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Household Coping and Adaptive Strategies Undertaken by Households to Enhance Food Security in Makueni County, Kenya

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Abstract:

Food insecurity remains a key problem in the World in general and in the low income countries in particular. Examining how households deal with the challenge of food insecurity is therefore important in order to have more informed policy interventions. This study examined coping and adaptive strategies undertaken by households to enhance food security in Makueni County, Kenya. The study adopted a descriptive research design and used a semi-structured questionnaire to gather data. Observation and photography methods were also used to compliment the questionnaire. While food insecurity was the dependant variable, the predictor variables were the coping and adaptive strategies used by the households to deal with food insecurity situations. From 400 respondents selected in Makueni County, Kenya, the study results revealed that nearly all (98%) of the farmers are resilient and uses a number of coping and adaptive strategies to deal with food insecurity. The coping strategies used include engaging in small scale business, engaging in casual labour jobs, food aid, food rationing and borrowing from relatives and friends to be able to acquire food among others. The adaptive strategies on the hand include keeping of livestock, agroforestry, seeking formal employment and undertaking small scale irrigation among others. The study further established that the coping and adaptive strategies used were not successful in making households food secure but they were a means of minimizing the effects of food insecurity. The respondents indicated that the coping and adaptive strategies were not successful in addressing food insecurity due to factors such as death of livestock due to drought, lack of dams for water, lack of employment opportunities, and lack of adequate support by the government. This implies that despite use of various coping and adaptive strategies, the farmers are still vulnerable to food insecurity because the strategies applied merely minimized the effects of food insufficiency. The study recommends the need to address the households' food insecurity through strengthening of households coping and adaptive strategies such as through credit facilities, training, use of technology, creating job opportunities, enhancing government support through for example extension services and a shift from food aid to inputs for work as well as diversifying farmers' livelihood activities.

Keywords: Food insecurity, coping and adaptive strategies, drought, households, Makueni, Kenya

1. Introduction

Food insecurity is one of the most challenging issues especially in Africa. Indeed, Africa is the only region in the World where food production continues to paint a gloomy picture. In this study, food insecurity refers to lack of access to sufficient, safe and nutritious food to meet dietary needs. This term encompasses aspects of challenges of food production through cultivation, food storage and preservation as well as food access through people's purchasing power or social linkages. In Kenya more than 70% of the Arid and Semi-Arid Lands (ASALs) face food shortage most of the time, yet more than 80% of the people are farmers (Ongwae and Karanja, 2005). Huho and Mugalavai (2010) further indicate that drought has increased in frequency in the last three decades and the number of people affected has been growing. They point out that agriculture has been the most affected by drought and this has led to more problems of food insecurity especially in the ASALs. GOK (2013) indicates that Makueni County of Kenya is largely an ASAL region and among the most affected by frequent droughts and food insecurity. Thus, the persistent food insecurity in the area calls as a matter of priority for more evidence-based comprehensive studies that can help analyse a myriad of coping and adaptive strategies with the aim of ensuring more effective methods of addressing food shortage in the region. In this study, the term coping strategies to food insecurity refers to all the short-term strategies or acts that individuals and households in a food insecurity situation use to be able to provide food resource for the survival of the family members. These include: selling of firewood, selling charcoal, selling, engaging in casual labour jobs, food aid, food rationing, and borrowing from relatives and friends to be able to acquire food among others. The term adaptive strategies on the other hand means the long-term strategies used by the individuals and households to deal with the problem of perpetual food insecurity. These include

keeping of livestock, use of new crop varieties, agroforestry, seeking formal employment and undertaking small scale irrigation among others.

A number of studies on coping and adaptive strategies to food insecurity have been done. *Derbile (2009)*, found out that farmers plant multiple indigenous drought resilient crop varieties and employing different rounds of seeding and or staggering planting between multiple farms. Farmers also apply indigenous forms of organic manure, checking soil erosion through grass strips and stone terracing and adopting paddy farming for improving soil and water conservation towards enhancing plant adaptive to drought. He asserts that through conscientious effort, farmers are reducing vulnerability of rain-fed agriculture to drought through indigenous knowledge systems of drought risk management.

Molua (2009) sought to establish the gendered response and risk-coping capacity to climate variability for sustained food security in Northern Cameroon and observed that households are exposed to stresses related to food production and availability, low incomes and food accessibility and utilization of food supplies, heightened by the real and perceived effects of the variability of current climate. Short-term coping choices include diversification of livelihood which in turn impacts food accessibility and consumption choices. He further observed that market and income manipulation choices for food supply stability include a range of non-farm income generation strategies to cope with expected shortages induced by climatic variability. The current climate variation, household demography, and farming conditions via access to credit, tenure, and extension service delivery are significant determinants of coping choices for households perceiving change in climatic patterns.

Potter (2015) conducted a study in Kampala, Uganda on coping with urban food insecurity. The study used survey method and based on primary data, the results show that as part of coping strategies, food insecure households dropped or decreased consumption of *matoke*, the plantain staple, soon after its availability declined or its market price rose. According to Potter (2015), the population in turn shifted to a diet for which the base was a stiff maize porridge (*posho*), eating just one meal a day. Berlie (2015) also conducted a study on coping strategies and household food security in drought-prone areas in Ethiopia focusing on Lay Gayint district. Using a questionnaire, in-depth interview and focus group discussions, the study revealed that planting trees for the market, livestock diversification and natural resource conservation were crucial adaptive strategies used by the better-off households. Short-term strategies employed by households included selling charcoal and fuel wood, taking loans/credits and borrowing in kind or cash from friends. The study recommends the need to adapt early maturing and drought-resistant varieties, efficient use of available water and the growing of highland apple trees and planting Eucalyptus trees in accessible areas for better livelihoods. The studies Potter (2015) and Berlie (2015) relates to the present study on the variable of coping strategies and that they are based on low income countries. However, while Potter (2015) only focused on one coping strategy i.e. dietary changes Berlie (2015), on the other hand addressed more coping and adaptive strategies to food insecurity. The present study examined a variety of coping and adaptive mechanisms applied by households in an ASAL region in Kenya and also established their success or non-success in ensuring food security in Makueni County.

Law et al (2018) contributes to this study through their qualitative study on identification of common coping strategies practiced by indigenous peoples (Orang Asli) in Peninsular Malaysia during periods of food insecurity. Using qualitative case study design and in-depth interviews, the study found out that there were different coping strategies used which were grouped into two themes. Firstly, food consumption (these were: dietary changes, diversification of food sources, decreasing the number of people and rationing). Secondly, financial management (these were: increasing household income, reducing expenses for schooling children and reducing expenses on daily necessities). This study sheds some light on the current study not only on the methodology applied but also on the key variables of coping and adaptive strategies applied during food insecurity. The current study used both qualitative and quantitative techniques and also focused on the coping and adaptive strategies to food insecurity with reference to an ASAL region in Kenya.

2. Study Area

This study was undertaken in Makueni County, Kenya. This county was purposively selected because it falls within the ASAL regions of Kenya. The county is a representative case of low to medium potential areas and with many households involved in small-scale farming but most often faced with food insecurity. According to GOK (2013) and Government of Makueni County (2019), the county mainly lie within Agro-ecological zones 4 and 5 where crop failure is usually three times out of five seasons. Within these zones, communities are mainly agro pastoralists. The County is classified as an ASAL region as it receives very little and erratic precipitation that varies year to year making it difficult for farmers to plan their farming activities. The lower side which is very dry receives rainfall as little as 300 – 400 mm. The county experience an increasing shift from sorghum and millet growing in preference for maize, which is the main staple crop. Aridity of this county has negatively affected agriculture which is the main economic activity (GOK, 2013). Crops in these areas often fail due to the low rainfall thus contributing to food insecurity. Other factors contributing to food insecurity include: small farms due to sub division, crop diseases, poor storage facilities and sale of harvested crops to highly exploiting middle traders to meet other domestic needs.

Makueni County has two rain seasons: the long rain season (April to June) whose average is 329.3mm and the short rain season (October to December) whose average is 372.4mm. The highest temperatures are usually in February (24.6°C) while the lowest are in July (20.2°C). High temperatures of up to 35.8°C are experienced in the low lying areas causing high evaporation which worsens dry conditions. The region has also experienced climate change and variability as a result of human activities such as farming on the top hills and burning charcoal among others. This has contributed more to crop failure and thus increased the problem of food insecurity. In spite of this, agriculture is the key driver of the

economy in Makueni county contributing about 47.2% of the Gross County Product. The average small-scale farm size is 2.5 Ha (GoK, 2013; 2019 and Makueni County Government, 2019).

In terms of demography, Makueni County's population size as per the 2019 census was 987,653 while as per the 1999 census it was 771,545. This was a 28% growth of the population size from 1999 to 2019. The average population density is 121 persons per Km². In terms of population structure, a large population is young as approximately 75% are under 35 years. Those under 15 years puts pressure on the income of working class making their resources inadequate. The youthful population is however a resource if they are adequately imparted with skills through education and training (GoK, 1997; 1999; 2002; 2013; 2019).

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3. Data and Methods of Analysis

Descriptive research design was used in this study. Using this design enabled the researcher to describe such things as behavior, attitude, values and characteristics among subjects. The study focused on a number of variables. Considering food security as a dependent variable, its relationship was considered alongside various independent variables relating to coping and adaptive mechanisms to food insecurity.

A sample of respondents was acquired from a target population of 144,320 households in Makueni county based on the 1999 population. Census. The sample size for the households was determined by using Yamane (1967) formulae:

$$n = N / (1 + N\epsilon^2)$$

Where n = Optimal size

N = Total number of respondents in the largest population

ϵ = The probability error or significant level; in this study $\epsilon = 0.05$

Thus, since the total number of households is 144,320, then the sample size is:

$$144,320 / 1 + 144,320 \times (0.05^2) = 398.9 \text{ households} \approx 400 \text{ households}$$

Thus, a sample of 400 households was involved in data gathering process. A proportion of 66 households was selected in each of the six sub-counties in the county.

A semi-structured questionnaire was used to gather data from the households on the coping and adaptive strategies used by households to deal with food insecurity. Photographs and Observation schedule were also used to complement the questionnaire in data collection and also to record the information. After data collection, the responses were coded and entered for analysis using Statistical Package for Social Scientists (SPSS). Descriptive statistics such as the means, modes, percentages frequencies and correlations were derived to determine the various aspects of the coping and adaptive mechanisms, applied to deal with food insecurity at the household level. Other statistics that were used to analyze data were the Chi Square (χ^2) which was used to establish relationships between the various dependent and independent variables. Regression/logit model was also used to determine the relationship between the variables. This model is widely used to examine and describe the relationship between a binary response variable and a set of predictor variables. Thus, the model was used to determine how food insecurity relates to a set of predictor variables such as the coping and adaptive strategies used to deal with food insecurity.

4. Results and Discussion

This paper presents results from the objective on the coping and adaptive strategies undertaken by households to enhance food security in Makueni County. In order to achieve this objective, a number of aspects which reflect that the region is food insecure were examined and their results are as follows.

4.1. Main Crop Harvest

The findings on amount of maize yield during the long rain and short rain season are indicated in Table 1

Long Rain Season			Short Rain Season	
Harvest	Frequency	Percent	Frequency	Percent
0-50kgs	10	3.0	12	3.0
51-100Kgs	60	16.0	72	20.0
101-150Kgs	55	15.0	67	18.0
151-200Kgs	44	12.0	38	10.0
201-250Kgs	61	17.0	76	21.0
251-300Kgs	59	16.0	47	13.0
301-350Kgs	37	10.0	21	6.0
351-400Kgs	22	6.0	19	5.0
over 400Kgs	19	5.0	15	4.0
Total	367	100	367	100

Table 1: Average Maize Harvest in Kilograms during Long Rain and Short Rain Season

According to the findings, 61(17%) indicated that they harvested 201-250 Kgs of maize during the long rain season, 60(16%) harvested 51-100 Kgs, 59(16%) 251-300 Kgs, 55(15%) harvested 101-150 Kgs, 44(12%) harvested 151-200 Kgs, 37(10%) harvested 301-350 Kgs, 22(6%) harvested 351-400 Kgs, 19(5%) harvested over 400 Kgs and 10(3%) harvested 0-50 Kgs during the long rain season. The findings indicate that the majority (89%) of the respondents

harvested about four 90 Kg bags of maize during the long rains season. There was no much difference with maize harvest during the short rain season since 76(21%) indicated that they harvested 201-250 Kgs of maize during the short rain season, 72(20%) harvested 51-100 Kgs, 67(18%) 101-150 Kgs, 55(15%) harvested 101-150 Kgs, 47(13%) harvested 251-300 Kgs, 38(10%) harvested 151-200 Kgs, 21(6%) harvested 301-350 Kgs, 15(4%) harvested over 400 Kgs and 12(3%) harvested 0-50 Kgs during the short rain season. Overall, approximately 91% of the respondents harvested about four 90Kg Bags of maize during the short rain season.

As far as beans production is concerned, the study results for their harvest during the long rain and short rain season are indicated in Table 2

Long Rain Season			Short Rain Season	
Harvest	Frequency	Percent	Frequency	Percent
0-50kgs	21	6.0	15	4%
51-100Kgs	63	17.0	32	9%
101-150Kgs	54	15.0	63	17%
151-200Kgs	43	12.0	60	16%
201-250Kgs	33	9.0	27	7%
251-300Kgs	47	13.0	52	14%
301-350Kgs	23	6.0	38	10%
351-400Kgs	58	16.0	47	13%
over 400Kgs	25	7.0	33	9%
Total	367	100	367	100

Table 2: Average Beans Harvest in Kilograms during Long Rain and Short Rain Season

According to the findings, 63(17%) indicated that they harvested 51-100 Kgs of beans during the long rain season, 58(16%) harvested 351-400 Kgs, 54(15%) harvested 101-150 Kgs, 47(13%) harvested 251-300 Kgs, 43(12%) harvested 151-200 Kgs, 33(9%) harvested 201-250 Kgs, 25(7%) harvested over 400 Kgs, 23(6%) harvested 351-400Kgs and 21(6%) harvested 0-50 kgs during the long rain season. The findings indicate that about 78% of respondents harvested about four 90Kg bags of beans during the long rains season. On the other hand, 63(17%) indicated that they harvested 101-150 Kgs of beans, 60(16%) harvested 151-200 Kgs, 52(14%) harvested 251-300 Kgs, 47(13%) harvested 351-400 Kgs, 38(10%) harvested 301-350 Kgs, 33(9%) harvested over 400 Kgs, 32(9%) harvested 51-100 Kgs, 27(7%) harvested 201-250 Kgs and 15(4%) harvested 0-50 kgs during the short rain season. The results reveal that about 77% of the respondents harvested four 90 Kg bags of maize during the short rain season.

The study also established that farmers grow cow peas. The findings of cow peas yield during the long rain and short rain season are indicated in Table 3

Long Rain Season			Short Rain Season	
Harvest	Frequency	Percent	Frequency	Percent
0-50kgs	36	10.0	25	7%
51-100Kgs	38	10.0	30	8%
101-150Kgs	35	10.0	24	7%
151-200Kgs	72	20.0	51	14%
201-250Kgs	41	11.0	52	14%
251-300Kgs	56	15.0	37	10%
301-350Kgs	44	12.0	67	18%
351-400Kgs	34	9.0	53	14%
over 400Kgs	11	3.0	28	8%
Total	367	100	367	100

Table 3: Average Cow Peas Harvest in Kilograms during Long Rain and Short Rain Season

According to the findings, 72(20%) indicated that they harvested 151-200 Kgs of cow peas during the long rain season, 56(15%) harvested 251-300 Kgs, 44(12%) harvested 301-350 Kgs, 38(10%) harvested 51-100Kgs, 36(10%) harvested 0-50 Kgs, 35(10%) harvested 101-150 Kgs, 34(9%) harvested 351-400 Kgs and 11(3%) harvested over 400 Kgs during the long rain season. The findings indicate that the average yield of cow peas in the region during the long rains season was below 200 kgs. According to the table, 67(18%) indicated that they harvested 301-350 Kgs of cow peas during the short rain season, 53(14%) harvested 351-400 Kgs, 52(14%) harvested 201-250 Kgs, 51(14%) harvested 151-200 Kgs, 30(8%) harvested 51-100 Kgs, 28(8%) harvested over 400 Kgs, 25(7%) harvested 0-50 Kgs and 24(7%) harvested 101-150 Kgs during the short rain season. There was more harvest of cowpeas during the long rain season (88%) harvesting about four 90Kg of cowpeas compared to 78% of respondents harvesting four 90Kg bags of cowpeas during the short rain season.

4.2. Food Utilities in the Household per Annum

The farmers were asked to give the approximate food utilities in kilograms that were used in their households per annum. The findings are indicated in Table 4

Average Food Utility/Year	Maize		Beans		Cow Peas	
	Freq	Perc	Freq	Perc	Freq	Perc
0-50kgs	3	1.0	18	5.0	33	9.0
51-100Kgs	49	13.0	51	14.0	60	16.0
101-150Kgs	93	25.0	85	23.0	68	19.0
151-200Kgs	121	33.0	93	25.0	77	21.0
201-250Kgs	33	9.0	48	13.0	70	19.0
251-300Kgs	21	6.0	51	14.0	38	10.0
301-350Kgs	36	10.0	21	6.0	21	6.0
351-400Kgs	0	0.0	0	0.0	0	0.0
over 400Kgs	11	3.0	0	0.0	0	0.0
Total	367	100	367	100	367	100

Table 4: Approximate Food Utilities in Kilograms Used in the Household per Annum

According to the findings, 121(33%) indicated that they approximately used 151-200 Kgs of maize in their households per annum, 93(25%) used 101-150 Kgs, 49(13%) used 51-100 Kgs, 36(10%) used 301-350 Kgs, 33(9%) used 201-250 Kgs, 21(6%) used 251-300Kgs 11(3%) used over 400 Kgs, 3(1%) used 0-50 Kgs and none of them used 351-400 Kgs of maize in their households per annum.

Based on the findings, 93(25%) indicated that they approximately used 151-200 Kgs of beans in their households per annum, 85(23%) used 101-150 Kgs, 51(14%) used 51-100 Kgs, 51(14%) 251-300Kgs, 48(13%) used 201-250 Kgs, 21(6%) used 301-350 Kgs, 18(5%) used 0-50 Kgs and none of them used 351-400 Kgs and over 400 Kgs of beans in their households per annum.

In addition, according to the findings, 77(21%) indicated that they approximately used 151-200 Kgs of cow peas in their households per annum, 70(19%) used 201-250 Kgs, 68(19%) used 101-150 Kgs, 60(16%) used 51-100 Kgs, 38(10%) used 251-300Kgs, 33(9%) used 0-50 Kgs, 21(6%) used 301-350 Kgs, and none of them used 351-400 Kgs and over 400 Kgs of cow peas in their households per annum.

From the above findings, it is clear that nearly all the households interviewed in Makueni county encounter food insecurity all year round because they consume all what they produce and some part of it is sold to meet other household requirements.

4.3. Asset Investment/Run Down in Food Insecurity Situations

The study also established which assets the respondents chose to invest in or run down in the face of food insecurity. The findings are shown in Table 5

Assets Invested On	Reason For Investment	Freq	Perc	Assets Run Down	Reason For Running Down Assets	Freq	Perc
Business	To make profit	322	81%	Entertainment	Save money	369	92%
Poultry farming	To get profit	126	32%	Travelling	Save money	237	59%
Construction work	Get cash	95	24%	Beer taking	To save money	298	75%
Grazing	Increase number of cattle	44	11%	sale of food	Save food	344	86%
Education	To improve standards of living	289	72%	Sale of second hand clothes	Utilize the money in buying food	325	81%
Vegetable irrigation	To get money	312	78%	Paying fees	To buy food	286	72%
Cattle trade	To make enough capital	128	32%	Reduce women groups	To reduce the money lending out	139	35%
Vegetable selling	To meet basic needs	258	65%	N/A	N/A	N/A	N/A
Real estate	High returns	13	3%	N/A	N/A	N/A	N/A
Selling cereals	To cater for other household needs	342	86%	N/A	N/A	N/A	N/A
Hawking	To satisfy basic needs	215	54%	N/A	N/A	N/A	N/A

Table 5: Asset Investment and Assets Run Down during Food Insecurity Situations

According to the findings, majority of the respondents, 322(81%) chose to invest in business with an aim of making profits, 126 (32%) engaged in poultry farming to get profits, 95(24%) engaged in construction jobs to get cash, 44(11%) grazing by increasing the number of livestock, 289(72%) getting an education which will improve their standards of living, 312(78%) did invest in vegetable irrigation to get money, 128(32%) engaged in cattle trade to make enough capital, 258 (65%) sold vegetables to meet their basic needs, some few respondents, 13(3%) engaged in real

estate business because of the high returns, 342(86%) sold cereals in order to cater for other household needs, and 215 (54%) engaged in hawking in order to satisfy their basic needs.

On the assets that were run down, majority of the respondents, 369 (92%) indicated that they run down entertainment, 237 (59%) travelling and 298 (75%) beer taking in order to save money, 344(86%) reduced the sale of food so that they had enough for their own consumption, 325(81%) selling second hand clothes, utilizing the money in the purchase of food, 286 (72%) they differed the payment of fees using that money instead in purchase of food and 139 (35%) reduced the number of women groups and in so doing reduced the money the lending out of money.

4.4. Coping and Adaptive Strategies Used to Enhance Food Security at Household Level

With regard to coping and adaptive strategies that the respondents used in enhancing of food security at the household level, the respondents were asked to respond to several statements based on the Likert scale rating as follows: Strongly Agree (S.A), Agree (A), Don't Know (D.K), Disagree (D) and Strongly Disagree (D.S). The findings are shown in Table 6

Statements	SA	A	DK	D	SD	N	Mean	Std. Dev
I engage in formal employment hence food secure	48	97	0	193	62	400	2.69	1.317
I engage in a small scale businesses to support my family with food	24	291	12	73	0	400	3.67	0.842
I keep livestock which I sell to provide food for the family	12	351	0	25	12	400	3.82	0.719
My family receives remittances from well up relatives to buy food	36	49	0	61	254	400	1.88	1.388
My family relies on food aid from the government and the private sector	12	36	13	86	253	400	1.67	1.090
I engage in casual labour to provide food for my family	12	230	0	61	97	400	3.00	1.350
Abandonment of farming	12	38	0	66	284	400	1.57	1.085
I engage in food rationing	60	243	0	25	72	400	3.49	1.326
Buying cheapest food available	36	279	12	49	24	400	3.64	1.01
Eating a lot when food is in plenty	12	74	60	169	85	400	2.40	1.103
Trade-offs to purchase food i.e. buying food instead of buying medicine, transport, education etc.	36	277	0	51	36	400	3.57	1.106
Eating wild fruits and animals	12	145	0	182	61	400	2.66	1.199

Table 6: Coping and Adaptive Strategies Used to Enhance Food Security at Household Level

From the findings, in Table 6 above, majority of the respondents indicated that they engaged in small scale businesses to support their families with food, they kept livestock which they sold to provide food for their families, they engaged in casual labour to provide food for their families, with mean scores of 3.67, 3.82 and 3.00 respectively. Majority of the respondents disagreed with the statements that they engaged in formal employment hence they were food secure with a mean score of 2.69. Also majority of the respondents strongly disagreed that their families received remittances from well up relatives to buy food, their families relied on food aid from the government and the private sector and that they had abandoned farming with mean scores of 1.88, 1.67 and 1.57 respectively.

Further findings based in table 6 reveal that majority of the respondents indicated that they engaged in food rationing, they bought the cheapest food available and they traded-off to purchase food for example buying food instead of buying medicine, transport, education etc. with mean scores of 3.49, 3.64 and 3.57 respectively. Majority of the respondents disagreed with the statements that eating a lot when food is in plenty and eating wild fruits and animals with mean scores of 2.40 and 2.66 respectively.

Although the respondents indicated that sale of livestock was one of the coping strategies to food insecurity, the observation schedule established that not all households had livestock as indicated in Figure 1

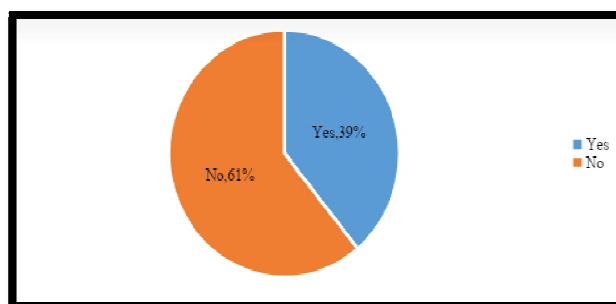


Figure 1: Presence of Livestock

According to the observations, majority of the households, 244(61%) did not engage in livestock rearing while 156(39%) of the households reared livestock. The findings indicate some of the homesteads diversify their farming

activities through rearing of livestock which could enhanced their household food security. However, some of the livestock observed in the households was emancipated due to drought. Figure 2 shows some of the livestock that was observed in the region during the research.

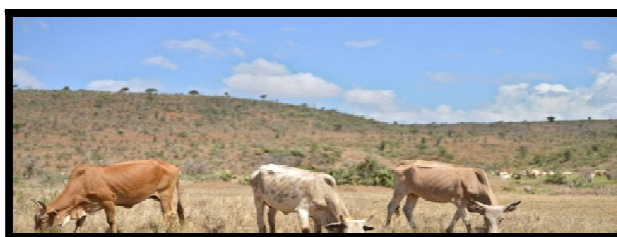


Figure 2: Livestock Grazing in Kilome, Makueni County – 20th November, 2017
Source: Researcher, 2020

Further, as part of strategies of addressing food insecurity challenge, some farmers pointed out that they engage in small scale businesses. This was validated by the observation method whose findings are as indicated in table 7, figure 3, 3 and figure 5

Crop Sold in the Markets	Frequency	Percentage
Mangoes	322	81%
Maize	359	90%
Beans	266	67%
Cowpeas	300	75%
Pumpkin	101	25%
Green grams	299	75%
Pigeon peas	254	64%
Tomatoes	312	78%
Bananas	152	38%
Cassava	329	82%

Table 7: Crops Sold in the Markets

According to the observations, the major crops that were sold in the market were: maize (90%), cassava (82%), Mangoes (81%), tomatoes (78%), Cowpeas (75%), green grams (75%), beans (67%), pigeon peas (64%), bananas (38%), and pumpkins (25%). The findings therefore indicate that there was a great variety of food crops in the nearby markets which enhances the household food security in the region of Makueni County. Plate 4.4 below indicate the food crops sold in the market areas.



Figure 3: Tomatoes Sold in a Market Place in Kibwezi East – 20th November, 2017
Source: Researcher, 2020



Figure 4: Bananas Sold in Kaiti Sub County Market Places– 20th November, 2017
Source: Researcher, 2020



*Figure 5: Mangoes Sold in Market Places in Kibwezi
West- 20th November, 2017
Source: Researcher, 2020*

From the foregoing, it is clear that the coping strategies largely applied by the households during food insecurity include engaging in small scale businesses, food aid from government and private sectors, engaging in casual labour and food rationing. Other coping strategies that some households mentioned include eating wild fruits, eating more food when there is plenty of harvest, remittances from relatives and friends, buying cheap food and tradeoffs (buying food at the expense of other necessities such as medication and education). The adaptive strategies used though by a few households included keeping of livestock, seeking for formal employment, small scale irrigation, proper utilization of available resources and some abandoned farming all together and engaged in non-farm activities such as full engagement in business and agroforestry. The coping and adaptive strategies applied have however not eradicated food insecurity at the household level but have helped to reduce the impact of food insufficiency. The households therefore still remain vulnerable to food insecurity situations.

When asked the reasons for lack of success of coping and adaptive strategies in food security enhancement at the household level in Makueni County. The findings are indicated in Table 8

Reasons for Non-Success of Coping and Adaptive Strategies in Food Security Enhancement	Frequency	Percentage
Death of cattle due to drought	297	74.3
Lack of employment	30	7.5
Drought	289	72.3
Low rainfall	159	39.8
Poor climatic conditions	349	87.3
Arid conditions hence only a few cattle can be sustained	321	80.3
Business gives very little income	344	86.0
Climatic conditions in the region at times makes basic food commodities rare and very expensive	335	83.8
Lack of government enforcement to ensure the households are food secure	376	94.0
Absence of dams in the study area	386	97
Lack of knowledge on soil conservation and lack of finance to buy enough water for irrigation	367	92
Deficient knowledge on how to curb food insecurity	319	80

Table 8: Reasons for Success/Non-success of Coping and Adaptive Strategies in Food Security Enhancement

From the table above, majority of the respondents, 297 (74.3%) cited the death of cattle due to drought, 289 (72.3%) attributed the problem to the drought conditions, 349(87.3%) suggested poor climatic conditions, 321(80.3%) blamed the arid conditions hence only a few cattle can be sustained, 344(86.0%) pointed out that their business gave very little income, 335(83.8%) said that climatic conditions in the region at times makes basic food commodities rare and very expensive, 376(94.0%) blamed the non-success of coping strategies in the food security enhancement on the lack of government enforcement of policies that can ensure the region is food secure.

From the findings, in Table 8 above, it is also clear that majority of the respondents gave the following reasons for non-success of the coping and adaptive strategies: 386(97%) reported the absence of dams in the study area; 367(92%) cited the lack of knowledge on soil conservation and lack of finance to buy enough water for irrigation and; 319(80%) mentioned deficiency in knowledge on how to curb food insecurity.

4.5. Actions Taken to Improve Coping and Adaptive Strategies of Addressing Food Insecurity

The respondents were asked to give the various actions that can be put in place to improve the coping and adaptive strategies used to deal with food insecurity. The findings are indicated in Table 9

Strategy	Action of improving the coping and Adaptive strategy	Frequency	Percentage
Growing vegetables	Drilling boreholes and harvesting water to use during dry season	302	75.5
Small scale business	Increase stock, getting loans to increase stock	349	87.3
Poultry farming	Buying chicken feed, use modern technology to keep poultry	287	71.8
Dairy Farming	Buying and treating cattle, rearing of exotic breeds and artificial insemination	313	78.3
Education	Saving for fees	215	53.8
Food rationing	farmers should be encouraged to exercise food rationing	239	59.8
Construction of dams	Through government support	359	89.8
Buying cheapest food available	Encourage locals to buy cheapest food products	297	74.3
Abandonment of farming	Peasants should not abandon farming since it is the only source of income	363	90.8

Table 9: Actions Taken to Improve Coping and Adaptive Strategies

Based on the findings, there were several actions that the respondents felt can be taken to improve the coping and adaptive strategies. Majority of the respondents, 302(75.5%) stated that the growing of vegetables had been made possible through the drilling of boreholes and harvesting water for use during the dry season; 349(87.3%) stated that their small scale businesses can be boosted through getting of loans to increase stock; 287(71.8%) stated that buying of chicken feeds, use of modern technology in keeping poultry are some of the actions that will improve poultry farming. On keeping dairy farming, 313(78.3%) pointed out that the action to be taken was purchasing and treating cattle, rearing of exotic breeds and artificial insemination. Education is also an important coping strategy to which 215(53.8%) of the respondents indicated that there should be savings made towards school fees. For the farmers to ensure that the little food available sustains them to the next harvest season, 239(59.8%) stated that farmers should be encouraged to exercise food rationing; on dam construction, 359(89.8%) of the respondents suggested the need of government support in the construction of dams; 297(74.3%) stated that the locals should to buy cheapest food products. The findings also indicated that some farmers had begun abandoning farming, however, 363(90.8%) of the respondents pointed out that peasants should not abandon farming since it is the only source of income.

A hypothesis test was conducted using chi square. The hypothesis tested is: There is no significant effect of coping and adaptive strategies undertaken by households to enhance food security in Makueni County. The results of the analysis are indicated in Table 10.

Contingency Table for Coping and Adaptive Strategies and Food Insecurity				
		Effect		Total
		Present	Not present	
formal employment	Observed Outcome	59	12	71
	Expected Outcome	33	44	77
keeping of livestock	Observed Outcome	41	8	49
	Expected Outcome	28	30	58
engaging in casual labour	Observed Outcome	49	9	58
	Expected Outcome	39	23	62
irrigation replacing rain-fed agriculture	Observed Outcome	67	13	80
	Expected Outcome	21	40	61
food aid from the Government and the private sector	Observed Outcome	45	17	62
	Expected Outcome	29	31	60
remittances from relatives among others	Observed Outcome	36	44	80
	Expected Outcome	47	35	82
Total	Observed Outcome	297	103	400
	Expected Outcome	197	203	400

Table 10: Contingency Table for the Coping and Adaptive Strategies and Food Insecurity

$$X^2=27.468$$

$$d=15$$

$$p=0.05$$

$$\text{Critical value}=4.073$$

- H_0 : Coping and adaptive strategies were not significantly related to food insecurity in Makueni County

The Chi square analysis for this variable $\{X^2=27.468\}$, revealed that there was a significant relationship between coping and adaptive strategies and food insecurity in Makueni County. This means that the more effective coping and adaptive strategies, the more likely to minimize food insecurity. The null hypothesis that there was no significant relationship between coping and adaptive strategies and food insecurity was rejected. This statistical test was significant at $p<0.05$, meaning that the relationship observed was not likely to have been contributed by chance of random sample. The Relationship between Coping and Adaptive strategies and the enhancement of Food security was also considered using regression model. The hypothesis analyzed was:

- H_0 : There is no significant effect of coping and adaptive strategies undertaken by households to enhance food security in Makueni County

- H_1 : There is significant effect of coping and adaptive strategies undertaken by households to enhance food security in Makueni County.

For this model, food insecurity was the dependent variable while coping and adaptive strategies were the independent variables. The results of the analysis are as shown in table 11 and table 12.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.861 ^a	.73	.726	.88993

Table 11: Model Summary

a. Predictors: (Constant), Coping and adaptive strategies

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	65.273	3	21.758	27.473	.000 ^b
	Residual	313.621	396	.792		
	Total	378.894	399			

Table 12: ANOVA^a

a. Dependent Variable: Food Insecurity

b. Predictors: (Constant), Coping and adaptive strategies

From the results shown in the Table 11 above, the R square is indicated as 0.73 which is an indication that the independent variable (coping and adaptive strategies) explains 73.0% of food security with 27.0 percent unexplained.

From the results shown in Table 12 above, the significant value ($P=0.000$) indicates the presence of a strong significant association between the predictor variable (coping and adaptive strategies) and dependent variable (food insecurity). The P- value of 0.000 which is less than 0.05 signifies that the model of food insecurity is significant at the 5 percent significance level. Thus, the alternative hypothesis is accepted, that is; there is a significant effect of coping and adaptive strategies undertaken by households to enhance food security in Makueni County.

The results on coping and adaptive strategies to food insecurity suggest that though they are unsuccessful in eradicating food insecurity, the households are able to continue with their livelihood even in situations of food insufficiency especially resulting from drought. This means that despite the fact that the coping and adaptive strategies have not wiped out food insecurity in the area, it is clear that the when applied, these strategies help to cushion them against food insecurity challenges. A number of scholars, suffice to mention, (Derbile, 2009; Molua, 2009; Potter, 2015; Berlie, 2015 and Law, et.al 2018) among others have examined ways in which households address food insecurity. The studies concur that households look out for a variety of coping and adaptive strategies when they are faced with food insecurity. Derbile (2009) for example observed that households in North-Eastern Ghana adopted planting of multiple indigenous drought resistant crops and used indigenous organic manure. In Northern Cameroon, farmers diversified their livelihood and engaged in non-farm income generation activities (Molua, 2009).

Whereas households in Kampala, Uganda coped by dropping or decreasing consumption of their plantain stable (matoke) and eating one meal a day, in Ethiopia, households coped with food insecurity by livestock diversification, sold fuelwood and charcoal and also sought for credit facilities including borrowing from friends (Potter, 2015 and Berlie, 2015). In Makueni county, Kenya, the current study established that households reduced their vulnerability to food insecurity through seeking formal employment, keeping of livestock, engaging in casual labour, doing some irrigation, seeking for food aid, food rationing, trade-offs to buy food instead of other essentials and remittances from family members and friends among others. Other scholars such as Law, et.al (2018) observed that farmers in Peninsular, Malaysia embraced strategies such as dietary changes, diversification of food, food rationing, reducing expenses on daily necessities, reducing expenses on schooling and increasing household income.

5. Conclusion and Recommendations

The study concluded that there is a strong significant association between the predictor variable (coping and adaptive strategies) and dependent variable (food insecurity). This implies that the coping and adaptive strategies undertaken by households, though not successful in eliminating food insecurity, they help to minimize the effects of food insufficiency at the household level in Makueni County. Among the coping mechanisms that farmers engaged in to address food insecurity include: seeking for jobs on causal basis; food rationing; seeking for remittances from family relatives and friends; and food aid among others. The adaptation strategies include keeping livestock, seeking formal employment, small scale irrigation, non-farm activities and proper utilization of resources among others.

This study recommends that policy makers can build on the coping and adaptive strategies that are already being applied by the farmers to address food insecurity as well as come up with best agricultural practices that can make the region food secure at all times. There is need to support households with credit facilities that can help them to diversify their systems of livelihood; promote investment in non-farm economic activities such as manufacturing that can help them secure increased income for purchase of food; need to enhance training of the farming community especially on the new agricultural practices; investment in irrigation schemes in the area and the need for the government at the county and national levels to invest more financial resources in order to boost food production in the region. The study also recommends the need for enhanced provision of extension services and also a shift from food aid to support on inputs such as seeds so as to make farmers more productive. Since information is power, the study also recommends the need for

an effective communication technology system such as through radio, television sets and mobile phones that can transmit up to date information to farmers on, weather and climate, agricultural production and marketing among others. Both government and non-government institutions should also have a framework of working with farmers, for instance by forming groups whose sole purpose would be to improve food security in the region.

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