48 (22.2)	72 (33.3)	53 (24.5)	43 (19.9)
Watermelon	92 (42.6)	49 (22.7)	62 (28.7)	13 (6.0)
Pineapple	66 (30.6)	57 (26.4)	78 (36.1)	15 (6.9)
Avocado/Pear	26 (12.0)	37 (17.1)	47 (21.8)	106 (49.1)
Cabbage	47 (21.8)	43 (19.9)	69 (31.9)	57 (26.4)
Carrots	53 (24.5)	65 (30.1)	70 (32.4)	28 (13.0)
Cucumber	51 (23.6)	57 (26.4)	72 (33.3)	36 (16.7)
Okra	68 (31.5)	66 (30.6)	64 (29.6)	18 (8.3)
Tomatoes, Pepper, Onions	174(80.6)	22 (10.2)	18 (8.3)	2 (0.9)
Ewedu, Soko, Green	128 (59.3)	42 (19.4)	43 (19.9)	3 (1.4)

4.Discussion

This study evaluated the nutritional knowledge and dietary practices related to fruit and vegetable consumption among adolescents at LAUTECH International College (LICO), Ogbomoso, Oyo State, Nigeria. The findings revealed that the mean age of the students was 13.33 ± 1.69 years, which is consistent with the results, who reported a mean age of 12.43 years. (Silvia *et al.,* 2017) Similarly, (Akintunde,2023) reported a mean age of 15.3 ± 1.30 years, while Ariyo *et al*., 2023 found a mean age of 15.5 ± 2.3 years. Adolescents are between age range of 10-19 years

Further results indicated that slightly above average (51.9%) of the students were female, while 48.1% were male. This finding aligns with a study who reported 58.1% female and 41.9% male respondents(Ariyo *et al*., 2023). However, (Rohin *et al*., 2019) documented 48% female and 52% male respondents.

The study also found that the majority of respondents (91.7%) were of Yoruba ethnicity, while 6.0% were Igbo, indicating Yoruba dominance within the school. This observation aligns with (Silvia *et al*., 2017), who reported 59.36% Yoruba and 22.37% Igbo respondents.

Regarding parental education, results showed that 25.9% of respondents' fathers and 29.2% of mothers had tertiary education; 12.5% of fathers and 14.4% of mothers had secondary education; 4.6% of fathers and 2.3% of mothers had primary education; and 3.7% of both fathers and mothers had no formal education. In contrast, it was reported that 12.2% of fathers and 13.1% of mothers attained tertiary education; 67.8% of fathers and 48.3% of mothers completed secondary education; 5.6% of fathers and 22.7% of mothers had primary education; while 14.4% of fathers and 11.4% of mothers had no formal education (Ariyo *et al*., 2023)

The study further revealed that 55.6% of respondents demonstrated poor nutritional knowledge, while 58% exhibited good dietary practices regarding fruit and vegetable consumption. This contrasts with (Rohin *et al*., 2021), who reported that 42% of respondents had poor knowledge, while 58% had good dietary practices. Similarly, (Silvia *et al.,*2017) found that 84.99% of respondents had good nutritional knowledge, but only 5.48% demonstrated good dietary practices.

The analysis of daily fruit and vegetable consumption showed varying proportions: apple (20.8%), banana (26.9%), mango (22.2%), watermelon (42.6%), pineapple (30.6%), pear (12.0%), cabbage (21.8%), carrot (24.5%), cucumber (23.6%), okra (31.5%), tomato (59.3%), pepper, onion, *ewedu*, *soko*, and green leafy vegetables. These findings were comparable to (Akintunde, 2023), who reported daily consumption rates for apple (31.2%), banana (31.8%), mango (30.5%), pineapple (30.8%), orange, tangerine, pawpaw, okra (27.9%), tomato (40.9%), *ewedu* (32.9%), and green leafy vegetables (35.5%). In contrast, Fadeiye*et al.,*2020 documented lower consumption rates of apple (5.0%), banana (9.0%), mango (3.84%), watermelon (2.3%), pineapple (3.07%), cabbage (0%), carrot (8.46%), okra (11.5%), tomato (29.2%), and other vegetables.

The chi-square test results indicated no significant association between nutritional knowledge and dietary practices of fruit and vegetable consumption among respondents ($\chi^2 = 0.309$, $P = 0.579 > 0.05$). This finding concurs with (Dada *et al.,*2021), who similarly reported no significant association between nutritional knowledge and dietary practices.

5. CONCLUSION

This study has revealed that the students attending LAUTECH International College (LICO), Ogbomoso, Oyo State, Nigeria has demonstrated poor nutritional knowledge and good dietary practices of fruits and vegetables consumption.

RECOMMENDATIONS

In accordance with the results of this study, the following recommendations were made:

1. Nutrition education should be included in the school curricula to educate students about importance of fruits and vegetables and effects of not taking it.
2. Addition of fruits and vegetables should be considered in school feeding program.

CONSENT
All authors declare that 'written informed consent was obtained from the respondents before participation in the research.

ETHICAL APPROVAL
Ethical permission was sought from the Bowen University Teaching Hospital (BUTH) Research Ethics Committee, Bowen University Teaching Hospital, Ogbomoso, Oyo State, Nigeria (Registration Number: NHREC/12/04/2012, Approval number: BUTH/REC-2160).

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1.

2.

3.

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