



Awareness and Contribution of African Indigenous Leafy Vegetables to Household Wellbeing: A Case of Smallholder Farmers in Kisii County, Kenya

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Author's contribution

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

This study investigated the contribution of African Indigenous Leafy Vegetables (AILVs) to the welfare of smallholder farmers in Kisii County. AILVs have recently been attracting research attention not only in terms of their inherent nutrition quality and healing properties but also for their economic potential that is brought about by increased consumer demand of these vegetables. Despite having multiple benefits and positive promise towards contributing to household food dietary quality and income, utilization of African indigenous Leafy Vegetables (AILVs) by farming households is still low as indicated by a constant deficit in supply. Based on the claimed benefits in the face of low volumes in terms of utilization, this study sought to examine the socioeconomic characteristics of AILVs smallholders and factors that influence production of these vegetables in Bomachoge Borabu Sub-County, Kisii County Kenya. A Multistage sampling method was used to obtain a sample of 150 AILV farmers. Questionnaires were used to collect the data. Descriptive statistics were used to characterize the socio-economic characteristics while Tobit model was utilized in analyzing the factors that influence production of AILVs. The Tobit regression results indicated that age, gender, education, value awareness, occupation and household income

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significantly influenced AILV production. The study concluded that engagement in AILVs utilization brings along unmatched benefits. The study recommends a long term campaign majorly targeting the young and the non-growing communities in creation of value awareness to improve on the utilization of the vegetables. The study also recommends a similar study in regions of the Country that record low levels of utilization.

Keywords: African indigenous vegetables; well-being; utilization; production.

1. INTRODUCTION

Indigenous leafy vegetables are increasingly becoming a popular diet in the menus of a significant portion of the Kenyan population. However, the vegetables seem to be underutilized by the primary producers as seen through a persistent deficit in supply even in the face of a constantly increasing demand. As the demand goes higher than the supply, prices of the vegetables rise higher than those of the exotic counterparts making it unaffordable by the majority on the willing consumers.

Vegetable production is an important source of income, food and nutrition security for the smallholder farmers who often account for more than 70% of the vegetable export output [1]. The percentage contribution of indigenous vegetables to the total value of vegetables in the domestic market rose from 4% in 2001 to 10% in 2007 according to HCDA, (2008) and yet none is exported. According to USAID- KHCP, (2012) the share of AILVs on the domestic value for vegetables was 5% although the quantity produced was 11% of all the vegetables produced during the year. This probably explains that globally, utilization of indigenous vegetables is low.

The role AILVs can play in the livelihoods of the poor communities cannot be underscored. In many instances, these underutilized species are mostly the crops that have higher nutritive value, health benefits, agronomic advantages, high income generation potential and require little capital to start compared to their exotic counterparts [2]. Kisii County is largely known for the production and utilization of these vegetables, however the region records a 63% of its population living below the poverty line, which is slightly above the national rate of 53% and a 24% prevalence of malnutrition, children being the most affected (FAO, 2009). The region being among the densely populated Counties in Kenya, calls for the need for sensitization and paradigm shift in the production patterns and

utilization of the indigenous vegetables to harness their nutrition and economic potential [2]. since the vegetables require little space for cultivation and at times they grow as weeds.

2. CONCEPTUAL FRAMEWORK

This study is built on a modified framework that indicates the causative factors affecting food production and hence consumption and commercialization. Since the target sample are the primary producers in this study, it is presumed that firstly, the decision to produce the indigenous vegetables is informed by knowledge of the positive outcomes associated with the utilization of the vegetables. Secondly, being informed or uninformed about the values of the indigenous vegetables is influenced by other factors which include some of the socio-economic and institutional factors as well as farmer attributes. It is also assumed that once the smallholder farmer has the indigenous vegetable in their gardens they able to utilize it for consumption and commercialization for income generation. Thus, food produced in a household is identified as a factor that eventually improves the income levels, nutritional and health status of a household and an individual. For instance, the decision to produce and consume the AILVs is assumed to be positively influenced by the knowledge of its values which in this study are medicinal and nutritional as well as the economic value of use and maintenance of the vegetables and also availability of AILVs which is achieved through production. Medicinal, Nutritional and indigenous values are value awareness variables which are believed to be influenced by socioeconomic factors whereas Commercialization on AILVs is assumed to be influenced by a number of market factors which include transaction cost and distance to the market. All these processes are therefore assumed to lead to improved welfare of the smallholder.

3. METHODOLOGY

3.1 The Study Area and Sampling Procedure

This study was done in Bomachoge Borabu Sub-county of Kisii County, which is located in the former Nyanza province region of Kenya. The County is located to the South East of Lake Victoria and is bordered by six counties with Narok to the South, Migori to the West, Homa Bay to the North West, Kisumu to the North, Bomet to the South East and Nyamira to the East. It is divided into nine constituencies namely: Kitutu Chache North, Kitutu Chache South, Nyaribari Masaba, Nyaribari Chache, Kenyenyia (Bomachoge Borabu), Bomachoge Chache, Bobasi, South Mugirango and Bonchari. Bomachoge Borabu Constituency has a population size of 107,199 persons and occupies an area of 115.0 km square. The Constituency has four wards namely: Magenche, Bokimonge, Boochi Borabu and Borabu Masaba.

The arable land is overwhelmed with economic activities, which include subsistence agriculture, vegetable farming, dairy farming, coffee and tea farming. Over 77% of land is fertile and often wet throughout the year, making it rich agricultural area. As a result, the County is the leading in indigenous vegetable production in Kenya but the land is over portioned with a single household owning averagely less than 2 acres.

Multistage sampling procedure was employed in selecting the respondents, where in the first stage Kisii County was purposively selected owing to the presence of AILV farmers in the area. Within Kisii County, Bomachoge Borabu Constituency was purposively selected because there is a more widespread production of indigenous vegetables compared to other constituencies in the County. The third stage involved random selection of two wards from the four in Bomachoge Borabu constituency (Boochi and Bokimonge wards). From the two wards a simple random sampling procedure was used to select 150 smallholder farmers proportionate to the size of each of the two wards. Using the 2009 population of Bomachoge Borabu constituency, as reported by the Kenya population and housing census, a proportional to population size for each of the two wards was calculated to arrive at 150 respondents who were then interviewed.

3.2 Methods of Data Analysis

SPSS and STATA were used in data analysis. To analyze socio-economic features of indigenous leafy vegetable farmers, descriptive statistics were utilized.

To determine the factors that influence production of AILVs, the production intensification/size allocated to AILV variable, production (PRDCTN) was used as a dependent variable in the Tobit model. This denoted the proportion of land allocated to AILVs to the total household land size. The size allocated to AILV helped to show the production level of the same. Tobit model is based on the maximum likelihood technique (Gujarati, 2004).

The structure of the Tobit model is given as;

$$Y_i^* = \beta' X_i + \varepsilon_i \dots \dots \dots (1)$$

Where; Y_i^* is a vector of the latent variable that is not observed for values less than zero and greater than one.

X_i represent vector of the independent variables, β is vector of the unknown parameters, ε_i is vector of the error terms that are distributed normally with mean 0 and variance σ^2 $i=1, 2, 3, \dots, n$ represents the number of observations.

If Y_i is the observed variable representing the proportion of produce, its value is censored from below at $L=0$ and from above at $U=1$.

Thus, giving rise to equation (2)

$$\left\{ \begin{array}{l} Y_i = 0 \text{ if } Y_i^* \leq L \\ = Y_i^* \text{ if } L \leq Y_i^* \leq U \\ = 1 \text{ if } Y_i^* \geq U \end{array} \right\} \dots \dots \dots (2)$$

The expected value of the latent variable Y_i^* is given by equation (3)

$$E(Y_i^*/X) = \beta' X \dots \dots \dots (3)$$

The change in probability of producing and proportion of land size allocated as an explanatory variable changes by a unit is given by equation (4)

$$\frac{\partial E(Y_i^*/X)}{\partial X_i} = \beta_i \dots \dots \dots (4)$$

As the values of the proportion of land size Y is truncated from below at 0 and from above at 1, its conditional expected value is given by equation (5)

$$E(Y/X, L < Y^* < U) = \beta X + \sigma \frac{\phi(Z_L) - \phi(Z_U)}{\Phi(Z_U) - \Phi(Z_L)} \dots \dots \dots (5)$$

Where, $Z_L = (L - \beta X) / \sigma$ and $Z_U = (U - \beta X) / \sigma$,
 ϕ

$\phi(\cdot)$ and $\Phi(\cdot)$ are the density function and cumulative distribution of a standard normal variable respectively. In the absence of the limits, $Z = (\beta X) / \sigma$.

Table 1. Description of Variables and the Expected Signs to be used in the Tobit Model

Code	Variable	Measurement of the variable	Sign
Dependent variable			
Prdctn	Production Intensification	Ratio (continuous)	
Independent variables			
Age	Age in years	Years (continuous)	+
Gender	Gender	1 =Male, 0= Female (Dummy)	+
Educ	Education of household head	Education level of the household head (highest level attained)	+/-
AccExt	Access to extension service	1=access, 0=otherwise (Dummy)	+/-
FmSize	Farm Size	Size in hactares(continuous)	+/-
HhInc	Household	1=Income 0=no income(dummy)	+/-
VA	Value	Value awareness level of the farmer	+
Occp	Occupation	Nature of Occupation	+/-

Table 2. Summary statistics of continuous variables for household heads

Characteristic	n	Min	Max	Mean	Std
Age	150	18	102	41.093	15.4795
Land size	150	0.1	4.2	4.168	5.1746
Household size	150	1	12	4.853	2.6907
Income	150	100	94000	218850	22672.15

Source: Survey data 2015

Table 3. Summary Results of Discrete variables

Variable	Description	Frequency	Percentage
Gender	Male	82	54.67
	Female	68	45.33
Marital Status	Married	139	92.67
	Single	11	7.33-
Education Level	Primary	40	26.67
	Secondary	38	25.33
	Tertiary	29	19.33
	University	28	18.67
	No formal education	15	10.00
Occupation	Employed	40	26.67
	Self employed	110	73.33
Extension services	Yes	60	40.00
	No	115	60.00

The Tobit coefficients however, do not directly give the marginal effects of the independent variables on the dependent variable. But their signs show the direction of change in the intensity of production as the respective explanatory variable change (Amemiya, 1984; Maddala, 1985; Goodwin, 1992). The production level of a household could be affected by socio-economic factors, farm attributes and institutional characteristics. The variables are assumed to affect the production level of the households. The Tobit model was used to determine the influence of socio-economic, farm attributes and institutional factors in enhancing household production level.

3.3 Tobit Model Specification

$$Y_i^* = \alpha + \beta_0 X_1 + \beta_1 X_2 + \beta_2 X_3 + \beta_3 X_4 + \dots + \beta_n X_n + \epsilon \dots \dots \dots \quad (6)$$

$$\text{Prdcn}(Y_i^*) = \alpha + \beta_1 \text{age} + \beta_2 \text{gender} + \beta_3 \text{Educ} + \beta_4 \text{H/Hsize} + \beta_5 \text{FmSize} + \beta_6 \text{HHincm} + \beta_7 \text{occ} + \beta_8 \text{AccEx} + \beta_9 \text{VA} + \epsilon \dots \dots \dots \quad (7)$$

4. RESULTS AND DISCUSSION

This chapter presents descriptive results of the socio-economic characteristics and empirical results of Tobit model analysis.

The socioeconomic characteristics of the respondents are categorized as either continuous or discrete variables. In this case continuous variables included age, land size, household size, and income. Discrete variables included gender, marital status, Access to extension services, occupation and education level of the household head.

As presented in Table 2 below, the mean age of the respondents from the study area is 41.09 years while the overall youngest and oldest age is 18 and 102 years respectively. The overall mean for land size 4.17 hectares with the smallest and the largest sizes being 0.1 and 4.2 ares respectively. While the overall mean of the household size was found to be 4.9 members, which is close to the Kenya’s national mean figure of 5 members per household. The aggregated annual income (both farm and off-farm) was found to have overall mean of \$21 8.85 for the year 2015 with the least having \$ 1 and the highest having \$94, 0.00.

Table 3 presents results of discrete variables. In terms of education level of the household head in Bomachoge Borabu, it was noted that only 15% of the respondents had no formal education (not gone to school) implying that 85% of the respondents accessed at least some formal education. However, majority (52%) attained both primary and secondary education. That is (26%) of them attained primary and (25%) attained secondary education while (38%) attained both tertiary and university education. The results on gender of the household head showed that 44.30% were male and 55.70%

were female. These results concur with the Kenya population census of 2009 which showed that majority of the population in Kisii County are female (KHPC, 2009).

The Marital status of the household heads revealed that a higher proportion of the respondents (92.67%) were married implying that only a small percentage of (7.33%) were singles.

Results on occupation showed that majority of the respondents (73.33) are self-employed while 26.67% are in formal engagement. In terms of access to extension service, 40% of the respondents claimed to have access to extension services, while 60% have little or no access to extension services.

5. Econometric results

5.1 Factors that influence the production of AILVs

Tobit regression analysis was utilized to determine the factors that influence production of AILVs by the smallholder farmer, measured in terms of intensification level and results presented in Table 4. The pseudo-R squared of 0.6297 was above the statistical threshold of 20% demonstrating that the explanatory variables described about 62.97 % of the variable considered in the model. The goodness-of-fit measured by the $\text{Prob} > \chi^2 = 0.000$ showed that the choice of explanatory variables included in the Tobit model explained the production of AILVs by the smallholder farmer.

Among the nine variables considered in the model, six were found to have significant impact in determining production of the AILVs. These included Gender, Age, Value awareness,

Education, Occupation and extension services. From the analysis, age, value awareness and household income were found to have a positive relationship with production of indigenous vegetables. However, gender, education and occupation had negative and significant impact on production of indigenous vegetables. The P-values of these variables were significantly different at 0.1, 0.05 and 0.01 levels of significance. Other variables were however, not significant but A 26% decrease in AILVs production intensification is observed when there is a change from female headed households to male headed households. This is because men are more oriented to cash crops as compared to women who are seen to be better decision makers when it comes to engaging in activities that improve the general wellbeing of the household. These findings concur with those of Waudo et al. [3] who reported men to have less preference of the vegetables in terms of production compared to women and also those of [4] who reported that, in many parts of Africa, indigenous vegetables are considered to be “women’s crops” because they are mostly grown or gathered by women, for both domestic and for sale in the markets [5]. This finding however disagrees with that of Maundu et al. [6] who reported in her study in Western Kenya that there was no significant difference between men and women with regard to perceptions on production of indigenous vegetables and also Kimiywe et al. [7] revealed that preference of indigenous vegetable species varies with geographical location and cultural norms.

Age positively influenced production at a 5% significance level. This implies that the older the household head, the higher the likelihood of increased AILV production. This can be attributed to rich experience on production and knowledge of the importance of the vegetables by the older than the younger, assets ownership and the more stability of the economy of the old’s farm household. This result is consistent with the findings of Maundu et al. [6] who found that AILVs production was low amongst the younger farmers (21-30 years) compared to farmers above 50 years. Similarly, a study in Nigeria showed that older people are the majority of the producers of indigenous vegetables because they recognize them for their health properties and ability to prevent diseases [7].

Value awareness had a positive influence on the production of AILVs at 5% significance level. This indicates that households that have embraced an existing culture of producing AILVs have increased production of AILVs. More than half of the respondents claimed culture to be the driving force behind their production of AILVs. This is because AILVs have been part and parcel of their grandparents’ farming systems and that is why they are also doing the practice. This finding is in line with [8], Maffi and Woodley, 2010) who reported that cultivation of indigenous vegetable depends on human activity, local knowledge and their culture. Abukutsa et al. [9] also pointed out that increased production of African night shades was observed in households that recognize their nutritional and disease-preventing mechanism.

Table 4. Tobit marginal effects (Coefficient) regression outcome on factors influencing production of AILVs

Variable	Coefficient	Standard Error	Z	P> z
Household size	.0051097	.00553757	0.92	0.358
Gender	-.2619216***	.0350673	-7.47	0.000
Age	.0023933**	.0011003	2.18	0.031
Occupation	-.0182054**	.0088024	-2.07	0.040
Education	-.0049573*	.0029542	-1.68	0.096
Extension services	.0105393	.008815	1.20	0.234
Total farm size	-.0155463	.0295985	-0.53	0.600
Household income	.1072195***	.0266867	4.02	0.000
Value awareness	.0742321**	.0294837	2.52	0.013
_cons	.26738448	.0722479	3.70	0.000

Number of observations = 150 LR $\chi^2 = 100.09$

Prob> $\chi^2 = 0.0000$ Pseudo $R^2 = 0.6297$

Log likelihood = -80.75077

Note: ***: significant at 1% level; **: significant at 5% level; *: significant at 10% level

Level of education was insignificant at 5%. This outcome implies that a change in level of education leads to an insignificant change in level of production. This outcome differs with that of [6] in that the educated is perceived to consider the vegetables as a low status food, a food for the poor and uneducated and AILVs utilization is often low amongst the group. However, this notion is apparently shifting to the positive side because the educated are gaining more access to knowledge of the importance of the vegetables hence increase in their utilization as supported by Gebremedhin and Jaleta [10] who indicated that as the education level increases there is a likelihood of increased production.

Occupation of the household head was significant and had a negative influence at 5% significance level. This result implies that household heads that are in formal employment are less likely to produce or increase production of AILVs as compared to casual labour or self-employment. This is because the former rarely have time for on-farm activities. This result is consistent with the findings of Mthombeni [11] which showed that engagement in other activities would likely limit time available to engage in on-farm activities. In addition, engagement in other occupations sometimes contributed to rural-urban migration which limited access to farm land thereby limiting farming activities. However, these findings disagree with a study by IFPRI (2005) that showed that there was high diversification and strong interactions among agricultural activities and off-farm activities in smallholder farmer's production systems. Non-farm activities enable households to obtain additional income, empower themselves financially and diversify their agricultural production. Ajani and Igbokwe (2012), established that diversification of occupations assured households of food security, additional incomes, poverty reduction and enabled them cope with seasonality of farming activities.

Household income was also seen to be significant and it positively influenced production of AILVs at 5% significant level. This means that there will be an increase in production of the vegetables if the farmer's intention is to commercialize so as to maximize on income generation while low production is observed if the vegetables are for domestic use. This result concurs with that of Igbokwe (2012) who established that in Nigeria indigenous

vegetables production was high since it was a major source of income amongst smallholder farmers. However, Mpala [12] differed with these results, in that in their study results, as monthly household income increased there was a likelihood of the farmer diversifying and investing in other activities to ensure stability of the household income.

Access to extension services was not statistically significant in influencing production of AILVs. This implies that access to information about where to get quality inputs, market information, and the general importance of AILVs has no effect on production of the vegetables. This finding agrees with those of Adebooye and Opapedo [13] who reported that of all mention of the status of food in Africa, AILVs often disappear. This is because their production is often on a small scale, with farmers being the primary custodians of the genetic material and production technologies; they produce for subsistence and sell the surplus.

Farm size was not statistically significant in influencing production of AILV. The result indicates that as the total farm size change there is no likelihood of change in production. This is because there will be high tendency to allocate more land for cash crops rather than the vegetables. The size of the land shows the potential to produce surplus for the market implying more income. This finding differs with those of Sebaso and Tol (2005) who found out that production increases with an increase in land size, therefore increasing income.

Household size was also not statistically significant in influencing production. It is expected that the bigger the size of a household the higher the likelihood of increased production of AILVs as a result of availability of labour. However, this finding disagrees with that of Frankenberger (2002) and Flores (2004) who revealed that households with more people exert more pressure on resources in this case land, than the labour it contributes to agricultural production.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Among the nine variables considered to influence production, six were found to have significant impact in determining production of the

AILVs. These included Gender, Age, Value awareness, Education, Occupation and extension services. From the analysis, age, value awareness and household income were found to have a positive relationship with production of indigenous vegetables. However, gender, education and occupation had negative and significant impact on production of indigenous vegetables. The P-values of these variables were significantly different at 0.1, 0.05 and 0.01 levels of significance.

This study has shown that promoting value awareness of AILVs could increase production, consumption and commercialization hence improved well-being of the smallholder household.

Lastly, the food choices that households head make apparently influence those of the children later on in life. It is therefore of essence that households' heads lead the way by always emphasizing on choosing a healthy nutritious diet for healthy productive lives.

5.2 Recommendations

It is in light of the results of this study, that we recommend AILVs utilization as a poverty reduction strategy. AILVs have higher returns since they have short life span thus can be cultivated many times in a year acting as a constant source of employment as well as income. Additionally, AILVs are currently increasingly becoming a much sought after vegetable making it a valuable item hence a good source of income for the smallholder farmer. Therefore, Government, World Vegetable Center, KALRO and all other relevant stakeholders should work together towards realizing an improved utilization of the vegetables.

AILVs utilization contributes to food and nutrition security; creating and promoting value awareness of AILVs helps increase its utilization and in the process food and nutrition security goals will have been achieved. Increase in production of AILVs helps reduce over-reliance on very limited major crops hence food security. Also, given that these vegetables are highly nutritious, it ensures a quality diet for the population and strong immune systems that can fight against NCDs such as Covid-19, Hypertension, HIV and AIDS amongst others. As a result less will be spent in the health sector thus focusing the resources to other development agendas.

The government and relevant stakeholders through its research and breeding agencies should promote dissemination of information and distribution of high yielding AILVs varieties to increase production of the vegetables country wide and meet the increasingly growing demand.

Teaching of the importance of AILVs should be included in formal education curriculum to create awareness amongst the youth.

There is need to introduce cess free agricultural trade especially on these very important vegetables so as to increase on their utilization. This is more so because the major producing Counties are several Counties away from the main markets. Doing away or rationalizing such taxes will help stabilize AILVs market prices thus increased demand as well as improved incomes for the smallholder farmers.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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