Original Research Article

Influence of Indigenous Knowledge on Household Food Security Status Among the smallholder farmers in Kilifi South Sub-county, Kenya.

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 South sub-county in the coastal areas of Kenya, one of the areas where food insecurity incidences are prevalent. The study assessed the effect of indigenous knowledge on food security status among smallholder farming communities through interview schedules. Non experimental design using descriptive survey was adopted for the study. The data was analyzed using descriptive statistics and multiple regression. The results indicated that 80% of all the farmers were food insecure. Those who practiced indigenous knowledge were 20% food secure and 80% food insecure. The farmers who had planted fast growing crops were 9% food secure while the ones who practiced traditional water conservation were 1% food secure and those who planted traditional seeds were 10% food secure. Farmers who practiced integrated pest management were 11% food secure while those who planted drought resistant crops were 9% food secure. There was a significant (P= .05) positive relationship between food security and practice of indigenous knowledge. This implies that indigenous knowledge was one of the most significant issues affecting food security in Kilifi South Sub-county. To further enhance the understanding and improvement of food security status in Kilifi South sub-county, indigenous knowledge is necessary. This will help households make long-term investments in new agricultural innovations hence improved food production and food security levels.

Key Words Indigenous knowledge, smallholder farmers, household food security, hunger, environment

1.0 Introduction

Food insecurity has been of great concern worldwide, and has emerged as one of the key development challenges in Kenya. Since independence, Kenya has been fighting hunger and food insecurity [1]. Most farmers and local communities use indigenous knowledge to ensure food security in various ecosystems such as harsh ones. Indigenous knowledge can be applied in innovative ways to help tackle the effects of climate change [2]. According to FAO, WFP and IFAD [3], this can be an important basis to ensure food security in the world today. A study by IFAD [4] revealed that indigenous knowledge is mostly used to observe, monitor and report weather related changes and this is important to smallholder farmers. According to Gadzinayl S., Mutandwa E. and Chikosha M. [5], lack of this knowledge, results to increased food insecurity and poverty to many households in the world. Extreme weather conditions are increasing and therefore, urgent responses are needed in order to reduce the risks related to climate change. Indigenous knowledge should be combined with science and technology in order to ensure food security. According to FAO [6], many smallholder farmers change their agricultural practices to mitigate climate change impacts such as droughts, floods and outbreak of pests and diseases. A study by IFAD and Iyagba A. G. [7], in order to reduce the impacts of climate change, the smallholder farmers select and improve both traditional and introduced seeds and crop varieties. The role of the government is needed in capacity building, disaster preparedness and mitigation [8].

A study by Osunade & Warren [9] revealed Indigenous Knowledge has been used for many generations by the people around the world in different ways. They further reported that it exists in every community since it is a cumulative body of knowledge and beliefs, handed down through generations by cultural transmission, about their relationships with one another and with their environment. Indigenous knowledge is sometimes referred to as traditional knowledge, traditional environmental knowledge or rural people's knowledge. According to Rao et al. [10], indigenous knowledge is the basis for local level decision-making in many rural communities as it is both dynamic and complex, and not confined to knowledge about uses and products but also about processes. He

further reported that indigenous knowledge though unique to a given culture or society has value not only for the culture in which it evolves, but also for scientists and planners striving to improve conditions in rural localities. Rao et al. [10] reported that much as climatic variability involved long term changes in seasonal or annual temperatures or precipitation, it was commonly associated with events such as droughts and floods and therefore involved anticipatory action. Coping strategies to climatic variability includes avoiding meals or securing resources. Since rain-fed farmers are already vulnerable to current weather variability and associated shocks, it is essential to help them build their livelihood resilience through coping better with current weather-induced risks as a pre-requisite to adapting to future climatic changes [11].

Bollier [12] demonstrated that indigenous Knowledge not only preserves the past, but can be vital in ensuring a sustainable future. It has been realized to be important in reducing disaster risk and adaptation to climatic variability. However, the importance of science in reducing disaster risk also needs to be recognized. Combining local knowledge and science may be a way to overcome problems that deal with the effects of climatic variability. The smallholder farming communities take a central position in agricultural activities but their role has been given very little attention in the past, where they are expected to adopt innovations that have been developed by others. What they need is technical guidance so that they can manage challenges in their farming activities. This can best be achieved by integrating their indigenous knowledge with science in order to fight food insecurity.

According to Olatokun & Ayanbode [13], farming communities through accumulated knowledge passed from generation to generation have known patterns of weather; how and when local natural disasters occurred; how to plan to cope with their impacts on the natural environment, livelihoods and lives. He further reported that many African farming communities have developed techniques and strategies for forecasting, and managing climatic variability including coping mechanisms to respond to both normal and harsh conditions of their local environments. A study by Nyong et al. [14] reported that farming communities base their forecasting on observation of the natural environment including flora, fauna and stars and this have enabled them to reduce their vulnerability climatic variability.

2.0 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 2º 20' South, and 26º 5' East covering an a9rea of 7,500km^2. 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 [9]. According to recent population census [10], the Sub-county has a total of 25 074 inhabitants comprising of 9 784 households who practice farming.

2.2 Research design

Kothari [11] 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 [12], 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 [13]. Cochran [14] 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.

$n=(1.96)^2(0.05)(0.05)/(0.005)^2 = 384$

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 n^{th} household in the population starting with a randomly chosen household in each of the villages in the three divisions. The n^{th} household was the 5^{th} 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 [1].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.

2.4 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 [*15*]. 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 multiple regression.

The regression equation is $y= a+ B_1X_1 + B_2X_2 + B_3X_3 + B_zX_z + e$ where z is the number of independent variables, y is the dependent variable, a is the constant and the Xs are independent variables. The Bs are listed in a column of coefficients. The study used Adjusted R Squared of 0.691. That is, 69 percent of a change in the dependent variable can be explained by changes in the independent variables. Before running statistical analysis, variables were examined for the presence of stochastic trends using normality test in order to confirm whether data conforms to ordinary least squares (OLS) assumptions. Using the P-P plots of regression, the data were found to be normally distributed.

According to Legendre [16], 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 [17]. 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 [18]. In order to cater for the measurement limitations mentioned by [19], [20] and [21], 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:

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

$$\text{Food security index } (Z_n) = \frac{Y_n}{R}$$

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 2060kcal [22]. The daily food (carolie) requirement was estimated by grouping household members into different age groups (Table I). 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 [23]

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 [24]

RESULTS AND DISCUSSION

The analysis of the influence of indigenous knowledge on food security indicate that 32% planted fast growing crops while 66% didn't have the title deeds, 48% practiced traditional water conservation while 66% planted traditional seeds. 42.8% practiced integrated pest management while 57.2% planted drought resistant crops. The results indicate that the household planting fast growing crops were 9% food secure while the households who practiced traditional water conservation were 1% food secure and finally, the household planting traditional seeds were 10% food secure (Table). This implies that planting traditional seeds creates confidence in making positive investment decisions. This sentiment was also expressed by [22] who reported that planting traditional seeds influence farmers' profit margins and land use decisions and thus food security. They reported 13% of the farmers in Ethiopia were food secure while the rest were food insecure.

Influence of Indigenous Knowledge as a livelihood strategy on the household food security status

Variables	**Sample**	**Percentage %**	**Food insecure %**	**Food secure %**
Response to erratic rainfall				
Planting fast growing crops.	164	32	26	9
Traditional water Conservation	20	48	47	1
Planting traditional seeds	66	20	7	10

Total	**250**	**100**	**80**	**20**
Response to increased pest incidences				
Integrated pest management	107	42.8	61	11
Planting drought resistant crops	143	57.2	19	9
Total	**250**	**100**	**80**	**20**

Source: Field survey April-August 2014

The study found out that 32% of the households planted fast growing crops, 48% practiced traditional water conservation while 20% planted traditional seeds (Table). The analysis also revealed that 1% of the households practicing traditional water conservation were food secure while 47% of the households were food insecure while those planting traditional seeds were 20%. A similar study by *Mitchell*, T *Tanner*, T. (eds.) [29]. revealed that majority (58%) of the rural households in Himalaya relied on traditional seeds for their livelihoods and 34% were food secure.

The analysis of the influence of response to increased pest incidences revealed that 11% of the households practicing integrated pest management were food secure while the households relying on drought resistant crops were 9% food secure. Another study by Morgan [30], reported that crop rotation and integrated pest management were practiced by most households. From his study 56% of the household practicing integrated pest management were food secure.

Variables	B	Std Error	Coefficients	t	Sig
(Constant)	3.670	.217		16.946	.000
Planting fast growing crops	.576	.098	.672	.777	.008
Traditional water conservation practices	.366	.131	.621	1.562	.104
Planting traditional seeds	612	.094	.703	1.185	.000
Integrated pest management	.683	.133	.671	1.117	.005
Planting drought resistant crops	.605	.025	.717	1.213	.002

Dependent variable: Food Security Status R^2=0.513

Smallholder farmers' believe that combining indigenous knowledge with science may be a way to overcome problems related to climate change and also deal with its effects. Indigenous knowledge can address climate change impacts but it must be combined with other knowledge and used in broader context of sustainable development. These findings agree with that of Osunade [9] who reported that the mixer of the two different systems of knowledge can create a mechanism of integration between smallholder farmers and experts in climate change and this can reflect smallholder farmers' aspirations and actively involved in farmers' activities. In Kilifi Sub-county, the mixer of indigenous knowledge with scientific strategies is seen in the use of zai pits and sunken beds which were farmers' ideas as a response to manage erratic rainfall and drought. The work of extension agents is to show them the correct measures of these technologies and the maximum number of maize plants or sorghum plants that are to be planted in each. Smallholder farm also know

the performance and reliability of traditional seeds because they have been with them for a long time. Unlike hybrids, traditional seeds are more reliable and store well without being damaged by pests. .

The relationship between planting fast growing crops and food security was found to be significant (P=0.008). and positively related to household food security status. The relationship between the dependent variable and independent variables was strong (R^2= 0.513). The results imply that as household heads increase the practice of early planting, food security status increases. These findings agree with a study conducted by Rao et al.[10] who reported that planting fast growing crops is vital in ensuring sustainable future in dry areas.

Planting traditional seeds was found to be significant and positively influence food security status in Kilifi South Sub-county (P= 0.000). This helps the farmers to manage erratic rainfall. Even though the extension agents are promoting the hybrid seeds, farmers plant traditional seeds because they are perceived as easy to carry out. These findings are consistent with a study conducted by Rao et al., [10] who demonstrated that indigenous Knowledge not only preserves the past such as using traditional seeds, but can be vital in ensuring a sustainable future. It has been realized to be important in reducing disaster risk and adaptation to climatic variability. However, the findings of this study do not agree with those of [26]. This is due to recognizing that the importance of science in reducing disaster risk also needs to be recognized.

Integrated pest management was found to be significant and positively influence food security status in Kilifi South Sub-county (P=0.005). The relationship between the dependent and independent variables was strong (R2=0.53) Integrated pest management involves the use of different methods in managing pests in crops at a given time, which include biological, cultural and chemical methods Harvested cereals are also preserved by keeping them above fire places. These findings are consistent with that of a study conducted by Osunade [9] who reported that smallholder farmers could find it easy to use integrated pest management IPM because of its diversity and ease of accessibility. He further noted that IPM also allows smallholder farmers to use their own knowledge to suit their environment and be compatible with their agricultural practices. However, the findings of this study do not agree with those of [10].

Planting drought resistant crops was found to be significant and positively influence food security status in Kilifi Sub-county (P =0.002). Crops like cassava, cowpeas and local maize are mostly used to manage the effect of excessive heat on crops. Smallholder farmers have a wealth if indigenous knowledge IK about their environment, crops and livestock and others which are built up over centuries. This outcome is consistent with the outcome of [26], who found out that IK together with the current technology development have the potential to help solve some of the problems faced by farmers. However these findings do not agree with those of [2].

Conclusion

The study shows that majority (80%) of the households in Kilifi South Sub-county were food insecure during the period of the survey. Consistent with the expectation and findings from previous studies the households with heads practicing indigenous knowledge were more food secure. it is recommended that efforts should be made to ensure farmers should practice indigenous knowledge in order to take care of hash climatic conditions. The farmers should take the advice of the agricultural extension officers seriously in order to increase the output. They should grow crops which are appropriate for the area. This knowledge is what food insecure citizens of South Africa possess and it can be enhanced and used as a resource for radically changing the way of farming and enhancing food access for low income households.

References

1. FAO 2013. The State of Food And Agriculture: Food Sysetms For Better Nutrition. Rome: FAO.
2. Bernet, D., Schmidt, H., Meier, W., Burkhardt-Holm, P. & Wahli, T., 1999, Histopathology in fish:

3. FAO, WFP & IFAD 2012. The Sate Of Food Insecurity In The World: Economic Growth is Neccessary But Not Sufficient to Accelerate Redcution of Hunger And Malnutrition. In: UNITED NATIONS. (ed.). Rome:
4. IFAD 2009. Smallholder Agriculture and Food Security in the 21st Century. In: VARGASLUNDIUS, R. (ed.) Proceedings of the Governing Council Round Tables.
5. FAO 2013. The State of Food And Agriculture: Food Sysetms For Better Nutrition. Rome: FAO.
6. Gadzirayi, C., Mutandwa, E., Chihiya, J. & Chikosha, M. 2006. Indeginous Knowledge Systems In Sustainable Utilization of Wetlands In Communal Areas Of Zimbabwe: Case of Hwedza District. African Journal of Agricultural Research, 1, 131-137.
7. IFAD and Iyagba, A. G. 2010. A Review on Root and Tuber Crop Production and their Weed Management Among Small Scale Farmers In Nigeria ARPN Journal of Agricultural and Biological Science, 5, 52- 58.
8. Jacobs, P. 2012. Household food access in rural South Africa: Lessons for Emerging Food Security Policy. human Sciences Research Council. Pretoria, South Africa.
9. Osunade & Warren, Beatrice. 1992. Sense Developments. Stockholm: Almqvist & Wiksell
10. Rao VR, Hunter D, Eyzaguirre PB, Matthews PJ (2010) Ethnobotany and global diversity of taro. In: Rao RV, Matthews PJ, Eyzaguirre PB, Hunter D (eds), The GlobalDiversity of Taro: Ethnobotany and Conservation. Biodiversity International, Rome, Italy, pp 1-5
11. Babatunde A. O., Omotoso O. A. and Sholotan O. S. (2007). Factors influencing food security status of rural farming households in Nigeria. Agricultural Journal, 2(3):351-357.
12. Klaver, W, Mwadime, RNM. Food consumption and nutrition in the Kenya coast. ASC working paper 1998: 31:1-71.
13. Government of Kenya. Kilifi District Development Plan, 2008-2013. Nairobi, Kenya Government Printer. 2009.
14. Kothari C. R. (2004). Research methodology. Methods and Techniques. Second revised edition. New age international publishers.
15. KNBS. Kenya National Bureau of Statistics. Ministry of Planning and National Development. 2012.
16. Cochran, W. G. (1963). Sampling Techniques, 2nd Ed., New York: John Wiley and Sons, Inc
17. Orodho, J (2005) Essentials of educational and Social Sciences Research methods.Nairobi: Masola publishers.
18. Legendre P. (2005). Species associations: the Kendall coefficient of concordance revised. *Journal of Agricultural, Biological and Environmental Statistics 2005: (10): 226-245.*
19. Gay, L (1992) Educational Research: Competencies for Analysis as Application. 4th Edition, Macmillan, New York.
20. Mbeza, J. K (2006) Introduction to management Research. A Student Handbook. Modern management consultants publishers Nairobi, Kenya.
21. Okigbo, B. N. (1991). Development of Sustainable Agricultural Production System in Africa: Role of International Agricultural Research Centres and National Agricultural Research System, Ibadan: IITA.
22. Arene, CJ, Anyaeji, RC. Determinants of food security among households in Nsukka metropolis of Enugu State, Nigeria. Pak J Soc Scienc. 2010; 30(1): 9-16
23. Ogeto RM, Cheruiyot E, Mshenga P, Onyari NC. Sorghum Production for Food Security: A Socio-Economic Analusis of Sorghum Production in Nakuru County, Kenya. Afric. J Agric. Res. 2013:8(47): 6055-6067.
24. Nyambose W, Jumbe CB. Does Conservation Agriculture Enhance Household Food Security? Evidence from Smallholder Farmers in Nichotakota in Malawi. 2013. www.ageconsearch.umn.edu/...5%20B.L.%20Jumbe.pde
25. Ojogho, O. (2010). Determinants of food insecurity among arable farmers in Edo state, Nigeria. *Agricultural journal ; 2010; 5: 151-156.*
26. Nyoro and Jayne (2004). Competitiveness of Kenya and Ugandan Maize Production: Challenges for the future. Working Paper 10, Egerton University. Tegemeo Institute, Nairobi.

27. Buyinza, M. & Wambede, N. (2008). Extension for agroforestry technology adoption: mixed intercropping of crotolaria (Crotolaria grahamiana) and maize (Zea mays L.) in Kabale district, Uganda. *Environmental Research Journal, 2(3), 131-137.*
28. Bollir Paine (2009), Rights of Man, Common Sense, and Agrarian Justice, with an introduction by Peter Linebaugh (proposing to understand Paine through his commoning and anti-enclosure experiences).
29. *Mitchell*, T *Tanner*, T. (eds.) (*2006*). 'Building Disaster Resilient Future: Lessons from. Participatory research in St Island Disaster.
30. Morgan G (1986) "A metaphorical analysis of client organizations and the briefingprocess", *Construction Management and Economics*, 14:155-64. *Images of Organization*, Sage.