Assessment of Campus Retail Food Environment and Dietary Diversity of Students in a Nigerian University

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ABSTRACT

Background: *The healthiness, availability, and affordability of retail food stores positively influence the consumption of healthy foods and diversified diets.*

Objective: *The study assessed the campus retail food environment and dietary diversity of students*

Methodology: *The study was a descriptive cross-sectional design carried out at Michael Okpara University of Agriculture, Umudike. A multi-staged sampling technique was used to select 300 students. Thirty (30) retail food stores were chosen randomly and assessed using an adapted Nutrition Environment Measures Survey in Stores for Mediterranean urban contexts (NEMS-S-MED) and an observational tool that assessed the healthiness, availability, and affordability of foods. Semi-structured questionnaire that includes socio-demographic, shopping pattern questions, and a 24-hour recall. Data were entered into IBM-Statistical Product and Service Solution version 23. Descriptive and correlation were used for analysis.*

Result: *Results showed that 65% of respondents were females with a mean age of 22.9±2.47 years. The campus food environment comprised mainly of convenience stores (63.3%), small grocery stores (26.6%), and specialty stores (10%), with groceries offering healthier foods at better prices. Most respondents (82.3%) shopped in more than two store types, and 45.7% perceived fruits and vegetables as expensive. The mean DDS was 3±1.6, with 90% not meeting the DDS. A weak but significant positive correlation (r=0.147, p=0.011) was found between those who shopped in convenience stores and DDS.*

Conclusion: *The retail food environment had a minimal significant impact on students' dietary diversity and fruit/vegetable consumption, whereas food prices, quality, and mobility influenced shopping decisions.*

Keywords: Food environments, Dietary diversity, Food stores, Students

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INTRODUCTION

The food environment encompasses the physical, economic, political, and sociocultural factors that influence people's eating habits and food preferences (1,2,3). Increasing evidence shows that the food environment impacts what people eat and promotes healthy or unhealthy nutritional practices. (1,2). In some nations, such as South Africa and Ghana, supermarkets have experienced an exponential rise (4, 5, 6) in the availability of ultra-processed foods, sugary snacks, and drinks, as well as an increase in restaurants serving food away from home. Researchers are focusing on the relationship between dietary intake and the local food environment (3,7). Environmental factors such as the retail food environment are gaining recognition as important determinants of dietary patterns and food choices of individuals. A substantial correlation between the retail food environment and dietary habits, dietary intake, and weight gain was also discovered by several studies (3,7).

The campus food environment is a major contributor to young adults' diets. Students on campus make decisions on what to consume

based on what is available, and this may form their dietary pattern (8,9). More so, there must be availability and access to healthy food on campus to enhance good nutrition choices (8,10). Studies have shown that the foods available in the campus environment are unhealthy (9, 11, 12, 13), and unhealthy food stores may pose risks to the dietary intake and diversity of young adults residing on the campus.

Dietary diversity refers to the number of food groups or products consumed throughout a reference period (14). A diversified diet is a great source of both macro and micronutrients to help maintain nutritional adequacy. Given that dietary characteristics are associated with an increased risk of chronic illnesses and malnutrition, both international and local guidelines recommend increasing dietary diversity (15). The association between the retail food environment and dietary diversity has been reported in previous studies (3, 7, 16).

Built food environments, also referred to as market or retail food environments (17), consist of both informal and formal markets. In Nigeria, retail food stores lack the formal level of organization seen in developed countries, here the market is spread out, each seller having a specialty e.g. provision, drinks and snacks, fruits and vegetables, meat, fish, and condiments although some stores can be mixed but not on a large scale as compared to the European context where every food item can be bought in one store (18, 19).

There is a paucity of data on the types of retail food stores found on campuses in Nigeria, and information on the price, availability, and quality of healthy food in retail food stores is limited. Understanding the food environment on campus is essential to identifying and implementing sustainable interventions to prevent chronic diseases later in life. Therefore, this study examines the relationship between the retail food environment and dietary diversity among campus students.

METHODS

Study design: The study is a descriptive cross-sectional design

Study location

Michael Okpara University of Agriculture, Umudike (MOUAU), Abia State. The institution is situated within the renowned Nigerian Root Crop Research Institute, approximately 9 kilometres from Umuahia, the state capital, along the Umuahia-Ikot Ekpene road axis, surrounded by the agrarian communities of Umudike and its neighbouring regions.

Sampling Procedure

The sample size was calculated using Fisher's sample size formula. A multi-stage sampling technique was used in the selection process of students for the study. Michael Okpara University of Agriculture, Umudike, was selected using purposive sampling, and all the 11 colleges in the University were selected. In the third stage, 27-28 students from the 11 colleges were randomly selected to participate, giving a total of 300 participants. A simple random sampling technique was employed in selecting the convenience, small grocery, and specialty stores used for this study. Thirty (30) retail food stores were chosen out of forty-five (45) stores identified within the campus environment, each representing various geographical locations within the campus.

Ethical Approval

Ethical clearance was obtained from the Health and Research Ethics Committee of Federal Medical Centre, Umuahia (FMC/QEH/G.596/Vol.10/631), and participants gave verbal informed consent.

Data collection

Data were obtained using two procedures, which included an interviewer-administered questionnaire and direct observation of the retail food environment, which consisted of the retail food stores around the campus. The questionnaire contained socio-demographics, socio-economics, food shopping, and food consumption patterns. Data on the campus food environment were collected by identifying and evaluating all food retail stores around the campus establishments using the Nutrition Environment Measures Survey in Stores for Mediterranean contexts (NEMS-S-MED) (20).

Assessment of dietary diversity

Subjects provided information on food intake using a 24-hour dietary recall contained in the questionnaire. The Dietary Diversity questionnaire (21) was used to ascertain dietary diversity. This indicator assesses individuals' diet quality and micronutrient adequacy from the number of food groups eaten over the previous 24 hours (22). The foods and drinks are arranged into 9 food groups (21): Vitamin A, vitamin-rich vegetables; grains, tubers, and plantains; dairy; other vegetables and fruits; legumes; meat, poultry, and fish eggs; nuts and seeds; dark green leafy vegetables. Each food group consumed during

the reference period was given one point, and the sum of all points was used to determine the individual's dietary diversity score. The minimum score that can be obtained is zero, and the maximum score obtainable is 9. To achieve minimum dietary diversity, an individual must score $\geq$ 5.

Measure of Retail Food Stores

The Retail food stores were assessed using NEMS-S-MED (23). The NEMS-S-MED was adapted from the original NEMS-S (Nutrition Environment Measures Survey in Stores), developed by Glanz et al. (20). The NEMS-S-MED is an observational measure of the nutrition environment within retail food stores (NEMS-S) to assess the availability of healthy options, price, and quality. NEMS-S-MED instrument includes 12 food groups: (i) vegetables (ii) fresh fruits; (iii) nuts (iv) non-alcoholic beverages; (v) bread, cereals, and baked goods; (vi) milk and dairy products; (vii) eggs; (viii) oil and butter; (ix) rice; (x) legumes; (xi) meat and meat products; and (xii) fish and fish products. Taking into account the peculiarities of the characteristics of the local foods in the Nigerian setting, some items within the same food groups were adapted in the instrument. Some small kiosks (in the open market) were merged to form stores during the data collection to meet the NEMS-S criteria.

Availability of healthy foods

The availability of healthy foods for each store was summed up to determine an overall score, with a range of 0 to 37 points. Healthful items are more likely to be available at higher scores. Scores ranging from 1-7 indicate low availability, 8-14 moderately low availability, 15-22 medium availability, and 23-30 moderately high, 31-37 high availability (peculiar to this study).

Price of healthy food options

The price of healthy food options versus less healthy ones was assessed within the range of 0-12 (low price 0-3, moderate price 4-7, high price 8-12). A lower price score meant that healthier foods were more expensive than their less healthy counterparts.

A total NEMS-S-MED Score (ranging from 0-49) reflected the degree of healthiness of the retail score. The higher the score, the healthier the store, which shows that there is availability of healthier food groups at lower prices

Data analysis

The statistical analyses were carried out using the R programming language for Statistical Computing version 4.2.2, using frequencies and percentages. Descriptive statistics were performed to analyze socio-demographic factors such as age, sex, monthly income, etc. Dietary Diversity Scores (DDS) for individuals were derived using the FAO Guidelines (22), and the mean was derived using descriptive statistics. Using SPSS, Pearson correlation was used for the association between the IDDS and the retail food store scores, with a $p < 0.01$ significance level.

RESULTS

Socio-demographic characteristics of the participants

Table 1 shows that the study population was predominantly female, aged 22–25 years, with a mean age was 22.9 ± 2.47 years, with most (39.0%) earning a monthly income below ₦30,000.

Types of retail food stores on campus

As shown in Figure 1, the retail food environment on the campus was densely populated with convenience stores having a percentage of 63.5%, small grocery stores with 26.7%, and specialty stores with 10%.

Retail food stores assessment for healthiness, availability, and affordability of foods by types of food stores

As shown in Table 2, the total NEMS-S-MED Score was a combination of the availability and price scores of the individual retail food stores. It shows that the low NEMS-S-MED Score was more obtainable in convenience and specialty stores, and this consequently indicates low availability of healthy food options. It was observed that convenience and specialty stores had lower availability scores as compared to grocery stores. The results also showed that the prices of food items were relatively higher in convenience stores than in grocery stores.

Food shopping patterns of respondents

As shown in Table 3, 26.2% of the respondents reported that they shop twice a week, while 11.3% shop once a month. A large percentage of the respondents (about 82%) indicated that they shop in more than two stores, while 7.6% indicated they shop at one store. The respondents indicated shopping mostly from convenience stores, closely followed by small grocery stores; 23.6% chose open markets, and 3% chose specialty stores.

In the area majority (65%) take a walk to shop for food, and 29% take public transport. About 32%

of the respondents estimated that it takes 6-10 minutes to walk to the food stores. When it comes to the price of fruits and vegetables, 45.4% of the respondents rate it as expensive, not very expensive (29%), very expensive (19%), and not expensive (8.3%).

Table 1: Socio-demographic characteristics of the participants

Socio-demographic characteristics	Frequency (300)	Percentage (%)
Sex		
Male	105	35.0
Female	195	65
Age (years)		
16-21	93	31
22-25	167	55.7
26-29	36	12.0
30 and above	4	1.3
Mean age =22.9±2.47		
Monthly Income (₦)		
10, 000 -20,000	117 (39.0%)	39.0
21,00 – 30,000	98 (32.7%)	32.7
31 00 - 50, 000	55 (18.3%)	18.3
51, 000 and above	30 (10 %)	10.0

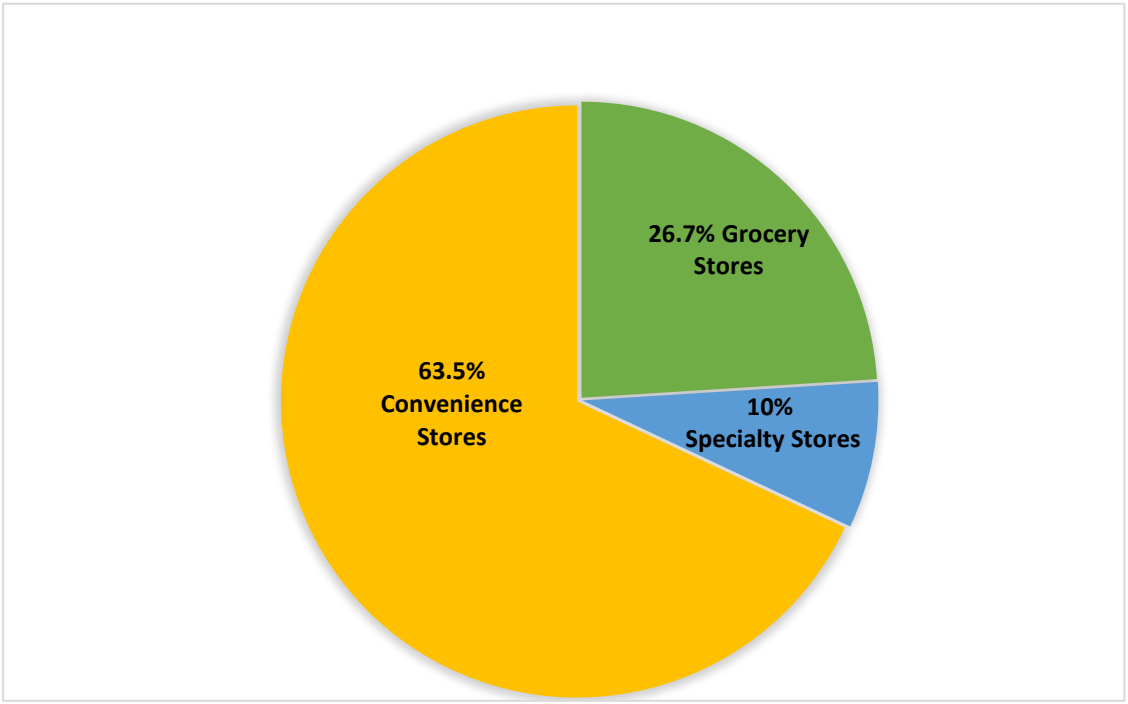

Figure 1: Types of retail food stores on campus

Table 2: Retail food stores assessment for healthiness, availability, and affordability of foods by types of food stores

Retail food stores assessment	Small Groceries (n=8)	Convenience stores (n=19)	Specialty stores (n=3)
Degree of store healthiness (Scores)			
Low (0-16)	2 (6.7%)	19 (63.3%)	2 (6.7%)
Moderate (17-33)	5 (16.7%)	0(0.0%)	1 (3.3%)
High (34-49)	1(3.3%)	0(0.0%)	0(0.0%)
Degree of availability			
Low availability (0-7)	2 (6.7%)	17 (56.7%)	2 (6.7%)
Moderate low availability (8-14)	5 (16.7%)	2 (6.7%)	1 (3.3%)
Medium availability (15-22)	1(3.3%)	0(0.0%)	0(0.0%)
High availability (23-37)	0(0.0%)	0(0.0%)	0(0.0%)
Price (affordability)			
Low price (0-3)	4 (13.3%)	3 (10%)	2 (6.7%)
Moderate (4-7)	4 (13.3%)	14 (46.7%)	0(0.0%)
High Price (8-12)	0(0.0%)	2 (6.7%)	1 (3.3%)

Dietary diversity of respondents

As shown in Figure 2, most of the respondents consume more of grains, tubers, and plantains (83.3%), followed by animal proteins such as meat, fish, and poultry (40.3%). Pulses, Dairy, and eggs were 30%, 24% and 21.3% respectively. There was minimal intake of dark green leafy vegetables (18.6%) and other fruits and vegetables (25.0%). Consumption of Vitamin A-rich vegetables and tubers was the least (9%). The result from Fig. 3 shows that most (80%) of the respondents failed to meet the benchmark of 5 food groups, while 20% met it. The mean dietary diversity score was 3.3 $\pm$ 1.6

Association of retail outlets and Individual Dietary Diversity Scores (IDDS)

Table 4 shows there is a weak positive but significant relationship between shopping in convenience stores and grocery stores and the IDDS, as the correlation coefficient is 0.147 with a significant value of 0.011. There are no significant relationships between shopping at the other retail outlets (specialty and open market) and IDDS.

DISCUSSION

This study assessed the retail food environment in a Nigerian Campus and also evaluated the shopping patterns and dietary diversity of students. A higher number of campus retail food stores was assessed in other studies. From this study, it was found that the retail food environment on the campus was densely populated with convenience stores than small grocery stores and specialty stores. This report was in contrast with (12), the availability of grocery stores was more than convenience stores.

In this study, grocery stores had higher NEM-S-MED scores than convenience stores and specialty stores. Higher scores imply the availability of healthier foods; however, the convenience stores sold mainly bread, pastries, breakfast cereals, carbonated drinks, etc, while grocery stores sold fresh fruits and vegetables such as oranges, tomatoes, okra, cucumber, and meat, fish, etc. The variety of foods in the grocery store encouraged making healthy food choices and increased the diversity of diets, whereas that of convenience may promote snacking on processed and unwholesome foods. However, the high density of convenience stores around the campus may not encourage the consumption of fresh fruits and vegetables. A previous study reported that the availability of convenience stores compared to supermarkets may reflect a poor and unhealthy food environment (24). A similar study also found that convenience stores sell ultra-processed foods that contain high calories (18). Grocery stores and specialty stores like fruit and vegetable stands, 100% fruit drinks, smoothies, and healthy (or smart) snacking

should be highly promoted to aid in making healthy decisions regarding what to eat at a time.

The price of food is an important determinant of food purchase and dietary intake. Consequently, the result showed that prices of food items were relatively higher in convenience stores than in grocery stores and that some healthier alternatives were more likely to be cheaper than the regular ones. For example, whole rice (i.e., local rice), which is sourced locally, was found to be lower in price than white rice (foreign rice), which is usually imported. Poultry was cheaper than red meat, and home-made juice drinks (e.g., zobo, kunu) were lower in price as compared to juice drinks, carbonated drinks, or soda. This was similar to a study in Madrid, where the price of healthy foods in supermarkets scored better than convenience stores (20).

Table 3: Food shopping pattern of respondents

Food shopping patterns of respondents	Frequency (300)	Percentage (%)
Frequency of food shopping		
Everyday	67	22.3
Once a week	73	24.3
Twice a week	86	28.7
Once every 1-2 weeks	41	13.7
Once a month	33	11.0
Number of stores where food shopping is done		
One Store	23	7.7
Two stores	30	10.0
More than two stores	247	82.3
Types of stores		
Small grocery stores	88	29.3
Convenience stores	89	29.7
Specialty stores	9	3
Open market	71	23.7
Others	43	14.3
Means of transportation		
Walk	195	65.0
Bicycle	3	1.0
Public Transportation	87	29.0
Drive your own car	2	0.7
Get a ride	13	4.3
Amount of time taken to get to food stores		
5 minutes or less	55	18.3
6 to 10 minutes	96	32.0
11 to 15 minutes	87	29.0
16 to 30 minutes	36	12
More than 30 minutes	26	8.7
Price of fresh fruits and vegetables		
Very expensive		
Expensive	57	19.0
Not expensive	137	45.7
Not very expensive	25	8.3
	81	27.0

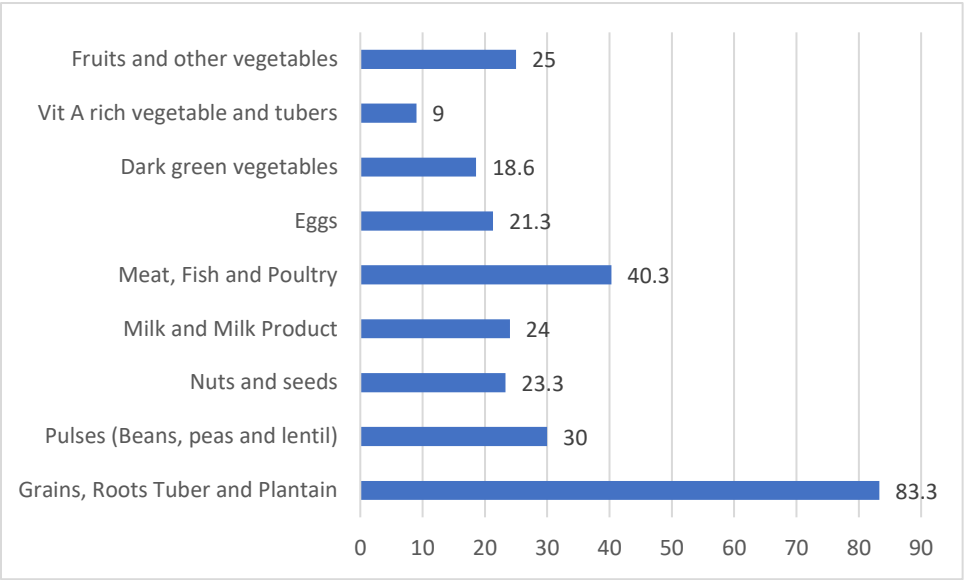

Figure 2: Food groups consumed by respondents

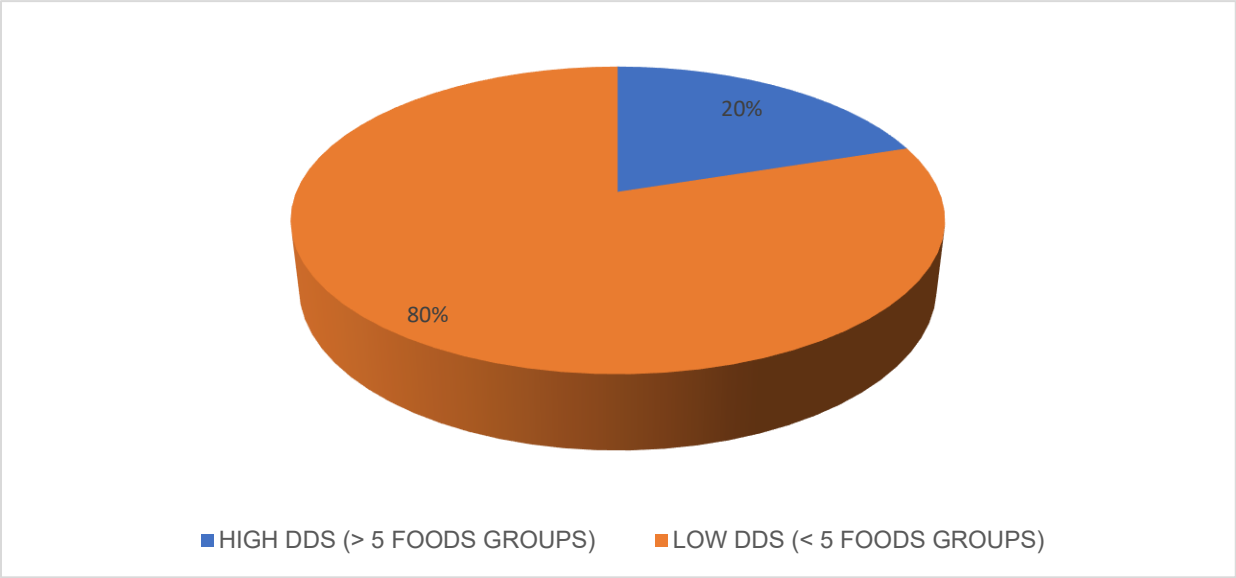

Figure 3: Dietary Diversity of respondents

Table 4: Pearson Correlation coefficient between retail outlets and Individual Dietary Diversity Score (IDDS)

Outlet type	Correlation coefficient (r)	p-value
Small grocery	0.012	0.032
Convenience store	0.147	0.011*
Specialty store	-0.002	0.972
Open market	-0.080	0.186
Number of shops	0.041	0.473

* Correlation is significant at the P<0.001 level

In the United States, healthy foods were found to be more expensive than less healthy options in grocery stores but not in convenience stores (12), while in Ghana, both convenience stores and supermarkets had high food prices (25). Variations in outcome measures may explain this difference. Similarly, prices of fruits and vegetables were higher, consistent with another U.S. study (26). Roberto et al. (27) reported that about one-third of the gap in fruit and vegetable intake is due to price distortions. Their high cost may discourage consumption, as over half of the students considered them expensive.

Evaluation of the food shopping practice of the student shows that most students purchased food within the campus retail environment, similar to a study showing 94% did the same (13). About 82% shopped in more than two stores, reflecting the Nigerian context where food shopping is spread across multiple outlets (18), a trend also observed in Asia (28). This occurs because no single store carries all food categories.

Other studies have reported that the proximity and distance of different types of retail food environments are important factors influencing the dietary consumption of their participants and weight gain (29, 30). From this study, more than half of the respondents walk to various food stores and spend 10 to 15 minutes, which accounts for approximately 500m to 1000m from their hostels. A similar study (31) examined how accessible healthy food stores may be to students in the vicinity of one of the University of Bucharest's main buildings, which were 500m away. However, in this study, accessibility to healthy food stores was not determined. The study only examines accessibility to all food stores. Places within schools that are farther from the open market and grocery stores may not encourage dietary diversity.

The food consumption of students in this study shows that dietary intake was poor; the respondents consumed more starchy staples, while there was a minimal intake of animal protein, vitamin A-rich fruits, and other fruits and vegetables. The meal pattern of the respondents observed in another tertiary Nigerian institution showed that the majority consumed more cereals, roots and tubers, fruits, meats, oils, and fats groups and less of foods belonging to the vegetables and eggs group (32) While a study in a Ghanaian university reported, a moderate intake of fish, meat, eggs, and dairy products, a moderate intake of legumes and nuts, a low intake of fruits and vegetables, and a high intake of soft drinks and fast food (33). It was observed that the consumption of fruits and vegetables is generally seen to be low amongst students; this may be due to the high cost of fruits and vegetables on campus. Low consumption of vitamin A-rich fruits and vegetables may pose threats such as nutritional deficiencies as adulthood advances.

The mean dietary diversity score was quite low and may have negative implications for the nutritional adequacy of the students. Similarly, more than half of the students were reported to have low scores in another Nigerian institution (34). This is in contrast to the DDS of students in a private tertiary institution in Nigeria, which showed that most of them ate more than six food groups, which makes available the necessary nutrients for optimal health (32). Previous studies have shown the association between food environment and dietary diversity; in this study, there is a weak but positive correlation between shopping in convenience stores and dietary diversity. In consonance with this, an increase in access to convenience stores was positively linked to an increase in consumption of high-calorie foods, according to (35). A positive correlation between convenience stores and dietary diversity may imply that dietary diversity is likely to increase as students shop more in convenience stores. The high density of convenience stores does not encourage the purchase of healthy food, as most foods sold there are calorie-dense and lack the availability of fruits and vegetables.

No significant relationships were found between shopping at the other retail outlets (i.e., small grocery, specialty, and open market) and dietary diversity score, although a negative but insignificant relationship existed between the specialty stores and IDDS, and between the Open market and IDDS. Also, the number of shops the students shopped in (either one, two, three, or four) did not influence the dietary diversity score.

CONCLUSION

The campus food environment is dominated by convenience and small grocery stores with limited healthy options that are less available, moderately affordable, and of lower quality. Students often shop weekly or bi-weekly in multiple nearby stores, but this has little impact on their dietary diversity or fruit and vegetable intake. The university management and stakeholders should prioritise making healthy foods more available and affordable on campus.

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