



Influence of Household Characteristics on Food Security Status of Smallholder Farmers in Kilifi Sub-County, Kenya

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Authors' contributions

This work was carried out in collaboration between all authors. Author JMC designed the study, wrote the protocol, performed the statistical analysis, managed the analyses of the study and wrote the first draft of the manuscript. Authors PPS and JKL supervised the work. Author EM managed the literature searches and edited the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Food security is critical to the economic, social, religious, political and cultural development Worldwide. It plays a great role in economic growth, poverty reduction and sustainable development in Kenya. A study was carried out in Kilifi sub- County in the coastal areas of Kenya, one of the areas where food insecurity incidences are prevalent. The study assessed the effect of household characteristics on food security status among smallholder farming communities through interview schedules. Non experimental design using descriptive survey was adopted for the study. Household and farm characteristics data was analyzed using descriptive statistics and logistic regression. The results indicated that 80% of all the farmers were food insecure. Elderly farmers were 1% food secure while adults were (40%) food secure. Households with at most two members were more food secure (10%) while households with >10 members least food secure (2%). Household heads with

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secondary school level of education were more food secure (10%). Women were more food secure (12%) than males (8%). There was a significant ($P = .05$) positive relationship between food security and household heads age, marital status and education level. This implies that household heads age, education level and marital status, are some of the most significant issues affecting food security in Kilifi sub-county. To further enhance the understanding and improvement of food security status in Kilifi sub-county, initiation of both formal and adult education is necessary. This will improve households understanding, decision making and adoption of new agricultural innovations hence improved food production and food security levels.

Keywords: Food security; household characteristics; logistic regression; marital status; smallholder farmers.

1. INTRODUCTION

Improved food security plays a critical role in economic development, rural development, reduced hunger and poverty worldwide [1,2]. Food insecurity, however, threatens the sustainability and livelihoods of smallholder farming communities in many parts of the world [3]. For example, Duffour [4] reported that (60%) of the community members of Sekyere-Afram plains district in Ghana were food insecure while Misselhorn [5] reported that (58%) of the community members in rural areas of Limpopo in South Africa to be food insecure. In Kenya, Wachira [6] reported (23%) of the households face chronic food insecurity while Government of Kenya [7], reported (68%) of rural community of Coastal Kenya to be food insecure. The authors attributed the food insecurity levels to diminishing food resources due to high population density and household social economic factors.

According to Hudson [8], improvement of food security does not only depend on individual community member's willingness but also upon the role of property rights on resources and collective action at community level. Demographic variables, water harvesting structures, information sources, knowledge, awareness and attitude also influence food security status among the smallholder farming community members [9]. In the year 2000, world leaders committed themselves to the Millennium Development Goals (MDGs) and one aim of the MDGs was to eradicate poverty and hunger, including "reduction by half the proportion of people who suffer from hunger" between 1990 and 2015. It was predicted that many people will not reach their MDG targets particularly in Sub-Saharan Africa where a third of the population is food insecure and there is an actual increase in the number of hungry people due to rapid population growth. However, in recent times some African countries have invested in agricultural production leading to some level of

growth, which insufficiently addresses the issue of food insecurity in the continent [2,10].

Kenya is a developing country within Sub-Saharan Africa whose economy is predominantly agrarian, where almost half of the GDP (45%) is contributed by the agricultural sector [1]. This sector creates employment opportunities for over 85% of the population. Agricultural sector in Kenya is characterized by subsistence farming with little surplus output and is heavily influenced by weather conditions. Only 20% of farm production is supplied to the local market while the balance of 80% is used for own consumption, which puts the vulnerable and food insecure community members at risk of starvation. This concern has been expressed by Kumba et al. [11] in Kisii central Sub-county, Kenya. He indicated that diminishing land resource caused by high population density resulted to continued sub-division of arable land and poverty level of about 54.2% and this lead to negative influence on agricultural production and income levels. Inadequate food availability is attributable to insufficient domestic production, low agricultural productivity and high poverty rate of over 50% below the poverty line are some of the factors that have been attributed to food insecurity [12,13]. This study have linked household food security status with household characteristic such as the age of the household head, household size, education level and marital status in Kilifi sub-county, while other studies [14,15] have linked household food security status to household socio economic factors such as crop yields, amount of land and household income.

Research carried out by Klaver and Mwadime [16] indicated that food security is not assured for sizeable portion of the population in the Kenyan coast. This is because their food pattern relies heavily on maize and cassava which is lacking in dietary quality and variety resulting to nutritional problems among the vulnerable groups such as

women and children. Kilifi sub-County is situated along the Kenyan coastal line. The area receives an average annual rainfall of between 400-1250 mm per year which is biannual and unpredictable. This leads to low agricultural productivity and high dependency / reliance on expensive agricultural products from other areas of the country. Limited research has been carried out on food security in the area. This study, therefore, sought to establish the determinants that influenced food security status among the smallholder farming community members in Kilifi sub-County, Kenya.

2. RESEARCH METHODOLOGY

2.1 Research Area

Kenya has 47 counties and one of them is Kilifi County which has several sub-counties namely, Ganze, Kaloleni and Magarini. Kilifi sub-county comprises Bahari, Chonyi and Kikambala divisions. The sub-county was chosen from other sub-counties because of the magnitude of food insecurity whose causes have not been researched on or documented. The sub-county lies between 2° 20' South, and 26° 5' East covering an area of 7,500 km². It is both arid and semi-arid, with erratic and unreliable rainfall. Most of the areas are generally hot and dry leading to high rates of evaporation. This combined with unreliable rainfall limit intensive land use and related development activities. It experiences two main rainfall seasons in a year. The long rains start from April to June, with a peak in May while the short rains falls from October to December. The rainfall pattern is influenced by the district's proximity to the Indian Ocean, relatively low altitudes, high temperatures and wind. The majority of the farmers are small-scale farmers with low investment for agricultural production [16]. According to recent population census [17], the Sub-county has a total of 25 074 inhabitants comprising of 9 784 households who practice farming.

2.2 Research Design

Kothari [18] defined a research design as the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to research purpose with a keen interest on procedure. The study adopted non experimental design using descriptive survey which is a method of collecting information by interviewing and administering questionnaire to a sample of individuals.

2.3 Target Population

The target population of this study was the accessible rural households of Kilifi sub county. According to Kenya Bureau of statistics population Census 2009, the sub county has a total population of 25 074 inhabitants comprising of 9784 accessible rural households spread across Bahari, Chonyi and Kikambala divisions.

2.4 Sample Size and Sampling Procedure

2.4.1 Sample size

A sample is a smaller group or sub-group obtained from the accessible population [19]. Cochran [20] provides a simplified formula for sample sizes leading to 256 households but 6 households were used for piloting leaving 250 households for the study.

$$n = \frac{Z^2 pq}{d^2}$$

Where

- n = the desired sample
- Z = the standard normal deviate at the required confidence level.
- P = the proportion in the target population estimated to have characteristics being measured.
- q = 1-p
- d = the level of statistical significance set.

$$n = (1.6)^2(0.05)(0.05)/(0.005)^2 = 256$$

2.4.2 Sampling procedure

Sampling refers to a selection of a representative sample from a target population to be used in a study to give desired characteristics about the population. This study used systematic random sampling which involved drawing every nth household in the population starting with a randomly chosen household in each of the villages in the three divisions. The nth household was the 5th household. The respondents were the head of the household or any available adult.

2.5 Research Instruments

The main data collection instruments that were used in this study included the questionnaire. This was used for the purpose of collecting primary quantitative and qualitative data.

Additionally, the questionnaires were used for the following reasons: Its potentials in reaching out to a large number of respondents within a short time, able to give the respondents adequate time to respond to the items, offers a sense of security (confidentiality) to the respondent and it is objective method since no bias resulting from the personal characteristics [21]. The questionnaire was divided into the main areas of investigation except the first part which captures the household characteristics of the respondents. Other sections were organized according to the major research objectives.

2.6 Piloting of the Instruments

A pilot study was conducted as a technique of testing the validity of the data collection instruments especially the questionnaire and the interview schedules. In this study, a sample of 6 respondents was selected for piloting out of the target population. Piloting helped to identify any unforeseen limitations that could adversely affect the results of the findings of research.

2.7 Validity and Reliability of the Instruments

To validate the questionnaire, after supervisors input, a panel of three competent officers from the sub county agricultural offices were requested to assessed the relevance and quality of the questionnaire and their recommendations were also incorporated in the final questionnaire. The final questionnaire was then administered to a few identical respondents who were not included in the main study and the answers evaluated. After two weeks the same questionnaire was administered to the same group and re evaluated. Thus, test –retest method was used. The consistency in the answers provided assurance of reliability of the instrument.

2.8 Data Collection and Analysis

Household heads or adult representatives provided information on their age, gender, marital status and level of education. Data on household food security was collected based on self-report in reference to the Experience-based Method [22]. The Statistical Package for Social Sciences (SPSS version 20.0) was used to run descriptive statistics to present the quantitative data in form of tables based on the major research questions. Subsequent analysis was done which involved assessing the relationship between the factors influencing food security using logistic analysis.

Logit model was used instead of probit due to its simplicity in the interpretations of the coefficients, accommodation of all household members and is compatibility with logistic regression. The logistic probability model is as shown below:

$$P_i = F(Z_i) = 1 + \frac{1}{1 + e^{-(\alpha + \sum \beta_i x_i)}} \tag{1}$$

P_i is the probability of being food secure, X_i are explanatory variables; α and β_i are the parameters being estimated. The log odds that the probability of an individual is food secure is given by the formula below.

$$\log\left(\frac{P_i}{1-P_i}\right) = Z_i = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \dots + \beta_i x_i \tag{2} [23]$$

According to Legendre [24], identifying an appropriate food security measure is a difficult issue as not all aspects of food security can be captured by any single outcome measure. This is because the subsistence production is harvested piecemeal and is neither measured nor recorded. In order to avoid this difficulty; most analyses depend on measuring food consumption. Food security can be analysed in terms of food availability as compared with requirements [25]. They further reported that the net food available after selling the surplus to the market is a function of domestic production at household level. Food security at household level is best measured by food calorie intake [26]. In order to cater for the measurement limitations mentioned by [26], [27] and [28], the study adopted food security index which is constructed using FAO calorie intake approach. It helped to determine the food security status of each household based on the food security using the Recommended Daily Calorie Required approach. Households with daily calorie intake equal or higher than the recommended daily calorie were treated as food secure and those below the recommended daily calorie were food insecure. To get the average daily calorie intake of each household; daily calorie intake of each individual was multiplied by its household size. The following formula was adopted:

Food security index $Z_n = [\text{Household's daily per capita calorie availability (A) / Household's daily per capita calorie requirement (B)}$

Food security index (Z_n) = (Y_n / R)

Where

Z_n is food security index of n^{th} household.

Y_n is the actual daily calorie intake of the n^{th} household.

R is the Recommended Daily Calorie Required by n^{th} household.

Food security index ≥ 2060 = food secure household while food security index < 2060 = food insecure household. The 2060 kcal was used because the Daily Recommended Calorie Requirement for Kenya is 2060 kcal [29]. The daily food (calorie) requirement was estimated by grouping household members into different age groups (Table 1). Total household calorie requirement was then obtained by multiplying total number of adults in each household by the 2060 kcal. Total energy requirements for children were converted to adult equivalent using conversion scale in Table 1.

Table 1. Recommended daily energy intake and conversion factor

Age category (Years)	Average energy allowance per day	Conversion factor
<6	750	0.29
7-15	1200	0.51
16-30	1500	0.71
31-50	2350	0.98
51+	2200	0.90

*Source: Kenya National Bureau of Statistics [25]

Daily calorie intake was obtained by converting data on food consumed (maize, cowpeas, sorghum and cassava) by every household per week into kilograms and equating using the information in Table 2.

Table 2. Cereal equivalent conversion ratios

Food crop	Calorie/kg	Milling ratio	Maize equivalent ratio
Maize	3590	0.85	1.00
Cowpeas	3640		0.92
Sorghum	1350	0.65	0.40
Cassava	1490	0.85	0.40

*Source: Okigbo [26]

3. RESULTS AND DISCUSSION

3.1 Household Characteristics and their Role in Determining Food Security

Age is an important characteristic that influences management and distribution of roles in a

household [27]. This is because age plays a great role in defining various roles played by household members which impacts household decision-making on land use and food security. Respondents were classified as adolescents, adults and old (Table 3). Distribution of age categories among sample population showed that 7% of the household heads were adolescents, and majority were adults (58%). These results are similar to those of Kumba et al [11] who found that majority of farmers in Kisii central Sub-county were aged between 30 to 50 years. Similar findings were reported by Ogeto et al. [28] in Nakuru County. Similarly, studies conducted in Malawi and Uganda by Nyambose and Jumbe [29] and Turyahabwe [30] indicated that the average age for household heads in farming communities was 41.1 and 40 years respectively.

Analysis of the relationship between household food security and age showed that adults were more food secure (18%) while adolescents and elderly farmers were 1% food secure respectively. Additionally, the households headed by adults were 18% food secure while those headed by elderly farmers were 1% food secure. The research is in agreement with Babatunde et al. [21] who found out that middle aged household heads were energetic and were able to cultivate larger farms and obtain off-farm jobs for extra income compared to older and weak ones. Similarly, Muindi et al. [31] and Teklewold et al. [32] reported that young household heads adopted new farming technologies easier compared to older farmers. They further attributed the trend to fear of the unknown. This is because older people fear the risk of unexpected events whilst young farmers tend to be more flexible in their decisions to adopt new ideas and technologies more rapidly hence improved productivity leading to better food security status.

Households containing at most two members were 10% food secure while households containing above 10 members were 2% food secure. These findings are similar to those of Adepoju et al. [33] who found that increase in household size led to significant reduction of food security status of farmers in Osun state, Nigeria.

Gender of household head is an important factor in households because it influences farm organizations, income earning opportunities hence food security. The present study indicated that 58% of the households were headed by

women while 42% of the households were headed by men. The higher percent of women headed farming households can be attributed to scenarios where male family members leave rural households to try and find waged labour in urban centers to increase family income [34]. Female headed households (12%) were more food secure compared to male headed households (8%). The findings are in agreement with work carried out by Kassie et al. [35], who found that female headed households were 87% food secure compared to male headed households. Similar findings have also been reported by Kumba et al. [11] in Kisii, Kenya.

The economic stability of most African families depends on the contribution of the family members in income generating activities or food production. A large proportion of the household heads were married (88%) while only 12% were single. The married household heads were also found to be more food secure (18%) compared to the households headed by unmarried (2%). This

implies that joint effort of husband and wife plays a great role in food security improvement compared to a single attempt by one person. Yusuf et al. [36] further attributed the improved food security in married households to increased household members who engage in income generating activities hence increased income. Similar findings have been reported in other parts of Kenya by Kumba et al. [11] and Kiprono [37].

Education level influences farmers' or household heads' access to information as well as their ability to understand technical aspects of innovations which largely affects production decisions [38,39]. This in turn influences productivity, access to food and living standards. Results from the study indicate that the household heads who had attained Secondary school education were 30% while those with primary certificate were 36%. This implies that most household heads in the area were illiterate. This trend can be attributed to the role of education in enhancement of decision making

Table 3. Sample distribution by household characteristics

Household characteristics	Sample	Percentage of the total population	Food insecure	Food secure
Age				
Adolescents	18	7	(6%)	(1%)
Adults	146	58	(40%)	(18%)
Old	86	35	(34%)	(1%)
Total	250	100	(80%)	(20%)
Household size				
At most 2	41	16	(6%)	(10%)
3-6	82	33	(28%)	(5%)
7-10	94	38	(35%)	(3%)
Above 10	33	13	(11%)	(2%)
Total	250	100	(80%)	(20%)
Educational level				
None	85	34	(32%)	(2%)
Primary certificate	90	36	(28%)	(8%)
Secondary	75	30	(20%)	(10%)
Total	250	100	(80%)	(20%)
Marital status				
Married	221	88	(70%)	(18%)
Single	29	12	(10%)	(2%)
Total	250	100	(80%)	(20%)
Gender				
Male	105	42	(34%)	(8%)
Female	145	58	(46%)	(12%)
Land size				
1-2 acres	184	73.6	(59%)	(2%)
3-5 acres	46	18.4	(16%)	(3%)
5-10 acres	20	8	(5%)	(15%)
Total	250	100	(80%)	(20%)

*Source: Field survey, 2014

skills hence better adoption and utilization of new technologies and innovations hence improved food production. Similar findings have been reported by Kirimi et al. [40], Olayemi [41] and [34] respectively.

The size of the land is a proxy for wealth. It was found to influence food security status. Results from the study indicate that 59% food insecure and 2% food secure respondents had 1-2 acres of land, This implies that most of the household heads in the area were food insecure. This trend can be attributed to the increasing population.

3.2 Logistic Regression of Household Characteristics as Determinants of Food Security Status

There was a significant positive relationship ($P=.02$) between the age of household head and food security (Table 4). This implies that households headed by adults are likely to be more food secure than those headed by old people. These findings agree with Kalirajan and Shand [42] who reported that the presence of adults leads to improved information absorption and dissemination hence improved food security. However, the findings do not agree with those of Haluet et al. [43] and Nata et al. [44] who reported a negative relationship between household heads age and food security in Ethiopia and Ghana respectively.

The relationship between the household size and food security was significant ($P=.01$) at 5% significant level. The odds ratio in favour of food security decreased by a factor of 1.520 as household size increased. An increase means more people to feed and this means increased demand for food. The coefficient of household size was negative, meaning that there was a negative correlation between household size and food security. Large sized households need more resources to fulfill household food needs. These findings agree with those of [45] in Ethiopia and [11] in Kisii, Kenya. This could be due to the fact

that the demand for food cannot be matched with existing food supply. The findings disagree with those of Ayuk [39] who found that, large household size provided more labor for peak period agricultural activities.

The relationship between education level of the household head and food security was significant ($P=.04$) at 5% significant level. The odds ratio in favour of food security increases by the factor 2.711 as education level of the household head increases. This implies that, the households headed by educated household heads are more food secure compared to households heads with low or no formal education. The level of education of the household head has a positive relationship with the household food security. This is consistent with a study conducted by Kirimi et al. [40], who found that education enhances skills and ability to make decisions which can enable access to better economic opportunities or better utilization of information including use of technology and farming practices to improve agricultural production hence food security.

Marital status of household heads was found to significantly was ($P=.01$) influence food security. The odds ratio in favour of food security increases by the factor 2.838 as the number of marriage couples increases. The role of marriage in food security enhancement can be attributed to either adequate supply of family labour [16,25] or increased family income [17], or improved level of decision making, investments and utilization of available resources. Studies by Grinstein-weiss et al. [46], Lupton and James [47], Schoeni [48], Willmoth and Koso [49], Kaloi et al. [50] and Kumba et al. [10] reported that marital status significantly influences household food security.

The relationship between land size and household food security was significant ($P=.00$) at 5% significant level. The odds ratio in favour of food security increases by the factor 1.36 when

Table 4. Logistic regression of household characteristics as determinants of food security status

Variables	Coefficients	Odds ratio	z-values	P-values
Age	0.26	1.97	2.31	0.02
Household size	-0.41	1.52	2.16	0.01
Education	0.341	2.71	2.41	0.04
Marital status	0.17	2.84	3.10	0.01
Land size	1.71	1.36	3.85	0.00

land size is increased by one acre. The correlation coefficient of farm size was positive indicating that it is a determinant of food security. These findings are consistent with the outcome of a study conducted by Amudavi [51] who showed significant relationship between farm size and household food security in Kenya. It also supported by research findings of Buyinza and Wambede [52] who reported that farmers with big farms were more likely to be food secure. This is because they can diversify and produce more food. The size of land is a proxy for wealth.

The results of logistic regression on household characteristics as determinants of food security status are presented in Table 4.

4. CONCLUSIONS AND RECOMMENDATIONS

The study identified that majority (80%) of households in Kilifi subcounty were food insecure. The food insecurity status in the study area was found to be greatly influenced by household size, age of household heads, marital status and levels of education of family members. The study, therefore, recommends that household members should be encouraged to acquire formal education through enrolment in schools and / or participation in adult literacy training programmes. This will play a great role in improving their decision making levels and adoption of new innovations hence improved productivity and food security.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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