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African Indigenous Vegetables Production and Consumption Behavior of Farmers in Zambia: An Econometric Analysis

Surendran Arumugam[1], Ramu Govindasamy[2], James E. Simon[3], Emil Van Wyk[4], Kenneth Chali[5], Mwangala Mbewe[6], Inonge Siziya[7], Steve Weller[8], Xenia K. Morin[9]

[1 2 3 9]Rutgers, The State University of New Jersey, New Brunswick, New Jersey, USA
[4 5 6 7]Lusaka Office, 13K Reedbuck Road, Kabulonga, Zambia
[8]Purdue University, West Lafayette, IN, USA

suren.tnau@gmail.com[1], govind@sebs.rutgers.edu[2], jimsimon@rutgers.edu[3], emil@agrismartafrica.com[4], kenneth@agrismartafrica.com[5], mwangala@agrismartafrica.com[6], nonisiziya@icloud.com[7], weller@purdue.edu[8], xenia.morin@rutgers.edu[9]

Abstract. African indigenous vegetables (AIVs) have recently received wide attention for their contribution toward food and nutrition security. Promoting the production and consumption of AIVs is likely to mitigate food insecurity and alleviate malnutrition in the African region. To document and analyze existing patterns of AIV production in Zambia, farmers were surveyed in person using a structured questionnaire. A total of 300 farmers were selected from Lusaka (50), Katete (50), Chipata (75), Lundazi (75), and Petauke (75). Analysis of the survey results using logit model identified that those who farm less than 10 acres of farming land, were concerned about nutrition quality of AIVs, reported that price of farm produce is fixed by buyers, were registered as a member of any community group or association, received training related to nutrition and health, saved money for unexpected expenses, and were single are more likely than other farmers to produce AIVs for home consumption. Whereas, those who visited the nearest market two times or more, traded agricultural produce through intermediaries, owned a TV, earned an income above 30,000 kwacha and has a University degree are less likely to produce AIVs for home consumption. These results indicate that interventions aimed at increasing AIV production for home consumption should target specific groups of farmers rather than all farmers. This survey also captures the most common AIVs that are grown in these regions in Zambia: Sweet potato leaves, amaranth and orange sweet potato.

Keywords. Willingness to grow AIVs, Home consumption, Farmers Survey, Demographic Characteristics, Logit Model, Sub-Saharan Africa

Introduction

In general, the Sub-Saharan Africa region is habitat to more than 45,000 species of plants, of which, about 1,000 can be consumed as green leafy fruits or vegetables (MacCalla, 1994). However, few of these fruits or vegetables are eaten regularly, which contributes to malnutrition in rural farming communities (Afari-Sefa *et al.*,2012; Thompson and Meerman, 2010). Malnutrition exists because most households rely largely on carbohydrate-rich foods and consume limited quantities of fruits, vegetables, and animal products. The consumption and

production of indigenous vegetables have been crucial in many African countries for income generation and in promoting health and food security (Onyango, 2002; Chadha, 2007). The most popular AIVs include Amaranthus, Nightshade, Spider plant, Cowpea and Crotalaria respectively (Irungu, *et al*., 2007; Gilbert Muhanji *et al*., 2011; Kamga *et al*.,2013). Indigenous vegetables also known as African Indigenous Vegetables (AIVs), are of great interest in Zambia because of their nutritional and medicinal values. Some AIVs have 13 times more iron and 57 times more vitamins than exotic vegetables (IPGRI, 2004). They are also easily produced and provide millions of consumers with healthy nutrients namely, vitamins, minerals, antioxidants and anticancer factors (Abukutsa, 2007; Van den Heever and Venter 2007; Mbugua *et al*., 2011; Reta Alemayehu *et al*., 2014). Yet, few AIVs are cultivated for home consumption and commercial production (Weller et al. 2015).

Although many countries in the world have made good progress in many health indicators over the past few years, the nutritional status of sub-Saharan Africans remains low (UNICEF, 2016; Hoffman *et al*., 2017). Low-income women and children under five years old are especially vulnerable to malnutrition, and are susceptible to infectious diseases such as diarrhea and respiratory infections that inhibit nutrient absorption and decrease appetite (Ivers and Cullen, 2011) because they consume a diet of mainly carbohydrate-rich foods with low minerals and vitamins (Savy *et al*., 2005; Leach and Kilama, 2009). The declining production and utilization of indigenous vegetables non-competitive and unattractive compared to the "major" crops, may lead to reduced dietary diversity at household levels with associated adverse nutritional consequences (Van den Heever & Venter, 2007; Pauline *et al*.,2015). Dietary diversity is a qualitative measure of food consumption that reflects household access to a variety of foods including traditional indigenous vegetables and is also a proxy for nutrient adequacy of the diet of individuals (FAO, 2011).

Expanding diets with AIVs is a viable way to provide sufficient nutrients to the human body to overcome malnutrition and associated health problems, mostly for poor urban and rural households. Particularly for children below five years of age, girls and women who are usually vulnerable in terms of nutrition, and whose health would benefit from traditional African vegetable consumption (Keatinge *et al*., 2011; Afari-Sefa *et al*., 2012; Keding *et al*., 2012). Besides, AIVs are better adapted to the environment than other vegetables and provides quality nutrition with low prices to a large population segment (Chweya and Eyzaguirre, 1999). Many universities and international organizations like the World Vegetable Center-Regional Center for Africa (RCA) have been working on research and development, training, and information on indigenous vegetables with a major emphasis on eco-geographic assessment, collection, evaluation, and identification of promising germplasm (Chadha, 2007). Subsequently, since 1998 more than 5 tons of traditional leafy vegetables seeds have been produced and distributed to the NGOs, private sector, and over 12,000 farmers in Africa (Chadha, 2007) However, many of these farmers are not familiar with the best crop production practices, vegetable preparation, and utilization; nor are many farmers familiar with the best postharvest handling practices, especially preservation methods and simple processing and seed production techniques.

Further, many AIVs have been considered as 'weeds' as reflected in their former names. For example, Spider plant (*Cleome Gynandra*) was called 'Spider Weed'; vegetable Amaranths (*Amaranthus* Species) were referred to as 'Pig Weed' and 'Black Jack'; 'Obnoxious weed' (*Bidens pilosa*) is a delicacy in Zambia (Abukutsa-Onyango, 2009). These perceptions will need to be changed in order to grow more AIVs. Since the overarching goal of this project is to determine if AIVs varieties offered in family diets help to improve household nutritional security, Zambian farmers' understanding of AIV's nutrition and economic characteristics, quality seed, production practices, breeding, conservation, commercialization, processing, value addition and product development is critical to successful implementation and

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revolutionizing the horticultural sector for food security, nutrition, income and sustainable developments. It is, therefore, time to strategically understand the farmer's interest in AIVs production and their interest in increasing home consumption. Against this background, the present study investigated the characteristics of producers those who produce AIV's for home consumption in their community. The objective of this study was to predict the characteristics of those who produce AIVs for home consumption in Zambia.

Methodology

Data : The baseline production survey for African Indigenous Vegetables (AIVs) was undertaken in two provinces in Zambia, that is, Lusaka and Eastern province. AIVs producers from a total of six districts were interviewed: Lusaka and Chongwe districts from Lusaka province, and Chipata, Lundazi, Katete and Petauke districts from Eastern province. The survey was conducted in person by the survey team between 19th October 2015 and 6th November 2015 at various locations in Zambia, and on farms where the farmers produced indigenous vegetables in several areas of these districts. The study population included 50 producers from Lusaka, 50 from Katete, 50 from Chipata, 75 from Lundazi, and 75 from Petauke. The survey participants were selected based on their production of AIVs for home consumption, sale, or both. A structured questionnaire was used as a tool to collect data on the production of AIVs. The purpose of the survey was explained to the farm household and their consent was obtained before collecting information required for the survey. Local names of these indigenous vegetables were used during the survey to help farmers identify the vegetables. The survey was administered in English and also in the appropriate provincial native languages. English, Soli, Bemba, Tonga, and Nyanja languages were used in Lusaka province; and Tumbuka, Chewa, and Nsenga languages were used in the Eastern province. After surveys were completed, survey information was coded as per the software and data analyzed.

Data Analysis : Descriptive statistics were determined using Stata version 12 (STATA Inc., 2011). Depending on the type of data, means, frequencies, and logit regression were computed.

Empirical Modeling of Farmer Characteristics and AIVs : Farmers were asked to indicate whether they produce AIV's for home consumption. In the logit model framework, the dependent variable is defined as '1' if the farmers produced AIV's for home consumption and '0' otherwise. A logistic regression analysis was used to examine the relationship between binary responses and a set of dependent variables or covariates (Arumugam *et al*., 2016[a]). For binary response models, the response variable (Y) can take one of two possible values as 1 and 0. Suppose x is a vector of independent variables that denotes the socio-demographic characteristics. The relationship explored as

$$P_i = F(\beta_j \chi_{ij} + \varepsilon) \quad (1)$$

$$= \beta_0 + \beta \text{SocioDemographic Characteristics} + \varepsilon$$

Where:

P_i is the probability of farmers who produce AIV's for home consumption,

$\beta_j \chi_{ij}$ is the combination of the independent variable.

β is the parameters to be estimated.

ε is a disturbance term or error term.

The logistic distributional assumption for the random term, the probability P_i can be expressed as:

$$P_i = F\left(\beta_0 + \sum_{j=1}^{j} \beta_j \chi_{ij}\right) = F(\beta \chi_i) = 1/[1 + \exp(-\beta \chi_i)] \quad (2)$$

The estimated coefficients in Equation 2 do not directly represent the marginal effects of the independent variables on the probability P_i.

If the dependent variable is continuous, the marginal effect of χ_i on P_i is given as:

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$$\partial P_i/\partial \chi_{ij} = [\beta_j \exp(-\beta\chi_i)]/[1+\exp(-\beta\chi_i)]^2 \quad \text{..... (3)}$$

In the case of a binary explanatory variable χ_{ij} which take values of 1 and 0, and the marginal effect is determined as:

$$\partial P_i/\partial \chi_{ij} = [P(\chi_{ij}=1) - P(\chi_{ij}=0)]/[1-0] \quad \text{..... (4)}$$

The description of means and standard deviation of explanatory variables included in the logit model are shown in Table-I.

The following model was developed to predict demographic characteristics of farmers who produce AIVs for home consumption in Zambia. The study used the estimation method similar to Arumugam *et al*., 2016[b]; Govindasamy *et al*., 2015; Govindasamy *et al*., 2014. which has been explained below

Table-I Description of Explanatory Variables

Variable	Variable Description	No. of Cases	Mean Units /%	SD Units /%
Dependent variables				
AIV_Cons	1 if the farmers those who consume AIVs at home ; 0=Otherwise;	285	69%	0.46
Independent variables				
Less_10acre	1 if the farmers have less than 10 acre; 0=Otherwise;	284	88%	0.33
Livestock	1 if the farmers have livestock ; 0=Otherwise;	285	91%	0.29
Nutritive_Value	1 if the farmers concern about nutritive quality of AIVs ; 0=Otherwise;	285	8%	0.27
Processed_AIVs	1 if the farmers preferred processed AIVs for home consumption ; 0=Otherwise;	285	39%	0.49
>2 Market Visit	1 if the farmers visited nearest market 2 times and above ; 0=Otherwise;	293	33%	0.47
Intermediaries	1 if the farmers trades their produce through intermediate ; 0=Otherwise;	291	23%	0.42
Price_Buyers	1 if the farmers reported that price of their produce fixed by buyers; 0=Otherwise;	282	4%	0.19
Community_ Group	1 if the farmers are member of any community group or association; 0=Otherwise;	285	98%	0.14
Health_Nutritio n	1 if the farmers received training related to nutrition and health; 0=Otherwise;	285	54%	0.5
Drought	1 if the farmers reported about frequent drought; 0=Otherwise;	285	90%	0.3
Age_Less30	1 if the farmers age less than 30; 0=Otherwise;	297	16%	0.37
University	1 if the farmers received university degree; 0=otherwise	284	20%	0.4
Informal_EDU	1 if the farmers received informal education; 0=Otherwise;	282	74%	0.44
Nonfarm	1 if the farmers received major share of income from non-farm activities; 0=Otherwise;	261	10%	0.31
Income_<30k	1 if the farmers earn income less than 30,000 kwacha; 0=Otherwise;	284	31%	0.46

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Save_Money	1 if the farmers able to save money for unexpected expenses; 0=Otherwise;	282	76%	0.43
Gender	1 means male; 0 means female;	284	52%	0.5
No.of_Person	Average family size of the farmers	284	6.81	2.63
No.of child	Number of children in the family	284	3.58	2.32
Single	1 if the farmers was single ; 0 otherwise	285	19%	0.39
TV_Home	1 if the farmers who has TV at their home; 0=Otherwise;	285	31%	0.46
Income<30k_ age<30	1 if the farmers earn income less than 30,000 kwacha and age below 30 (Interaction term); 0=Otherwise;	284	7%	0.26
<30k_Upto_ HSchool	1 if the farmers earn income less than 30,000 kwacha and up to high school education (Interaction term); 0=Otherwise;	284	29%	0.45
Income <30K _farm	1 if the farmers earn income less than 30,000 kwacha and major share of income from farming activities (Interaction term); 0=Otherwise;	284	22%	0.41
Income>30k_ University	1 if the farmers earn income above 30,000 kwacha and University degree (Interaction term); 0=Otherwise;	284	10%	0.3

Logit model is formulated as:

$$\begin{aligned} AIV\_Cons = {} & \beta_0 + \beta_1 Less\_10acre + \beta_2 Livestock + \beta_3 Nutritive\_value + \beta_4 Processed\_AIVs \\ & + \beta_5 2Above\_m\_vists + \beta_6 Intermediaries + \beta_7 Price\_Buyers + \beta_8 Community\_Group \\ & + \beta_9 Health\_Nutrition + \beta_{10} Drought + \beta_{11} Age\_Less30 + \beta_{12} University \\ & + \beta_{13} Informal\_EDU + \beta_{14} Non\_Farm + \beta_{15} Income\_<30k + \beta_{16} Save\_Money + \beta_{17} Gender \\ & + \beta_{18} No.of\_Person + \beta_{19} Single + \beta_{20} TV\_Home + \beta_{21} No.of\_child \\ & + \beta_{22} Income<30k\_age<30 + \beta_{23} <30k\_Upto\_HSchool + \beta_{24} Income<30K\_farm \\ & + \beta_{25} Income>30k\_University + \mathcal{E} \ldots\ldots (5) \end{aligned}$$

Results and Discussion

Household Demographics : A total of 300 respondents participated in this baseline production survey. Men constituted about 52% of the total respondents and women about 48% (Table-II).

Table -II Summary Statistics of Demographic Characteristics of Households

Particulars	Frequency	Percent
Gender		
Female	143	47.7%
Male	157	52.3%
Relationship to Household Head		
Head	278	93.6%
Spouse	5	1.7%
Son / daughter	12	4.0%
Parent	1	0.3%
Brother / sister	1	0.3%
Marital Status		
Never married	21	7.0%

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Married	240	80.5%
Divorced	11	3.7%
Separated	2	0.7%
Widowed	24	8.1%
Highest Level of Education		
None	37	12.4%
Primary	146	49.0%
Secondary	60	20.1%
College	49	16.4%
University	6	2.0%
Informal Education		
None	77	26.0%
Adult Education	24	8.1%
Training on vegetable	188	63.5%
Artisan training	7	2.4%
Most Important Education		
Farming	245	89.7%
Salary earner	4	1.5%
Wage earner in agricultural sector	2	0.7%
Wage earner in non-agriculture large business	1	0.4%
Petty business	20	7.3%
Others (specify)	1	0.4%
Main Source of Farm Labor		
Household	95	69.3%
Extended family	5	3.6%
Hired	37	27%

A total of 297 (99%) farmers completed this survey. Ninety-four percent of the respondents were the head of the household themselves, 2% of the respondents were the spouses, 4% were either the son or daughter and less than 1% were either the parent or brother or sister. Eighty percent of the respondents were married, 7% were never married, 8% were widowed, 4% were divorced and less than 1% were separated. Only 2% of the respondents stated that their highest level of education was university. Forty-nine percent had only primary school education, 20% had secondary school education, 16% had a college education and about 13% had no education. With respect to informal education, 64% had training on vegetables, 8% attended adult education, 2% had artisan training and 26% had no informal education. Farming (90%) was the most common occupation, followed by petty business (7%), salaried job (2%), wage earner in the agricultural sector (1%) and less than 1% as a wage earner in the non-agriculture large business sector. Household (69%) was the main source of farm labour, followed by hired labour (27%) and extended family (4%).

Producers Growing Preference Related to AIV'S : Sweet potato leaves (246), amaranth (205) and orange sweet potato (204) are the three most preferred among the nine AIVs surveyed that are grown by the households while nightshade (28), kale (37) and jute mallow (45) are the least popular AIVs among the households (Table-III). Irrespective of whether the AIVs has grown were most preferred, or least preferred, on the range between 37% to 72% of farmers grew specific AIVs primarily for home consumption. The second most important influencing factor

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to grow specific AIVs was the good prices prevailing in the market. One clear exception was the case of nightshade where production experience (18%) and the opportunity to earn extra income (14%) were more dominant compared to good prices (7%). The opportunity to earn extra income is the third most influential factor to grow these AIVs.

Table -III Preference and Reasons for Growing AIVs

Vegetable Name	Preference and Reason to grow AIV (Number of farmers)								
	Good prices	Contract with partner	Production experience	Available market	Extra income	Cultural Reasons	Home consumption	Others	Total
Amaranth	50	1	13	14	17	2	107	1	205
%	24.4	0.5	6.3	6.8	8.3	1	52.2	0.5	100
Nightshade	2	0	5	2	4	1	14	0	28
%	7.1	0	17.9	7.1	14.3	3.6	50	0	100
Spider plant	8	0	2	3	4	1	47	0	65
%	12.3	0	3.1	4.6	6.2	1.5	72.3	0	100
Cowpea	34	5	4	13	20	1	74	0	151
%	22.6	3.3	2.6	8.6	13.2	0.7	49	0	100
Jute mallow	11	1	2	1	8	0	22	0	45
%	24.4	2.2	4.4	2.2	17.8	0	48.9	0	100
Kale	9	0	1	4	7	0	16	0	37
%	24.3	0	2.7	10.8	18.9	0	43.2	0	100
Sweet Potato Leaves	44	1	13	31	32	1	123	1	246
%	17.9	0.4	5.3	12.6	13	0.4	50	0.4	100
Orange Sweet Potato	52	1	19	24	17	3	87	1	204
%	25.5	0.5	9.3	11.8	8.3	1.5	42.6	0.5	100
Okra	59	0	7	18	20	0	63	2	169
%	34.9	0	4.1	10.7	11.8	0	37.3	1.2	100
Other	5	1	0	0	0	9	1	0	16
	31.3	6.3	0	0	0	56.3	6.3	0	100

Empirical Results for Logit Model : Demographic attributes were used as explanatory variables to construct the logit model. Dependent and independent variables were used in the logit model to predict which farmers consume AIVs at home, and these data are presented in Table-I. On average, 69% of farmers reported that they consume AIVs at home (AIV_Cons) if they grew AIVs, and the remaining 31% did not consume them at home even if they did grow them. Of the farmers who participated in survey, nearly 88% of them had less than 10 acre of farming land (Less_10acre). and 91% of them had livestock at home/farm (Livestock). Surprisingly, only 8% of the farmers were concerned and preferred AIVs for nutrition quality, while the remaining farmers may not be aware of the nutritive quality of AIVs (Nutritive_value). Finally, 39% of people surveyed preferred processed AIVs like cleaning, trimming, sorting, drying, grading and other kind of value addition for home consumption (Processed_AIVs).

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Farmers were asked to respond to questions pertaining to marketing. Nearly 23% of the farmers trade their produce through intermediaries such as wholesalers, retailers and brokers (Intermediaries), 33% of them visited nearest market 2 times or more per week to sell their produce (>2 Market Visit), and 4% of the farmers reported that price of their produce fixed by buyers (Price_Buyers). Data also revealed that, nearly 98% of the farmers were members of community group or other association (Community_Group), and 54% of them received training from the experts related to nutrition and health (Health_Nutrition). Global climate change has already had observable effects on the environment and agriculture, nearly 90% of the farmers reported that they faced frequent drought in this region for the past few decades (Drought). Respondents were asked questions relating to their socioeconomics and demographic status. In terms of respondents' age, 16% were less than 30 years old (Age_Less30), rest of the 84% of them were above 30 years old. In the case of farmer's education, on average 20% completed college and a university degree (University), 74% had an informal education like adult education, training on vegetables and artisan training (Informal_EDU) and 10% earned a major share of income through non-farm activities (Non_Farm). Regarding the farmers' annual household income, nearly 31% had an annual income of less than 30,000 Kwacha (Income_<30k), about 61% of them had an annual income above 30,000 Kwacha, and 76% of them reported that they can able to save money for unexpected expenses (Save_Money). Among the total respondents, 52% of them were male and the rest of the 48% of them were female (Gender). An average household size included 6.8 people (HSIZE), out of 6.8 people, nearly 3.6 of them were children (No. child_A16A). In terms of the partnership, nearly 17% of the respondents were single (Single). The interaction between two variables also included in the model, nearly 7% of the farmers earn an income less than 30,000 kwacha and age below 30 (Income<30k_ age<30), whereas 27% of them earn an income less than 30,000 Kwacha and up to high school education (<30k_Upto_ HSchool). Although, 22% producer earn an income less than 30,000 Kwacha and received major share of income from farming (Income <30K _farm), while 10% of them earned income above 30,000 Kwacha with a University degree (Income>30k_University). No a priori sign expectations were made on the coefficients of these socio-economic and demographic variables while formulating the logit model.

Results from the Logit model (Tables-IV, V, and VI) confirm the factors that influenced farmers to consume AIVs. Of the 254 observations that were used in this model reset of the 43 were not answered this question, 69% of the farmers produce AIVs for home consumption, while 31% did not. The goodness of fit for this model, shown by the Pseudo R^2, was 0.35 and the chi-squared value was reported as 109. The overall model was significant at the 0.00 level. The prediction success is shown in the classification Table-V. With a 50-50 classification system, almost 84 percent of the individuals in the sample were correctly classified as those who place a high degree of importance on AIVs' home consumption.

Table-IV Predictive Accuracy of Logit Model

Classified	True		Total
	D	~D	
+	167	29	196
-	12	46	58
Total	179	75	254

Classified + if predicted Pr (D) >=0.5; True D defined as Home_Cons != 0

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Table-V Percentage of Correct Predictions

Sensitivity Pr(+| D)	93.30%
Specificity Pr(-|~D)	61.33%
Positive predictive value Pr(D| +)	85.20%
Negative predictive value Pr(~D| -)	79.31%
False + rate for true ~D Pr(+|~D)	38.67%
False - rate for true D Pr(-| D)	6.70%
False + rate for classified + Pr(~D| +)	14.80%
False - rate for classified - Pr(D| -)	20.69%
Correctly classified	83.86%

The logit model summary of farmers who produce AIVs for home consumption is displayed in Table-VI. In the logit model, all the explanatory variables were defined as binary dummy variables. A total of 25 explanatory variables were used in the logit model, of which, seven variables were positively significant and four were negatively significant. A positive sign shows that the variable was estimated to have a positive coefficient with a positive marginal effect, and hence had a positive impact on the dependent variable. A negative sign indicates that the variable was estimated to have a negative coefficient with a negative marginal effect, and hence had a negative impact on the dependent variable. The star symbol represents the significance level of the variable at 1%, 5%, and 10% level respectively.

The logit model indicates that farmers were more likely to grow and consume AIVs at home if they have less than 10 acres of farming land (Less_10acre), concerned about the nutritional quality of AIVs (Nutritive_value), reported price of farm produce fixed by buyers (Price_Buyers), member of any community group or association (Community_Group), received training related to nutrition and health (Health_Nutrition), able to save money for unexpected expenses (Save_Money), and single (Single). On the other hand, farmers visited the nearest market two times and above (>2 Market Visit), those who trade agricultural produce through intermediaries (Intermediaries), the producer who has a TV at their home (TV_Home), those who earn income above 30,000 Kwacha with a University degree (Income>30k_University) were less likely to grow and consume AIVs at home, respectively.

Table-VI Summary of Estimation Results of Producers Those Who Consume AIVs at Home: Logit Model Estimates

Number of obs.	=	254
LRchi2(25)	=	109.18
Prob>chi2	=	0.00
PseudoR2	=	0.35
Log likelihood	=	-99.54

AIV_Cons	Coef.	Std.Err.	Z	P>|Z|	MG_dy/dx
Less_10acre	0.803*	0.502	1.600	0.109	0.158
Livestock	1.059	0.677	1.560	0.118	0.218
Nutritive_value	2.792***	1.014	2.750	0.006	0.228
Processed_AIVs	0.201	0.504	0.400	0.690	0.034
>2 Market Visit	-0.848**	0.424	-2.000	0.045	-0.155
Intermediaries	-2.753***	0.727	-3.780	0.000	-0.588

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Price_Buyers	2.169*	1.346	1.610	0.107	0.195
Community_Group	3.336**	1.762	1.890	0.058	0.672
Health_Nutrition	1.585***	0.446	3.550	0.000	0.271
Drought	0.715	0.612	1.170	0.243	0.140
Age_Less30	-0.842	0.691	-1.220	0.223	-0.165
University	-0.234	0.737	-0.320	0.751	-0.041
Informal_EDU	0.266	0.470	0.570	0.571	0.047
Non_Farm	-0.032	0.839	-0.040	0.969	-0.006
Income_<30k	-1.462	1.572	-0.930	0.353	-0.286
Save_Money	0.876*	0.472	1.850	0.064	0.169
Gender	-0.393	0.408	-0.960	0.336	-0.067
No.of_Person	-0.076	0.094	-0.810	0.420	-0.013
No. of _Child	-0.063	0.121	-0.520	0.601	-0.011
Single	1.144**	0.556	2.060	0.040	0.158
TV_Home	-1.387***	0.553	-2.510	0.012	-0.274
Income<30k_ age<30	1.371	1.109	1.240	0.216	0.161
<30k_Upto_ HSchool	-0.370	1.277	-0.290	0.772	-0.066
Income <30K _farm	0.463	1.115	0.420	0.678	0.073
Income>30k_University	-2.334***	0.863	-2.700	0.007	-0.513
_Cons	-3.804	2.080	-1.830	0.067	-

*** 1%, **5% and *10% significant

The computation of marginal effects indicates that farmers who have less than 10 acres of farming land (Less_10acre) were 15 % more likely to consume AIVs compared to those who have more than 10 acres of farming land. The result shows that (Table I) 88% of the sample respondents have less than 10 acres and therefore, based on the logit model, there is a likelihood that most of the small landholders are likely to grow AIVs for home consumption. Also, those who are concerned about the nutritional quality of AIVs (Nutritive_value) were 22% more likely to grow AIVs for home consumption compared to those who think otherwise. Previous literature supports these findings noting that ALVs contain some nutritional values which are important for humans' balanced diet and help to cope with several diseases (Husselman and Sizane, 2006: Faber *et al*., 2010; Taruvinga and Nengovhela, 2015). Produce prices also played a vital role to grow AIVs for home consumption. Although farmers reported that the price of their produce fixed by buyers were 19% more likely to grow AIVs for home consumption compared to those who fix price by themselves and negotiate. Similarly, farmers belonging to any community group or association (Community_Group) were 67% more likely to grow AIVs for home consumption compared to those who are non-members. Further, those who received training relating to nutrition and health (Health_Nutrition) were 27% more likely to grow AIVs for home consumption compared to others. These findings support the positive role played by agricultural extension services across the region (Taruvinga and Nengovhela, 2015). Those who can save money for unexpected expenses were 17% more likely to grow AIVs for home consumption. Interestingly singles were 16% more likely to grow AIVs for home consumption compare to those who are not single.

Pertaining to market visits, those who frequently visit the nearest market were 15% less likely to consume AIVs at home (>2 Market Visit). Those who trade through intermediaries (Intermediaries) and have a TV were 58 % and 27% less likely to consume AIVs at home.

Education facilitates and acquisition of skills would enable a household to have better access to human nutritional information and may enhance understanding of the importance of increasing consumption of traditional vegetables. However, based on previous research, household heads with higher educational status have a lower probability of consuming traditional vegetables compared to the less educated (Taruvinga and Nengovhela, 2015). Similarly, households earn income above 30,000 Kwacha with a University degree (Income>30k_University) were 51% were less likely to consume AIVs.

Conclusions

This study analyses demographic characteristics that influence farmers' willingness to grow AIVs for home consumption. On average 69% of the farmers produce AIVs just for home consumption. The logit model results indicate that farmers were more likely to consume AIVs at home if they own less than 10 acres of farmland, are interested or concerned about the nutritional quality and benefits of AIVs, price of farm produce fixed by buyers, member of any community group or association, received training related to nutrition and health, able to save money for unexpected expenses, and single. Whereas, farmers who were less likely to consume AIVs at home can be described as farmers who visit the nearest market two times or more per week, trade agricultural produce through intermediaries, a producer who has a TV at their home, earn income above 30,000 Kwacha with a University degree. The results of the logit model should provide valuable information to target a specific proportion of households to grow more efficient and nutrient-rich AIVs for home consumption. These findings, when applied, can present an important component of increasing dietary diversity, especially for children under five and pregnant women. Awareness and promotional training activities will encourage farmers to grow and eat traditional vegetables in Zambia.

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