

Exploring urban dietary pattern in Nigerian households: A case for nutrient adequacy

IKUDAYISI Adesola Adebola

Department of Agricultural Economics, University of Ibadan, Nigeria

Abstract

Aims: To identify dietary patterns of urban households in Southwest, Nigeria and explore their links with nutrients adequacy.

Study design: Cross sectional household-level data, from the two urban locations selected through a multistage random sampling procedure in southwest Nigeria was employed.

Place and Duration of Study: Urban households were sampled in South west zone of Nigeria between October to November, 2017.

Methodology: Socio/demographics were documented using a descriptive analysis. The pattern of food subgroups was determined econometrically using the factor analysis, while the test for differences was examined using Mann Whitney U.

Results: Using factor analysis, five distinct dietary patterns emerged named as vitamin A, modern, protein, roots, and cereals patterns with 50.7% variance contribution rate. The vitamin A rich food dietary pattern explained 12.8% of the total variance and the pitch in diet quality of this factor was explained mostly by dark leafy vegetables and fruits. The fourth and fifth factors which accounted for 9.2% and 7.5% of total variance, respectively characterised by high intakes of roots/tubers (0.69), plantain (0.57) and cereals (0.79) are food rich in dietary energy. Consumption frequency revealed that a higher intake of vitamin A foods was associated with LUA, while HUA had more intake of spices (46.3%), oil (44.5%) and beef products (41.3%). Both urban locations had a lower intake of iron rich foods (dairy, poultry and organ meat) which suggest likely risk of heme iron deficiency. Dietary energy intake in form of cereals (52.3%) was higher in HUA with tubers (14.6%) in LUA. The test of difference across the two locations revealed significant disparities in the observed dietary pattern with respect to vitamin A food, beef meat, spices and poultry at 5% level.

Conclusions: Urban disparity in dietary patterns is evidenced in this paper. However, the different dietary patterns across urban locations were associated with some nutritional outcomes. Although, both dietary patterns had healthful elements of the diets, low consumption of iron rich foods was observed. Programmes focusing on the prevention of diet-related chronic diseases in this population should balance the identified pattern of consumption with iron rich foods.

Keywords: dietary pattern, factor analysis, urban households, food items, nutritional status

1. Introduction

That factors such as income growth, urbanization, changing socioeconomic position and food retail modernization tend to influence dietary shifts is well known (Hiza et al., 2013; Mayen, et al., 2014; Weitherm-Heck et al., 2019, Ikudayisi et al., 2019). However, the direction of the association and extent of influence is not consistent among countries. This is as a result of the nutritional transition phase, level of economic development, cultural and social contexts prevailing in each country (Perez-Tepayo, et al., 2020). Evidence suggests that changing diets and urban lifestyle factors are associated with decline in nutrition quality and diet related chronic diseases (Eme et al., 2020). This incidence mostly in urban areas thus, presents a platform to empirically look into level of nutrient adequacy through urban household dietary pattern. This will help proffer policies for improved nutrition sensitive programming through responses from household dietary pattern. A broader picture of food and nutrient consumption, often referred to as dietary pattern may be more predictive of diet related diseases risk than individual food or nutrient (Crespedes and Hu, 2015). It describes the overall diets with respect to the foods items, food groups, and nutrients included with associated frequency and the quantity habitually consumed. Therefore, profiling food frequency consumption of households characterized by the usual intake of eating habits have become a focus in food policy programs (UNWFP, 2015; Omege and Omuremu, 2018).

Methods for defining dietary pattern includes the a priori approach which uses numerical indexes, different scoring and weighting schemes to measure adherence to a dietary pattern. This method has been predefined on the basis of previously recommended scientific evidence (Crespedes and Hu, 2015). In line with this approach, Omege and Omuremu (2018) and Perez-Tepayo et al. (2020) used Dietary Diversity scores, Healthy Eating Index in defining dietary pattern in Nigeria and Mexico, respectively. Another approach is the posteriori, that empirically defines common patterns of foods that tend to be consumed together using multivariate analytical tools (the principal components analysis, factor analysis etc) (Yang, et al., 2016). This tends to explain the largest variation in dietary pattern outcomes (Auma, et al., 2019; Salmani, et al., 2020). For instance, Sodjinou et al., (2009) examined the dietary patterns of urban Beninese adults and explore their links with overall diet quality and socio-demographics using cluster analysis. Two distinct dietary patterns revealed a 'traditional' and transitional type. The 'transitional' type were predominantly from the upper socioeconomic status or born in the city. It had a significantly higher percentage of energy from fat and in cholesterol but lower in fibre. The 'traditional diet' was associated with higher healthy score in consumption of fruits and vegetables. Using principal component analysis, Kehoe et al., (2014) identified two diet patterns among Indian children. The 'snack and fruit' pattern was characterised by frequent intakes of snacks, fruit, sweetened drinks, rice and meat dishes and leavened breads. The 'lacto-vegetarian' pattern was characterised by frequent intakes of finger millet, vegetarian rice dishes, yoghurt, vegetable dishes and infrequent meat consumption.

Extraction of factors of the dietary patterns by principal component analysis was employed by de Lanerolle-Dias et al., (2015) among Sri Lankan adolescent girls. Two dietary patterns were identified; a convenience-based dietary pattern with higher factor loadings for starchy

foods and a traditional pattern with higher factor loadings for rice, tubers and potatoes, vegetables and dark green leafy vegetables. Using rural urban dichotomy, urban adolescents followed a convenience based dietary pattern with associated risk of overweight and higher body fat than a rural girl. Wang, et al., (2014) used factor analysis to establish dietary patterns among Chinese adults in Baoji and explore the association between these dietary patterns and chronic diseases. Five dietary patterns were identified with protective effects with protein, balanced, and beans dietary patterns on chronic diseases compared to the prudent and traditional patterns. To explore evidence for dietary transitions and identify how environmentally sustainable women's dietary patterns in Uganda are, principal component analysis was performed by Auma et al. (2019). Four dietary patterns explained 23.6% of the variance. Urban residence was positively associated with "transitioning, processed, low environmental impact" and "animal-based high environmental impact" patterns; but negatively associated with the "plant-based low environmental impact" pattern. A traditional, high-fat dietary pattern with medium environmental impact persists in both contexts. These findings provide some evidence that urban women's diets are transitioning.

Most of the studies on dietary diversity pattern in developing countries focused on specific population like women, children, adults with little attention on households which makes up the fabric of the society and lies at the centre of most policies. Identifying household characteristics of diets can serve as a basis for formulating nutritional interventions and public-health policies aimed at improving the diets of populations. Most importantly, analysis of household dietary patterns which considers particularly urban population give a more comprehensive impression of the food consumption habits. This may be better at predicting the risk of diseases than the analysis of rural urban dichotomy as the joint effect might hide some important information which would be better identified separately.

Using household level data from urban areas of southwest, Nigeria, this paper analyses the nutritional implications of the dietary shift empirically by exploring the dietary pattern, particularly within urban areas using factor analysis approach. As dietary patterns are likely to vary, a comparative study was done to know the possible differences in eating patterns derived from different populations using Mann Whitney U test. This is necessary as a result of differences in the stages of nutritional transition, changing food preferences and socioeconomic status prevailing within the urban population.

2.1 Material and methods

A cross-sectional survey was administered to 438 households randomly selected through a multi-stage sampling from two urbanising states in southwest, Nigeria. Choice of southwest zone was based on the level of urbanization in the area (Ikwuyatum, 2016). The selected states, Oyo and Ekiti are representative of high urban areas (HUA) and low urban areas (LUA), respectively. The most urbanized location within each of the sampled states was purposively selected on the basis of their administrative procedures and urban activities. Households were randomly sampled from the Enumeration Areas (EAs) mapped by National Population Commission. The EAs represented the primary sampling units used for 2006 population census in Nigeria. The data provided information about household head's

socioeconomic characteristics, types of food eaten and the frequency of consumption of each the food items by households over the period of seven days. Based on nutritional capabilities, six (6) key food groups was further disaggregated into 16 subgroups. The specific food subgroups included in the survey are cereals, pastas, tubers, plantain, pulses, beef meat, poultry, organ meat, fish, eggs, dairy/milk, oils, spices, dark green leafy vegetables, fruits and other vegetables. A four-point rating scale used for the consumption frequency of the food items include: seldom/never=1, 1-2 times/week=2, 3-5 times/week=3, 6-7 times/week=4. The frequency-based dietary indicators would offer a quick way to assessing consumption of foods rich in both macro- and micro- nutrients, particularly, protein, vitamin A and heme iron.

2.1.1 Model specification

Consumption levels of different food items in a week could be assessed by their variations and covariations using factor analysis. Factor analysis refers to a statistical technique that summarizes the relationships between original variables in terms of smaller set of derived variables called factors or components (Hardy and Bryman, 2004). It defines the covariance relationships among correlated variables and reveals the underlying casual structure based on some unobservable factors, in this case, factors peculiar to urban areas food consumption pattern (Mulaik, 2010; Hair et al. 2013). These underlying factors possibly exert causal influence among the variables but their impact is hidden and cannot be measured directly. The model is given as:

$$\begin{aligned}
 r_1 &= \alpha_{11}P_1 + \alpha_{12}P_2 + \dots + \alpha_{1m}P_m + e_1 \\
 r_2 &= \alpha_{21}P_1 + \alpha_{22}P_2 + \dots + \alpha_{2m}P_m + e_2 \\
 &\dots \\
 r_k &= \alpha_{k1}P_1 + \alpha_{k2}P_2 + \dots + \alpha_{km}P_m + e_k
 \end{aligned}
 \tag{1}$$

where $r_i (i=1, \dots, k)$ denotes standardized variables with mean of zero and variance equal one, $\alpha_{11}, \alpha_{12}, \dots, \alpha_{n1}$ are the factor loadings of these variables, P_1, P_2, \dots, P_m are standardized uncorrelated common factors, and e_i are the error terms which are independently distributed.

Bartlett's Test of Sphericity (BTS) was also examined and the sampling adequacy was verified by Kaiser-Meyer-Olkin (KMO) test. Varimax rotation method was used to explore the factor structure of food component. This approach helps to improve and simplify the interpretability of components by maximizing the dispersion of loadings within factors. The main criteria for verifying the factor structure to extract from all the factors was decided using the Kaiser's criteria (eigenvalue > 1 rule) and the Scree plot (Salmani et al., 2020).

Mann-Whitney U-test was employed to establish the level of consistency in dietary pattern across the two urban locations. Although, *T-test* is most widely used statistical tools to test the difference between two means. However, due to unequal data size obtained for the two areas (HUA=282 and LUA=156) based on population density, the assumptions underlying the *t-test* are not met, then the non-parametric equivalent tests, may be used (Nadim, 2008). The Wilcoxon - Mann - Whitney test is a non-parametric test that test the null hypothesis that two samples come from the same population (Shier, 2004). It compares two independent

groups that do not require large normally distributed samples and requires all the observations to be ranked as if they were from a single sample. It is calculated as:

$$U = n_1 n_2 + \frac{n_1(n_1 + 1)}{2} - R_1 \quad (2)$$

$$E(U) = \mu_U = \frac{n_1 n_2}{2} \quad (3)$$

$$Var(U) = \sigma_U^2 = \frac{n_1 n_2 (n_1 + n_2 + 1)}{12} \quad (4)$$

$$Z = \frac{U - \mu_U}{\sigma_U} \quad (5)$$

where n_1 = sample size for HUA; n_2 = the sample for LUA; R_1 = the sum of the ranks of the HUA sample, σ_U^2 = the variance of the Mann–Whitney U, and μ_U = the mean of the Mann–Whitney U. The null hypothesis (H_0) stipulates that the two groups come from the same population. It requires that the two independent groups are homogeneous and have the same distribution. The level of significance as determined by the Z value and the P-value based on the normal approximation determines the decision either to reject or accept the null hypothesis.

3.1 Results and Discussion

Summary statistics of household heads and the mean values of food expenditure across the two urban areas are presented in Table 1. Result revealed that majority of the household heads were male with a higher percentage in HUA (70 %). Age of household heads across the two locations (about 47 years) were similar. Household size averaged at five persons in LUA and with four persons in HUA. About three-quarters of household heads had tertiary education but more educated house heads were in HUA (81.0 %). Average monthly income for household heads in LUA (N48,848.85) was lower than those of HUA (N53,144.87) which suggests income differentials. This might likely be attributed to variation in economic opportunities and uneven urban social processes across the two urban areas. From the occupational structure, more than half of household heads were into formal employments. In general, findings suggest that the socioeconomic status of household heads are not uniform within the urban areas considered and this might influence their household food consumption pattern. The weekly food expenditure estimates revealed that households in LUA expended more money on staple foods (N4510.18) than those of HUA. The increase in intake of food sourced from grains, roots and tubers might be linked to its availability and affordability. There was a decrease in the intake of staples among households in HUA which suggests that sedentary nature of urban lifestyles often with less physical activities might be linked to the reduced caloric intake in comparison to LUA. However, an increase in expenditure on non-staple foods (pulses, milk, meat, fish, eggs, vegetables and fruits) was observed among HUA households (N6336.50) relative to the LUA. As observed by Ikudayisi and Omotola (2019) and Drewnowski and Poulain, (2018), changing affluence and concern for food quality with

lesser calorie in urban areas might be responsible for the increased demand for non-staple foods.

Table 1: Statistics of Urban Household Heads

Variables	Description	Low Urban Area (LUA) N=156		High Urban Area (HUA) N=282	
		Mean	Standard Deviation	Mean	Standard Deviation
Sex	Household is Male headed or otherwise (Female headed)	0.67	0.47	0.70	0.46
Age	Age of household head in years	47.25	9.60	47.32	11.99
Household size	Number of persons in the household	4.70	1.54	4.29	1.56
Educational status	Household head level of education being formal (primary, secondary and tertiary) or otherwise (non-formal)	0.77	0.42	0.81	0.40
Average monthly income	Income earned by household head on a monthly basis in Naira	48848.85	16794.25	53144.87	18465.58
Occupational status	Occupational type of household head is in formal sector (government worker, private organizations) or otherwise (traders, farmers, artisans)	0.69	0.46	0.64	0.48
Staple food expenditure	Amount expended on staple foods by households in a week (Naira)	4510.18	2323.46	3511.10	1577.49
Non-staple food expenditure	Amount expended on non-staple foods by households in a week (Naira)	5298.14	2603.58	6336.50	3087.89

The factor analysis was performed using SPSS Statistics 20. The sampling adequacy criterion (KMO = 0.745) and BTS tests ($\chi^2 = 787.52$; $P < 0.000$) showed that the data was adequate for factor analysis. The acceptable adequacy level was similarly observed by Salmaniet al., (2020) and Wang et al., (2014) with BTS significant at 1%. The communality values indicated how much variance of each variable factor extraction can reproduce. There is no commonly agreed threshold for a variable's communality, however, it is appropriate that the extracted factors should account for at least 50% of a variable's variance (Hair, et al., 2006). The result from table 2 showed that eight food items had values above the threshold, which implies that their shares are more than half in their variability with other variables.

Five factors were extracted from the scree plot (Figure 1) out of 16 food components. The factors with eigenvalue above one revealed the maximum variance each factor contributed the most to the explanation of the variance in the food dataset. The varimax rotation method loaded five factors (Table 2). The values of the factor loading greater than .50 were reported and operationalised for the 16 food items following Hair et al. (2005) guideline for practical significance of more than ± 0.5 . A positive loading designates positive association with the

factor, while a negative loading designates negative association with the factor, and the larger the loading of a given food item to the factor, the greater the contribution of that food item to a specific factor (Wang, et al., 2014). Each factor generated some distinct food categories which explained the different aspects of urban food consumption pattern. The five patterns identified explained 50.7% of the dietary intake variance in the 16 food subgroups. The first component explained about 12.8% of the total variance and the fifth component had the least variance (7.8%). Factors were named according to the nutritional value of the food which represented the nature of each factor.

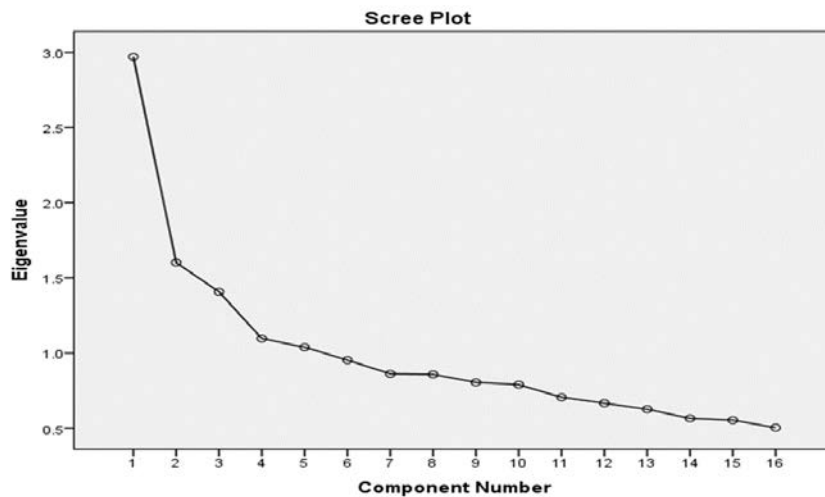


Figure 1: Scree plot of factor loadings of 16 food items

From Table 2, the vitamin A rich food dietary pattern explained 12.8 % of the total variance and was characterized by high intakes of dark green leafy vegetables (0.78), fruits (0.75) and vegetables(0.58) (Table 2). This reflects the extent to which households source formicronutrient adequacy. The findings strengthened the viewpoint presented in the previous studies(Sodjinou, et al. 2009; Auma, et al., 2019) about the increase in intake of fruits and vegetables among urban residents. Similarly, Aggarwal et al. (2011) reported that the pitch in diet quality of this factor was explained mostly by dark leafy vegetables and fruits. This finding followed previous studies that have identified this dietary pattern as effective in significantly improving micronutrients status and reduction of many chronic diseases (Esfahani, et al., 2011; Wang, et al., 2014; Auma, et al., 2019).

The second component was represented by four strongly loading variables; spices (0.71); beef meat (0.60), dairy (0.55) and oils (0.54) termed ‘modern’ dietary pattern. The combination of these subgroups accounted for 11.4% of the total variance in their consumption frequency. This dietary pattern is somewhat similar to the ‘balanced’ dietary pattern identified by Wang, et al., (2014) with a comprehensive intake of protein, carbohydrate and fat and oil. The high intake of beef meat and fat/oil foods could be attributed probably to living in urban areas and relatively highly-educated household heads sampled. This finding was supported by Adetunji and Rauf (2012) and Guo, (2016) among urban households in Nigeria and Asia, respectively. The nutritional implication of this dietary patterns characterized by high intakes of red meat, refined oils, and fried foods might be associated with increased risk of some diseases. This was regarded as ‘transitional diet’ by Sodjinou et al., (2009) with a significantly higher percentage of fat and subsequent rise in cholesterol in Benin. However, this dietary

pattern was also reported by Auma et al.(2019) as animal-based pattern with high environmental impact in Uganda.

The third most important factor was assessed through two food items: poultry (0.80) and organ meat (0.71) which accounted for about 9.5% of the total variance. The ‘protein’ based dietary pattern are also a source of micronutrient called heme iron. This result had likely finding with Wang, et al., (2014) who identified their protein dietary pattern to be positively associated with factor loadings of organ meats (0.713) and poultry (0.692). The fourth and fifth factors which accounted for about 9.2% and 7.5% of total variance, respectively are referred to as staple dietary pattern. It was characterized by high intakes of roots/tubers (0.69), plantain (0.57) and cereals (0.79). They are basically foods rich in dietary energy. This finding corroborates Ikudayisi et al. (2019) and Erhabor and Ojogho (2011), who reported that cereal-based foods had the highest food consumption share in most urban areas of Nigeria. Also, many households in Africa and Asia consumed sufficient dietary energy which are predominantly plant-based as reported by Kuku et al., (2015), Holmes, et al.(2018). This staple dietary pattern showed some similarities to the “roots, tubers and plantain” dietary pattern found in Ghana (Galbete, et al., 2017); in Uganda (Auma, et al., 2019). Also, it was similar to traditional dietary pattern rich in whole grains in China (Wang, et al., 2014). Findings from the identified five factors revealed the urban dietary pattern which highlights important nutrients adequacy with respect to level of micronutrients (vitamin A and heme iron), macronutrients (protein) and dietary energy (staples) consumption.

Table 2: Factor analysis rotated component matrix (Varimax rotation)

	<i>Communalities</i>	<i>Factors</i>				
		<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>
<i>Dark green leafy vegetables</i>	0.638*	0.777				
<i>Fruits</i>	0.587*	0.750				
<i>Other vegetables</i>	0.459	0.580				
<i>Eggs</i>	0.401	0.388	0.348			
<i>Spices</i>	0.549*		0.705			
<i>Beef meat</i>	0.415		0.602			
<i>Dairy/milk</i>	0.446	0.346	0.553			
<i>Fat/oils</i>	0.402		0.539			
<i>Poultry</i>	0.665*			0.795		
<i>Organ meat</i>	0.573*			0.710		
<i>Tubers</i>	0.528*				0.692	
<i>Plantain</i>	0.460		0.346		0.569	
<i>Pulses</i>	0.495				0.494	-0.466
<i>Fish</i>	0.540*	0.419		-0.365	0.446	
<i>Cereals</i>	0.648*					0.794
<i>Pastas</i>	0.307					0.338
<i>Variance explained (%)</i>		12.83	11.40	9.52	9.16	7.80
<i>Total variance (%)</i>	50.7%					
<i>KMO</i>	0.745					
<i>Barlett's test of sphericity (BTS)</i>	747.524***					

Note: BTS *** significant at 1%. Communalities: * values above the 0.5 threshold. Factor loadings above 0.50 are in bold.

The percentage distribution of household consumption frequencies across the two locations based on the identified dietary pattern is presented in Table 3. In the vitamin A category, the consumption of fruits and vegetables was more pronounced in LUA than those of HUA. This might probably be that the former been less urbanised have better access to foods in their natural state and cheaper to afford. As regards food items in second category, low intake of milk/dairy was found to be a major problem in both locations. However, in HUA, spices (46.3%) and beef meat (41.3%) was well consumed which followed similar finding by Ikudayisi et al., (2019) that urban households expended more money on meat and its products. This was also evident in their food expenditure on non-staple (HUA) compared with LUA (Table 1).

From the protein category, poor protein intake remains the predominant problem in the two locations as shown by their consumption frequency. The reduced intake of these iron rich foods in LUA – poultry (73.2%) and organ meat (78.8%) – might be attributed to dietary cost of these foods which are more expensive coupled with income differential in urban areas. This finding followed Aggarwal et al., (2011) who asserted that the social gradient in diet quality may be explained by diet cost among lower socioeconomic strata. The cost effect might be responsible for the rising prevalence of anaemia and protein deficiency particularly among urban poor. Similarly, Gaiha et al., (2014) reported that high rates of anaemia have been attributed to a diet that is heavily concentrated on starchy staples like rice and wheat relative to iron-rich foods like green leafy vegetables and meat, fish, or poultry products. Although, the dietary pattern suggests protein had a higher loading in urban diets, however, the food frequency level further revealed the extent of consumption which showed variation in their intake of foods rich in heme iron.

Across the two locations, level of consumption of cereals increased along the scale with greater percentage in HUA (52.0%). This could be attributed to the fact that cereals are predominant food in urban food basket because of convenience and ease of food preparation (Kuku et al., 2015; Ikudayisi and Omotola, 2019). However, considering the two extremes in the frequency scale for tubers and plantains, there was a decline in their frequency of consumption. This suggests lesser intake of dietary energy by consumers across the two locations. Socioeconomic position of household heads, desire for lesser caloric and diversified diets might be responsible for such variations. In sum, findings suggest an improvement in intake of vitamin A rich food, however, households were still vulnerable to some micronutrients (heme iron) and macronutrients (proteins).

A Mann Whitney U test was performed to examine the differences in the dimensions of dietary pattern for food subgroups based on nutritional implications with factor loadings above 0.50 in the two locations. There was a statistically significant difference at $\alpha = 0.05$ in the selected food subgroups as shown by their *P* values. From the results in Table 3, all the food items in vitamin A category was significant at 5% level, which implies differences in frequency of consumption of those food items across the two locations. A higher intake of vegetables associated with urban dietary pattern may explain why it was significantly associated with diet quality. Thus, underscoring the importance of these foods in urban household dietary pattern across the two locations. Promoting fruits and vegetables consumption would therefore appear as a promising strategy for the prevention of nutrition-related chronic disease in this population.

Finding a statistically significant difference between the two locations with respect to fruits/vegetables (5%), spices (5%), beef meat (5%), poultry (5%) and plantain (1%) revealed

the relevance of these foods in supply of micronutrients and energy in urban food consumption. With the exception of food items such as dairy/milk, fat/oil, organ meat, tubers and cereals, it is evident from the result that households in each of the two locations viewed their dietary pattern differently to some extent. The different perspectives on dietary pattern across the locations can again be explained based on the locational and socio-economic differences of respondents. It is important to establish that across the urban areas considered, fruits/vegetables, spices, beef meat appear prominently in the pattern of frequency of food consumed. However, in the quest for diversified diets, without care for moderation in the high intake of the modern dietary pattern (spices, fat/oil and meat), there could be an incidence of high risk of overweight and obesity.

Table 3: Percentage distribution of consumption frequency of food subgroups

	Locations	1 %	2 %	3 %	4 %	Wilcoxon-Mann Whitney U	Asymptotic Significance
Vitamin A							
Dark green leafy vegetables	LUA	24.2	8.3	32.5	35.0	32163.500	0.059**
	HUA	32.0	10.7	27.8	29.5		
Fruits	LUA	20.4	11.5	17.2	51.0	31973.000	0.039**
	HUA	21.4	11.4	32.0	35.2		
Other vegetables	LUA	14.6	4.5	17.8	63.1	31818.000	0.022**
	HUA	13.5	7.1	31.0	48.4		
Spices/oils/protein							
Spices	LUA	41.4	3.8	16.6	38.2	59396.000	0.054**
	HUA	31.3	7.1	15.3	46.3		
Beef meat	LUA	31.2	6.4	28.0	34.4	58894.000	0.020**
	HUA	20.6	4.3	33.8	41.3		
Dairy/milk	LUA	44.6	14.6	23.6	17.2	60518.500	0.331
	HUA	45.6	8.5	19.2	26.7		
Fat/oils	LUA	23.6	7.6	24.8	43.9	60200.00	0.214
	HUA	13.5	7.8	34.2	44.5		
Protein/Iron							
Poultry	LUA	73.2	8.9	9.6	8.3	59078.500	0.015**
	HUA	61.6	11.4	16.0	11.0		
Organ meat	LUA	78.8	6.4	6.4	8.3	61092.500	0.923
	HUA	78.6	6.1	6.4	8.9		
Staples							
Tubers	LUA	29.3	26.1	29.9	14.6	32731.500	0.155
	HUA	31.3	29.5	32.7	6.4		
Plantain	LUA	42.0	19.7	22.9	15.3	58554.000	0.010***
	HUA	31.0	14.9	37.4	16.7		
Cereals	LUA	4.5	7.6	38.9	49.0	60253.500	0.208
	HUA	2.1	2.8	42.7	52.3		

Items measured on a 4-point consumption frequency scale (1=seldom/never; 2=one-two times/week; 3=three-five times/week; 4= six-seven times/week). Statistical significance: ***1%; **5%.

4. Conclusion and policy recommendation

This cross-sectional study identified dietary pattern based on food groups in a representative sample of urban households in Nigeria. Using factor analysis, five distinct dietary patterns emerged named as vitamin A, modern, protein, roots, and cereals patterns with 50.7% variance contribution rate. Significant differences between the two urban locations with respect to fruits/vegetables (5%), spices (5%), beef meat (5%), poultry

(5%) and plantain (1%) revealed the relevance of these foods in supply of micronutrients and energy in urban diets. Urban disparity in dietary patterns was found in this study, and different dietary patterns were associated with some nutritional outcomes. Without care for moderation in the high intake of the westernization dietary pattern (spices, fat/oil and beef), there could be increase in the risk of overweight/obesity while the low iron-rich food structure could increase the risk of anemia among residents of less urbanized areas. Policy interventions toward increased access to nutrient-dense foods through income generating activities is highly essential. The observed responses from dietary pattern serves as a benchmark to evaluate the health effects of adherence to dietary guidelines by urban household's intake of macro and micronutrients. It also broadens the conceptual understanding of urban dietary practices in relation to diet related disease outcomes. The findings can guide in nutrition intervention and public enlightenment on dietary strategies because it better provides stakeholders and policymakers with sufficient information and sense of direction on dietary interventions for urban citizens.

References

- Adetunji, M.O. and Rauf, M.O. 2012. Analysis of household demand for meat in southwest, Nigeria. *Global Journal of Science Frontier Research Agriculture and Biology*. 12 (1)
- Aggarwal, A., Monsivais, P., Cook, A. J and Drewnowski, A. 2011. Does diet cost mediate the relation between socioeconomic position and diet quality? *European Journal of Clinical Nutrition* (2011), 1–8.
- Auma, C. I., Pradeilles, R., Megan K. Blake, M. K., and Holdsworth, M. 2019. What Can Dietary Patterns Tell Us about the Nutrition Transition and Environmental Sustainability of Diets in Uganda? *Nutrients*, 11, 342; doi:10.3390/nu11020342.
- Cespedes, E. M., and Hu, F. B. 2015. Dietary patterns: from nutritional epidemiologic analysis to national guidelines. *American Journal of Clinical Nutrition*, 101:899–900.
- de Lanerolle-Dias, M., Lanerolle, L, Atukorala, S. and de Silva, A. 2015. Urbanisation, dietary patterns and body composition changes in adolescent girls: a descriptive cross sectional study. *BMC Nutrition*, 1(30):1-7. DOI 10.1186/s40795-015-0027-5.
- Drewnowski, A. and Poulain, J. (2018), What Lies Behind the Transition from Plant-Based to Animal Protein? *AMA Journal of Ethics*, 20(10):E987–993. <https://doi.org/10.1001/amajethics.2018.987>.
- Eme, P. E., Kim, N. D., Douwes, J., Burlingame, B., Foliaki, S. and Wham, C. 2020. Are Households in Kiribati Nutrition Secure? A Case Study of South Tarawa and Butaritari. *Food and Nutrition Bulletin*. 1-16. DOI: 10.1177/0379572119891024.
- Erhabor, P. O. I. and Ojogho, O. 2011. Demand analysis for rice in Nigeria. *Journal of Food Technology*, 9(2), 66-74.
- Esfahani, A., Wong, J. M. W., Truan, J. et al., 2011. Health effects of mixed fruit and vegetable concentrates: a systematic review of the clinical interventions. *Journal of the American College of Nutrition*. 30,5, 285–294.
- Gaiha, R., Kaicker, N., Imai, K. S., Kulkarni, V. S. and Thapa, G. 2013. Has dietary transition slowed in India? An analysis based on the 50th, 61st and 66th rounds of the National Sample Survey. ISBN 978-92-9072-377-6. March 2013.
- Galbete, C., Nicolaou, M., Meeks, K. A., de-Graft Aikins, A., Addo, J., Amoah, S. K., Smeeth, L, Owusu-Dabo, E., Klipstein-Grobusch, K., Bahendeka, S. et al. Food consumption, nutrient intake, and dietary patterns in Ghanaian migrants in Europe and their compatriots in Ghana. *J. Food Nutr. Res.* 2017, 61, 1341809.

- Guo, F. 2016. The influence of urbanisation on food consumption patterns in East Asia: A comparative study on China and Indonesia in 2002-2010. *East Asia Economy and Society*. Retrieved from <http://othes.univie.ac.at>
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2013). *Multivariate data analysis. A global perspective (7th ed.)*. Upper Saddle River: Pearson Prentice Hall.
- Hair, J. F., Black, W.C., Babin, B. J., Anderson, R. E. and Tatham, R. L. 2006. *Multivariate data analysis*. Sixth ed. Pearson Prentice Hall, Upper Saddle River, NJ.
- Hiza, H., Casavale, K., Guenther, P., Davis, C. 2013. Diet quality of Americans differs by age, sex, race/ethnicity, income, and education level. *Journal of Academic Nutrition and Diet*. 2013; 113:297–306.
- Holmes, M. D., Dalal, S., Sewram, V., Diamond, M. B., Adebamowo, S. N., Ajayi, I. O., Adebamowo, C., Chiwanga, F. S., Njelekela, M., Laurence, C. et al. Consumption of processed food dietary patterns in four African populations. 2018. *Pub. Health Nutrition*. 21, 1529–1537.
- Ikudayisi, A. A, Okoruwa, V. O. and Omonona, B. T. (2019). From the lens of food accessibility and dietary quality: Gaining insights from urban food security in Nigeria. *Outlook on Agriculture*: 48(4): 336–343. doi:10.1177/0030727019866462. Sage Publications.
- Ikudayisi, A. and Omotola, A. (2019), Analysis of expenditure path beyond staple foods consumption in Nigeria. *Agricultural and Resource Economics: International Scientific E-Journal*, [Online], vol. 5, no. 4, pp. 54–65.
- Ikwuyatum, G. 2016. Migration and Urbanisation: Exploring the Factors of the Nexus in Nigeria. *International Journal of Humanities and Social Science*, 6(8):161-175.
- Kehoe, S. H., Krishnaveni, G. V., Veena, S. R., Guntupalli, A. M., Margetts, B. M., Fall, C.H.D, et al. 2014. Diet patterns are associated with demographic factors and nutritional status in South Indian children. *Maternal and Child Nutrition*, 10(1):145–58.
- Kuku-Shittu, O., Mathiassen, A., Wadhwa, A., Myles, L. and Ajibola, A. 2013. *Comprehensive Food Security and Vulnerability Analysis: Nigeria*. IFPRI Discussion Paper 01275, July 2013.
- Mayen, A., Marques-vidal, P., Paccaud, F., Bovet, P., Stringhini, S. 2014. Socioeconomic determinants of dietary patterns in low-and middle-income countries: a systematic review. *American Journal of Clinical Nutrition*;100:1520–1531.
- Mulaik, S. A. 2010. *Foundations of factor analysis*. 2nd Ed. Boca Raton, FL: Chapman and Hall/CRC.
- Nadim, N. 2008. The Mann-Whitney U: A Test for Assessing Whether Two Independent Samples Come from the Same Distribution. *Tutorials in Quantitative Methods for Psychology*. 4(1),13-20.
- Omage, K., Omuemu, V. O. Assessment of dietary pattern and nutritional status of undergraduate students in a private university in southern Nigeria. 2018. *Food Sci Nutr*. 6:1890–1897. <https://doi.org/10.1002/fsn3.759>.
- Pérez-Tepayo, S., Rodríguez-Ramírez, S., Unar-Munguía, M., and Shamah-Levy, T. 2020. Trends in the dietary patterns of Mexican adults by sociodemographic characteristics. *Nutrition Journal*: 51. <https://doi.org/10.1186/s12937-020-00568-2>.
- Salmani, F, Norozi, E, Moodi, M and Zeinali, T. 2020. Assessment of attitudes toward functional foods based on theory of planned behavior: validation of a questionnaire. *Nutrition Journal* (2020) 19: 56. <https://doi.org/10.1186/s12937-020-00574-4>.
- Sodjinou, R.; Agueh, V.; Fayomi, B.; Delisle, H. 2009. Dietary patterns of urban adults in Benin: Relationship with overall diet quality and socio-demographic characteristics. *European Journal. Clinical. Nutrition*, 63, 222–228.

- United Nations World Food Programme, (UNWFP), 2015. Food Consumption Score Nutritional Quality Analysis Guidelines (FCS-N). Technical Guidance Note on Food security analysis (VAM). Rome – Italy.
- Wang, H., Deng, F., Qu, M., Yang, P., and Yang, B.2014. Association between Dietary Patterns and Chronic Diseases among Chinese Adults in Baoji. *International Journal of Chronic Diseases*. <http://dx.doi.org/10.1155/2014/548269>.
- Wertheim-Heck, S., Raneri, J. E., and Oosterveer, P. 2019. Food safety and nutrition for low-income urbanites: exploring a social justice dilemma in consumption policy. *Environment & Urbanization*. 1–24. DOI: 10.1177/0956247819858019.
- Yang Y., Hu, X., Tian-Jiao Chen., T., and Bai, M. (2016). Rural-Urban Differences of Dietary Patterns, Overweight, and Bone Mineral Status in Chinese Students. *Nutrients*, 8, 537; doi:10.3390/nu8090537.