Research Article

Sodipe O. Solaja*, Olasunkanmi M. Bamiro, Matthew D. Ayeni and Glory Mohammed

# Fruit and vegetable intake among Nigerian University students: patterns, preferences, and influencing factors

https://doi.org/10.1515/opag-2025-0468
Received May 13, 2025; accepted September 9, 2025;
published online November 18, 2025

**Abstract:** Adequate consumption of fruits and vegetables is globally recognized as a cornerstone of healthy living and a critical strategy for preventing micronutrient deficiencies and non-communicable diseases. Yet, among young adults, particularly university students in low and middle-income countries like Nigeria, dietary habits often fall short of recommended guidelines, raising public health concerns. This research, therefore, examined fruit and vegetable intake among Nigerian university students, specifically exploring patterns, preferences, and influencing factors of fruit and vegetable consumption. Using a stratified random sampling technique, 309 students aged 15–25 years were selected across various colleges in the study area. Data were collected through a structured food frequency questionnaire with a 7-day recall period, alongside anthropometric measurements including weight, height, and Body Mass Index (BMI). Descriptive statistics and an ordered probit model were employed to analyse the data. The findings reveal that the average BMI was 23.11 kg/m$^2$, and the mean age was 19 years. Fruit and vegetable intake among the students was significantly below the World Health Organization's (WHO) recommended daily intake of 400 g. Key factors influencing consumption included age, sex, monthly allowance, availability, nutritional knowledge, and preference for fast food. The study highlights the need for targeted interventions that go beyond nutritional education and fruit and vegetable availability to holistically address behavioral drivers and facilitate consumer decision-making. A comprehensive approach could involve cooking workshops, price reductions, appealing food presentation, prominent display of fruits and vegetables in university cafeterias and expert dietary guidance to foster long-term healthy eating habits.

**Keywords:** fruit; vegetable; consumption; university students; Nigeria

***Corresponding author: Sodipe O. Solaja**, Landmark University SDG 2 (Zero Hunger Research Group), Omu Aran, Kwara State, Nigeria; Landmark University SDG 12 (Responsible Consumption and Production Research Group), Omu Aran, Kwara State, Nigeria; Landmark University SDG 3 (Good Health and Well-Being Research Group), Omu Aran, Kwara State, Nigeria; and Department of Agricultural Economics and Extension, Landmark University, Omu Aran, Kwara State, Nigeria,
E-mail: solaja.sodipe@lmu.edu.ng. https://orcid.org/0000-0003-0516-2503
**Olasunkanmi M. Bamiro,** Landmark University SDG 2 (Zero Hunger Research Group), Omu Aran, Kwara State, Nigeria; and Department of Agricultural Economics and Extension, Landmark University, Omu Aran, Kwara State, Nigeria
**Matthew D. Ayeni,** Landmark University SDG 12 (Responsible Consumption and Production Research Group), Omu Aran, Kwara State, Nigeria; and Department of Agricultural Economics and Extension, Landmark University, Omu Aran, Kwara State, Nigeria
**Glory Mohammed,** Department of Agricultural Economics and Extension, Landmark University, Omu Aran, Kwara State, Nigeria. https://orcid.org/0000-0003-2954-6456

## 1 Introduction

Fruits and vegetables are vital to healthy consumption because they provide vitamins, minerals, fiber, energy, and other minor nutrients like phytochemicals that are key to maintaining healthy living. Inadequate consumption is associated with acute disorders like hypertension, heart conditions, type 2 diabetes, several malignancies, and musculoskeletal diseases [1–4]. The World Health Organisation [5] and Afshin et al. [6] have rated low consumption of fruits and vegetables as the sixth major cause of global mortality. In 2016, WHO estimated that inadequate intake contributed to 2.7 million deaths worldwide, a figure that rose to 3.6 million by 2017 [6]. Conversely, higher consumption of fruits and vegetables has been shown to minimize the threats of strokes and stomach cancer by 19 %, and ischemic heart disease by 31 % [7].

Since no single fruit or vegetable provides all required nutrients, the WHO recommends a daily intake of 400 g (approximately five servings) to prevent micronutrient deficiencies [8]. However, despite these guidelines, adolescents and young adults worldwide fall short of this target [2, 6, 9, 10]. This gap is partly driven by the rising demand for

convenience, leading to diets dominated by high-fat, high-processed carbohydrate, and high-salt foods at the expense of fresh produce [11, 12].

This issue is particularly acute in low and middle-income countries, which account for three-quarters of global non-communicable disease deaths [9], regions where fruit and vegetable intake are lowest [8]. In Africa, the gap is glaring; A School-Based Global Health study across seven African nations found that over 75 % of adolescents failed to meet the required fruit and vegetable intake [13]. Further studies in Africa showed that 98.5 % of Ethiopians, 95.8 % of Mozambicans, and 82 % of Tanzanians consumed insufficient amounts of fruits and vegetables [13]. In South Africa, National Health and Nutrition surveys confirmed alarmingly low intake among adults [14, 15], while in Nigeria, young males from low socioeconomic backgrounds exhibited inferior consumption patterns [16].

Socioeconomic disadvantage, which includes a high rate of unemployment, low income, and limited dietary options, is a key driver of this trend [9]. Given the worsening public health crisis, understanding the determinants of low fruit and vegetable consumption in low- and middle-income countries is critical to help shape initiatives and policies for an optimal diet and health.

Fruit and vegetable diets tend to decrease when a person enters their early adult years [2]. During this period, young adults often follow unhealthy lifestyles while they learn to be independent and form other lifelong good behavior habits. As a result, this transition phase may considerably impact the dietary practices that young adults embrace, which may have long-term effects. Early embrace of healthy diets is crucial for halting the progression of acute illness later in life [17]. Adolescence to young adulthood is also a period when young folks gain admission to higher citadels of learning. Campus life is characterized by a great deal of freedom. Some people make good decisions, while others regrettably do not, particularly when it comes to diet. They have diverse perspectives on fruit and vegetable intake. Students are more inclined to explore quick food possibilities and consume more energy-dense meals than fruits and vegetables [18]. These tendencies may result in undernutrition and obesity-linked abnormalities, which are becoming increasingly prevalent health concerns [18]. As a result, increasing fruit and vegetable diets is a known health and food security necessity that requires special attention among adolescents and young adults in universities. Dietary patterns are created and maintained during the early adult stage which is between 18 and 24 years, this time many people are admitted into the university and go through substantial life changes that might lead to a loss of interest in consuming fruit and vegetable food, this makes it tough to sustain a healthy and balanced diet. As a result, this is an important area of research.

Understanding the dietary habits of university students in Nigeria is crucial because university students form part of a significant population of young adults, and their nutritional practices can have long-term implications for public health in the country. This is because this stage of their development is often characterized by the transition from adolescence to adulthood, where independent lifestyle choices, including decisions about their diet, begin. The examination of their dietary habits at this stage can offer valuable insights into potential health risks and other diet-related illnesses, which could manifest later in life. Eating a healthy diet is critical to academic success and cognitive function, as the quality of one's food affects one's ability to focus, recall information, and brainstorm. Also, the development of preventive healthcare methods to address nutritional deficiencies and lessen the burden of diet-related diseases in the future can be facilitated by detecting dietary patterns and potential risk factors for poor nutrition among university students. Additionally, Nigeria is a multicultural nation with a wide range of food preferences and socioeconomic inequalities. Thus, understanding university students' dietary habits enables the identification of socioeconomic and cultural determinants that may affect food choices, which in turn informs the development of context-specific and culturally sensitive interventions to encourage healthy eating.

Although [19, 20] researched fruit and vegetable consumption among university students in Nigeria, research is still very few and there appear to be scanty statistics on fruit and vegetable intake among Nigerian students. Hence, this study is committed to adding to the body of knowledge by providing information on the pattern and socioeconomic drivers of fruit and vegetable diets among students in Nigeria. Insights from the research will provide empirical evidence and increase awareness of the consumption patterns of fruits and vegetables among university students in Nigeria. Furthermore, this study will be useful in postulating a workable policy toward increasing fruit and vegetable consumption by highlighting the variables that influence students' consumption of fruit and vegetables in Nigeria. It is highly expedient to inform and educate Nigerian university students on the benefits of fruit and vegetable diets for optimal productivity and performance. It is imperative to study the actual pattern of fruit and vegetable consumption in Nigeria before initiating any policy to enhance fruit and vegetable diets among university students in Nigeria. This study's objective is, therefore, to assess the patterns, preferences, and influencers of fruit and vegetable consumption among Nigerian university students.

# 2 Theoretical framework

This study is underpinned by the Theory of Planned Behavior (TPB), which was postulated by [21]. This theory was built on these components: attitude, subjective norm, and perceived behavioral control, which constitute a person's intention. An action or behaviour is driven by an intention. Intention is a direct precursor to the behavior itself and encompasses both cognitive planning and motives. Attitude is generally defined as the beliefs held by people on the possible consequences of executing a behaviour as well as the appraisal of the outcome of such behaviour [21]. It portrays how individuals perceive and evaluate distinct qualities of certain behaviour. For instance, when it comes to the consumption of fruits and vegetables, people may hold two primary behavioral beliefs: the first is that including fruits and vegetables in one's diet is healthy, and the second is that they are delicious.

The conviction in the health benefits may be stronger than the belief in their tastiness, and vice versa. People's beliefs about how much other people would accept or disapprove of the target behavior, as well as their likelihood of adhering to these views are known as subjective norms [21]. It shows how decision-making is influenced by social pressure. Teenagers who frequently hear their mothers' recommendations that eating fruits and vegetables is beneficial to their development, for instance, may be very motivated to follow such advice. The elements that are viewed as either facilitators or barriers to the behaviour are represented by perceived behavioral control. It is the ease with which a particular behavior can be carried out. The ease may depend on knowledge, skills, assets, challenges, etc. According to [22–24], TPB significantly accounts for intention and food consumption behaviour in adults. Thus, this theory sufficiently underpins this study. This study questionnaire captures the key constructs of the TPB by measuring attitudes with questions like preference for fast food and nutritional knowledge, subjective norms through fruits and vegetables consumption at home and university programmes that signal social and institutional expectations, and perceived behavioral control with indicators of availability and monthly allowance, which measure the perceived ease or challenge of healthy eating habits.

# 3 Research methodology

## 3.1 Study design

This study adopted a cross-sectional descriptive design.

## 3.2 Target population

The target population for this research is the students of Landmark University.

## 3.3 Description of the study area

This research was conducted at Landmark University. Landmark University is a faith-based university situated at Omu Aran, Kwara State. Kwara State is located in the northcentral zone of Nigeria. It shares boundaries with Oyo State to the west, Kogi State to the east, Niger State to the north and Ekiti and Osun States to the south. The state is home to over 3.5 million people and has a land area of about 36,825 square kilometers. The average annual rainfall is between 1,000 and 1,200 mm while the mean annual temperature is between 26 °C and 36 °C. Kwara State's climate supports the production of fruit and vegetables and other arable crops.

## 3.4 Method of data collection

This research relied on primary data. Printed questionnaires were employed using a 7-day memory recall template to collect thorough information on students' fruit and vegetable intake patterns. Also, Information such as students' socioeconomic characteristics and frequency of fruit and vegetable diet were collected. Students were recruited from the four colleges of the university: College of Agricultural Sciences (CAS), College of Business Studies (CBS), College of Pure and Applied Sciences (CPAS), and College of Engineering (COE).

## 3.5 Validity of the instrument

The instrument used in this study, a structured questionnaire on fruit and vegetable consumption, was validated for content by a panel of nutrition, health and economic experts from Landmark University to ensure its adequacy in covering all relevant aspects of fruit and vegetable intake, including frequency, portion sizes, and factors influencing its consumption. Three experts were involved in validating the instruments to ensure the questions were well-structured, meaningful, and accurately captured the researchers' intent. Their contributions included defining precise frequency and portion sizes, aligning questions with WHO recommendations, and refining them to account for culturally relevant fruit and vegetable varieties and

seasonal availability. Additionally, the experts ensured the questionnaire explored multidimensional determinants of fruit and vegetable intake like socioeconomic factors, household consumption, preferences, and knowledge, while also verifying that the collected data could guide targeted nutrition programs, including school-based fruit and vegetable interventions.

## 3.6 Reliability of the research instrument

To ensure the reliability of the research instrument, the questionnaire was pre-tested on a group of 50 students and had a high internal consistency, with a Cronbach's alpha of 0.85. Test-retest reliability was also measured by administering the questionnaire to the same group of 50 students two weeks apart, a correlation coefficient of 0.82 was obtained, which indicates good stability over time.

## 3.7 Sampling techniques

A stratified sampling method was employed to divide the target population into strata, i.e., male and female to ensure that each sub-group (colleges and levels) of the target population was adequately represented. Afterwards, simple random sampling was applied in selecting a sample size of 309 students with 206 male students and 103 female students. The breakdown of the sample from each college is as follows: CAS 59, CBS 99, COE 104, and CPAS 47. The sample size of the study was calculated using $n = \frac{Z^2 P(1-P)}{d^2}$ following Olatona et al. [16], where $n$ is the minimum sample size, Z is the 95 % confidence level which is 1.96, and P is the prevalence of adults who had adequate intake of fruits and vegetables in a previous Nigerian study which stood at 27 % according to (Olatona et al. [16] while d is the margin of error put at 5 %).

$n = \frac{1.96^2\ 0.27\ (1-0.27)}{0.05^2} = 302.9$, therefore, the minimum sample size for this study was approximately 303 participants, however, a total of 340 students participated in the survey out of which only 309 responses were found adequate for the study. The survey responses from 31 respondents were not complete, which makes them unsuitable for analysis.

### 3.7.1 Ethical approval and informed consent

Our study involved university students aged 15 to 25. Although some respondents were under 18, we did not seek parental or guardian consent for the following reasons:

i. Students were tertiary students and typically deemed mature enough to make independent choices in academic environments. Following American Psychological Association [25], teenagers over the age of 14 can, in some circumstances, offer legitimate informed consent independent of parents, particularly for minimal-risk, survey-based studies
ii. The questionnaire was non-invasive, anonymous, and addressed dietary behaviour. According to national guidelines in Nigeria, adolescents aged 12–17 are considered emancipated minors and can independently consent to participate in research that poses no risk and involves an intervention with direct health benefits to them [26]
iii. The research protocol, including the consent procedure, was reviewed and approved by the Landmark University Center for Research, Innovation and Discoveries (LUCRID), which deemed it ethically appropriate for all participants, including those under 18. All students gave written informed consent and were fully briefed on their rights, the purpose of the study, and confidentiality protections.

## 3.8 Data analysis

Descriptive statistics such as mean, percentages, and bar charts were used in describing the socio-economic characteristics, frequency of fruit and vegetable consumption of students, and preference for fruit and vegetable consumption, while ordered probit regression was used to explain variations in the ordered categorical outcome variable as a function of one or more explanatory variables.

## 3.9 Ordered probit model specification

In the ordered probit regression, there is an observed ordered (Y) which is a function of another latent variable $(Y^*)$ that is not measured. The $Y^*$ is given as;

$Y_i^* = X_i\beta + \varepsilon_i$ and can be expanded into;

$$Y^* = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_{4\ldots\ldots} + \varepsilon_i$$

where $Y^*$ is the latent variable of fruits and vegetable consumption, $X$ is the socio-economic factors explaining the student consumption behaviours of fruits and vegetables, and $\varepsilon_i$ is the error term. The fruits and vegetables are categorized into three (3) outcomes, 1-low consumption, 2-moderate consumption, and 3-high consumption. Where;

$Y_i = \{1 \text{ if } Y_i^* \le \theta_1\}$ (low consumption)

$Y_i = \{2 \text{ if } Y_i^* \le \theta_2\}$ (moderate consumption)

$Y_i = \{3 \text{ if } Y_i^* \le \theta_2\theta_3\}$ (high consumption)

The socioeconomic factors were;

$X_1$ = Age in years

$X_2$ = Sex (male = 1, female = 0)

$X_3$ = BMI (measured in kg/m$^2$)

$X_4$ = Monthly allowance (₦)

$X_5$ = Availability of fruit and vegetable (1 if fruits and vegetables are available, 0 otherwise)

$X_6$ = Preference for fast food to fruits and vegetables (1 if fast food preferred to fruits and vegetables, 0 otherwise)

$X_7$ = Consumption at home (1 if fruits and vegetables are consumed at home, 0 otherwise)

$X_8$ = Nutritional knowledge (1 if the respondent has nutritional knowledge, 0 otherwise)

$X_9$ = University programs (1 if university programs do not avail time for consumption of fruit and vegetable, 0 otherwise)

# 4 Results and discussion

## 4.1 Socio-economic factors of the students

The result of the socioeconomic attributes of the students is presented in Table 1. The total sample included 309 students of Landmark University; male students constitute the major part of the sample (about 68) because the university population comprises more males than female students. The students are between 15 and 25 years of age, with an average of 19 years, revealing that the students are within the young adulthood stage. BMI showed that the majority of the students are within the normal weight category (64.72 %) with a mean BMI of 23.11. This result is akin to the findings of Schroeter and House [27] and Alsunni and Badar [28], who found that the average BMI of the university in their studies was around 23 kg/m$^2$. About 92 % of the population claimed to be aware of the dietary merits of consuming fruits and vegetables. The vast proportion of the students has between ₦31,000–₦50,000 monthly allowances, while the mean monthly allowance is ₦44 506.15 kobo.

**Table 1:** Socio-economic factors of the students.

| Variable | Frequency | Percentage | Mean |
|---|---|---|---|
| Sex | | | |
| Male | 206 | 33.33 | |
| Female | 103 | 66.67 | |
| Age category | | | 19.78 |
| 15–18 | 76 | 24.60 | |
| 19–22 | 206 | 66.67 | |
| 23–26 | 27 | 8.74 | |
| BMI | | | 23.11359 |
| Under-weight (BMI < 18.5) | 36 | 11.65 | |
| Normal weight (BMI 18.5–24.9) | 200 | 64.72 | |
| Over-weight (BMI 25–29.9) | 61 | 19.74 | |
| Obese (BMI > 30) | 12 | 3.88 | |
| Nutritional benefits of FV | | | |
| Aware | 285 | 92.23 | |
| Not aware | 24 | 7.77 | |
| Monthly allowance | | | 44,506.15 |
| ≤30,000 | 109 | 35.27 | |
| 31,000–50,000 | 127 | 41.10 | |
| 51,000–70,000 | 46 | 14.89 | |
| 71,000–90,000 | 12 | 3.88 | |
| >90,000 | 15 | 4.85 | |

Source: field survey 2022.

**Table 2:** Frequency of fruits and vegetable intake.

| Variable | Frequency | Percentage |
|---|---|---|
| **Fruit intake** | | |
| Low (≤1 serving per day) | 179 | 57.93 |
| Moderate (2 servings per day) | 100 | 32.36 |
| High (≥4 servings per day) | 30 | 9.71 |
| Total | 309 | 100 |
| **Vegetable intake** | | |
| Low (≤1 serving per) | 248 | 80.26 |
| Moderate (2 servings per day) | 59 | 19.09 |
| High (≥4 servings per day) | 02 | 0.65 |
| Total | 309 | 100 |

Source: field survey 2022.

## 4.2 Frequency of fruits and vegetables intake among the students

The frequency of fruit and vegetable intake among students is presented in Table 2. The frequency of consumption is classified into low (≤1 serving/day), moderate (2 servings/day), and high (≥4 servings/day), which aligns with whom recommendations and the Nigerian Food Guide [29]. Low intake (≤1 serving/day) is substantially below the WHO minimum and contributes insufficiently to the recommended 5-a-day target, while moderate intake (2 servings/day) reflects partial compliance, still falling short of the full recommendation but contributing meaningfully to daily goals. High intake (≥4 servings/day) approaches the full daily target. The ≥4 servings threshold is justified, as few respondents achieve the ideal 5 servings/day, making this a realistic marker of high consumption in the study area. This categorization also aligns with Nigeria's Food-Based Dietary Guidelines, which emphasize consuming fruits and vegetables at every meal, underscoring their foundational role in a

healthy diet. While the Nigerian guidelines do not specify exact daily servings numerically (unlike the WHO), they consistently promote the consumption of fruits and vegetables in frequent amounts.

The result reveals that more than half of the population (57.93 %) has less than or equal to one serving of fruits, which indicates a low intake of fruits, while less than 10 % of the students met the recommended fruit intake by the WHO. The result of vegetable consumption (Table 2) shows that about 80 % of the respondents consumed less than or equal to one serving of vegetables, which is very low compared to the WHO recommendation of five servings per day, while less percentage of students consumed the recommended vegetable intake by the WHO. These results suggest that fruits and vegetables may seem expensive in comparison with other meal options, particularly for students on a tight budget. Their finances may restrict students' ability to buy and eat fruits and vegetables. Students' motivation to include fruits and vegetables in their diets may also be a result of their lack of knowledge about the health benefits of eating fruits and vegetables, which could be caused by low nutrition education and awareness programmes in the university. There is also a possibility of low availability and accessibility of fruits and vegetables in nearby markets or on the university campus. This may have an adverse effect on students' capacity to incorporate them into their diets. Moreover, the reasons for low fruit and vegetable consumption among students may also be connected with the housing conditions in the student hostel, which lacked appropriate food storage facilities. This makes it difficult to plan meals and to purchase larger quantities of fruits and vegetables at affordable prices. The poor intake of fruits and vegetables recorded in this research is at par with (Shisana et al. [14]; Olatona et al. [16]; Onyeji and Ejike [20]; Alsunni and Badar [28]; Kpodo et al. [30]; Poscia et al. [31], who reported poor intake of fruits and vegetables among their respondents).

## 4.3 Preference for types of fruits and vegetables consumed by the students

In this study, students' preferences for specific fruits and vegetables were also identified. The data is presented in Figures 1 and 2. As shown in Figure 1, Banana is considered the most preferred fruit by about 80 % of the students, followed by apples, which are favoured by 74 % of the respondents. The least preferred fruits are pear and avocado. This might have to do with the fact that apples and bananas are frequently less expensive and readily available compared to other fruits like pears and avocados, which makes them reasonable choices for students on limited funds. Another reason could be that apples and bananas are convenient choices for busy students who might value convenience above preparation time. They are both easy to eat on the go.

On the other hand, as shown in Figure 2, the most preferred vegetables are carrot (93.85 %) and tomato (82.20 %); okra and jute mallow were the least preferred vegetables. This may be connected to the fact that tomatoes and carrots are adaptable vegetables that go well with a variety of recipes, such as salads, soups, stews, sauces, and snacks. Their popularity among students could be attributed to their versatility. A similar study in Ghana by Kpodo et al. [30] reported banana and watermelon as the most preferred fruits by the majority of students, while the most preferred vegetable by the students was tomato. Taste, appearance, and nutritional knowledge are likely the basis for the choice

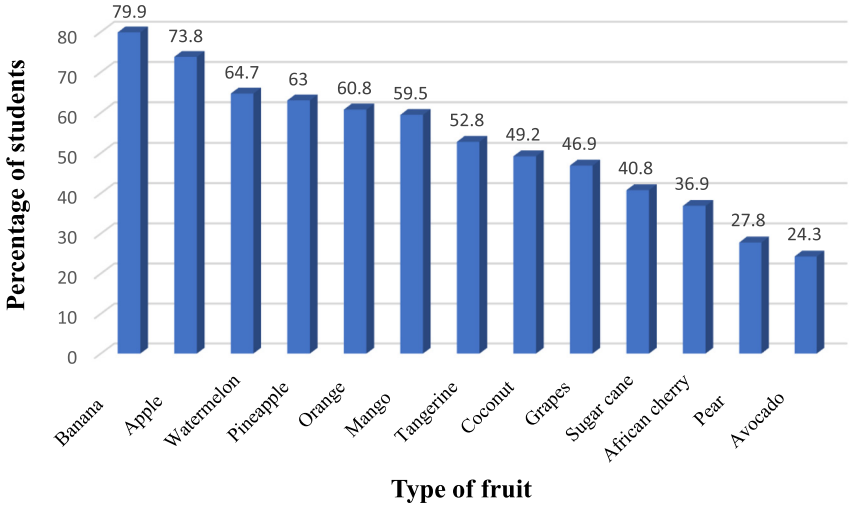


**Figure 1:** Preference for types of fruit consumed among students. Selection of fruit preferences is not mutually exclusive.

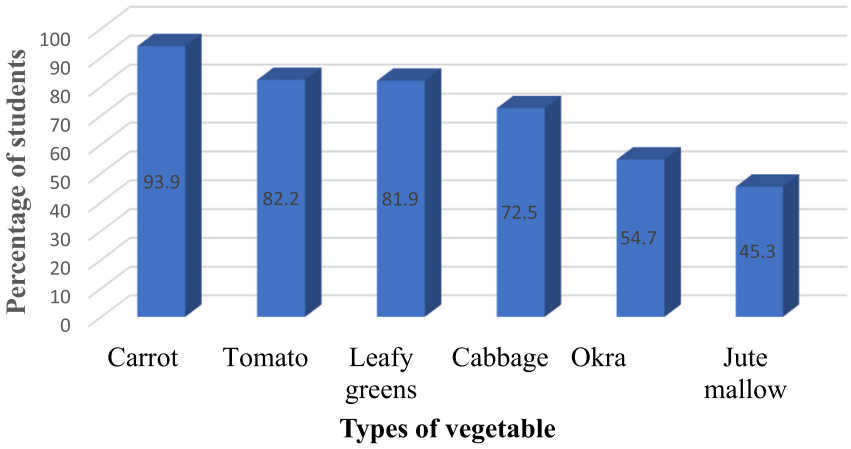


**Figure 2:** Preference for types of vegetables consumed among students. Selection of vegetable preferences is not mutually exclusive.

of specific fruits and vegetables by the respondents. Students' tastes for vegetables may also be influenced by cultural factors and societal standards. The highly preferred vegetables by the students are those that are frequently consumed in their social or cultural circles.

## 4.4 Factors influencing fruit and vegetable intake among students: regression findings

The factors that influence the consumption of fruits among the respondents are presented in Table 3. Availability of fruits, nutrition knowledge, fast food preference, sex, age, and monthly allowance were found to be statistically significant predictors, highlighting the complex nature of dietary behavior on campus.

The age of the students is positive and significant at 5 %, which suggests that fruit intake is likely to increase as the age of students increases. Health and well-being may be more important to older students as they acquire more information and knowledge about the benefits of fruit consumption compared to younger students. Due to this change in focus, older students could become more aware of their eating patterns and consciously try to eat more fruit to achieve better health results. This implies that early interventions for younger students could help establish healthier long-term behaviour. This result agrees with Peltzer and Pengpid [13] and Pengpid and Peltzer [32]. They confirmed in their study that younger age is associated with low fruit consumption; however, this result negates Layade and Adeoye [19].

Sex is negative and significant at 1 % which suggests that students' sex influences fruit consumption and female students are likely to consume more fruits than their male colleagues. This may mirror culturally entrenched gendered norms in food choice, in which fruits are not seen as suitable and satisfying for men. Additionally, females are more concerned about their skin appearance than their male counterparts, and empirical evidence has shown that the consumption of fruits improves the skin and gives it a healthy and radiant appearance. It is also more common for women than for men to worry about managing their weight and body image. Fruits may be more frequently included in diets by female students as a part of weight management or body-consciousness initiatives because they are frequently thought of as healthy, low-calorie foods. This finding demonstrates the requirement for gender-conscious health promotion initiatives that confront prevailing stereotypes and reframe fruit eating in more generally appealing terms. This result is supported by Poscia et al. [31]; Pengpid and Peltzer [32], who reported that males consume significantly fewer fruits than their female counterparts.

Students' monthly allowance has a positive relationship with fruit consumption and was significant at 5 %, which suggests that an increase in students' allowance may result in increased fruit consumption. The role of monthly allowance as a predictor also unveils the contribution of economic

**Table 3:** Drivers of fruit diets among the students.

| Variable | Coefficient | Standard error | P-Value |
|---|---|---|---|
| Age | 0.0781742[a] | 0.0391642 | 0.046 |
| Sex | −0.4344391[b] | 0.1482469 | 0.003 |
| BMI | 0.0131484 | 0.0159494 | 0.410 |
| Monthly allowance | 6.55e-06[a] | 3.25e-06 | 0.044 |
| Availability | 0.5514602[b] | 0.1482799 | 0.000 |
| Preference for fast food | −0.3708075[b] | 0.1430132 | 0.010 |
| Consumption at home | −0.0928045 | 0.2057148 | 0.652 |
| Nutritional knowledge | 0.746833[a] | 0.3302948 | 0.024 |
| University programs | 0.1126098 | 0.1569733 | 0.473 |
| Number of obs = 309 | LR chi2(9) = 47.32 | Prob > chi2 = 0.0000 | |
| Pseudo R2 = 0.0843 | Log likelihood = −256.84877 | | |

[a]Significant at 5 %, [b]Significant at 1 %, obs = observations.

access in the determination of dietary behavior. Individuals with financial means are likely to have discretionary income to allocate to healthier foods, such as fruit, that tend to be more expensive than energy-dense, nutrient-poor foods. Affordability, therefore, is a relevant dimension to address. Institutions of higher education can consider subsidisation programmes or fruit-incentive initiatives to balance this inequality. Furthermore, the influence of students' monthly allowance may be moderated by nutrition knowledge. For example, students with higher knowledge may be more inclined to allocate financial resources toward healthy foods, whereas those with limited knowledge may not prioritise fruits and vegetables, even if affordability barriers are reduced. This result was corroborated by Layade and Adeoye [19], who reported that increasing the monthly allowance of students increases their consumption of fruits.

Another factor that significantly determined the fruit intake by the students was the availability of fruits, which is significant at 1 % implying that the consumption of fruits by students is likely to increase with the availability of desired fruits. It is easier for students to get fruits when they are available in close vicinity, like in the university mall or campus dining facilities. Students who have easy access to fruits are more likely to include them in their diets as quick snacks or meal items. However, there is a possibility that the effect of availability may be conditional on student allowance, which means greater access to fruits and vegetables is unlikely to translate into higher intake among students who lack sufficient allowance. Conversely, knowledgeable students may be more responsive to improved availability, as they recognise the health benefits and actively seek these foods, highlighting the importance of pairing structural improvements with education. This result was supported by Layade and Adeoye [19], who concluded in their research that the availability of fruits increases the consumption of fruits which they opined might be a result of seasonal variations.

The preference for fast food over fruits is negative and significant at 1 %, suggesting that students' preference for fast food over fruits likely decreases their consumption of fruits. Expressive feedback from students through the questionnaire administered to them revealed that higher prices and inconsistent or no availability of fruits influence their preference for fast food. This follows El Ansari et al. [33], who reported that consuming fruit and vegetables is negatively related to the number of fast-food restaurant visits in a study carried out in European universities.

Students' nutritional knowledge of the benefits of consuming fruits was significant and positive, indicating that increased awareness of the benefits associated with regular fruit consumption has the likelihood of increasing the consumption of fruits by the students. However, the presence of other significant behavioral deterrents, such as a preference for fast food, indicates that knowledge alone is insufficient. This reinforces the intention-behavior gap in health psychology [34]. Despite awareness of healthy eating guidelines, students may still default to less nutritious options due to entrenched habits, taste preferences, or perceived convenience. This disjunction suggests that interventions must go beyond educational campaigns and equally address behavioral drivers holistically. Interventions should directly challenge fast food appeal through healthier but convenient and tasty fruit alternatives made available at affordable prices.

Additionally, this study also reveals the socio-economic factors determining vegetable consumption among the students, only two factors are significant as presented in Table 4 below. Availability of vegetables is positive and significant at 1 % suggesting that with an increase in the level of availability of desired vegetables by students, consumption of vegetables would likely increase among the students. The strong positive effect of availability on vegetable intake underscores the importance of improving physical access to vegetables across university environments. This could be in the form of augmenting access points such as vegetable stands, vending machines, or adding vegetables to meal plans. Even if students possess the knowledge or will to eat healthily, lack of accessibility still represents a structural problem that can trump motivation. This result affirms that availability is a key factor in dietary choices. This result is confirmed by Bernardo et al. [35], who opined in a study among Brazilian universities that a one-point increase in vegetable availability and accessibility increases the likelihood of consumption by 27 %.

Students' preference for fast food over consumption of vegetables is negative and significant at 5 % which implies that preference for fast food over vegetables will likely

**Table 4:** Drivers of vegetable diets among the students.

| Variable | Coefficient | Standard error | P-Value |
|---|---|---|---|
| Age | 0.0011524 | 0.0453939 | 0.980 |
| Sex | −0.2488481 | 0.1783628 | 0.163 |
| BMI | −0.0035549 | 0.0207885 | 0.864 |
| Monthly allowance | 4.88e-06 | 3.81e-06 | 0.201 |
| Availability | 0.4817932[b] | 0.006 | 0.006 |
| Preference for fast food | −0.3523422[a] | 0.1703861 | 0.039 |
| Consumption at home | 0.3165942 | 0.2570546 | 0.218 |
| Nutritional knowledge | 0.3290752 | 0.3884737 | 0.397 |
| University programs | 0.0846959 | 0.1893288 | 0.655 |
| Number of obs = 309 | LR chi2(9) = 17.84 | Prob > chi2 = 0.0371 | |
| Pseudo R2 = 0.0550 | Log likelihood = −153.39067 | | |

[a]Significant at 5 %, [b]Significant at 1 %, obs = observations.

decrease the consumption of vegetables by students. These results suggest a cultural-behavioral gap in which fast food is perceived as socially desirable and a core part of student identity, widening the divide between dietary ideals and practices. This stems from a cultural prioritization of fast, palatable, and convenient food, reinforced by social norms, peer influence, and the normalization of fast food in student life. Such dynamics likely contribute to the preference for fast food over vegetables. Additionally, students may be subjected to persuasive marketing messages that promote fast food as desirable and convenient, leading them to choose fast food over healthier options like vegetables. The widespread marketing and advertising of fast food, especially targeting young adults and college students, can influence preferences and consumption patterns. These findings highlight the need for universities to develop intervention strategies that are socially embedded and culturally attuned.

# 5 Conclusions

This study assessed the fruit and vegetable intake among Nigerian university students, specifically analysing patterns, preferences, and influencing factors. The outcome of this study is relevant and germane to guiding public health policies targeted at promoting fruit and vegetable diets among this demographic. The findings from this study confirm that fruit and vegetable consumption among the students is much lower than the WHO-recommended five servings a day. This indicates the pressing need for public health initiatives that encourage greater fruit and vegetable intake. The study also provides evidence that determinants of consumption of fruits and vegetables are sex, age, knowledge of health benefits, availability, preference for fast food, and monthly allowance.

This study recommends a comprehensive intervention that combines education, improved accessibility, and strategies to shift students' dietary attitudes, ensuring long-term healthy eating habits. Specifically, these three priority actions are recommended:

i. Improve access and affordability by partnering with local growers and incorporating diverse, budget-friendly fruits and vegetables into cafeteria menus to ensure an all-year-round supply.
ii. Create campus-based initiatives such as an on-campus farm, managed by the university community and integrated into academic programmes and research, to provide sustainable fresh produce and encourage interdisciplinary collaboration.
iii. Support healthy behavioural change by implementing nutrition programmes, cooking workshops, and attractive displays, etc., to encourage long-term healthy eating habits.

## 5.1 Research limitation

A few of the respondents are 15 years old. This may limit generalisability, as younger participants often have less dietary autonomy than older peers with greater independence in food choices. Notwithstanding, this study has contributed to knowledge by exploring the patterns, preferences, and influencers of fruit and vegetable intake among Nigerian university students. Findings and recommendations from this study will go a long way in improving the fruit and vegetable intake among university students in Nigeria.

## 5.2 Recommendation for further studies

To better understand student behaviour and institutional influences, future research should expand the current study by assessing awareness, consumption habits, and the effectiveness of university-led initiatives with a larger sample. Future research should also compare fruit and vegetable consumption patterns and their determinants between public and private institutions, as well as urban and rural sectors.

**Funding Information:** This study received no funding from any entity.

**Author contributions:** SOS: Conceptualisation, methodology, software, validation, formal analysis, visualisation, project administration, resources, writing – original draft. OMB: Validation, formal analysis, visualisation, supervision, resources, data curation and writing – review and editing. MDA: Methodology, validation, supervision, resources, data curation and writing – review and editing. GM: Methodology, software, formal analysis, resources, and writing – original draft.

**Conflict of interest:** The authors declare no conflicts of interest.

**Data availability statements:** The data that support the findings of this study are available from the corresponding author upon reasonable request.

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