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Research

Contributions of street foods to dietary intakes of traders in selected open markets in Uyo, Akwa Ibom State, Nigeria

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Abstract

Street food (SF) consumption is gaining popularity across urban settings, making significant contributions to dietary intake, even in low-income settings. The objective of this study was to assess the contributions of SFs to the dietary and nutritional intakes of market traders within the Uyo metropolis. This was a cross-sectional study. Participants (421, with an average age of 41.2±11.5) were selected using probability sampling to be representative of traders who were active over the past two years in Uyo. The multi-pass 24-hour dietary recall methodology was used to assess usual dietary intakes. Total Dietary Assessment Software was used to derive energy and nutrient intake values from food intake information. Energy intake was compared with the Estimated Energy Requirement, and nutrient intakes were assessed against their respective Recommended Dietary Allowances to determine percentage adequacy. In their overall diets, traders met the recommended intake level for carbohydrate, but generally had suboptimal intakes of energy, dietary fibre, vitamin A, and calcium in both men and women, as well as iron among women aged 19-50 years. A majority (74.6%) consumed SFs. Among SF consumers, percentage contributions of SFs to energy and nutrient intakes among men and women, respectively, were as follows: energy (34.9% and 28.5%), carbohydrate (108% and 68.8%), protein (51.2% and 32.8%), dietary fibre (0.0%-23.7% and 26.0%-31.0%) and calcium (16.1% and 6.5%-7.8%). Overweight, general, and abdominal obesity were 30.2%, 4.8%, and 44.5%, respectively. Increased BMI was significantly related to reasons for SF consumption ($p < 0.001$). Abdominal obesity had significant associations with the forms of SFs commonly consumed and with the amounts spent on SF consumption ($p < 0.001$), respectively. Traders had suboptimal intake levels for most nutrients and met substantial proportions of their daily energy and nutrient requirements through SF consumption. Increased BMI and abdominal obesity were prevalent and associated with SF consumption practices. Policy regulations that selectively promote the preparation and sales of healthier meals by vendors in the marketplace are warranted.

INTRODUCTION

Street foods refer to foods and beverages sold and often prepared by vendors in streets and other public places for immediate consumption or consumption at a later time, without further processing or preparation (World Health Organization, 1996). They are vital components of urban food systems, especially in developing countries, where they serve as readily available, accessible, affordable, and convenient sources of nutrition for a wide range of people (Steyn et al., 2014). Because of these features, SF consumption is becoming increasingly popular in Nigeria (Dada, 2017; Oladoyinbo et al., 2019; Adeosun, et al., 2022; Oyeyemi et al., 2024; Anyabolu & Okoye, 2017). SFs are sold in public spaces, including shops, street corners, transport terminals, schools, and marketplaces (Adeosun, et al., 2022). In Nigeria, SF encompasses a wide range of items, ranging from indigenous staples to processed foods, including snacks and sugar-sweetened beverages (Israel & Samuel, 2020). While SFs are recognized as important sources of energy and certain nutrients in consumers' diets, there are concerns over consumer safety (Mazi et al., 2023) and their nutritional quality. They are often high in energy;

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sodium; sugars; and total, saturated, and trans fats, while lacking some essential nutrients (Steyn et al., 2014). This nutritional profile predisposes consumers to obesity and diet-related chronic diseases (Leshi & Leshi, 2017; Oyeyemi et al., 2024).

Market traders play a crucial role in informal economies, providing essential services that help individuals and families access the basic necessities of life. They often engage in day-long trading activities, performed under unfavourable financial and physical conditions (Basavanna, 2024). Because trading activities are time- and energy-demanding, traders often face the challenge of time constraints, which limits their ability to attend to personal needs, including preparing healthy meals. Consequently, SFs have become a readily available means of obtaining nourishment during the day among traders (Tacardon et al., 2023; D'Hooghe et al., 2024). Market traders face numerous nutritional and health challenges. The monotonous nature of meals sold in the marketplaces leads to low dietary diversity, resulting in both nutrient inadequacies and overweight among traders (Leshi & Leshi, 2017). Physical inactivity, resulting from prolonged periods of sitting and standing with minimal movement, constitutes a significant risk factor for chronic non-communicable diseases (NCDs) (Oladoyinbo et al., 2015; Oladoyinbo et al., 2019). In addition, risky lifestyles, including smoking, alcohol consumption, along with low awareness and uptake of health services predispose traders to exceptionally high risks of NCDs (Oladoyinbo et al., 2019; Udeh et al., 2025).

Already, chronic disease burdens, including obesity, cardiovascular diseases, diabetes, and renal diseases, are becoming prevalent among adults in Uyo (Morgan et al., 2019). In light of these problems, information on nutritional intakes of traders can provide valuable insights into both nutrition and health challenges among traders and guide the design of appropriate interventions. However, data on SF consumption among market traders in Nigeria are scanty and not representative of the different regions (Oguntona & Tella, 1999; Afolabi et al., 2004; Leshi & Leshi, 2017; Ekerette, et al., 2025). Those reporting nutritional contributions to nutrient intakes are outdated (Oguntona & Tella, 1999; Afolabi et al., 2004). This study was conducted to assess how SF consumption contributes to meeting the daily energy and nutrient requirements of market traders in selected open markets within Uyo metropolis, Nigeria. Street food consumption practices, as well as anthropometric indices, were also assessed.

METHODOLOGY

STUDY SETTING

This cross-sectional study was designed to report contributions of SFs to dietary intakes of traders in selected markets. It was conducted in Uyo, the capital city of Akwa Ibom State in South-south Nigeria, with a projected population of 1,400,000 (Uyo Population 2025). Residents are predominantly Christians of the Ibibio ethnicity, although other ethnicities, including Annang and Oron, are also represented within the city. Ibibio is the primary language spoken in the region besides English. Development and economic activities are primarily driven by public services, trade, education, and hospitality. The city houses a wide range of open markets that cater to the diverse needs of the residents. The sampling frame for this study consisted of eight major open markets in Uyo metropolis that operate daily to provide a wide range of services to individual consumers as well as retail and wholesale dealers, making them vital commercial centres within the city.

SAMPLE DESIGN

The study included men and women aged 18 years and above who sold in open markets. To obtain a more representative sample with food consumption patterns typical of traders in the region, only traders who have been trading in respective markets for at least the immediate past two years were included. Data collection was performed from March to April 2025.

We used the Cochran formula (Cochran, 1977) for estimating the required sample size. A 5% precision level, 95% confidence interval, and 52.6% combined prevalence of overweight and obesity among adults in South-south Nigeria (Chukwuonye et al., 2022), were adopted to derive the total number of participants as indicated below.

$$n = z^2 \, x \frac{pq}{d^2}$$

where,

n = represents the minimum sample size;

z^2 = the normal deviate corresponding to the desired confidence interval = 3.8416

p = proportion of elements in study population with the key attribute being measured = 0.526

q = unaffected population (1 – p) = 0.474

d^2 = the desired degree of accuracy = 0.0025

The minimum sample size calculated was 383. Adjusting to account for a 10% non-response rate, a total of 421 was obtained.

Participants were selected using a multi-stage sampling technique. From a total of eight major markets, three were selected using a simple random balloting. Furthermore, the total number of stalls in each selected market were used to derive the proportionate sample sizes for each market. Using the already existing stall numbering within each market, systematic sampling was performed to select market stalls for inclusion in the study. Eligible traders found within the selected stalls were included as participants in the study. Where an eligible participant was not available during the first visit, at least a follow-up visit was conducted at a different time of the day. Where the participant remained absent after two follow-up visits, they were replaced with the next eligible trader in a nearby stall.

DATA COLLECTION

DATA COLLECTION TOOL

Data were collected using a semi-structured questionnaire, comprising four sections designed to obtain information on demographic characteristics, SF consumption practices, dietary intakes, and to record anthropometric measurements. SF consumption practices were assessed through questions adapted from existing literature. The questionnaire was reviewed for reliability by two experts in the field, and feedback was used to revise and finalize the tool. Data collection was performed by trained personnel

who had received instruction on the study's data collection protocols.

DIETARY INTAKE ASSESSMENT

The information obtained on consumption of SFs included reasons for SF consumption, place of consumption, eating occasion, frequency of consumption, weekly expenditure on SF consumption, and forms of SFs commonly consumed.

Multi-pass 24-hour dietary recall (Gibson & Ferguson, 2008) was used to obtain information on traders' overall food intake. Respondents were asked to list all items consumed over the reference period. Items that were possibly forgotten during the initial listing were identified through further probing. Detailed descriptions, including brand names (where available), ingredients, and recipes for each listed item were obtained. Portion sizes were estimated using simple household measures and selected replicas of food models. Information on food intakes was further used to derive specific nutrient intake values using the Total Dietary Assessment (TDA) Software (version 3.0).

Energy and nutrient intake values were compared with the Dietary Reference Intakes (DRIs) to report percentage adequacy (Institute of Medicine, 2005). For energy, the Estimated Energy Requirement (EER) was computed for each participant using the following equations for men and women, respectively.

EER (men) = 662 – (9.53 x A) + PA x [(15.91 x W) + (539.6 x H)]
EER (women) = 354 – (6.91 x A) + PA x [(9.36 x W) + (726 x H)]

Where
A = age (years)
PA = physical activity coefficient
W = body weight (kg)
H = height (m)

Since traders typically engage in sedentary activities, a physical activity coefficient for a low physical activity level was applied in the EER calculation. Nutrient intake adequacy was evaluated against the respective Recommended Dietary Allowances (RDAs) for each nutrient.

We report dietary intake information separately for both SF consumers and non-consumers (i.e. traders who rarely or never patronize SF vendors). The percentage contribution to intakes was defined as the proportion of EER for energy and RDA for nutrients that were provided by SF consumption.

ANTHROPOMETRIC MEASUREMENTS

Using Center for Disease Control (2020) procedures, anthropometric measurements of weight, height, and waist circumference (WC) were taken using a sensitive electronic bathroom scale (Seca 874, Germany), stadiometer, and a non-stretchable measurement tape, respectively. In addition to achieving the desirable posture, participants were instructed to remove all ornaments and outer clothing that could cause inaccurate readings for each measurement. Weight readings were recorded to the nearest 0.1 kg, while those of height and WC were each recorded to the nearest 0.1 cm. All measurements were performed twice to obtain two readings, and the mean of these readings was used in the analyses. Information obtained from weight and height measurements was used to compute BMI. Body mass index values corresponding to ⩽ 18.5kg/m^2; 18.5-24.9kg/m^2; 25.0-29.9 kg/m^2 and ⩾30kg/m^2 were classified as underweight, normal, overweight and obesity, respectively (WHO, 2010). Waist circumference readings greater than 102 cm for men and 88 cm for women were classified as abdominal obesity (WHO 2011).

STATISTICAL ANALYSIS

All data were analysed using the IBM-SPSS statistical software package, version 20. Results were presented as mean and standard deviation for continuous variables. Nutrient intake values were presented as medians with interquartile ranges (IQRs). Frequency counts and percentages were reported for categorical variables. Chi-square test was used to report associations across categorical variables. Statistical significance was ascertained at $p < 0.05$.

RESULTS

DEMOGRAPHIC CHARACTERISTICS

Table 1 presents the demographic and anthropometric characteristics of our sample, which consisted primarily of women (76.7%) and had a mean age of 41.2±11.5 years. The mean BMI was 24.6±3.0 and the mean WC was 90.1±9.0.

Table 1. Demographic and anthropometric characteristics of market traders in Uyo (N=421)

Variable	Frequency	Percent
Sex		
Male	98	23.3
Female	323	76.7
Age Categories		
< 20 years	9	2.1
20 – 39 years	197	46.8
40 – 64 years	203	48.2
⩾ 65 years	12	2.9
State of Origin		
Akwa Ibom	392	93.1
Abia	21	5.0
Anambra	5	1.2
Cross River	3	0.7
Marital Status		
Single	140	33.3
Married	245	58.2
Widowed	36	8.6
Highest level of education attended		
Primary	59	14.0
Secondary	251	59.6
Tertiary	111	26.4
Estimated Monthly Income (₦)*		
⩽ 30,000	103	24.5
31,000 – 50,000	190	45.1
51,000 – 200,000	125	29.7
201,000 – 500,000	3	0.7
Business line		
Local food stuff	310	73.6
Provisions	18	4.3
Kitchen Utensils	28	6.7
Clothing	44	10.5
Others	21	5.0
BMI		
Underweight	8	1.9
Normal	266	63.2
Overweight	127	30.2
Obesity	20	4.8
Waist circumference		
Normal	234	55.5
Abdominal Obesity	187	44.5

*At the time of the study, the value of the Nigerian Naira was $0.00062

NUTRIENT INTAKE ADEQUACY

Table 2 presents findings on the percentage adequacy of nutrient intakes among our sample of market traders, divided into two groups: those who consumed street foods and those who did not. Overall, traders had optimal carbohydrate (100.0% in men and 99.0% in women), but suboptimal energy intakes (41.8% and 45.3%, respectively). This was accompanied by low percentage adequacy for fibre (9.7% and 16.3% among men aged 19-50 years and ⩾51 years; and 11.8% and 30.3% among women aged 19-50 years and ⩾51 years), vitamin A (16.3% among men and 36.6% among women), calcium (3.1% among men; and 0.0% among all women) and iron (47.5% among women aged 19 to 50 years). Among men, energy ($p = 0.002$) and zinc ($p = 0.021$) intake adequacies were significantly higher among consumers (47.7%) than non-consumers (0.0%). While carbohydrate (100.0%) and iron (100.0%) intakes were adequate for all men, energy and most other nutrients remained inadequate for both consumers and non-consumers. Among women, there were no significant differences in energy and nutrient intakes between SF consumers and non-consumers. Among those aged 19 to 50 years old, iron intake adequacy ranged from 45.5% among consumers to 53.6% among non-consumers, and fibre intake adequacy was equally low, ranging from 10.7% among non-consumers to 12.1% among consumers.

STREET FOOD CONSUMPTION PRACTICES

A total of 314 (74.6%) traders reported that they often consume SFs (Table 3). Of these, 77.4% listed hunger as the main reason, and 20.7% indicated time constraints as the main reason for consuming SFs. About 93.9% of SF consumers eat SFs within the marketplace, with lunch (62.4%) being the most common eating occasion. Up to 89.5% consume SF three or more times per week. The majority of consumers spend between ₦600 and ₦2,000 on SFs weekly. Most consumers, 65.9%, prefer cooked meals as SF options over other items, while 13.4% take sugar-sweetened beverages (SSBs). Only a few (7.3%) reported consuming fruits and vegetables as SF.

STREET FOOD CONSUMPTION PRACTICES AND OBESITY

There was no statistically significant association between SF consumption and overweight/obesity, $p = 0.057$ (Table 3). However, a significant association was observed between overweight/obesity and the reasons for consuming SFs ($p < 0.001$), as well as the preferred location of eating ($p = 0.044$). In addition, significant associations were observed between abdominal obesity and both weekly expenditure on SF consumption and the types of SFs commonly consumed.

CONTRIBUTIONS OF STREET FOODS TO ENERGY AND NUTRIENT REQUIREMENTS AMONG CONSUMERS

Information on the percentage contributions of SFs to energy and nutrient requirements among SF consumers is presented in Table 4. Among men, percentage contributions of SF to energy, carbohydrate, and protein requirements were 34.9%, 108% and 51.2%, respectively. For fibre intake, SF contributed 23.7% of the RDA in men aged 19–50 years, but did not contribute in men aged ⩾51 years (0.0%). For micronutrients, contributions of SF to vitamin A, vitamin C, and calcium requirements were 37.1%, 23.4% and 16.1%, respectively, while those of zinc and iron were 89.1% and 123%, respectively.

Among women, percentage contributions of SF to energy, carbohydrate, and protein requirements were 28.5%, 68.8% and 32.8%, respectively. For fibre intake, SF contributed 26.0% of the RDA in women aged 19–50 years and 31.0% in those aged ⩾51 years. Regarding micronutrients, SFs contributed 19.6% of the RDA for vitamin A, 23.5% for vitamin C, and 42.5% for zinc. For calcium, SF consumption contributed 7.8% of the RDA among women aged 19-50 years and 6.5% among those aged ⩾50 years. For iron intake, SFs provided 28.3% of the RDA among women aged 19-50 years and 61.3% among those aged 50 years and older.

Table 2. Estimated nutrient intake of market traders in Uyo

Nutrient	RDA	Age (years)	Street Food Consumers		Non-Consumers of Street Foods		Total		p-value
			Median (IQR)	Adequacy No (%)	Median (IQR)	Adequacy No (%)	Median (IQR)	Adequacy No (%)	
Men									
Energy (kcal/d)	NA	NA	2351.7 (1922.4, 2961.8)	41 (47.7)	1962.5 (1861.2, 2048.7)	0 (0.00)	2334.1 (1922.4, 2950.0)	41 (41.8)	0.002*
Carbohydrate (g/d)	130	NA	355.7 (293.0, 465.2)	73 (100.0)	318.6 (272.9, 352.6)	12 (100.0)	350.2 (293.0, 463.0)	85 (100.0)	NA
Protein (g/d)	56	NA	76.5 (51.8, 99.3)	56 (65.1)	56.0 (45.8, 68.8)	6 (50.0)	68.1 (49.3, 94.3)	62 (63.3)	0.309
	38	19 - 50	20.2 (13.4, 35.8)	9 (11.1)	23.7 (16.9, 26.0)	0 (0.0)	20.8 (13.4, 30.1)	9 (9.7)	0.224
Fibre (g/d)	30	51 and above	33.1 (14.6, 33.1)	3 (60.0)	-	-	33.1 (14.6, 33.1)	3 (60.0)	NA
Vitamin A (RAE)	900	NA	632.9 (500.7, 849.0)	16 (18.6)	616.9 (596.3, 641.5)	0 (0.0)	632.9 (542.6, 828.5)	16 (16.3)	0.102
Vitamin C (mg/d)	90	NA	106.6 (75.0, 163.5)	55 (64.0)	102.7 (78.4, 115.5)	9 (75.0)	105.5 (75.0, 145.6)	64 (65.3)	0.451
Calcium (mg/d)	1000	NA	477.9 (387.8, 707.4)	3 (3.5)	548.8 (531.1, 573.5)	0 (0.0)	499.0 (389.2, 699.6)	3 (3.1)	0.511
Zinc (mg/d)	11	NA	13.8 (11.6, 17.1)	69 (80.2)	11.1 (9.9, 11.4)	6 (50.0)	13.5 (11.2, 17.1)	75 (76.5)	0.021*
Iron (mg/d)	8	NA	24.2 (17.7, 24.5)	86 (100.0)	18.8 (17.2, 18.9)	12 (100.0)	19.4 (17.2, 24.5)	98 (100.0)	NA
Women									
Energy (kcal/d)	NA	NA	1811.0 (1420.5, 2178.7)	100 (43.9)	1989.4 (1655.4, 2352.7)	45 (48.9)	1829.4 (1443.0, 2243.4)	145 (45.3)	0.242
Carbohydrate (g/d)	130	NA	279.5 (210.8, 335.7)	220 (98.7)	290.4 (243.5, 342.2)	89 (100.0)	280.7 (220.6, 340.8)	309 (99.0)	0.272
Protein (g/d)	46	NA	48.7 (38.0, 68.4)	133 (58.3)	63.8 (35.8, 91.5)	57 (62.0)	50.4 (37.2, 73.3)	190 (59.4)	0.550
Fibre (g/d)	25	19 – 50	15.7 (10.7, 21.3)	20 (12.1)	15.9 (10.4, 22.1)	6 (10.7)	15.7 (10.7, 21.3)	26 (11.8)	0.495
	21	51 and above	14.5 (8.8, 20.9)	15 (23.8)	17.0 (12.4, 22.3)	15 (41.7)	14.5 (10.9, 21.7)	30 (30.3)	0.063
Vitamin A	700	NA	606.8 (403.7, 845.2)	77 (33.8)	674.3 (451.9, 841.0)	39 (43.8)	613.3 (415.3, 843.1)	116 (36.6)	0/095
Vitamin C (mg/d)	75	NA	86.1 (51.6, 136.2)	132 (57.9)	86.4 (56.5, 133.2)	53 (59.6)	86.3 (54.1, 135.2)	185 (58.4)	0.788
Calcium (mg/d)	1000	19 – 50	325.5 (229.9, 542.6)	0 (0.0)	337.0 (265.5, 535.0)	0 (0.0)	332.5 (237.5, 542.6)	0 (0.0)	NA
	1200	51 and above	445.1 (347.4, 567.7)	0 (0.0)	398.4 (323.9, 576.6)	0 (0.0)	420.1 (339.0, 567.7)	0 (0.0)	NA
Zinc	8	NA	11.9 (8.5, 13.8)	189 (82.9)	12.1 (9.1, 14.8)	81 (88.0)	11.5 (8.7, 13.8)	270 (84.4)	0.251
Iron (mg/d)	18	19 – 50	17.3 (12.4, 21.1)	75 (45.5)	18.5 (14.1, 21.2)	30 (53.6)	17.6 (13.0, 21.1)	105 (47.5)	0.293
	8	51 and above	16.9 (14.0, 20.5)	63 (100.0)	19.5 (15.5, 23.34)	36 (100.0)	17.5 (14.1, 22.9)	99 (100.0)	NA

IQR*: Interquartile range; NA: Not applicable, *Differences between groups are statistically significant at p < 0.05; EER used for energy*

Table 3. Street food consumption practices and obesity

SFs Practices	Overweight/Obesity			Abdominal Obesity			Total
	No	Yes	p-value	No	Yes	p-value	
Street Food Consumption							
Yes	197 (71.9)	117 (79.6)	0.084	173 (74.2)	140 (74.9)	0.488	314 (74.6)
No	77 (28.1)	30 (20.4)		60 (25.8)	47 (25.1)		107 (25.4)
Reasons for consumption of SFs							
Hunger	168 (85.3)	75 (64.1)	<0.001*	141 (81.5)	101 (72.1)	0.140	243 (77.4)
Time Constraints	26 (13.2)	39 (33.3)		29 (16.8)	36 (25.7)		65 (20.7)
Others	3 (1.5)	3 (2.6)		3 (1.7)	3 (2.1)		6 (1.9)
Preferred place of consumption of SFs							
At Home	6 (3.0)	3 (2.6)	0.044*	3 (1.7)	6 (4.3)	0.268	9 (2.9)
In the Market	181 (91.9)	114 (97.4)		163 (94.2)	131 (93.6)		295 (93.9)
Other Places	10 (5.1)	0 (0.0)		7 (4.0)	3 (2.1)		10 (3.2)

Table 3. Continue

Preferred eating occasion for SFs							
Breakfast	60 (30.5)	46 (39.3)	0.139	66 (38.2)	40 (28.6)	0.203	106 (33.8)
Lunch	131 (66.5)	65 (55.6)		101 (58.4)	94 (67.1)		196 (62.4)
In-between Meals	6 (3.0)	6 (5.1)		6 (3.5)	6 (4.3)		12 (3.8)
Weekly frequency of SF consumption							
Once	13 (6.6)	5 (4.3)	0.097	13 (7.5)	5 (3.6)	0.157	18 (5.7)
Twice	6 (3.0)	9 (7.7)		6 (3.5)	9 (6.4)		15 (4.8)
Thrice	103 (52.3)	50 (42.7)		89 (51.4)	63 (45.0)		153 (48.7)
More than three times	75 (38.1)	53 (45.3)		65 (37.6)	63 (45.0)		128 (40.8)
Weekly expenditure on SF consumption							
⩽ ₦500	15 (7.6)	9 (7.7)	0.263	6 (3.5)	18 (12.9)	<0.001*	24 (7.6)
₦600 – 2,000	151 (76.6)	79 (67.5)		134 (77.5)	96 (68.6)		230 (73.2)
₦2,100 – 5,000	28 (14.2)	26 (22.2)		33 (19.1)	20 (14.3)		54 (17.2)
> ₦5,000	3 (1.5)	3 (2.6)		0 (0.0)	6 (4.3)		6 (1.9)
Forms of SFs commonly consumed							
Main Meals	135 (68.5)	72 (61.5)	0.181	120 (69.4)	87 (62.1)	<0.001*	207 (65.9)
Flour based Products	15 (7.6)	12 (10.3)		6 (3.5)	21 (15.0)		27 (8.6)
Sugar Sweetened beverages	24 (12.2)	18 (15.4)		30 (17.3)	12 (8.6)		42 (13.4)
Fruits and Vegetables	17 (8.6)	6 (5.1)		6 (3.5)	17 (12.1)		23 (7.3)
Local Snacks	6 (3.0)	9 (7.7)		11 (6.4)	3 (2.1)		15 (4.8)

**Differences between groups are statistically significant at p < 0.05*

Table 4. Percentage contributions of street foods to energy and nutrients requirements among consumers

Nutrient	Age (years)	Men		Women		p-value	Total
		Median (IQR)	Contribution to REQ (%)	Median (IQR)	Contribution to REQ (%)		Median (IQR)
Energy (kcal/d)	NA	883.2 (629.3, 1205.8)	34.9	507.1 (269.1, 763.4)	28.5	< 0.001*	
Carbohydrate (g/d)	NA	140.1 (94.9, 203.9)	107.8	89.5 (52.3, 122.3)	68.8	< 0.001*	89.1 (58.7, 118.8)
Protein (g/d)	NA	28.8 (19.5, 36.5)	51.2	15.1 (8.9, 26.0)	32.8	< 0.001*	14.3 (9.6, 25.5)
Fibre (g/d)	19 - 50	9.0 (3.8, 17.6)	23.7	6.5 (4.0, 9.7)	26.0	0.005*	6.8 (4.0, 11.3)
	51 and above	0.0 (0.0, 0.0)	0.0	6.5 (1.2, 7.5)	31.0	0.233	5.9 (1.2, 7.4)
Vitamin A (RAE)	NA	334.0, (0.0, 402.5)	37.1	137.3 (30.5, 345.6)	19.6	0.167	135.6 (23.0, 340.1)
Vitamin C (mg/d)	NA	21.1 (11.3, 92.9)	23.4	17.6 (6.8, 48.2)	23.5	0.214	27.5 (10.6, 86.6)
Calcium (mg/d)	Calcium (males)	161.0 (72.5, 389.2) [@]	16.1	-	-	-	-
	19 - 50	-	-	77.8, (41.4, 116.7)	7.8	-	-
	51 and above	-	-	77.7 (34.9, 152.7)	6.5	-	-
Zinc	NA	4.9 (2.8, 7.7)	89.1	3.4 (1.2, 6.8)	42.5	0.090	4.2 (1.5, 7.1)
Iron (mg/d)	Iron (males)	9.8 (5.3, 15.6) [@]	122.5	-	-	-	-
	19 - 50	-	-	5.1 (3.1, 9.6)	28.3	-	-
	51 and above	-	-	4.9 (2.4, 13.1)	61.3		-

NA: Not applicable; REQ: Requirement (EER for energy; RDA for nutrients); [@]Values imputed for all males; *Differences in median intakes between groups are significant at p < 0.05.

DISCUSSION

This study evaluated the nutritional contributions of SF consumption to the nutrient intakes of traders in open markets within Uyo metropolis. Food-related trading activities dominated economic activities in the markets, corroborating the notion that traditional open markets in low-income settings constitute primary food outlets for accessing nutritious foods for members of the population (Hannah et al., 2022).

In line with our findings, high carbohydrate intakes have been reported in similar studies conducted among market traders in Nigeria (Afolabi et al., 2004; Oladoyinbo et al., 2019). In our research, cooked meals were the most commonly consumed street foods. These dishes are predominantly carbohydrate-based (such as rice, cassava-based swallows, yams, and plantain prepared in various forms). They are typically served with soups or sauces containing little or no vegetables. And because consumers have the option of choosing both the type and quantity of proteins to include when buying SF, some may choose to omit protein entirely, leading to variability in protein and low micronutrient intakes. Similarly, excessive carbohydrate intake among market traders in Nigeria has been previously attributed to a high intake of roots, tubers, cereals, and fried foods, as well as large portion sizes and frequent snacking (Afolabi et al., 2004; Awosan et al., 2014).

Overall, traders had inadequate intake levels for energy and most nutrients, except for carbohydrate, where the majority met 100.0% of the requirement. Previous studies have generally not reported low energy intakes among market traders in Nigeria (Afolabi et al., 2004; Oladoyinbo et al., 2019). Findings from our study may be linked to changes in food consumption resulting from the recent spike in food prices (Akidi & Ikue, 2024; Idisi et al., 2025) in Nigeria. This is because households often reduce the quantity and frequency of food consumption, and shift to cheaper and less diverse diets that are predominantly carbohydrate-based, following spikes in food prices (Elijah, 2010; Adekunle et al., 2020, 2024; Fajobi et al., 2024). This could explain why traders in the present study had adequate carbohydrate, but low energy and nutrient intakes. Iron intake adequacy was low among women aged 50 years and below, highlighting the urgent need for targeted intervention to reduce the risk of iron deficiency anaemia among women of reproductive age in the population. Iron deficiency anaemia, often resulting from menstruation, childbirth, low intake of iron-rich foods, etc., can cause serious health complications, including impaired physical and emotional well-being, as well as adverse pregnancy outcomes (Petraglia & Dolmans, 2022) in women of reproductive age within the setting.

Findings also revealed that SF consumption was a common practice among traders. Street foods in the present study were mainly comprised of cooked main meals, convenient foods, and SSBs that were consumed especially during lunch. Consumption of main meals, including rice, bread, roots and tubers, snacks, and pastries with SSBs appears to be the most common meal pairing practice in Nigeria (Israel & Samuel, 2020; Oyeyemi et al., 2024), aligning with observation in the present study. It is believed that these meals are both filling and affordable, which is why they are prevalent among traders. However, there is a need for policies that regulate and moderate the consumption of SSBs in this setting. Persistent intakes of carbonated drinks, along with energy-dense meals, constitute an important feature of the nutrition transition driving increased prevalence of obesity and diet-related diseases in the country (Oyeyemi et al., 2024).

Among consumers, SF contributed substantially to energy and nutrient intakes among traders. Studies on SF consumption among market traders in Nigeria and the African region, are scanty and often outdated (Oguntona & Tella, 1999; Afolabi et al., 2004). Furthermore, lack of information on contributions of SF to specific nutrient intakes among traders makes comparison of findings difficult. Nonetheless, Afolabi et al., (2004) attributed high energy intakes and obesity among market women to increased SF consumption. Energy and nutrient intakes derived from SF among women traders in Abeokuta (Oguntona & Tella, 1999) were considerably higher than those from the present study. Differences in contribution of SFs to dietary intakes may be attributed to several factors, including socio-cultural differences in food intakes between regions. Energy and nutrient intake values obtained from SF consumption differed significantly and were higher among men. A study in Uganda indicated that men often ate more SFs, even in higher frequency and portion sizes than women, leading to higher contribution of SF intakes (Sseguya et al., 2020). The marked differences in fibre intake values from SF consumption between younger men and women may also have resulted from differences in food preferences. However, there are no consistent information on sex differences in vegetables or fibre-rich foods consumption (Nasreddine et al., 2020; Igarashi et al., 2024), particularly among traders.

Prevalence of overweight reported in the present study is comparable to values reported in studies across Nigeria (Charles-Davies et al., 2012; Okudu & Nwabekee, 2016; Anyabolu & Okoye, 2017; Oladoyinbo et al., 2019). Conversely, prevalence of obesity among market traders in the present study is far lower than those reported in some previous studies (Charles-Davies et al., 2012; Okudu and Nwabekee, 2016; Anyabolu and Okoye, 2017). Relatively low prevalence of obesity has been reported among traders in Abeokuta (3.7%), and another southwest location (8.0%) in Nigeria (Dada, 2017; Oladoyinbo et al., 2019). Low rates of obesity alongside high rates of overweight among market traders in these regions may reflect a transitional stage in nutrition and lifestyle, where increased energy intake and physical inactivity has led to weight gain enough to indicate overweight but yet to manifest as obesity.

The positive relationship between SF consumption and obesity in our research aligns with findings from other studies. Consumption of energy-dense meals, along with sugary drinks often causes high energy intakes, leading to weight gain and overweight/obesity among traders (Oyeyemi et al., 2024). The moderate, but consistent expenditure on SFs noted in the present study confirms the popularity of SFs among traders. Street food consumption was significantly associated with overweight/obesity, and may be explained by heavy patronage of SF vendors for their convenient, accessible, and affordable meals. This patronage therefore translates into higher expenditure on, and consumption of,

street foods, which in turn contributes to overweight and obesity (Okudu and Nwabekee, 2016; Oyeyemi et al., 2024). Hunger was the major reason for SF consumption in this study, and may manifest as a result of meal skipping associated with time constraints that limit the ability to prepare home-cooked meals. This often leads to over-reliance on snacking and SFs among traders, resulting in high energy intakes and weight gain (Okudu and Nwabekee, 2016), as was observed in this study.

Our findings have several public health implications. Street food consumption practices among traders in the study reveal typical features of nutrition transition in this setting. Increased consumption of SFs is often associated with overweight, obesity, and other diet-related NCDs. Moreover, findings indicated a substantial prevalence of overweight and obesity among traders. Traders are particularly vulnerable to high disease burdens from obesity, diabetes, cardiovascular diseases, and even cancers, occurring as a result of high intake of SSBs (Malik and Hu, 2022). These practices call for context-specific and targeted interventions to correct dietary abnormalities, ensure consumers' safety, and guard against widespread chronic diseases in the population.

The strength in our study lies in the adoption of age- and sex- specific dietary recommendations to evaluate nutrient adequacy. This minimized misclassifications of subjects for nutrient intakes. Street food consumption practices also revealed important information that helped explain some of the findings. For instance, consumption of SFs, especially in the form of cooked dishes, was popular among traders in this study and may have contributed to the high iron intakes observed across most groups. Street foods, served in the form of cooked meals, have been identified as important contributors to iron intakes among consumers in developing settings (Steyn et al., 2014), probably owing to the use of animal proteins – such as beef, goat meat, and offals - in many SF recipes. Furthermore, ingredients like iron-fortified bouillon cubes used in preparing SF may have increased the iron content of the meals, resulting in higher intakes. However, the cross-sectional design adopted in the study supports the establishment of associations, but limits the ability to draw causal inferences and potentially restricts the generalizability of findings beyond the study setting and time.

CONCLUSION

Market traders exhibited suboptimal energy intakes, as well as inadequate intakes of dietary fibre and selected micronutrients, particularly vitamin A, and calcium. Additionally, women of reproductive age may be at risk of iron deficiency due to inadequate iron intake. Consumption of SF, especially in the form of cooked meals and SSBs, was often taken as lunch. Street foods made substantial contributions to both energy and nutrient intakes among consumers. Overweight, general, and abdominal obesity were prevalent among traders. Policy regulations that can modify the broader food environment around the marketplace and selectively promote the preparation and sales of healthier meals by SF vendors are important.

AUTHOR CONTRIBUTIONS

Conceptualization and methodology: NNE, YEA and TEE. Data curation: TEE. Formal analysis: NNE, YEA and TEE. Supervision: NNE and YEA. Writing – original draft: NNE. Writing-review and editing: YEA. All authors read and approved the final version of the manuscript for publication.

CONFLICT OF INTEREST

The authors declare that they have no other potential conflicts of interest.

ETHICAL CONSIDERATIONS

Ethical approval for the study was obtained from the Health Research Ethics Committee of the University of Uyo (UU/CHS/IHREC/VOL.1/103). The research was conducted in line with the principles of the Declaration of Helsinki.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN SCIENTIFIC WRITING

ChatGPT (OpenAI) was used solely for language editing to improve clarity and flow. The authors are fully responsible for the content.

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