

Contribution of Selected Indigenous Fruits on Household Income and Food Security in Mwingi, Kenya

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Abstract: The objectives of this study were to evaluate the factors that influence consumption of indigenous fruits during periods of food shortage among the Arid and Semi Arid Lands (ASAL) and then assess the contribution of the indigenous fruits to household income and food security. The study was carried out in Nuu division, Mwingi District where a sample size of 120 households were interviewed using a structured questionnaire. Multi stage sampling method was used. The logit, Gross Margin Analysis, Pearson's correlations and t-tests were used for analysis. The results of the logit model indicated household size, education and income to be significant variables in influencing household decision to consume indigenous fruits in order to cope with food shortage with income and education having a negative influence and household size a positive influence. Utilization of indigenous fruits for consumption and sale was found to be higher among the low income earners and contributed to total household food insecurity coping strategies.

Keywords: Arid and Semi Arid Lands (ASAL), food security, gross margins, indigenous fruits, rural incomes

INTRODUCTION

Reliance upon indigenous fruits as a source of household diet especially during drought when there are food shortages is not a new phenomenon in Kenya especially within some of the nomad and pastoralist communities (Maundu *et al.*, 1999; Muok *et al.*, 2001). These fruits are essential to the livelihoods of most rural communities in the dry lands. Notably, indigenous fruits contribute to food security of the rural population by providing a vast array of food which supplies essential nutrients especially at times when other food sources are unavailable (Mithöfer *et al.*, 2003). The fruits act as an important source of vital nutrients and essential vitamins especially to the growing children who are prone to malnutrition. Baobab fruits, for example, provide six times vitamin C compared to an orange and have calcium level higher than that of a cow's milk (Ondachi, 2001).

Not only do indigenous fruits provide food for household consumption during the dry seasons, but they also act as a source of income for the households. Trade in indigenous fruits contribute to livelihoods through income generation and as a safety-net for consumption and income-smoothing (Angelsen and Wunder, 2003; Belcher *et al.*, 2005; McSweeney, 2005). Greater proportions of poor households engage in commercialization of indigenous fruits than do wealthy

households and it represents a greater fraction of their total livelihood. Typically, the poor households have low skills, education and limited employment opportunities. They have limited abilities to negotiate with buyers and are price-takers (Shackleton *et al.*, 2002). Some households see trade in indigenous fruits as only a temporary activity whilst they seek or hope for permanent formal employment. Others trade in non timber forest products as their primary livelihood activity, in which they take pride in being self-employed.

During periods of drought, households either use their savings to purchase food or consume other alternatives like the indigenous fruits. A worrying characteristic of the changing pattern in Mwingi District is that rains come when least expected and farmers cannot plan their farm operations. Results from the 2010 short rains assessments indicated that households in Mwingi District were unlikely to sufficiently meet their food needs even though there was a decline in cereal prices due to low purchasing capacities after experiencing nearly five poor or failed seasons in succession (FEWSNET, 2010).

Due to the recurrent crop failures and livestock losses, initiatives for integration of indigenous fruit trees in the farming systems could enhance contribution of indigenous fruits to food security besides income generation and ensuring short and long-term

sustainability of agricultural production. A number of research studies have been carried out on indigenous fruits in Mwingi District and other arid areas in Kenya (Maundu *et al.*, 1999; Muok *et al.*, 2001). However, they have only focused on the multiple uses of indigenous fruits with little analysis of their economic contributions to household incomes and food security. The purpose of the study was to analyze the factors that influence consumption of indigenous fruits during food shortage and the contribution of the selected indigenous fruits on household incomes in Mwingi District.

MATERIALS AND METHODS

The study was conducted in Nuu division in Mwingi District on March 2010. Mwingi District is located in Kitui County and is one of ASAL districts in Kenya. The climate is hot and dry for the greater part of the year and falls under two climatic zones; semi arid and arid. Mwingi District has 65.5% of its population below the food poverty line while 58.5% of the households are food poor. Consequently, 62% and 66.5% of the people and households in the district, respectively, live in absolute poverty (GoK, 2008). Poverty levels and food insecurity have been aggravated by recurrent droughts causing severe crop failures and animal deaths, resulting in food shortages.

Nuu Division was purposively selected out of the eight Divisions in Mwingi District because it has a widespread natural indigenous fruit trees. A Multi stage sampling technique was used to arrive at a sample size of 120 households and a questionnaire was used to collect the data.

Empirical model: The analysis of socioeconomic factors influencing the decision of a household to consume indigenous fruits relied on the use of qualitative choice models hence the logit model was used for this study. Conceptually, the following is the general behavioral model used to examine the factors influencing the household's decision to consume indigenous fruits during periods of food shortage:

$$P_i = f(Z_i) \tag{1}$$

$$f(Z_i) = f(X_{ji}, \beta_j) \tag{2}$$

where,

P_i = The probability that an individual will consume indigenous fruits during periods of food shortage (the binary variable, $P_i = 1$ for consuming indigenous fruit during period of food shortage and $P_i = 0$ for otherwise)

Z_i = Estimated variable or index for the i^{th} observation

$f(Z_i)$ = The cumulative logistic function

$i = 1, 2 \dots, m$ are observations on the variables. m being the sample size 120)

X_{ji} = The j^{th} explanatory variable for the i^{th} observation, $j = 1, 2 \dots n$

β_j = A parameter, $j = 0, 1 \dots n$

$j = 0, 1, \dots, n$ where n is the total number of explanatory variables

The contribution of each on farm production activity towards the household income was established via gross margin calculation Eq. (3). The on farm activities captured in the study were crops, livestock and indigenous fruits. The gross margin is defined as gross income net off direct variable cost (FAO, 1985).

$$GM_i = R_i - VC_i - wL_i \tag{3}$$

where,

R_i = Revenue (cash and in-kind from the sale and use of products) from the i^{th} activity

VC_i = Variable cost (cash and in-kind) from the i^{th} activity

wL_i = Cost of hiring labor and work parties from the i^{th} activity

Products from livestock keeping which include milk, eggs, meat, manure, hides and skin were also captured. The operational costs for the crop enterprises included expenses for seeds, fertilizers, manure, pesticides, draught power, transport and hired labor. Direct variable costs of livestock keeping included expenses for medical treatments, feeds and hired labor.

Off-farm income was defined in net terms, that is, net of any costs incurred related to a person's engagement in an activity. Off-farm income was generated by summing up the incomes from the off-farm activities. These include income from employment, small-scale non-farm market production, business activities and rent from properties.

RESULTS AND DISCUSSION

Contribution of indigenous fruits in coping with food insecurity: The different strategies of coping with food insecurity in the study area were identified and ranked by the respondents. The score of each coping strategy was computed by summing up the responses of all the respondents for the particular strategy and the results are as given in Table 1. The proportion that each coping strategy makes to the total food insecurity coping strategies was then calculated by dividing the score of that strategy out of the total score.

On average, food rationing was the commonly used strategy to cope with food insecurity in the study area; it contributed 19% to the total coping strategies with a score of 332. During food scarce periods, households

Table 1: Proportions of different coping strategies to food insecurity

Coping strategies	Score	Mean	S.D.	Proportions (%)
Skipping meals	256	2.1333	0.82943	14
Consumption of wild animals	168	1.4000	0.57101	10
Consumption of indigenous fruits	323	2.6917	0.80748	18
Borrowing food	215	1.7917	0.72060	12
Relying on food aid	230	1.9167	0.78412	13
Food rationing	332	2.7667	0.88625	19
Food for work	225	2.1500	0.87591	14

Table 2: One sample t-test results of food insecurity coping strategies

Coping strategies	t	Sig.	95% confidence interval	
			Lower	Upper
Skipping meals	-4.843***	0.000	-0.5166	-0.2167
Wild animal	-21.103***	0.000	-1.2032	-0.9968
Indigenous fruits	2.600***	0.010	0.0457	0.3376
Borrowing food	-10.768***	0.000	-0.8386	-0.5781
Food aid	-8.149***	0.000	-0.7251	-0.4416
Food ration	3.296***	0.001	0.1065	0.4269
Food for work	-4.377***	0.000	-0.5083	-0.1917***

Test value: 2.0; Significant at 0.01 level

would reduce the amount of food they prepare for meals to help them save some food for the consequent days. Consumption of indigenous fruits took the second biggest share (18%) in coping with food insecurity and had a score of 323. Most households consume indigenous fruits as a strategy to cope with food insecurity because even when there are harsh climatic conditions and the households face severe crop failures; the indigenous fruits rarely fail to produce. Other respondents claimed that they were introduced to this coping strategy (consumption of indigenous fruits) by their parents and it has thus become a part of them. Consumption of wild animals on the other hand was the least contributor to food insecurity coping strategies (10%) and this could be a result of the strict ban by the Kenya Wildlife Society on poaching of wild animals.

A one-sample t-test was used to identify if the contribution of indigenous fruits in coping with food insecurity was significant with the results presented in Table 2.

The results of the one sample t-test showed that the contribution of all the strategies indicated above are significant in coping with food insecurity amongst the households and this is plausible because the proportions occupied by any of them are somewhat clustered. At 99% confidence level, consumption of indigenous fruits in coping with food insecurity was found to be significant, the hypothesis that indigenous do not contribute significantly to coping with food insecurity was rejected at 99% confidence level.

Socio-economic factors influencing consumption of indigenous fruits during food shortage: Results of the estimated Logit model are given in Table 3.

Table 3: Logit results explaining consumption of indigenous fruits during food shortage

Variables	Coefficient	Standard error	Z	p> z
Gender	0.6240	1.1295	0.55	0.581
Age	-0.3529	0.3591	-0.98	0.326
Marital status	-0.0777	0.6407	-0.12	0.904
Education	-0.8110**	0.3518	-2.31	0.021
HH size	0.4958*	0.1245	1.34	0.091
Employment	-0.6471**	0.2553	-2.54	0.011
Income	-0.8943***	0.3431	-3.57	0.000
Constant	6.9010	2.5716	2.68	0.007

LR χ^2 (7) = 107.82; Log likelihood = -29.002231; Prob> χ^2 = 0.0000; Pseudo R² = 0.6502; Number of obs = 120; ***: Significant at the 0.01 level, **: Significant at the 0.05 level, *: Significant at the 0.10 level

Education as expected had a negative influence in the consumption of indigenous fruits during periods of food shortage. Additional year of formal education decreased the probability of a household consuming indigenous fruits because of food shortage by 81% and this was significant at 90% confidence level. These results agree with studies carried out by Gunatilake (1998), Adhikari *et al.* (2004) and Mamo *et al.* (2007) who found out that a higher level of formal schooling is associated with less collection and dependency on Non-Timber Forest Products (NTFPs). A higher level of education provides a wider range of employment opportunities and as a result alternative sources of income.

Income level was a significant variable that determines the decision of a household to consume indigenous fruits due to food shortage. Income is measured in units of Kenya Shillings (KES). The results indicate that, for every unit increase in total household income, the probability of a household to consume indigenous fruits in order to cope with food shortage decreased by 89%. Households with high incomes have the purchasing power to buy food. These households can afford to buy foodstuff which are usually highly priced when food is scarce. On the other hand, low income earners shift to other food alternatives like indigenous which they can collect from the forest or buy at a very low price. These results agree with a study carried out in Brazilian Amazon by Caviglia and Sills (2005) which found household wealth to have a negative and significant relationship with forest dependency. This indicates that households with more diverse income sources are less dependent on forest resource extraction (Caviglia and Sills, 2005).

Formal employment of the household head was a significant variable that negatively influenced the decision of a household to consume indigenous fruits in order to cope with food shortage. The households with heads who were formally employed had access to other income sources apart from the farm income hence less dependency on indigenous fruits. The probability that the household would consume indigenous fruits due to

Table 4: Gross margins for the different income classes figures in 000' KES

Income class	Gross margins			Total
	Crops	Livestock	Indigenous fruits	
Low income	483.660	612.370	1,221.46	2,317.490
Middle income	505.730	641.380	556.110	1,703.216
High income	311.290	1,455.72	14.8700	1,907.876
Total	1,300.68	2,709.46	1,928.44	5,928.582

1 US dollar (US\$) = KES 85

food shortage decreases by 65% when the household head acquires formal employment. Full-time farmers are most affected by food shortages because they rely on farming activities that are prone to crop failures. They therefore turn to indigenous fruits to cope with food insecurity.

An increase in the family size by one would increase the probability of the household consuming indigenous fruits to be able to cope with food shortage by 50%. Individuals from larger families may find it difficult to access alternative sources of subsistence and thus become dependent on indigenous fruits during times of food shortage. These results are consistent with other studies carried out in Ethiopia and Burkina Faso where dependency on non timber forest products was found to be positively related to household size (Mamo *et al.*, 2007; Lingani *et al.*, 2009).

Contribution of indigenous fruits to household income as compared to other income sources:

From the Table 4, livestock enterprise had the highest total gross margin (KES.2, 709,462) followed by indigenous fruits (KES 1,918,440) with crops enterprise having the least (KES1, 300,680). The short rains are more reliable in the area as a result most households harvest once in a year, the harvests are hardly enough to sell, therefore, most households keep the grains for household consumption. As a result of poor harvests experienced by most households, livestock farming has become the major farming activity which supplies major income to most households. A higher gross margin from indigenous fruits was noted from the low income earners (KES 1, 221,460) with the high income earners recording a gross margin of only KES 140,870 from indigenous fruits. This could be explained by the alternative sources of income by the high income earners. The middle income earner is the most the study diversified group when it comes to income sources. In

area, most of the middle income earners run small businesses and involve themselves in keeping of livestock which they sale when need arises. However, still some of them participate in the sale of indigenous fruits especially in distant markets. The middle income recorded a gross margin of KES 556, 110 from indigenous fruits.

These findings agree with studies from South Africa by Shackleton *et al.* (2002) and Cocks *et al.* (2008), which show income as an influence to procurement and sale, with a greater proportion of low income households procuring NTFPs through self-collection and selling products on either a full-time or ad hoc basis. However, they contradict with a study carried out by Ambrose-Oji (2003) in Cameroon, which found NTFPs to make a greater contribution to middle-income groups (predominantly through trade), with wealthy and poor households benefiting to a lesser degree.

In both locations as shown in Table 5, off-farm income contributed majorly to the total household income among the respondents Livestock farming was the major farming activity among many household in both locations. However the livestock gross margins in Yumbu were notably higher (KES 1,714,716) because the location is nearer to the major market in the district and therefore creating an ease in the sale of livestock. The gross margin for indigenous fruits in Mutyangome was more than double that of Yumbu. This could be explained by the fact that chocolate berry is the major indigenous fruit in Yumbu location; because of it is perishable, it is mainly used for household consumption and local market sales unlike in Mutyangome where high volumes of baobab are sold not only in local markets but also distant markets.

The proportion of each enterprise's gross margin out of the total income indicated that Off-farm income was the major contributor to total household (71.3%) with Mutyangome recording a higher off-farm income share (76.4%) than Yumbu (66.2%). Interestingly, in Mutyangome location, indigenous fruits' enterprise was the second largest contributor (9.7%) to total household income after off-farm income. On average in both locations, indigenous fruits contributed 8.9% to the total household income among the sampled households ranking it third after off-farm income (71.3%) and livestock (14.5%).

On average, the crops enterprise contributed the least (5.6%) to total household income. Most

Table 5: Income share of the income sources to total household income figures in 000' KES

Enterprise	Mutyangome		Yumbu		Average income share (%)
	Income	Income share (%)	Income	Income share (%)	
Crops	951.41	6.80	349.270	4.40	5.60
Livestock	994.75	7.10	1,714.72	21.8	14.5
Indigenous fruits	1,322.72	9.70	595.720	7.60	8.60
Off-farm	10,603.60	76.4	5,208.20	66.2	71.3
Total	13,872.48	100.0	7,867.91	100.0	100.0

Table 6: Correlation estimates between income from indigenous fruits and other sources

Enterprise	Correlation coefficient	Sig. (2-tailed)
Crop	0.402	0.078
Livestock	-0.238	0.009***
Off-farm	-0.259	0.004***

***: Correlation is significant at the 0.01 level

respondents claimed to harvest very little or sometimes even nothing because of the unreliable rainfall. As a result, the little harvest is seldom sold, unless on rare occasions when emergencies arise.

The Pearson's bivariate correlation whose results are given in Table 6 was used to evaluate if there existed any significant relationship between income from indigenous fruits and other household income sources.

As expected, there was a significant negative correlation (-0.259) between income from indigenous fruits and off-farm income. This indicates that, an increase in off-farm income will cause a decrease in income from indigenous fruits. This could be attributed by the fact that income from indigenous fruits is mainly generated by the low income earners who have little or no off-farm income. The biggest proportion of the off-farm income comes from the formally employed who are the high income earners in the study area and least involve themselves in the sale of indigenous fruits.

Livestock income had a negative significant relationship (-0.238) with income from indigenous. Most low income earners have no or very few livestock because of high costs involved in acquisition livestock, as a result, they tend to rely more on sale of indigenous fruits. Livestock income is on the other hand higher among the high and middle income earners. Income from crops had a positive and insignificant relationship (0.402) with income from indigenous fruits. The recurrent crop failures in the region make the high income earners to resent crop production for commercial purposes; because of the high opportunity costs and labor associated with crop production in the region.

CONCLUSION AND RECOMMENDATIONS

Indigenous fruits were widely used by rural households in Mwingi District for both direct household provisioning and income generation, with low income households using and benefiting more from these products than do the high income. Although trade in indigenous fruits is seasonal, households take advantage of the opportunity it presents due to the increasing harsh climatic and economic conditions.

It can therefore be concluded that socio-economic factors are very important in determining household decision to consume indigenous fruits in order to cope with food shortage. Income, education, household size and form of employment have been identified as significant factors that influence a household decision

to consume indigenous fruits in order to cope with food insecurity. Whereas alternative sources of income provided households with purchasing power to acquire food in times of food shortage; education is essential in provision of opportunities for formal employment and ultimately alternative income sources and; bigger household size on the other hand created more demand for food pushing the household to consume indigenous fruits to cope with food shortage.

Indigenous fruits contributed substantially to household income although trade was mainly orientated at local village markets and a few distant markets. In one of the locations, however, income from indigenous fruits was the second major contributor after off-farm income. Dependency on indigenous fruits was less among households with more diversified income sources. The low income earners rely more on income from indigenous fruits; as a result, the gross margins of indigenous fruits were higher among the low income earners and least among the high income earners

More households were involved in the sale of indigenous fruits with baobab fruits being the most highly traded indigenous fruits. Leasing of indigenous fruit trees was also noted, this was another alternative way of generating income from the indigenous fruits. The average contribution of indigenous fruits was ranked third after off-farm and livestock income.

Consumption of indigenous fruits as a coping strategy to food insecurity contributed 18% and was ranked second after food rationing as being the most frequently used strategy in coping with food shortage. Since the area is dry and experiences frequent food shortage, contribution of indigenous fruits was found to be very significant in assisting households to cope with food insecurity. Indigenous fruits were therefore found to be a coping strategy that provides safety or emergency net when food availability is threatened in the households.

Policy recommendations: The value of indigenous fruits in the livelihoods of communities living in harsh climatic conditions has been shown to be very critical especially among the low income earners who are the majority in the area. Policies that will increase volumes of indigenous fruit trees need to be stressed upon. Policies on indigenous fruit trees domestication can further this purpose.

The government through agricultural extension needs to provide services for improved natural resource management for sustainable extraction of not only indigenous fruits but other Non Timber Forest Products. Sustainable extraction will ensure that the benefits from the indigenous fruit tree

Gross margins of indigenous fruits were lower because of lack of access to markets where most traders rely on local markets. The government and other stakeholders need to increase the market reach of the traders. They need to identify that trade in indigenous

fruits generates economic implications not only to individual traders but to the country's economy. There is need therefore to link fruit sellers with both regional and international markets.

Sale of chocolate berry indigenous fruits is low in the area because of its perish ability. The government and other key stakeholders need to put in place policies that will promote value addition. Value addition will not only increase the shelf life of the fruits but also their market prices.

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