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Assessing diet quality and its determinants among adults in two Southern Nigerian States

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ABSTRACT

Background: Adherence to high-quality dietary patterns is crucial for preventing diet-related chronic diseases. However, global dietary shifts towards energy-dense, nutrient-poor foods are prevalent. **Aim:** This study aimed to assess diet quality (DQ) among adults in two States – Akwa Ibom State (AKS) and Cross River State (CRS) in southern Nigeria. **Methods:** Diet quality was evaluated using the Diet Quality Index-International (DQI-I), comprising components of food variety, adequacy, moderation, and balance. Binary logistic regression was employed to examine factors associated with low diet quality. **Results**. Among 1,188 adults (mean age: 35.47 ± 11.2 years), the mean DQI-I score was 56.08 ± 7.3. Mean scores for DQI-I components were 11.24 ± 3.9, 24.43 ± 4.8, 19.70 ± 5.8, and 0.70 ± 1.5 for total food variety, dietary adequacy, moderation, and overall balance, respectively. Low diet quality was significantly more prevalent among adults in AKS (p = 0.001), females (p = 0.034), and rural dwellers (p = 0.003). Further analyses revealed that, rural dwellers [Adjusted Odd Ratio (AOR): 0.72; 95% Confidence Interval (CI): (0.55 – 0.93); p = 0.014] and females [AOR: 0.76; CI: (0.60 – 1.00); p = 0.028] were less likely to adopt moderate-to-high DQ, when compared to their respective counterparts. **Conclusion:** This study revealed suboptimal diet quality among adults in Akwa Ibom and Cross River States in southern Nigeria. Dietary intakes were characterized by dietary adequacy, moderation and appreciably, food variety. Targeted interventions addressing all aspects of diet quality are necessary to improve dietary patterns and reduce the burden of diet-related diseases.

Keywords: Diet Quality Index-International, total food variety, dietary adequacy, moderation, overall balance, South-South Nigeria.

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1 Introduction

A high-quality diet is characterized by a balanced consumption of various foods in appropriate quantities to fulfill nutritional needs while mitigating chronic disease risk. Such diets prioritize nutrient-dense foods, emphasizing variety, adequacy, and moderation. Dietary guidelines often underscore these principles to promote optimal dietary patterns (U.S. Department of Health and Human Services & U.S. Department of Agriculture, 2015; National Health and Medical Research Council, 2019 .

Adequate dietary intake necessitates the consumption of nutrient-dense foods to support growth, development, and overall health within appropriate energy levels. Careful consideration of energy sources is crucial, aiming to limit excessive intake of saturated and total fats while balancing energy expenditure. It is well established that diverse food consumption is essential to ensure adequate intake of various micronutrients. Moderation in the consumption of sodium, saturated fats, cholesterol, and added sugars is vital for preventing chronic disease development.

A global shift towards energy-dense, nutrient-poor diets has emerged as a critical public health concern (Pokin et al., 2012). Recent findings reveal dietary patterns predominantly feature starchy staples such as cassava, yam, rice and maize with limited vegetable consumption (Chiaka et al., 2022). Consequently, micronutrient deficiencies are prevalent due to inadequate intake of fruits and animal-source foods

(Mekonnen et al., 2021). The convergence of poor diet quality, characterized by excessive energy intake and insufficient micronutrient consumption, with non-communicable diseases (NCDs) poses a significant public health challenge.

The World Health Organization (WHO) has identified dietary factors and physical inactivity as primary drivers of the global NCD epidemic (WHO, 2021, 2023). Approximately 77.0% of global annual deaths are attributed to NCDs, with over three quarter of these deaths occurring in low- and middle-income countries (LMICs) (WHO, 2023). However, health systems in LMICs are among the least equipped to manage the growing burden of NCD burdens in their populations (Bollyky et al., 2017). In Nigeria, the highest prevalence of overweight and obesity is observed in the South-South geopolitical zone (Chukwuonye et al., 2022).

Evaluating the quality of dietary intakes can highlight key characteristics of the prevailing intake patterns within the population and inform on appropriate intervention measures to protect individuals against the detrimental effects of poor diets. Several studies assessing dietary intake in Nigeria frequently utilize methodologies that do not provide comprehensive information on the overall quality of dietary intakes typically focusing on nutrient intake adequacy and/or dietary diversity. Whereas, several DQ indices have been developed to evaluate the overall diet and categorize individuals based on the healthfulness of their eating behaviors (Gil et al., 2015). The DQI-I developed by Kim et al., (2003), is a comprehensive measure of diet healthfulness, capturing various aspects of DQ, including both under-nutrition and over-nutrition, and considering most features of high-quality diet. This study was conducted to assess DQ among adults in Southern Nigeria.

2 Material and Methods

2.1 Study design and participants

A cross-sectional study was conducted among adults aged 20 – 64 years old to examine dietary quality. This age range was selected to exclude adolescents (WHO, 2016 and the elderly population. To enhance data reliability, participants were required to have resided in the study area for at least two years prior to enrollment. To further ascertain eligibility of respondents, individuals experiencing pregnancy, lactation, illness, fasting, or significant life events were excluded from the study.

2.2 Study location

The study was conducted in AKS and CRS states in the South-South geo-political zone in Nigeria. These states share cultural and historical ties, having been a single entity before the creation of Akwa Ibom state. Covering land areas of 7,249 km2 and 23,074 km2, respectively, the States have populations of 7.2 and 2.89 million. Both States primarily engage in agriculture, trade, and public service, with a significant proportion engaging in agricultural activities in Cross River State. The predominant ethnic groups in Akwa Ibom are Ibibio, Anaang, and Oron, while Cross River State is inhabited primarily by Efik, Bekwarra, and Ejagham people.

2.3 Sampling techniques

The states were selected based on their similarity in food culture and other lifestyle factors. Two Local Government Areas (LGAs) were randomly selected from each of the three Senatorial Districts within both states resulting in a total of 12 LGAs. Subsequently, one urban and two rural electoral wards were randomly selected from each LGA to reflect the urban-rural disparities in population density (Akwa Ibom State Government, 2015; NPC & ICF, 2009). One community was randomly selected from each ward. Eligible households, defined as those with residents aged 20 years and older, were selected using identified systematic random sampling. Adults aged 20 to 64 years residing in these households were included in the study.

2.4 Sample size determination

Sample size calculations were conducted to ensure adequate statistical power. A prevalence rate of 22.2% for obesity among Nigerian adults (Chukwuonye et al., 2013 , was used as the basis for estimation. To achieve a precision level of 2.5% with a 95% confidence interval, the required sample size was determined using the following formula:

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

where;

n = represents the minimum sample size;
z = the normal deviate corresponding to the desired confidence interval = 1.96
p = the proportion of elements in the study population with the key attribute being measured = 22.2%
q = unaffected population = 77.8%
d = the desired degree of accuracy = 2.5%

To account for a potential 10.0% attrition rate, the calculated sample size of 1,168 was increased to 1,188 included in this study.

2.5 Ethical considerations

Ethical approval for this study was granted from the Human Ethics Committee of the University of Ibadan/University

College Hospital (UI/EC/21/0098). Written informed consent was obtained from all participants and participants' confidentiality was strictly maintained throughout the study.

2.6 Data collection

2.6.1 Socio-demographic characteristics

To investigate potential ecological influences on dietary patterns (Gibson, 2023 , sociodemographic data were collected. Information obtained included urban-rural settings, sex, age, marital status, education, primary occupation and income.

2.6.2 Dietary intake assessment

Dietary intake data were obtained using a multi-pass 24-hour dietary recall (Gibson and Freguson, 2008). Prior to the interview, participants were guided through a structured recall process to enumerate all food and beverage items consumed within the preceding 24 hours, including consumption times, locations, and sources. To enhance data accuracy, participants were prompted to describe food items in detail and estimate portion sizes using familiar household measures. Four distinct passes were adopted in obtaining food consumption information from respondents. The first pass assisted participants to list all items consumed on the reference day. Information on time, eating occasions, place and food sources were also obtained. Information on food sources was important where participants were unable to provide sufficient information for adequate portion size estimation for items bought and consumed outside the home. In such instances, participants were asked to provide information on prices and outlets where the foods were purchased and eaten. The items were eventually bought from respective outlets to obtain respective food weights. In addition to detailed description of foods in second pass, interviewers probed for possible omissions and food additions that may not have been reported during food listing in the first pass. During the third pass, portion sizes of all foods consumed were estimated using simple household measures (such as teaspoon, tablespoon, serving spoon, measuring cup, plates, sales measures and food models) and recorded. For packed foods, information reported on food labels were recorded. The fourth pass consisted of detailed reviews of information obtained from the first three passes to ensure clarity and accuracy.

2.7 Data analyses

2.7.1 Dietary analyses

Dietary data collected through the 24-hour recall were analyzed using the DQI-I to assess overall diet quality (Kim et al., 2003). The DQI-I has a total score range of 0 to 100 and comprises four components: total food variety, dietary adequacy, moderation, and overall balance. Total food variety was assessed by evaluating both overall food group consumption and within-group diversity of protein sources (meat/poultry/fish/eggs; dairy/beans; grain; fruit and vegetable) and within-group variety for protein sources (meat, poultry, fish, dairy, beans and eggs). This component has a score range of 0 – 20 points, 0 to 15 points for overall food group variety and 0 -5 points for within-group variety. The dietary adequacy component, having a score range of 0 - 40 points, measures the intake of eight items - vegetables, fruits, grains, fiber, protein, iron, calcium and vitamin C intakes. The DQI-I was adapted to suit the Nigerian population; for example, 'starchy roots and tubers' was incorporated into the grain food group aligning with the Nigerian Food Guide pyramid (Federal Ministry of Health, 2001). Starchy roots and tubers form important dietary staples in the country, as such, roots and tuber-based foods were included as part of items assessed for consumption under grains intake. Each item received a minimum of 0 point for no intake and a maximum of 5 points for attaining 100% adequate level, depending on the energy level. Moderation component, with a score range of 0 – 30 points assesses consumption of - total fat, saturated fat, cholesterol, sodium and empty calorie foods. Each component had a maximum of 6 points for optimum intake levels and 0 point for exceeding safe levels. Overall balance assesses energy contributions from both macronutrients - carbohydrate, protein and fat (0 – 6 points) and fatty acid - polyunsaturated, monounsaturated and saturated fatty acids (0 – 4points).

2.7.2 Statistical analyses

Data were analyzed using IBM-SPSS Statistics version 20. To assess the normality of continuous variables, the Kolmogorov-Smirnov (K-test was employed. Diet quality scores were categorized into terciles: (low (T1, moderate (T2, and high (T3 based on DQI -I values. Independent samples T-test was conducted to report mean differences in DQI-I scores between States and sexes. Chi-Square tests examined the association between DQ and sociodemographic characteristics. Binary logistic regression was utilized to identify predictors of low versus moderate-to-high diet quality, with diet quality tertiles recategorized accordingly. Statistical significance was set at α=0.05.

3 Results

3.1 Socio-demographic information

The study included 1,188 adults, with a mean age of 35.47 ± 11.2 years. Participants were distributed across Akwa Ibom (56.1%) and Cross River (43.9%) States. The sample comprised 50.4% females and 65.7% rural residents. Educational attainment was relatively high, with 94.9% of participants completing at least primary education. The

predominant occupations were agriculture (31.8%), followed by formal employment (18.8%), informal trading (14.2%), and casual labor (12.1%). Approximately 71.8% of participants reported incomes below the national minimum wage.

Table 1. Socio-demographic characteristics

Variables	Number (Percentage)
State	
- Akwa Ibom	667 (56.1)
- Cross River	521 (43.9)
Residence	
- Urban	408 (34.3)
- Rural	780 (65.7)
Sex	
- Male	589 (49.6)
- Female	599 (50.4)
Age	
- < 40 years	781 (65.7)
- ≥ 40 years	407 (34.3)
Marital Status	
- Single	637 (53.6)
- Married	119 (10.0)
- Divorced and others	432 (36.4)
Education	
- None	60 (5.1)
- Primary	254 (21.4)
- Secondary	623 (52.4)
- Tertiary	251 (21.1)
Primary Occupation	
- Civil/Public Service	109 (9.2)
- Registered Business/Artisan	223 (18.8)
- Agriculture Related Activities	378 (31.8)
- Company/Casual Work	165 (13.9)
- Petty Trading	169 (14.2)
- Others (including unemployed)	144 (12.1)
Income (Naira)	
- ≤ 30,000	853 (71.8)
- > 30,000	335 (28.2)

3.2 Diet Quality Scores

The mean DQI-I score obtained from this study was 56.08 ± 7.3 as shown in Table 2. While dietary adequacy (24.43 ± 4.8) and moderation (19.70 ± 5.8) components demonstrated relatively higher scores, total food variety (11.24 ± 3.9) and overall balance (0.70 ± 1.5) were notably lower. Within the food variety component, animal protein consumption was particularly low (1.82 ± 1.5). Adequate intake was observed for grains/tubers (4.71 ± 0.9); protein (4.59 ± 0.8); iron (4.21 ± 1.2); vitamin C (3.97 ± 1.5) and fiber (3.97 ± 1.5). However, fruit (0.23 ± 1.1), vegetables (1.68 ± 1.2) and calcium (1.79 ± 1.1) intakes were suboptimal. Moderation was evident in cholesterol (5.82 ± 0.9), empty calorie foods (5.31 ± 1.7) and sodium (4.32 ± 2.3) consumption, when intake of total and saturated fats was excessive (2.20 ± 2.4) and (2.05 ± 2.6), respectively.

3.3 Factors associated with diet quality

Independent samples *t*-test revealed significant differences ($p < 0.001$) in DQI-I score between CRS (56.99 ± 7.1) and AKS (55.37 ± 7.3). The mean scores for selected components and sub-components of the DQI-I also differed between States. Comparative analysis of DQI-I components indicated greater dietary diversity among residents of Akwa Ibom State (11.72 ± 4.1) compared to Cross River State (10.63 ± 3.6) ($p < 0.001$). While overall dietary adequacy did not differ significantly between the two states ($p = 0.376$), Akwa Ibom State residents exhibited higher consumption of fruits (0.43 ± 1.3 vs. 0.18 ± 0.9, $p < 0.05$) and calcium (1.90 ± 1.2 vs. 1.66 ± 1.1, $p < 0.05$). Conversely, Cross River State residents demonstrated higher grains/tubers intake (4.81 ± 0.7 vs. 4.63 ± 1.0, $p < 0.001$) and overall dietary moderation (21.18 ± 5.8 vs. 18.55 ± 5.6, $p < 0.001$). Specifically, moderation in total fat (2.66 ± 2.4 vs. 1.84 ± 2.3), saturated fat (2.57 ± 2.6 vs. 1.65 ± 2.4), and sodium (4.69 ± 2.1 vs. 4.03 ± 2.5) consumption was significantly higher in Cross River State ($p < 0.05$).

The distribution of adults across DQ terciles differed appreciably between States (Table 3). Akwa Ibom State exhibited a higher prevalence of low diet quality (37.8%), compared to Cross River State (27.6%) $p = 0.001$. However, multivariate analysis did not identify state as an independent predictor of diet quality as shown in Table 4 (AOR = 1.08; CI: 0.64 – 1.82; $p = 0.782$).

Further socio-demographic characteristics displayed significant associations with diet quality as summarized in Table 3. Rural residents demonstrated a higher prevalence of low diet quality (36.0%) compared to urban counterparts (28.2%) ($p = 0.003$). Multivariate analysis confirmed a lower likelihood of achieving moderate-to-high diet quality among rural dwellers (AOR = 0.72, CI: 0.55-0.93, $p = 0.014$) compared to urban residents. When classified into sex and age groups, only males in rural settings (AOR: 0.68; CI: (0.46 – 0.99); $p = 0.046$) and adults <40 years old who dwell in rural settings (AOR: 0.68; CI: (0.49 – 0.98); $p = 0.016$), were less likely to follow moderate-to-high DQ patterns. Sex also had remarkable relationship with DQ. While males exhibited a slightly higher mean DQI-I score (56.48 ± 7.3) compared to females (55.68 ± 7.2), this difference was not statistically significant ($p = 0.057$). However, males demonstrated significantly higher dietary adequacy (24.90 ± 4.6 vs. 23.98 ± 5.0, $p = 0.001$).

Table 2. Diet Quality Components among Adults in Southern Nigeria

DQI-I Component	State			Sex			Total
	Akwa Ibom	Cross River	*p*-value	Male	Female	*p*-value	
Total DQI-I Score (100)	55.37 ± 7.3	56.99 ± 7.1	**<0.001***	56.48 ± 7.3	55.68 ± 7.2	0.057	56.08 ± 7.3
Total Food Variety (20)	11.72 ± 4.1	10.63 ± 3.6	**<0.001***	11.30 ±3.8	11.19 ± 4.0	0.605	11.24 ± 3.9
- Overall food group variety (15)	9.73 ± 2.7	9.03 ± 2.4	**<0.001***	9.45 ± 2.6	9.40 ± 2.7	0.758	9.42 ± 2.7
- Within-group Variety for protein Sources (5)	1.99 ± 1.9	1.60 ± 1.4	**<0.001***	1.85 ± 1.5	1.78 ± 1.5	0.431	1.82 ± 1.5
Dietary Adequacy (40)	24.54 ± 5.2	24.30 ± 4.4	0.376	24.90 ± 4.6	23.98 ± 5.0	**<0.001***	24.43 ± 4.8
- Vegetable group (5)	1.63 ± 1.3	1.74 ± 1.2	0.121	1.71 ± 1.2	1.66 ± 1.2	0.466	1.68 ± 1.2
- Fruits group (5)	0.43 ± 1.3	0.18 ± 0.9	**<0.001***	0.24 ± 1.0	0.40 ± 1.3	**0.011***	0.23 ± 1.1
- Grains/Tuber group (5)	4.63 ± 1.0	4.81 ± 0.7	**<0.001***	4.72 ± 0.8	4.69 ± 0.9	0.541	4.71 ± 0.9
- Fiber (5)	3.18 ± 1.3	3.16 ± 1.6	0.831	3.14 ± 1.4	3.21 ± 1.3	0.337	3.17 ± 1.4
- Protein (5)	4.59 ± 1.3	4.58 ± 0.9	0.373	4.60 ± 0.8	4.57 ± 0.8	0.604	4.59 ± 0.8
- Iron (5)	4.23 ± 1.2	4.17 ± 1.2	0.388	4.77 ± 0.7	3.65 ± 1.3	**<0.001***	4.21 ± 1.2
- Calcium (5)	1.90 ± 1.2	1.66 ± 1.1	**<0.001***	1.84 ± 1.1	1.75 ± 1.2	0.172	1.79 ± 1.1
- Vitamin C (5)	3.94 ± 1.5	4.00 ± 1.4	0.517	3.89 ± 1.5	4.04 ± 1.5	0.065	3.97 ± 1.5
Moderation (30)	18.55 ± 5.6	21.18 ± 5.8	**<0.001***	19.60 ± 6.0	19.80 ± 5.7	0.558	19.70 ± 5.8
- Total fat (6)	1.84 ± 2.3	2.66 ± 2.4	**<0.001***	2.31 ± 2.4	2.10 ± 2.4	0.132	2.20 ± 2.4
- Saturated fat (6)	1.65 ± 2.4	2.57 ± 2.6	**<0.001***	2.07 ± 2.6	2.03 ± 2.5	0.790	2.05 ± 2.6
- Cholesterol (6)	5.80 ± 1.0	5.85 ± 0.9	0.375	5.81 ± 1.0	5.84 ± 0.9	0.537	5.82 ± 0.9
- Sodium (6)	4.03 ± 2.5	4.69 ± 2.1	**<0.001***	4.31 ± 2.3	4.32 ± 2.4	0.982	4.32 ± 2.3
- Empty calorie foods (6)	5.24 ± 1.8	5.41 ± 1.6	0.079	5.10 ± 1.9	5.51 ± 1.4	**<0.001***	5.31 ± 1.7
Overall Balance (10)	0.55 ± 1.3	0.88 ± 1.6	**0.002***	0.68 ± 1.4	0.71 ± 1.5	0.740	0.70 ± 1.5
- Macronutrient ratio (6)	0.54 ± 1.3	0.81 ± 1.5	**0.025***	0.66 ± 1.4	0.66 ± 1.5	0.958	0.66 ± 1.4
- Fatty acid ratio (4)	0.02 ± 0.3	0.08 ± 0.5	**<0.001***	0.03 ± 0.4	0.05 ± 0.5	0.421	0.04 ± 0.4

**Differences in DQI-I scores between groups are statistically significant at* α0.05

As well, males exhibited significantly higher iron intake (4.77 ± 0.7) compared to females (3.65 ± 1.3) ($p < 0.001$). Conversely, fruit consumption was higher among females (0.40 ± 1.3) than males (0.24 ± 1.0) ($p = 0.011$). Females also demonstrated greater moderation in empty calorie food consumption (5.51 ± 1.4) compared to males (5.10 ± 1.9) ($p < 0.001$). Chi-square analysis revealed a higher prevalence of low diet quality among females (36.6%) compared to males (30.1%) ($p = 0.034$) as shown in Table 3. Multivariate analysis confirmed a lower likelihood of achieving moderate-to-high diet quality among females (AOR = 0.76, CI: 0.60-1.00, $p = 0.028$), particularly those aged under 40 (AOR = 0.68, CI: 0.50-0.92, $p = 0.012$).

4 Discussion

The mean DQI-I score of 56.08 ± 7.3 indicates a moderate level of diet quality among the study population. These findings align with previous research reporting comparable DQI-I scores in Korea (59.1 ± 8.7 to 61.7 ± 7.1) (Shin et al., (2015), Tunisia (59.5 ± 0.3) (Abassi et al., 2019) and Southeast Nigeria (58.8 ± 8.1) (Onyeji and Sanusi, 2018). Diet adequacy, moderation, and variety emerged as the primary contributors to overall diet quality in the present study. While it was comparable to findings in other studies, the overall balance component was notably lower. This discrepancy with previous research, particularly among Nigerian women of reproductive age (Onyeji and Sanusi, 2018), warrants further investigation. Similar patterns in the contribution of individual DQI-I components to overall diet quality were observed in a study conducted among Indian adults (Mediratta and Mathur, 2023).

The limited representation of within-group protein source variety underscores the underconsumption of these essential nutrients in the study population. These findings corroborate previous research findings highlighting the low consumption of animal-source foods in developing regions (Dasi et al., 2019; Ahmed and Salih, 2019). Animal-based proteins are crucial for fulfilling daily essential amino acid requirements, a function often inadequately addressed by plant-based protein sources unless complemented by other animal proteins or specific amino acid-rich plant foods.

Socioeconomic factors, including food costs and income, as well as sociocultural influences, likely contributed to the low consumption of animal-source foods observed in this study,

Table 3. Factors associated with diet quality among adults in Southern Nigeria

Variables	Low Number (%)	Average Number (%)	High Number (%)	*p*-value
State				
- Akwa Ibom	252 (37.8)	215 (32.2)	200 (30.0)	**0.001***
- Cross River	144 (27.6)	182 (34.9)	195 (37.4)	
Urban-rural Setting				
- Urban	115 (28.2)	133 (32.6)	160 (39.2)	**0.003***
- Rural	281 (36.0)	264 (33.8)	235 (30.1)	
Sex				
- Male	177 (30.1)	212 (36.0)	200 (34.0)	**0.034***
- Female	219 (36.6)	185 (30.9)	195 (32.6)	
Age				
- < 40 years	269 (34.4)	259 (33.2)	253 (32.4)	0.500
- ≥ 40 years	127 (31.2)	138 (33.9)	142 (34.9)	
Marital Status				
- Single	162 (37.5)	140 (32.4)	130 (30.1)	
- Married	197 (30.9)	217 (34.1)	223 (35.0)	0.216
- Divorced and others	37 (31.1)	40 (33.6)	42 (35.3)	
Education				
- None	22 (36.7)	18 (30.0)	20 (33.3)	
- Primary	91 (35.8)	78 (30.7)	85 (33.5)	0.582
- Secondary	196 (31.5)	225 (36.1)	202 (32.4)	
- Tertiary	87 (34.7)	76 (30.3)	88 (35.1)	
Primary Occupation				
- Civil/Public Service	44 (40.4)	33 (30.3)	32 (29.4)	
- Registered Business/Artisan	71 (31.8)	75 (33.6)	77 (34.5)	
- Agriculture Related Activities	124 (32.8)	114 (30.2)	140 (37.0)	
- Company/Casual Worker	57 (34.5)	64 (38.8)	44 (26.7)	
- Petty Trading	59 (34.9)	64 (37.9)	46 (27.2)	
- Others (including unemployed)	41 (28.5)	47 (32.6)	56 (38.9)	0.147
Income				
- ≤ 30,000	289 (33.9)	286 (33.5)	278 (32.6)	0.713
- > 30,000	107 (31.9)	111 (33.1)	117 (34.9)	

**Differences in DQI-I scores amongst Terciles are statistically significant at* α 0.05

Table 4. Predictors of diet quality among adult males and females in Southern Nigeria

Variables		Total		Male		Female		< 40 Years		≥ 40 Years	
		AOR (95 CI)	*p*-value	AOR (95 CI)	*p*-value	AOR (95 CI)	*p*-value	AOR (95 CI)	*p*-value	AOR (95 CI)	*p*-value
State	**Cross River**	1.08 (0.64 - 1.82)	0.782	1.37 (0.62 – 3.05)	0.438	0.88 (0.44 -1.80)	0.733	1.11 (0.58 –2.14)	0.753	1.04 (0.42 – 2.55)	0.940
Setting	**Rural**	0.72 (0.55 – 0.93)	0.014*	0.68 (0.46 – 0.99)	0.046*	0.75 (0.52 –1.08)	0.118	0.68 (0.49 –0.98)	0.016*	0.79 (0.49 – 1.28)	0.338
Sex	**Female**	0.76 (0.60 – 1.00)	0.028*	-	-	-	-	0.68 (0.50 –0.92)	0.012*	1.60 (0.63 – 4.06)	0.323
Ethnicity	**Efik / Ejagham**	1.55 (0.90 - 2.68)	0.116	1.30 (0.57 – 2.97)	0.534	1.78 (0.85 –3.72)	0.125	1.51 (0.77 –2.97)	0.236	0.37 (0.08 – 1.76)	0.209
	Others	0.85 (0.37 - 1.96)	0.709	0.68 (0.21 – 2.20)	0.52	1.07 (0.33 –3.48)	0.906	1.22 (0.44 –3.37)	0.698	0.95 (0.62 – 1.45)	0.812

aligning with findings from other studies (Haileselassie et al., 2020).

While overall dietary adequacy was slightly above average compared to Southeast Nigeria (Onyeji and Sanusi, 2018), it fell short of levels reported in Korea (Shin et al., 2015) and Tunisia (Abassi et al., 2019). The insufficient calcium intake observed in this study may be attributable to the low consumption of dairy products, a common dietary pattern in Nigeria (Petrikova et al., 2019). Contrary to expectations, vegetable consumption was notably low, challenging the perception of abundant vegetable intake in African diets (Dasi

et al., 2019; Okop et al. 2019). Studies evaluating vegetable intake in African regions often employ dietary diversity and food frequency assessments. While these methods may indicate frequent vegetable consumption, they may not accurately capture intake quantities, potentially underestimating nutrient intake.

With regard to moderation, the current study indicated a higher level of dietary control compared to Tunisian and Korean populations (Abassi et al., 2019; Shin et al., 2015, but lower than that observed in Southeast Nigeria (Onyeji and Sanusi, 2018 . The lower cholesterol intake aligns with dietary recommendations (U.S. Department of Health and Human Services & U.S. Department of Agriculture, 2015; Institute of Medicine, 2005 , potentially reflecting the reduced consumption of animal-source foods. However, excessive intake of total and saturated fats indicates suboptimal dietary fat selection. The overall balance component, reflecting adherence to Appropriate Macronutrients Distribution Ranges (AMDRs , was notably low compared to previous studies in Tunisia (3.5 ± 0.1 (Abassi et al., 2019 ; Korea (2.1 ± 1.9 (Shin et al., 2015, and Southeast Nigeria (2.0 ± 1.8 (Onyeji and Sanusi, 2018 . This imbalance is associated with an increased risk of chronic diseases due to the potential for elevated saturated fat intake (Lee et al., 2015; National Academies of Sciences, Engineering, and Medicine, 2023 .

The observed higher diet quality in CRS compared to AKS may be attributed to geographic disparities influencing food environments and cultural practices (Kabir et al., 2018; Ng et al. 2018; Ekerette and Udo, 2023 . The predominance of agriculture in CRS, particularly subsistence farming, may have contributed to a more diverse and potentially healthier diet and exert some resilience against trends consistent with nutrition transition. These factors may have influenced the quality of diets in CRS against what is obtainable in AKS.

Urbanization was associated with higher diet quality, likely due to increased access to food options, higher educational attainment, and greater purchasing power (Martin et al., 2017; Rothman et al., 2019; Vogel et al., 2017). While males exhibited higher overall diet quality, this association was not consistent across all settings. The positive impact of urbanization on diet quality appeared to be more pronounced among males. Socioeconomic factors, particularly education and employment status, influenced diet quality disparities. It was indicated in previous research (Abassi et al., 2019), that, women, especially those with lower educational attainment and limited labor force participation, were more likely to exhibit lower diet quality.

Contrary to the findings of this study, previous research has reported higher diet quality among women compared to men (Bivoltsis et al., 2018; Pestoni et al., 2019 . However, these findings diverge from those of Abassi et al., (2019 who reported lower DQ among North African women. Explanations for the disparity in diet quality between sexes often cite factors such as greater health consciousness and body image concerns among women (Arganini et al., 2012 . The present study revealed that the lower diet quality among women was primarily attributable to younger age groups. This finding suggests that age may be a moderating factor influencing dietary patterns among women, with older women exhibiting better diet quality as reported in previous studies (Panizza et al., 2018; Winpenny et al., 2019 . Further exploration of sex-specific dietary patterns and associated determinants within this population is warranted to elucidate the underlying factors contributing to these disparities.

5 Conclusion

The present study revealed a moderate level of diet quality among adults in the study region, characterized by acceptable levels of dietary adequacy and moderation. However, limitations were observed in terms of food variety, particularly within the protein source group, and overall diet balance. Dietary adequacy was characterized by higher intakes of grain/tuber, protein, vitamin C, and iron but low dietary fiber, calcium, vegetable and fruit intakes. There were considerable moderations in consumption of cholesterol and empty calorie foods but not in total and saturated fats. Restriction in sodium intake was moderate. Geographic location, particularly the urban-rural divide, influenced diet quality, with urban residents exhibiting better dietary patterns. Sociodemographic factors, including sex and age, also played a role in shaping dietary behaviors. There is a need to reinforce the importance of assisting individuals with sufficient knowledge on appropriate ways to plan diets to ensure a representation of all aspects of diet quality. To improve dietary practices within the study population, targeted interventions aimed at enhancing dietary diversity, particularly in terms of protein and plant-based food sources, are essential. Additionally, promoting balanced macronutrient consumption and addressing the specific nutritional needs of different population subgroups is crucial.

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References

Abassi, M. M., Sassi, S., El Ati, J., Ben Gharbia, H., Delpeuch, F., & Traissac, P. (2019). Gender inequalities in diet quality and their socioeconomic patterning in a nutrition transition context in the Middle East and North Africa: a cross-sectional study in Tunisia. *Nutrition Journal, 18*(1), 18. https://doi.org/10.1186/s12937-019-0442-6

Ahmed, A. E., & Salih, O. A. (2019). Assessment of the Minimum Dietary Diversity of Reproductive Women in Saudi Arabia. *Pakistan Journal of Nutrition, 18*, 615–622. https://doi.org/10.3923/pjn.2019.615.622

Akwa Ibom State Government. (2014). Projected Population 2007-2015: Ministry of Economic Development, Uyo, Akwa Ibom State. Retrieved from: http://www.nigerianstat.gov.ng/pdfuploads/Population.pdf

Arganini, C., Saba, A., Comitato, R., Virgili, F., & Turrini, A. (2012). Gender Differences in Food Choice and Dietary Intake in Modern Western Societies. *Public Health - Social and Behavioral Health*, 83–102. https://doi.org/10.5772/37886

Bivoltsis, A., Trapp, G., Knuiman, M., Hooper, P., & Ambrosini, G. (2018). Can a simple dietary index derived from a sub-set of questionnaire items assess diet quality in a sample of Australian adults? *Nutrients*, *10*(4), 486. https://doi.org/10.3390/nu10040486

Blair, S. N., Kohl, H. W., 3rd, Paffenbarger, R. S., Jr, Clark, D. G., Cooper, K. H., & Gibbons, L. W. (1989). Physical fitness and all-cause mortality. A prospective study of healthy men and women. *JAMA*, *262*(17), 2395–2401. https://doi.org/10.1001/jama.262.17.2395

Bollyky, T. J., Templin, T., Cohen, M., & Dieleman, J. L. (2017). Lower-income countries that face the most rapid shift in noncommunicable disease burden are also the least prepared. *Health Affairs (Project Hope)*, *36*(11), 1866–1875. https://doi.org/10.1377/hlthaff.2017.0708

Chiaka, J. C., Zhen, L., & Xiao, Y. (2022). Changing food consumption patterns and land requirements for food in the six geopolitical zones in Nigeria. *Foods (Basel, Switzerland)*, *11*(2), 150. https://doi.org/10.3390/foods11020150

Chukwuonye, I. I., Chuku, A., John, C., Ohagwu, K. A., Imoh, M. E., Isa, S. E., Ogah, O. S., & Oviasu, E. (2013). Prevalence of overweight and obesity in adult Nigerians - A systematic review. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy, 6*, 43–47. https://doi.org/10.2147/dmso.s38626

Chukwuonye, I. I., Ohagwu, K. A., Ogah, O. S., John, C., Oviasu, E., Anyabolu, E. N., Ezeani, I. U., Iloh, G. U. P., Chukwuonye, M. E., Raphael, C. O., Onwuchekwa, U., Okafor, U. H., Oladele, C., Obi, E. C., Okwuonu, C. G., Iheji, O., Nwabuko, O. C., Nnoli, M. A., & Okpechi, I. G. (2022). Prevalence of overweight and obesity in Nigeria: Systematic review and meta-analysis of population-based studies. *PLOS Global Public Health, 2*(6), e0000515. https://doi.org/10.1371/journal.pgph.0000515

Dasi, T., Selvaraj, K., Pullakhandam, R., & Kulkarni, B. (2019). Animal source foods for the alleviation of double burden of malnutrition in countries undergoing nutrition transition. *Animal Frontiers, 9*(4), 32–38. https://doi.org/10.1093/af/vfz031

Ekerette, N., Udo, A. U., Ayandele, I. A., Udom, G. N., Effiong, G. O., Etuk, U. R., Ekpo, I. E., Inyang, U. G., Edet, G. E., & Moffat, I. (2023). Emerging Food Environments and Implications for Attaining Sustainable Development Goals in Africa. *Nyaudoh*, 401–409.

Federal Ministry of Health. (2001). Food-based dietary guidelines – Nigeria. Food and Agriculture Organization of the United Nations. Retrieved from: https://www.fao.org/nutrition/education/fooddietaryguidelines/regions/countries/nigeria/en/

Gibson, R. S. (2023). Principles of Nutritional Assessment: Introduction. (3rd Edition). [Online chapter]. Retrieved from https://nutritionalassessment.org/#intro/.

Gibson, R. S., & Ferguson, E. L. (2008). An interactive 24-hour recall for assessing the adequacy of iron and zinc intakes in developing countries. Washington, DC: International Food Policy Research Institute (IFPRI) and International Center for Tropical Agriculture (CIAT). Retrieved from https://www.ifpri.org/publication/interactive-24-hour-recall-assessing-adequacy-iron-and-zinc-intakes-developing-countries [Last accessed on December 26, 2022]

Gil, Á., Victoria, E. M. De, & Olza, J. (2015). Indicators for the evaluation of diet quality. *Nutrición Hospitalaria, 31*(3), 128–144. https://doi.org/10.3305/nh.2015.31.sup3.8761

Haileselassie, M., Redae, G., Berhe, G., Henry, C. J., Nickerson, M. T., Tyler, B., & Mulugeta, A. (2020). Why are animal source foods rarely consumed by 6-23 months old children in rural communities of Northern Ethiopia? A qualitative study. *PloS One, 15*(1), e0225707. https://doi.org/10.1371/journal.pone.0225707

Institute of Medicine. (2005). *Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids*. Washington, DC: The National Academies Press. Available from: https://doi.org/10.17226/10490

Kabir, A., Miah, S., & Islam, A. (2018). Factors influencing eating behavior and dietary intake among resident students in a public university in Bangladesh: A qualitative study. *PloS One, 13*(6), e0198801. https://doi.org/10.1371/journal.pone.0198801

Kim, S., Haines, P. S., Siega-Riz, A. M., & Popkin, B. M. (2003). The diet quality index-international (DQI-I) provides an effective tool for cross-national comparison of diet quality as illustrated by China and the United States. *The Journal of Nutrition, 133*(11), 3476–3484. https://doi.org/10.1093/jn/133.11.3476

Lee, E., Choi, J., Ahn, A., Oh, E., Kweon, H., & Cho, D. (2015). Acceptable macronutrient distribution ranges and hypertension. *Clinical and Experimental Hypertension (New York, N.Y.: 1993), 37*(6), 463–467. https://doi.org/10.3109/10641963.2015.1013116

Martin, J. C., Moran, L. J., Teede, H. J., Ranasinha, S., Lombard, C. B., & Harrison, C. L. (2017). Exploring diet quality between urban and rural dwelling women of reproductive age. *Nutrients, 9*, 586. https://doi.org/10.3390/nu9060586

Mediratta, S., & Mathur, P. (2023). The quality of Indian diets: A comparison of two indices to predict risk of dietary inadequacies linked to non-communicable diseases. *World Nutrition, 14*(3), 36–47. https://doi.org/10.26596/wn.202314336-47

Mekonnen, D. A., Trijsburg, L., Achterbosch, T., Brouwer, I. D., Kennedy, G., Linderhof, V., Ruben, R., Talsma, E. F., & Béné, C. (2021). Food consumption patterns, nutrient adequacy, and the food systems in Nigeria. *Agricultural Systems, 191*(103136), 1–14. https://doi.org/10.1016/j.agsy.2021.103136

Müller, A. M., & Koh, D. (2016). Effectiveness of active learning methods in health professional education: A systematic review. *Journal of Nursing Education, 55*(5), 282–288. https://doi.org/10.3928/01484834-20160414-06

National Institute of Diabetes and Digestive and Kidney Diseases. (2022). Body Composition. *What Is It, and What Are Its Risks?*. [National Institutes of Health (.gov)]. Retrieved from https://www.niddk.nih.gov/health-information/weight-management/body-composition.

National Population Commission (NPC) [Nigeria] and ICF. (2019). *Nigeria Demographic and Health Survey 2018.* Abuja, Nigeria, and Rockville, Maryland, USA: NPC and ICF.

Nielsen, S. J., & Popkin, B. M. (2003). Patterns and trends in food portion sizes, 1977–1998. *JAMA, 289*(4), 450–453. https://doi.org/10.1001/jama.289.4.450

Omonona, B. T. (2009). Quantitative analysis of rural poverty in Nigeria (NSSP Report 9). Nigeria Strategy Support Program (NSSP), International Food Policy Research Institute (IFPRI). Retrieved from: http://www.ifpri.org/publication/quantitative-analysis-rural-poverty-nigeria

Ruel, M. T. (2003). Operationalizing dietary diversity: A review of measurement issues and research priorities. *The Journal of Nutrition, 133*(11 Suppl 2), 3911S–3926S. https://doi.org/10.1093/jn/133.11.3911S

Sanusi, R. A., & Owolabi, O. O. (2022). Household Food Security Status, Food Consumption Pattern and Nutritional Status of Households in a Semi-urban Area of Nigeria. *Pakistan Journal of Nutrition, 21*, 91–100. https://doi.org/10.3923/pjn.2022.91.100

Shamah-Levy, T., Mundo-Rosas, V., & Villalpando-Hernández, S. (2013). Dietary intake and micronutrient status among Mexican women of reproductive age. *Nutrition Reviews, 71*(10), 680–690. https://doi.org/10.1111/nure.12073

Smith, L. C., & Haddad, L. (2015). Reducing child undernutrition: Past drivers and priorities for the post-MDG era. *World Development, 68*, 180–204. https://doi.org/10.1016/j.worlddev.2014.11.014

United Nations Department of Economic and Social Affairs. (2019). *World Population Prospects 2019: Highlights*. Retrieved from https://population.un.org/wpp/Publications/Files/WPP2019_Highlights.pdf

United Nations Development Programme (UNDP). (2020). Human Development Report 2020. Retrieved from: http://hdr.undp.org/en/2020-report

World Health Organization (WHO). (2015). *Healthy Diet*. Retrieved from: https://www.who.int/news-room/fact-sheets/detail/healthy-diet

World Health Organization (WHO). (2018). *WHO | Healthy Diet*. Retrieved from: http://www.who.int/nutrition/publications/nutrientrequirements/healthydiet_factsheet/en/

World Health Organization (WHO). (2020). *Noncommunicable Diseases*. Retrieved from https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases