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Determinants of traders' nutrition knowledge and intake of traditional African vegetables in Tanzania

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Indigenous and traditional African vegetables are receiving increasing attention because of their potential to contribute to food and nutritional security as well as enhance livelihoods in sub-Saharan Africa. Traditional African vegetables are important sources of nutrients like iron and calcium and also vitamins A, B complex, C, and E. The consumption of vegetables in sub-Saharan Africa, however, falls way below the recommended levels by the World Health Organization and Food and Agriculture Organization. This situation has led to micronutrient deficiencies and widespread nutritional disorders among the low-income and food insecure populations. This study explored the factors that determine the nutritional knowledge, frequency of intake, and attitudes of traders towards consumption of traditional African vegetables. Data were collected from 65 purposively selected households of traders in Manyire, Embaseny, and Bangata markets in Arumeru District of Tanzania from July to November 2015. Generalized Poisson and factor analysis were used in the analysis of data. The results showed that education, age, and annual income influenced traders' nutritional knowledge. The consumption of traditional African vegetables was influenced by education, household size, occupation, nutritional value, and preparation time. Factor analysis results indicated that knowledge of health benefits, taste, preparation time, and perception influenced consumption of traditional African vegetables. These findings imply that the consumption of traditional African vegetables can be enhanced by educating traders about the health benefits of these commodities as well as the taste-preserving preparation techniques. The study recommends inclusion of the health attributes of traditional African vegetables in promotional campaigns.

Key words: Diet, health, education, nutrients, vitamins.

INTRODUCTION

Indigenous and traditional African vegetables (TAVs) are receiving increasing attention because of their potential to contribute to food and nutritional security as well as enhance the livelihoods of smallholder farming households in sub-Saharan Africa (Afari-Sefa et al., 2012). Compared with exotic vegetables, the TAVs contain high levels of nutrients such as vitamins A, B complex, C, and E as well as iron and calcium. For example, amaranth greens have

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been shown to contain 57 times more vitamin A precursor, 13 times more iron, and 8 times more calcium compared with cabbage (Yang and Keding, 2012). The TAVs are also marketed and traded at the local, regional, and international levels, thus providing a revenue stream (Humphry et al., 1993; Smith et al., 1995; Smith et al., 1996).

The consumption patterns and preferences for traditional African vegetables vary from household to household within different countries (Uusiku et al., 2010). In Tanzania, 17.2% of the TAVs consumed were naturally occurring in the wild, while 56.9% were cultivated (Weinberger and Msuya, 2004). Keding et al. (2007) also found that about 78% of the participants in a study in Tanzania were cultivating TAVs with 75% of these households having consumed these vegetables on the previous day. Furthermore, 50% of all cultivated TAVs was sold in the markets while the remaining half was either consumed at home or given out as gifts (Keding *et al*., 2007).

Kobe (2004) points out that the level of consumption of vegetables and fruits (27 to 114 kg/capita per year) in sub-Saharan Africa is much less than the WHO/FAO recommendation (146 kg/capita per year). Low vegetable consumption is a major factor causing micronutrient deficiencies and widespread nutritional disorders including birth defects, weakened immune systems, and mental and physical retardation in Sub-Saharan Africa (FAO, 2003). In Tanzania, for instance vegetable consumption per capita is below the minimum recommended intake of 200g per person per day (FAO, 2009). Vegetable consumption in the country only grew from 107 to 113 g per capita per day between 1993 and 2000 (FAO, 1994). By 2012, vegetable consumption had reached 317 g per capita per day for the highest quintile consumers (Keding et al., 2012). For most medium and low-income consumers, however, vegetable consumption is still below the recommended levels. Furthermore, little is known about the consumption and nutritional importance of TAVs in Tanzania since indigenous knowledge about them is no longer passed on from one generation to the next (Weinberger and Msuya, 2004).

According to the World Bank (2010), malnutrition in Tanzania is a problem with stunting affecting 42% of children under five years old while anemia affects 53% of pregnant women, 60% of children under five years old, and 81% of infants aged 9-11 months. In addition, vitamin A deficiency affects 33% of children and 37% of women. Given that TAVs provide dietary fiber and other important components of nutritional value, their consumption could significantly contribute to the prevention of chronic and lifestyle diseases (Uusiku et al., 2010). However, these vegetables are neglected and despised even though they are rich in nutrients like proteins, carbohydrates, vitamins, and dietary fiber which are essential for good health (Nnamani et al., 2009). The consumption of TAVs is threatened by competition from global vegetables (Chweya and Eyzaguirre, 1999).

This study focused on traders who consume and also trade in TAVs. Traders have a wealth of information unknown to researchers about supply, demand and markets emanating from their trading activities, extensive handling, and consumption of TAVs. Thus, establishing the factors that determine traders' household nutritional knowledge about TAVs as well as frequency of intake and attitude towards consumption of TAVs is essential for the promotion, marketing, and trading of these commodities to consumers. An understanding of these relationships could provide policy-makers with information to design policies and programs that can contribute to measures needed to expand the consumption of TAVs.

MATERIALS AND METHODS

Theoretical framework

Economic policies are often directed towards measurable outcomes. Models based on count data allow for regression-type analyses when the dependent variable of interest is a numerical count. Jörgen (2002) observes that count data modeling techniques have become important tools in empirical studies of economic behavior. Economic studies usually begin with the specification of a theoretical model, which attempts to explain an agent's (for example household, firm, individual) behavior or choice as depending on other variables (Jörgen, 2002). The Poisson regression model is the main building block in this kind of modeling framework. However, researchers routinely employ more general specifications, usually the negative binomial model. This approach constitutes the standard choice for a basic count data model in an attempt to avoid implicit restrictions on the distribution of observed counts in the Poisson model. From the theoretical model, an empirically feasible regression model is formulated. This study thus used the generalized Poisson model to determine the factors influencing nutritional knowledge and frequency of intake of TAVs.

Consul and Famoye (1992) have presented an excellent overview of the basic generalized Poisson regression model and its derivation. The probability distribution function of a generalized Poisson distribution is defined as:

$$f(y;\lambda,\theta) = \theta\left(\theta + \lambda_i^{y_i}\right)^{y_i} \frac{exp\left(-\theta-\lambda_i^{y_i}\right)}{y_i} \quad (1)$$

Consul and Famoye (1992) and Hilbe (2011) show that the log-likelihood (LL) transformation for the above generalized Poisson probability distribution is given by:

$$\mathcal{L}(\mu,\alpha;y) = \sum_{i=1}^{n}\left\{y_i ln\left(\frac{\mu_i}{1+\alpha\mu_i}\right) + (y_i-1)ln(1+\alpha y_i) - \left[\frac{-\mu_i(1+\alpha y_i)}{1+\alpha\mu_i}\right] - ln\Gamma(y_i+1)\right\} \quad (2)$$

In terms of $x\beta$ this distribution can be given as:

$$\mathcal{L}(\beta,\alpha;y) = \sum_{i=1}^{n}\left\{y_i ln\left(\frac{exp\left(x_i'\beta\right)}{1+\alpha exp\left(x_i'\right)}\right) + (y_i-1)ln(1+\alpha y_i) - \left[\frac{exp\left(x_i'\beta\right)(1+\alpha y_i)}{1+\alpha exp\left(x_i'\beta\right)}\right] - ln\Gamma(y_1+1)\right\} \quad (3)$$

Where, y_i= random response variable corresponding to the level of nutritional knowledge possessed by respondent (i); x =covariate vectors of explanatory variables and β= linear predictor of random response variable.

Model specification: factors affecting TAV nutritional knowledge

Parmenter and Wardle (1999) designed a reliable and valid instrument which provides a comprehensive measure of nutritional knowledge possessed by adult consumers. This instrument helps to identify areas of weakness in peoples' understanding of healthy eating and also provides useful data for examining the relationship between nutritional knowledge possessed by an individual and dietary behavior. The instrument has five scale levels which are administered to determine the nutrition knowledge possessed by consumers. The scale/levels used are: (i) understanding of nutrition terms; (ii) awareness of dietary recommendations; (iii) knowledge of foods as sources of nutrients; (iv) ability to apply the information in each scale chosen by the respondent, and v) awareness of diet-disease associations.

This study adopted this design to assess the amount of nutritional knowledge possessed by traders in relation to TAVs. Traders of traditional African vegetables were asked to indicate their knowledge at each level of the nutrition scale and the implications. The level of nutritional knowledge possessed was tallied for each trader case interviewed. For example, if a trader possessed knowledge and application of scale item number 1 on understanding of nutrition terms and scale item number 2 on awareness of dietary recommendations out of the five, then the total number of nutrition knowledge possessed by this trader would be two (2). The dependent variable was, therefore, the number of items on the nutritional knowledge scale known to the trader, including an understanding of their implications. The expected responses ranged from zero to five. Some respondents indicated lack of awareness of all items in the nutritional knowledge scale, and hence their response implied zero knowledge. Few traders indicated having knowledge of all the five items identified in the nutritional knowledge scale. Ultimately, the implicit functional form of the generalized Poisson regression model estimated was:

Scale/level of nutritional knowledge possessed (y) = f (lnage, gender, education, lnincome, type of occupation, social capital) + e (4)

Model Specification: factors influencing frequency of intake of TAVs

The demand for TAVs was modeled using the frequency of consumption. In order to assess the factors influencing the frequency of intake of nutrient-dense vegetables, this study specified the dependent variable as the average number of times that TAVs were consumed by the trader's household per week. Hence, the dependent variable for the frequency of intake was a number such as zero times a week, three times a week, and so on. This study used the Standard Poisson and Generalized Poisson Regression models to isolate the determinants of the frequency of intake because the dependent variable was a count data variable. The model was specified as follows:

Frequency of TAV intake (Z) = f (lnage, gender of household head, household size, lnincome, occupation, education) + e (5)

Traders' attitudes towards traditional African vegetables (TAVs)

Descriptive and inferential statistics were used to examine the attributes of TAVs that were most preferred by traders' households. The descriptive statistics used were percentages and mean scores. Factor analysis was used to identify the latent dimensions underlying the variables used to measure the preferred attributes. The responses, which were given on a five-point Likert scale, were subjected to principal component factor analysis (PCA) with Varimax rotation. The component factors were subjected to the Kaiser-Meyer-Olkin and Bartlett's test (KMO and Bartlett's test) to determine the sampling adequacy. According to Leech et al. (2012), a KMO measure greater than 0.7 is preferable, while one that is less than 0.5 is inadequate. The KMO test is used to determine whether enough items are predicted by each factor. The above procedures were adopted for this study and used to analyze the preferred attributes leading to a higher frequency of intake of nutrient-dense vegetables by traders' households.

Data and variables

This study used data collected from trading households in Arumeru District located in Arusha Region in Tanzania. This is one of the districts where a project called "Improving Income and Nutrition in Eastern and Southern Africa by Enhancing Vegetable-based Farming and Food Systems in Peri-urban Corridors (VINESA)"[1] [VINESA is led by World Vegetable Center with financial support from Australian Center for International Agricultural Research (ACIAR)] is being implemented. The district is composed of three major ethnic groups, namely Wameru, Waarusha, and Maasai. A cross-sectional survey of TAVs traders was conducted from July to November 2015. A representative sample of the TAV traders was obtained through purposive sampling involving the selection of villages where the VINESA project was being implemented in the Arumeru District. A total of 65 small-scale TAVs traders from Manyire, Embaseny, and Bangata local markets were selected. A structured questionnaire was administered to the traders through face-to-face interviews. The variables used in the study were extracted from the household survey data and are shown in Table 1.

RESULTS AND DISCUSSION

Descriptive statistics results

Table 2 shows the descriptive statistics of the socio-economic characteristics of traders in the study. Majority of the traders interviewed (97%) were females. The results imply that the majority of those who trade in traditional African vegetables are women. The traders were also consumers of TAVs as shown by the ratio variables in Table 2. The results below therefore reflect traders' consumption of TAVs.

The results indicate that 89.23% of those surveyed had attained primary school education, 3.08% had no formal education, 7.69% had secondary school education, and none had attained middle-level college education. These results imply that the TAV trader group consists majorly of those with a low level of education. The mean age of traders consuming TAVs was 38 years, while the mean period of involvement in TAVs business was eight years, implying that the youth were relatively few among the traders. This situation raises the concern that non-consumption of TAVS by the youth (age group 15 to 35 years) and other individuals with higher levels of education is likely to promote poor diets and the incidence of nutritional deficiency disorders and diseases

Table 1. Description and expected sign of variables included in the nutritional knowledge and frequency intake models.

Variable name	Variable description	Variable coding	Expectations: nutritional knowledge, frequency intake models	Nutrition knowledge sign	Frequency intake sign
Gender	Gender of household head	1 if male, 0 if female	Men are generally expected to be more knowledgeable about their environment than women	+	+
Years of schooling	Number of years spent in school	Natural logarithm of number of years of schooling	The more the number of years of schooling the more the nutritional knowledge and frequency of intake of TAVs	+	+
Age	Age of the household head	Natural logarithm of age in years	One is expected to accrue more nutritional knowledge with age and also increase intake of TAVs	+	+
Occupation	Consumer's regular work or profession	1 if nutritionist, exposed to agricultural training, or teacher; 0 otherwise	Consumers that are nutritionists or those exposed to agricultural training are expected to have more nutritional knowledge and higher intake of TAVs	+	
Income	Annual household income	Natural logarithm of income	The higher the income, the more the nutritional knowledge and higher intake of TAVs	+	+
Group membership	Consumer is a member of a group	1 if yes; 0 otherwise	Consumers with membership in groups are expected to have more nutritional knowledge and higher intake of TAVs	+	+
Household size	Number of members in a household	Natural logarithm of the size of household	The higher the number of members in a household, the more the nutritional knowledge and higher intake of TAVs	+	+
Medicinal value	Medicinal value influences intake	1 if yes; 0 otherwise	The more the attachment to medicinal properties of TAVs, the higher the intake of these commodities		+
Nutritional value	Nutritional value influences intake	1 if yes; 0 otherwise	The more the attachment to nutritional properties of TAVs, the higher the intake		+
Time to prepare TAVs	Less time to prepare TAVs influence intake	1 if yes, 0 otherwise	The shorter the time required to prepare TAVs, the higher the intake		+
TAVs weekly expenditure	Amount spent weekly to purchase TAVs	Natural logarithm of expenditure	The higher the weekly expenditure on TAVs, the more the intake of TAVs		+

in the township areas. There is, therefore, need to promote the consumption of TAVs among the youth as well as educated traders.

The ethnic composition of the traders consisted of 41.54% Meru, 13.85% Arusha, and 21.54 Chagga. Business activity was the main occupation for 91% of the traders. The mean yearly income of the traders was 1,634,692 Tanzania shillings (Tshs) or (US$ 730), which was majorly derived from the sale of TAVs, other global vegetables, and fruits. The results further showed that traders spent approximately Tshs 9,143.10 (US$ 4.1) per week in purchasing TAVs for household consumption. The average frequency of household intake of TAVs was 1.4 times per week (that is basically once a week).

Factors affecting TAV nutritional knowledge

The respondents were asked five questions to assess their nutritional knowledge and scores from each case were added together. Knowledge about the nutritional value of TAVs ranged from zero to five. The mean nutritional knowledge of the traders was 2.27 out of 5 (that is 45.4%), implying that traders had moderate nutritional knowledge about TAVs. The mean deviance and the Pearson chi-square ratio (the Pearson chi-square value divided by its degree of freedom) were used to assess the goodness of fit of the standard Poisson model. The estimated deviance and Pearson ratios were as shown below:

Table 2. Socio-economic characteristics of the sample.

Demographic properties	Frequency
Gender (%)	
Female	96.92
Male	3.08
Marital status of respondent (%)	
Married	85.16
Single	9.23
Separated	3.08
Divorced	1.54
Ethnicity group (%)	
Meru	41.54
Arusha	13.85
Chagga	21.54
Others (Sukuma, Nyakyusa, Iraqw, Pare)	23.07
Main occupation (%)	
Agriculture	9.23
Business	90.77
Level of education (%)	
None	3.08
Primary	89.23
Secondary	7.69

Socio-economic characteristics of the sample-Ratio variable scales	Mean	Standard deviation
Age of respondent (mean)	38.15	9.497
Number of years of schooling (mean)	7.14	1.424
Household size (count) mean	4.338	1.123
Distance to nearest market (minutes) mean	51	57.637
Amount spent to purchase TAVs per week (Tshs) (mean)	9,143.10	6585.37
Household income (Tshs) (mean)	1,634,692	1,408,851
Nutritional Knowledge (count) mean	2.769	1.272
Frequency intake (count) mean	1.415	0.6096184

Source: Author's survey of TAVs consumers in Arumeru District, July to November 2015.

Deviance/df = 40.79479437/53 = 0.76
Pearson/df = 30.81113652/53 = 0.58

The two ratios are significantly smaller than 1, which is evidence of under-dispersion and the fact that the standard Poisson model was not a good fit for the data. However, the generalized Poisson model was a better fit for the data and hence the results derived from this model (Table 3) form the basis of the discussion that follows. The model results show that nutritional knowledge of traders was influenced positively by age, number of years of schooling, annual income, household size, and interaction terms (that is age and annual income; years of schooling and annual income; and age and household size). Table 4 shows the results of Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) tests of goodness of fit for the two models. Lower values obtained for either one of the two tests indicate a better fit.

Age of the respondent significantly influenced (P-value <0.05) the level of nutrition knowledge possessed. Each additional year was expected to increase the level of nutritional knowledge by a factor of 1.60e-06, with all other variables in the model being constant. Thus, an individual acquires more nutritional knowledge with increasing age, which means that younger traders would be expected to possess relatively less nutritional knowledge compared with their older counterparts. The results also show that the number of years of schooling significantly (P-value<0.01) influenced the level of nutritional knowledge, which suggests that education plays an important role in enhancing the level of

Table 3. Factors which influence traders' awareness of nutrition knowledge.

Dependent variable = Scale/level of nutrition knowledge possessed by respondent	Standard Poisson		Generalized Poisson	
	IRR	P-values	IRR	P-values
Gender	1.051	0.708	1.134	0.423
Ln of Years of schooling	0.0000134	0.018***	3.67e-06	0.005***
Ln of Age	4.54e-06	0.058**	1.60e-06	0.020**
Occupation	1.012	0.818	1.027	0.578
Ln of Income	0.064	0.020**	0.046	0.005***
Group membership	1.056	0.662	1.090	0.398
Ln of Household size	0.059	0.141	0.065	0.071*
Ln Age &ln Income	2.113	0.082*	2.305	0.027**
Ln Yrs. in school & ln Income	2.271	0.016*	2.477	0.005***
Ln Age & Ln HH size	5.223	0.204	5.024	0.109
Constant	1.89e+18	0.011	1.15e+20	0.003
Number of observations	64		64	
Wald chi2(10)	18.86		19.07	
Prob>chi2	0.0421		0.0394	
Pseudo R2	0.0186		0.0398	

*, ** and *** denote significance level at 10, 5 and 1 percent respectively.

Table 4. Akaike's and Bayesian Information Criterion.

Model	Obs.	ll(null)	ll(model)	df	AIC	BIC
Standard Poisson	64	-110.4389	-108.3874	11	238.7749	262.5226
Generalized Poisson	64	-104.1484	-100.0033	12	224.0065	249.9131

nutritional knowledge. In this case, respondents with more years of schooling had a higher likelihood of being more nutritionally aware with respect to TAVS compared with those who had spent fewer years in school.

Annual income of the respondent significantly (P-value<0.01) influenced nutritional knowledge of the traders. For each additional 1.00 Tsh, the level of nutritional knowledge changed by a factor of 0.046. Thus, more than their lower income counterparts, higher income traders are able to obtain more nutritional information because they have the capacity to move around and attend meetings and other fora that may facilitate the acquisition of nutritional knowledge. Household size also significantly (P-value<0.1) influenced awareness of nutrition knowledge. This implies that with increase in household size, the level of nutritional knowledge would be expected to change by a factor of 0.065, while holding all other variables in the model constant.

The interaction term between age and annual income significantly (P-value<0.05) influenced awareness of nutrition knowledge. The older respondents who also had higher income were more likely to possess more nutritional knowledge. In addition, the interaction term between the number of years of schooling and annual income of the respondent significantly (P-value<0.001) influenced the traders' awareness of nutritional knowledge. Hence, more educated traders with higher incomes would be expected to possess more nutritional knowledge about TAVs.

Factors affecting the frequency of TAV Intake

This section presents the results of the factors that influenced the frequency of intake of traditional African vegetables among traders. The results of the regression models are shown in Table 5. The Prob-chi^2 test statistic showed that both the models fit the data well (p-value = 0.0000and 0.0000 respectively). The mean deviance and the Pearson chi-square ratio (the Pearson chi-square value divided by its degrees of freedom) were used to assess the degree of fit of the Standard Poisson Model. The estimated deviance and Pearson ratios are shown below:

Deviance/df = 13.83700644/51= 0.271
Pearson/df = 12.32726424 /51= 0.241

These results show that both ratios are significantly smaller than 1, thus indicating under-dispersion and the fact that the standard Poisson model does not fit the data

Table 5. Factors which influence traders' frequency intake.

Dependent variable = Intake frequency	Standard Poisson		Generalized Poisson	
	IRR	P-values	IRR	P-values
Gender	1.134	0.462	1.497	0.299
Education	0.797	0.043**	0.721	0.085*
Ln of Age	0.921	0.790	0.914	0.764
Occupation	0.941	0.300	0.873	0.048**
Ln of Income	1.038	0.597	1.048	0.598
Ln of household size	1.463	0.119	1.986	0.013**
Member of group/social	0.955	0.743	0.828	0.184
Medicinal value	1.219	0.286	1.288	0.220
Ln of TAVs Weekly spent	1.092	0.183	1.100	0.187
Nutrition value	1.405	0.101	1.619	0.044**
Time to prepare	1.216	0.174	1.387	0.042**
Constant	0.191	0.202	0.052	0.060
Number of observations	65		65	
Wald chi2(13)	138.01		114.05	
Prob>chi2	0.0000		0.0000	
Pseudo R2	0.0293		0.0283	

* and ** denote significance level at 10 and 5 percent respectively.

Table 6. Akaike's and Bayesian Information Criterion.

Model	Obs.	ll(null)	ll(model)	df	AIC	BIC
Standard Poisson	65	-80.95128	-78.58167	14	185.1633	215.6048
Generalized Poisson	65	-67.94971	-69.87097	14	167.7419	198.1834

well. Table 6 shows the results of Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) tests of goodness of fit for the two models. Generalized Poisson model was a better fit for the data because it had lower values for both AIC and BIC. The discussion below is based on the results of generalized Poisson model.

Years of schooling significantly (P-value<0.1) influenced frequency of intake of TAVs. The longer the period spent in school, the higher the likelihood that traders would consume more TAVs. This implies that education can play an important role in sourcing for and accessing nutritional knowledge, which is likely to translate into improved consumption of TAVs. However, this occurrence is still at the lowest significance level (that is, 10%). Occupation of the respondent significantly (P-value<0.05) influenced frequency of TAVs intake. The incidence rate ratio for frequency of intake changed by a factor of 0.873, implying that traders without occupational training in nutrition, agriculture, or teaching had 13% less frequency of TAVs consumption compared with those that possessed these qualities.

Household size significantly (P-value<0.05) influenced frequency of intake of TAVs. Thus, if the size of the household increases by one individual, the incidence rate for frequency intake of TAVs would be expected to change by a factor of 1.986, if all other variables in the model are held constant. The bigger the household size, the higher the frequency of consuming TAVs.

The frequency of TAVs intake was significantly (P-value<0.05) influenced by traders' perception of their nutrition value. The incidence rate for frequency of TAVs intake changed by a factor of 1.619, or increased by 62%, when the respondent indicated consumption of TAVs for nutritional purposes. The time spent to prepare TAVs also significantly (P-value<0.05) influenced the frequency of TAVs consumption such that less time spent in the preparation of these vegetables increased the consumption incidence rate by a factor of 1.387 (that is, approximately 39%).

Traders' attitude towards consumption of traditional African vegetables

Factor analysis was used to identify latent dimensions underlying the different variables applied in measuring traders' attitudes. Responses to the 11 items on the five-point Likert-type scale were subjected to principal component factor analysis. Exploratory factor analysis with Varimax rotation was employed to create

Table 7. Results of exploratory factor analysis.

Factor and item description	Factor loading	% variance explained
Factor 1: Health benefits		32.38
Fresh TAVs contain more nutrients than dried ones	0.835	
Intake of variety of TAVs each day guarantees vitamins and minerals required	0.915	
It is important to choose diet accompanied with TAVs	0.721	
Consumption of TAVs improves eyesight and boosts body immunity	0.872	
TAVs are best consumed when fresh	0.838	
Factor 2: Personal taste		20.78
TAVs are inferior foods (poverty food)	0.664	
TAVs are tasteless and bitter	0.879	
Factor 3: Time factor		10.84
TAVs take more time to prepare	0.941	
Factor 4: Personal perception		10.48
TAVs are not good for me	0.956	

Source: Author survey of TAVs consumers in Arumeru District, July to November 2015.

measurement scales. The objective was to obtain fewer dimensions reflecting the relationships among these inter-related variables. An Eigen-value greater than one rule was applied in identifying the number of factors. The variables that had large loadings on the same factors were grouped together. A factor loading value of 0.50 and above is normally considered as good and significant (George and Mallery, 2003). The analysis produced a solution with five factors that accounted for 74.48% of the total explained variance as shown in Table 7. The Kaiser's overall measure of sampling adequacy obtained was 0.695, which borders on the recommended threshold of 0.7 (George and Mallery, 2003) suggesting that the data were appropriate for factor analysis.

Five attitude variables concerning importance of consuming TAVs varieties were loaded on factor 1 with the cross-correlation coefficients of 0.835, 0.915, 0.721, 0.872, and 0.838 (Table 7). This factor accounted for 32.38% of the total variance and was termed ‘health benefits’ because these variables focused mainly on the importance attached to the consumption of TAVs by local traders. Higher scores and positive responses on this factor implied a general understanding of the health benefits of TAVs among traders and the significance of consuming these commodities. Factor 2 had cross-correlation coefficients of 0.664 and 0.879. Since these variables focused mainly on attitude towards taste of TAVs varieties, factor 2 was labeled as ‘personal taste’ and accounted for 20.78% of the total variance. These scores and the positive responses on this factor emphasize an important general opinion about the taste of TAV varieties.

Only one attribute, that is, preparation time for TAVs, was loaded on factor 3 with cross-correlation coefficients of 0.941. This attribute focused on time taken to prepare TAVs. Therefore, factor 3 was termed ‘time factor’. Given that peri-urban consumers generally have very limited time to prepare TAVs, the traders usually sell already prepared packages of these commodities. On the other hand, this was not the case with rural consumers. Time factor accounted for 10.84% of the total variance. Factor 4 had a cross-correlation coefficient of 0.956, which was as a result of the attribute ‘TAVs are not good for me’. This variable was labeled as ’personal perception’ and it accounted for 10.48% of the total variance. This result suggested that negative perception towards TAVs still persisted among consumers. This perception has pervaded the communities for many years and is a hindrance to the consumption of these commodities. The cumulative percentage of variance for all the factors explained 74.47% of the total variance.

Conclusion and Recommendations

This study found that the factors which influenced traders' awareness of nutrition knowledge were level of education, age, annual income as well as the interaction of these factors. The factors which influenced traders' frequency of intake of TAVs were education, household size, occupation, nutrition value, and preparation time. The study, therefore, concluded that socio-economic factors have a significant effect on nutritional knowledge of TAVS and frequency of intake of these commodities. Traders had a positive attitude towards consumption of TAVs. The ‘health factor’ had the highest weight in the factor analysis, implying that traders strongly associate consumption of TAVs with health wellbeing. Moreover, they consider TAVs as normal food rather than inferior or food for the poor. There is need to improve the processing

and cooking of TAVs so as to maintain the nutrient content and also preserve taste. The weight for 'perception factor' was relatively high, suggesting that there is need for change of attitude towards the consumption of TAVs because they are important to human health. The study recommends inclusion of the health attributes of TAVs in promotional campaigns to encourage consumption. Finally, promotional approaches such as advertisements, posters, road shows, and cooking demonstrations can be used to enhance the consumption of TAVs.

CONFLICT OF INTEREST

The authors have not declared any conflict of interest.

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