



## Household Expenditure on Traditional African Vegetables: A Tobit Model

Johnson James Kimambo<sup>1\*</sup>

<sup>1</sup>Moshi Co-operative University, P.O.Box 474, Moshi, Tanzania.

### **Author's contribution**

*The sole author designed, analyzed, interpreted and prepared the manuscript.*

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### **ABSTRACT**

**Aims:** Tanzania is among countries of Sub-Saharan Africa that the effects of malnutrition as result of poor dietary diversity have been witnessed. Traditional African vegetables have proved valuable in providing important nutrients as well as for income generation. This study aims at assessing household expenditure on traditional African vegetables.

**Study Design:** Cross-sectional design was adopted during the study.

**Place and Duration of Study:** Study was carried out in Arumeru District, Arusha Region, Tanzania from January to November 2015.

**Methodology:** Study area was selected purposively to represent traditional African vegetables producing households where the VINESA-AVRDC project was being implemented. A pre-tested questionnaire was administered to 262 households.

**Results:** Descriptive statistics such as mean and standard deviation; and Tobit model was used during analysis of data. Tobit model results indicate that sex, marital status, education, distance to the market, nutritional knowledge, frequency intake, culture/ food taboos and price affordability had significant effect toward household expenditure on traditional African vegetable (TAV). Size of the household, yearly household income and occupation of the respondent were assumed to influence household expenditure, surprisingly, they were not.

**Conclusion:** These results suggests that intake of TAVs can be enhanced by increasing household expenditure for traditional African vegetables.

\*Corresponding author: Email: kimambojohnson1@gmail.com;

**Keywords:** Traditional African vegetables; Tanzania; Arumeru; Tobit model.

## 1. INTRODUCTION

Traditional African vegetables are recognized for providing nutritious food required for health living in Southern Africa region. These vegetables play a significant part in providing adequate micronutrients and income generation. Some of these vegetables have been perceived to contain medicinal-value properties and cultivated partly for home use. The consumption of traditional vegetables is increasing significantly amongst the urban population. This is due to growing recognition of their high nutritional value. However, the traditional Tanzanian diet relies heavily on staple foods; grains, cereals, roots and tubers.

Generally, the pattern of traditional Africa vegetables' uptake has dramatically shifted in sub-Saharan Africa [1]. As of recently, researchers have noted that the production and productivity of traditional African vegetables are on rise [2,3]. The most frequently consumed traditional vegetables are African nightshade, Amaranthus, Ethiopian mustard, African eggplant, [4,5]. However, uptake of these traditional vegetables is still low and depend on local customs [4,6].

Consumption of traditional African vegetables rely on households' socio-economic factors [7]. In Tanzania, malnutrition as a result of poor nutrition security many are affected. There have been many efforts by government and partners of development to address malnutrition, however, there has been no significant progress toward improving nutritional status. In this view, issues like stunting, as a result of macronutrients and micronutrients deficiency, impair immune development [8,9]. Stunting currently affects 42% of children under five years of age, and is only 2% lower than it was in 2005 [10]. The decline in use of traditional African vegetables by many rural communities has resulted in poor diets and increased incidence of nutritional deficiency disorders [11].

More than 80% of the African population live in rural areas and depend on agriculture for their livelihoods where they produce a wide range of horticultural crops including fruits and vegetables. Of all the indigenous tropical leafy vegetables, amaranth has the largest number of species and varieties [12].

## 2. METHODOLOGY

### 2.1 Theoretical Framework

Theories provide explanation for relationships between factors in research questions and hypotheses [13]. In this view, it was very relevant to look at some theories that could be used in explaining household expenditure of traditional vegetables. In the study area, it was important to understand the economic theory of household decision making. In the standard household model, households prefer using their resources such as labor, skills and equipment to attain the highest level of satisfaction possible. According to Ruel et al. [14], decision making is a result of certain income level.

Empirical models that have been used to study behavior that deals with choice include the Probit, Logit and Tobit models. Probit and Logit models use a binary variable that takes a value of one if the decision maker makes a decision in question, and zero otherwise. While the two models have wide empirical application in studies that consider household choice decisions, they have been criticized for their failure to measure and account for the extent of choice made by the household. This loss of information is prevented by using the Tobit model [15,16]. A Tobit model as developed by Tobin [17] may be specified as follows:

$$y_i = x_i\beta + \varepsilon_i, \tag{1}$$

where  $x_i$  is a vector of predictors,  $\beta$  a vector of regression coefficients, and  $\varepsilon_i \sim N(0, \sigma_i^2)$ , for some standard deviation  $\sigma_i$ .

For a normally distributed lower-censored variable's censored observations,

$$x_i\beta + \varepsilon_i \leq \tau, \tag{2}$$

Where  $\tau$  is the threshold, so that  $\varepsilon_i \leq \tau - x_i\beta$  and therefore

$$\Pr(y_i \leq \tau | x_i) = 1 - \Phi((x_i\beta - \tau)/\sigma_i) \tag{3}$$

where  $\Phi$  denoted the standard normal cdf. The estimated Tobit model was specified as:

$$y_i = \beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_{14}x_{14} + \varepsilon_i \tag{4}$$

where

$y_i$  = Proportion of total household consumption expenditure spent on traditional African vegetables

- $x_1$  = Respondent age (in years)
- $x_2$  = Household size
- $x_3$  = Number of years in school
- $x_4$  = Household annual income in Tshs.
- $x_5$  = Sex of the respondent (1 = male and 2 = female)
- $x_6$  = Distance to nearest market selling TAVs varieties (in km)
- $x_7$  = Marital status of respondent
- $x_8$  = Occupation of the respondent
- $x_9$  = Ethnicity of the respondent
- $x_{10}$  = Nutrition knowledge of the respondent
- $x_{11}$  = Frequency intake of TAVs
- $x_{12}$  = Culture/ food taboos
- $x_{13}$  = Affordable price
- $\varepsilon$  = Stochastic (error) term

## 2.2 Study Area, Data and Variables

This study was conducted in Arumeru District in Tanzania. Study was imbedded on the ongoing project called "Improving Income and Nutrition in Eastern and Southern Africa by Enhancing Vegetable-based Farming and Food Systems in Peri-urban Corridors (VINESA) is being implemented. Arumeru is one of the five districts in Arusha Region of Tanzania. Arumeru District has the largest number of households in the region and it has the second highest percentages of households involved in smallholder agriculture in the region. Vegetable production is an important activity in Arumeru District. It has the largest planted area with tomatoes which accounts for 79 percent of tomatoes grown in the region, and cabbage (13 percent of the cabbage planted area), though there is no large quantity production of onion reported in the district. The three major ethnic groups in the district are Meru, Arusha and the pastoralist Maasai. The study was undertaken for five months from July to November, 2015. A total of 262 households were selected. A semi-structured questionnaire was then administered to the sampled cases through face-to-face interviews. STATA software was then used for statistical analysis of the data.

## 2.3 Study Design

The study adopted cross sectional survey in studying particular phenomenon at a particular time due to time savings and accommodate large samples [18,19]. Design is proved to have high level of confidentiality at the same time convenient and efficient. It also gives the researcher an opportunity to get an accurate response to issues as well as test theories on

social relationship at both the individual and group level [20].

## 3. RESULTS AND DISCUSSION

### 3.1 Descriptive Statistics

Table 1 shows the socioeconomic characteristics of the study area. The survey results demonstrated that the majority of the household heads' interviewed 26% were males and 74% were females. 76% of the household head had primary school while only a few had middle-level college (0.76%) and university (1.14%) education of those who consumed TAVs. The observed results indicate that the educated population consume TAVs minimally. The mean age of the household head was nearly 40 years implying that youthful household head of TAVs were relatively few. Hence, there is need to promote consumption of TAVs among the youth. This trend raises a concern that if youth and educated groups are not consuming TAVs there is a likelihood of increased poor diets and incidences of nutritional deficiency disorders and diseases in the township areas. Farming was the main occupation for 62.6% of the household head. However, no portion of the farming land is put under TAVs. 45%, 21% and 20% of the household were from Meru, Chagga and Arusha ethnic groups respectively. The mean yearly income for household head was Tshs 1,411,663. The results further showed that household spend Tshs 6,328. 63 per week to purchase TAVs. The frequency for household intake on a weekly basis was 1.2 times per week i.e. basically once a week.

### 3.2 Determinants of Household Spending on Traditional African Vegetables

In order to examine determinants influencing household expenditure on traditional African vegetables, Tobit regression model was used. The results of the fitted model are shown in Table 2. The F-statistics (14, 225) = 5.24 with a  $P = .0001$  tells us that our model fits significantly.

Number of years household head spent in school was found significantly ( $P = .1$ ) influencing household expenditure. One-unit percentage change in years the household head spent in school, will decrease the probability of household expenditure on traditional African vegetables by about 40%. This clearly showed that education plays important role in deciding how much is

spent on TAV. The less educated household heads are likely to spend much on TAV. This findings are contrary to [21], where authors found that education was not significantly influencing intake of TAV.

Gender of the household head was significant (P=.1) determinant of household expenditure on TAV. Gender of the household influence negatively affected the probability of household spending on TAV by 19%. Findings revealed that household headed by female is less likely to spend much toward TAV purchases. Marital status of the household head was found to be significantly (P=.1) influencing household expenditure. One percentage change of marital status of the household head will eventually

increase the probability of the household expenditure by about 7%. Result revealed that as household head make marital status change the more they spend on TAV. In the study area, if a person is single her/his consumption of TAV is unreliable but the moment this status change and have family, they spend more on TAV.

Distance to the local market was significantly (P=.05) influencing household expenditure on TAV. Findings indicated that one percentage change in distance to the market, will tend to increase the probability of household expenditure by 13%. Less distance to the market, the more household expenditure on TAV will be spent. Nutrition knowledge of the household head was found to be significantly (P=.05) influencing

**Table 1. Socio-economic characteristics of the household sample**

<b>Demographic properties</b>	<b>Household head(262)</b>
<b>Gender (%)</b>	
Female	73.66
Male	26.34
<b>Level of education (%)</b>	
Number of years of schooling (mean $\pm$ s.d)	6.95 $\pm$ 2.80
None	8.78
Primary	75.57
Secondary	13.74
Middle-level college	0.76
University	1.14
<b>Marital status of respondent (%)</b>	
Married	81.68
Single	13.36
Separated	0.76
Divorced	0.76
Widow or widower	3.44
Age of respondent (mean $\pm$ s.d)	39.7 $\pm$ 16.9
Household size (count) (mean $\pm$ s.d)	3.9 $\pm$ 1.42
Knowledge in Nutrition (count) (mean $\pm$ s.d)	2.8 $\pm$ 1.2
<b>Ethnicity group (%)</b>	
Meru	45.42
Maasai	3.05
Arusha	20.23
Chagga	20.61
Others (Sukuma, Nyakyusa, Iraqw, Pare)	10.69
<b>Main Occupation (%)</b>	
Agriculture	62.60
Casual labor	3.06
Formal employment	14.50
Business	7.25
Agriculture and livestock	12.60
Household income (Tshs) (mean $\pm$ s.d)	1,411,663 $\pm$ 1,097,182
Amount spent to purchase TAVs per week (Tshs) (mean $\pm$ s.d)	6,328 $\pm$ 4500
Distance to nearest market (mints) (mean $\pm$ s.d)	28 $\pm$ 16
Frequency intake (count) (mean $\pm$ s.d)	1.21 $\pm$ 0.53

**Table 2. Factors influencing household expenditure on TAV**

<b>Explanatory variables</b>	<b>Marginal effects (dy/dx)</b>	<b>Robust std. error</b>	<b>P-value</b>
Gender	-0.1919696	0.0996654	0.055*
Marital status	0.0674736	0.0372171	0.071*
Age of respondent	-0.1131719	0.1373154	0.411
Number of years in schools	-0.3915136	0.2124257	0.067*
Ethnicity of respondent	0.0236132	0.0238829	0.324
Occupation of respondent	-0.0355623	0.0236435	0.134
Annual household income	0.031007	0.0526546	0.557
Household size	0.076108	0.1233321	0.538
Distance to the market	0.1387418	0.054839	0.012**
Nutrition knowledge	0.0938603	0.0383963	0.015**
Frequency intake	0.2801433	0.0783444	0.000***
Culture/ food taboos	0.220908	0.0533141	0.000***
Affordable price	0.1574396	0.0943177	0.096*
Nutritious value	0.1214668	0.1484751	0.414
Constant	8.284612	1.020667	0.000
/Sigma	0.6268915	0.0310843	
No. of observation	239		
F (14, 225)	5.24		
Prob>F	0.0000		
Pseudo R <sup>2</sup>	0.1019		
Log pseudolikelihood	-228.28045		

\*\*\*P=.001, \*\*P=.05 &amp; \*P=.1

household expenditure. One percentage change in nutrition knowledge, will increase the probability of household expenditure by 9%. Findings showed that, the more nutrition knowledge of the household head, higher the expenditure on TAV will be. Similar findings with [22], found nutrition knowledge to influence consumption of TAV.

Furthermore, frequency intake of TAV was significantly (P=.001) influencing household expenditure. Results shows that one percentage change of frequency intake, will increase the probability of household expenditure by 28%. More frequently intake of TAV tend to increase household expenditure. Culture or food taboos was significantly (P=.001) influencing household expenditure. Findings indicate that one percent change in culture or food taboos, will increase the probability of household expenditure by 22%. This finding is in contradiction to that of [22]. Affordable price of TAV was significantly (P=.1) influencing household expenditure. Study found that one percentage change of price, will increase the probability of household expenditure by 15%. Affordable price of TAV likely much money will be spent on it. Similar findings were observed in the studies of Kimambo et al.[4] and Kimambo [6] where price significantly influenced spending on TAV.

#### 4. CONCLUSION

In this study, determining factors explaining household expenditure were number of years of schooling, gender of household head, marital status, distance to the local market, nutritional knowledge, frequency intake, culture or food taboos and affordable price of TAV. Therefore, the study concludes that socio-economic determinants have influence on household expenditure on traditional African vegetables.

#### COMPETING INTERESTS

Author has declared that no competing interests exist.

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