



RESEARCH ARTICLE

DIVERSIFICATION OF INDIGENOUS AGRICULTURAL PRACTICES AND IMPLICATIONS ON HOUSEHOLD FOOD SECURITY: PRACTICES AND LESSONS FROM LOCAL COMMUNITIES OF BARINGO COUNTY, KENYA.

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Abstract

An estimated 690 million people worldwide are hungry denying them the fundamental human right on food. Agriculture, which ought to play a crucial role of sustaining household food security is climate sensitive, hence suffer from the effect of climate change and variability. The fundamental elements of food security which include availability, access, utilization and stability have become untenable. This paper examined the indigenous agricultural diversification strategies and their implication on household food security in Baringo County, Kenya. Descriptive survey design was used in the study. A sample of 140 households and 12 Agricultural Extension staff were selected using purposive, proportionate and simple random sampling techniques. Questionnaire, Focus group discussion guide and observation checklist were used to collect data. The findings indicated that a wide range of diversification strategies including knowledge and skill based, enterprise based, diet based, food sources, farming routines and storage based diversification were adopted by households. The study concluded that diversification strategies were mitigation measure against climate change and food insecurity. The study recommended the up scaling best practices of diversification to improve household food security.

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Introduction:-

Food insecurity is a global concern considering that over 690 million people worldwide still go to bed hungry each night (Food & Agriculture Organization [FAO], 2020). Agriculture, which is the main economic activity for most rural households plays an indispensable role in ensuring sustainable food security (Salami, 2020; Simatimbe et al., 2018). However, agriculture being climate sensitive is severely affected by climate change and increasing climate variability which negatively affect agricultural productivity and food production consequently impacting on food systems and rural livelihoods (FAO et al., 2019). Similarly, Gwambene and Liwenga (2016) opined that livelihoods of people who depend on climate sensitive agricultural resources are particularly vulnerable.

The effects of climate change and extreme weather variability has resulted in increased incidences of drought, floods, pests and diseases which curtail the achievement of the fundamental elements of food security which include availability, access, utilization and stability (Economic Survey, 2015; FAO, 2013; Government of Kenya [GOK], 2015; Kungu, 2014). Indigenous knowledge systems according to United Nations Educational, Scientific and Cultural Organization (UNESCO, 2018) is a major resource for adapting to climate change. Mafongoya and Ajayi

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(2017) justifies the use of IK to mitigate the effects of climate change citing that rural communities have developed a good understanding and knowledge of disaster prevention and mitigation, early warning, preparedness and response based on facts that are known or learnt from experience or acquired through observation and practice. Concern Worldwide (2020) further recommends the application of climate smart agriculture like the indigenous practices of diversifying crop varieties as solution to climate change and global hunger. Similarly, Ihenacho et al. (2019) advocate for adoption of climate smart indigenous practices as intervention against climate change effects.

Indigenous agricultural systems especially diversified farming systems bring about resilience to environmental changes and could cope with problems like drought (Ponge, 2013). Kumar (2014) also suggested preservation, expansion and application of IK skills and practices in agriculture to minimize the effects of climate change and variability. Siambombe (2018) argue that African farmers in particular have developed elaborate techniques for tackling climate change. Among the indigenous practices that communities have adopted to reduce the impacts of climate change is the diversification of agricultural practices which takes various forms like crop diversification (Kihila, 2017). Perroni (2017) also presents intercropping and mixed cropping as a form of diversification involving planting multiple crops and whose advantages are to maximize land use while reducing risks associated with single crop failure. This paper therefore examined the indigenous agricultural diversification practices among the rural communities of Baringo County, Kenya and derived lessons from the activities in mitigating food insecurity.

Methodology:-

Self-administered questionnaire were used to collect data from 140 households, 12 agricultural extension staff sampled through purposive, census, proportionate and simple random sampling techniques. In addition, a focus group discussion was conducted among key informants who were perceived to be experts in indigenous knowledge practices. An observation guide was also used to collect data in the study. The results from the tools were triangulated. Piloting was conducted and reliability of the households and extension staff questionnaire estimated using the Cronbach alpha which yielded coefficients of 0.78 and 0.81 respectively which implied that the instruments were reliable.

Results and Discussions:-

Dichotomies of diversification

This study established various dichotomies of diversification used by households in their farms. Various forms of diversification were found to be at the disposal of households to increase the chances of survival among the households against adverse effects of climate change and variability while striving to achieve food security. The diversification strategies adopted by households in the study area are presented in the subheadings that follow.

Knowledge based diversification strategies

One of the strategy that involve diversification according to the respondents was the application of both indigenous and scientific knowledge systems in the farming activities. Table 1 summarizes the results of the findings.

Table 1:- Agriculture Knowledge that Households Apply on their Farms.

Knowledge applied in the farm	Frequency	Percent
Modern	5	45.5
Indigenous	3	27.3
Both modern and indigenous	3	27.3

(n=11)

Households according to Table 1 apply both indigenous and scientific knowledge systems in the farm. The results suggest that households relied on blending both knowledge systems perhaps to reap the benefits associated with the two knowledge bases with regard to technologies and innovations. The results (Table 1) further concur with the findings from the focus group discussions who indicated that diversified knowledge and skills for farming practices often yielded positive results. The implication is that households in the study site often blend indigenous and scientific knowledge bases during their farming activities perhaps because the two types of knowledge combine to give a complementary role to each other. The study findings are supported by Salami (2020) in a study on the role of indigenous knowledge in sustainable urban agriculture who suggested the need for incorporating a blended mode of both the formal and indigenous knowledge for a better output. Similarly, (UNESCO (2018) advocate for the integration of the two knowledge based systems to maximize the benefits arising from the two. Besides, Wang

(2015) suggested the integration of both indigenous and scientific knowledge as a way of forming sustainable agricultural knowledge and for balancing the economic and ecological dimensions of sustainable agricultural development.

Enterprise diversification Strategies

Households according to the study findings engaged in a diversified or mixed enterprises in the farm. This varied from mixed farming where households engage in livestock and crop enterprises to diversification of the individual enterprises in both livestock and crops. Similarly, non-agricultural enterprises according to the study were undertaken to diversify income sources. Table 2 summarizes crop diversification strategies by households in the study site.

Table 2:- Diversified Crop Enterprises.

Crop	Households (n = 117)		Extension staff (n = 11)		Observation (n = 19)	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Maize	101	86.3	11	100.0	15	78.9
Beans	90	76.9	10	90.9	10	52.6
Millet	74	63.2	9	81.8	13	68.4
Sorghum	26	22.2	6	54.5	8	42.1
Cassava	12	10.3	5	45.5	-	-
Green grams	9	7.7	5	45.5	-	-
Cow peas	11	9.4	7	63.6	6	31.6
Sweet potatoes	9	7.7	5	45.5	3	15.8
Fruits	7	6.0	5	45.5	-	-
Vegetables	6	5.1	6	54.5	4	21.1

Households according to Table 2 tend to engage in diverse crop enterprises in the farm. The crop enterprises in their farms comprised of a variety of staple cereal and legume food stuffs that address household food security. The enterprises also combined vegetables and fruits for balanced diet while crops like sweet potatoes, sorghum, millet and cassava comprised of indigenous drought resistant crops. In addition, cow peas and green grams according to focus group discussions doubled up as food and cash crops. According to the focus group discussions, households undertook mixed cropping and intercropping to enable them gain from the variety of food stuffs emanating from the cultivation of wide variety of crops with diet variety which ultimately enhanced food and nutrition security at household level. In addition, the diversification strategy further addressed the problem of both transitory and chronic food insecurity consequently meeting the aspect of stability which is a basic component of food security.

Neudert et al (2020) described diversified livelihoods that combine farming, livestock keeping and non-farm income as the characteristics of households globally. Concern Worldwide (2020) singles out diversification of crop varieties as a climate smart agriculture which is a global solution to hunger. FAO (2016) indicated that there was a positive and significant association between crop diversification and food security while Makate et al. (2016) indicated that there was a significant positive association between crop diversification and farm income which has a bearing on household food security. On the other hand, Snapp and Fisher (2015) findings revealed that a positive correlation existed between crop diversification and dietary diversity. Perroni (2017) further opined that planting multiple crops as in the case of mixed cropping and intercropping would maximize land use while reducing the risks associated with single crop failure.

Diversification of livestock enterprises are summarized in Table 3.

Table 3:- Livestock Kept for Producing Food by Households.

Animal	Households (n = 117)		Extension officers (n = 11)		Observation (n = 19)	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Cattle	113	96.6	10	90.9	18	94.7
Sheep	103	88.0	11	100.0	16	84.2
Goats	107	91.5	10	90.9	18	94.7
Chicken	87	74.4	10	90.9	13	68.4

Bees	5	4.3	3	27.3	2	10.5
Camel	-	-	1	9.1	-	-
Pig	-	-	1	9.1	-	-

Table 3 reveal the diversified livestock diversification strategies by households in the study site. Different livestock types were kept by households leading to the generation of variety of livestock products. The focus group discussants further indicated that the practice were mechanisms for spreading risks associated with climate change effects and diseases. In addition, the discussants attributed the practices to increased volumes of production which improved food availability and access through the increased production and incomes. This agrees with Megersa et al. (2013) findings that livestock diversification through multiple species offered food production besides offering sufficient choices for off-take which could be liquidated in times of shortages hence increasing the purchasing power and food access thereby improving household food security. Regassa and Stoecker (2012) indicate that household food security is influenced by the number of livestock species. Megersa et al. (2013) summed up the benefits of diversification with regard to livestock to include shorter periods of food deficit, better dietary intake and lower magnitude of household food insecurity.

Diet Diversification Strategies

Households in the study area further attributed the production of a variety of food stuffs to diversified agricultural activities. Table 4 provide a summary of the resultant food stuffs.

Table 4:- Related Food Stuffs Produced by Households.

Category	Food Stuff	Frequency	Percentage
Crop Based	Maize	112	95.7
	Beans	93	79.5
	Millet	71	60.7
	Sorghum	42	35.9
	Green grams	25	21.4
	Vegetables	15	12.8
	Cow peas	40	34.2
	Potatoes	22	18.8
	Fruits	23	19.7
	Cassava	19	16.2
Livestock related	Groundnuts	14	12.0
	Milk	106	90.6
	Meat	111	94.9
	Eggs	53	45.3
	Honey	23	19.7
	Fat	10	8.5
	Butter	2	1.7

(n=117)

The results (Table 4) reveal a diversified foods from variety of crops and livestock sources. The implication for the households is increased availability of food through production, increased income sources from the sale of surplus foods which further improve income sources to enhance food access and finally increased dietary variety besides improving food stability as a result of continuous production of products from the diversified sources or enterprises. Asante et al. (2017) observed that diversification was one of the mechanisms for managing food security as it can spread risks among the multiple production enterprises besides providing a range of food items for the households. According to focus group discussion, diet diversity achieved through diversification of food stuffs was a strategy for addressing household food and nutrition security.

Diversification of Food Sources

Food sources was also used by the households in the study area to address household food security. Table 5 provide a summary of the food sources for the households.

Table 5:- Sources of Food According to Household Heads.

Food source	Frequency	Percentage
Produced	114	97.4
Bought	105	89.7
Relief	20	17.1
Gathered	40	34.2
Relatives/well wishers	63	53.8

(n=117)

Table 5 reveal that households in the study area had variety of options at their disposal of meeting their food needs. Majority (97.4%) produced their food stuffs from the farm, 89.7% obtained food through buying while 53.8% received their food from relatives and well-wishers. Similarly, 34.2% and 17.1% obtained their food stuffs from gathering and relief sources respectively. This imply that diversification of food sources was a significant practice for meeting household food security among the households in the study site. The findings concur with observations by Megersa et al. (2013) that, diversification generally improve access to food. Diversified food sources guarded the community against the reliance on one source of food hence a risk eversion mechanism.

Diversification on Farming Routines and Skills

Information on the farming routine practices was also sought from the respondents. The results are summarized in Table 6.

Table 6:- Diversified Farming Routines and Skills.

Coping Strategy	Frequency	Percentage
Planting at the onset of rains/early planting	5	45.5
Use of dry feeds	2	18.2
Feed conservation	3	27.3
Destocking	4	36.4
Water harvesting	3	27.3
Food preservation	3	27.3
Terracing	2	18.2
Migration	3	27.3
Use of IK based weather information in farming	3	27.3
Seed selection	2	18.2
Controlled grazing	4	36.4
Planting drought resistant crops	3	27.3

(n=11)

The results (Table 6) indicate that households undertake various production and post-harvest routine practices and apply various skills in the farm to deal with climate change and food insecurity. The results indicate that households engage in both crops and livestock routine practices and other practices that aim at mitigating climate change effects and food insecurity. For instance, planting at the onset of rains (45.5%) is a dominant crop related routine where farming households plant their crops early enough for their crops to benefit from early rains and get to the market early enough to fetch higher incomes. The routine practice reduces incidences of diseases, improve production and lead to increased income through better markets. As a result, it reduces risks associated with drought and diseases and avail more food and income for food security. Other routine practices include planting resistant crops, water harvesting, use of indigenous weather forecasting to predict weather and food preservation which accounted for 27.3% each. The strategies also require diversified skills for undertaking the practices.

Similarly, Destocking (36.4%) controlled grazing (36.4%) and feed preservation (27.3%) were some of the livestock based routines practices to deal with effects of climate change and food insecurity by most households (Table 6). Migration (27.3%) was also a strategy for coping with climate change to increase survival rate of livestock ultimately reducing chances of livestock deaths which negatively affect household food security. According to focus group discussion, mulching, practicing irrigation and use of animal manure and combining a variety of production techniques both indigenous and scientific were applied to diversify production techniques to increase food production and achieve food security besides addressing climate change effects. Blending both indigenous and

scientific weather forecasting according to the focus group discussants enabled the households to benefit from the skills on the two knowledge bases to improve accuracy of weather prediction in order to reduce effects of climate change and variability. Similarly, the use of different types of herbs and concoctions used to treat and control pests, parasites and diseases in the farm alongside combining commercial chemicals to manage the same was a diversification of skills and practices that increased the chances of success in farm activities.

Diversification in Storage and Preservation strategies

Diversification strategies involving storage and preservation of food stuffs was examined by the study. Results are presented in table 7

Table 7:- Diversified Food Preservation Strategies.

Preservation	Households n = 117		Extension Officers = 11		Observation n = 19	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Smoking	115	98.3	9	81.8	12	63.2
Sun drying	117	100.0	11	100.0	15	78.9
Use of Honey	67	57.3	2	18.2	-	-
Salting	116	99.1	4	36.4	13	68.4
Fermenting	98	83.8	2	18.2	4	21.1
Roasting	114	97.4	2	18.2	6	31.6
Frying	112	95.7	-	-	2	10.5
Use of Pepper	113	96.6	-	-	2	10.5
Cold places	-	-	2	18.2	2	10.5
Boiling	78	66.7	-	-	5	26.3
Use of Ash	115	98.3	4	36.4	10	52.6

The findings in (Table 7) revealed that households employed a variety of indigenous preservation strategies to ensure food security at household level. Sun drying (100.0%) for household heads and extension staff and (78.9%) in the observation checklist suggested that the strategy was commonly used for food preservation and could be an effective strategy among the community members. Salting (99.1%), smoking and use of ash (98.3%) each, roasting (97.4%) use of pepper(96.6%) and frying (95.7%) among the household heads were also cited as key strategies for food preservation which is also in agreement with the data from extension staff and observation guide.

The findings support Asogwa and Kaya (2016) and Asogwa et al. (2017) assertions that communities possess diverse indigenous food preservation systems which could solve food shortage reduce post-harvest losses and sustain household food security.Strategies for food storage also demonstrated a diversified pattern where a number of strategies were employed by households. Table 8 summarizes the results of the findings.

Table 8:- Diversified Food Storage Facilities.

Storage	Households n = 117		Extension staff n = 11		Observation n = 19	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Gunny bags	69	59.0	6	54.5	9	47.4
Granary	81	69.2	4	36.4	14	73.7
Traditional containers (calabash, gourds, skin bags)	15	12.8	9	81.8	17	89.5
Improvised metallic/plastic containers	11	9.4	3	27.3	-	-
Traditional store with crib	-	-	5	45.5	3	15.8
Modern store	8	6.8	2	18.2	-	-

Traditional granaries (69.2%), gunny bags (59.0%) and traditional containers (12.8%) ranked among the most prevalent storage facilities for storing food stuffs according to the households' heads. Other facilities include

improvised metallic/plastic containers, traditional store with a crib and the use of modern stores. The practices demonstrated a diversification strategy in which households applied a variety of storage facilities to keep their produce in order to increase their shelf life of food stuffs to ensure food availability to households when needed and hopes to ensure food security of households. Indigenous people according to the results on (Table 8) were conscious of enhancing future food security obligation through variety of effective storage facilities. This had implication on availability and access of food for household consumption. Rankoana (2017) assert that, local community members sustain their future household food security by using indigenous storage means. Households according to the study findings apply a variety of innovative and workable food preservation and storage strategies at their disposal to achieve better results of sustaining household food security.

Implication of diversification strategies on climate change and food security

This paper sought to establish the practices and lessons learnt from indigenous diversification strategies among the rural households of Baringo County. The Results indicated that households engaged in diversified agricultural practices in all aspects of the farming activities. This enabled farming households to benefit from the knowledge, skills and innovations from both the indigenous and scientific knowledge bases for instance in terms of weather forecasting which improved weather prediction resulting in improved farm production for food security.

Diversification of farming enterprises and diets involved practicing mixed farming, mixed cropping, intercropping and keeping a variety of livestock types in the farm. The practice enabled households to escape risks and uncertainties resulting from drought, pests, parasites and diseases besides increasing the amount of food per unit area in addition to availing a variety of food stuffs to ensure food and nutrition security at household level. The strategy has beneficial effect in increasing survival of households as the strategies helped in maintaining sustainable food and nutrition security through the continuous production from the diversified enterprises which avail both food and income.

Diversification of food sources, farming routines and storage and preservation were also employed by households in the study site as mechanisms of survival. Under the strategies, households widened the scope of food sources as a risk eversion strategy so that food could be sourced from a variety of sources. Farming routines like planting early at the onset of rains, water harvesting and irrigation, soil conservation measures like terracing, controlled grazing, social network systems, conserving feeds and destocking were diversified measures applied to reduce crop and livestock losses and geared towards improving household food security. Storage and preservation strategies were also applied to ensure increased shelf life of food and further availed food throughout the year to household members. Diversification according to this study findings is a survival strategy against risks and uncertainties among the rural farming communities of Baringo County, Kenya. This is concur with Feliciano (2018) assertion that diversification especially of crops is a cost effective way of reducing uncertainties in farmers' income particularly among the poor smallholder farmers. Similarly, diversification according to Rampa and Knaepen (2019) is an important aspect of promoting sustainable food systems.

Household food security status was determined by the study to establish whether indigenous strategies for diversification had any bearing on household food security. The results are presented in table 9.

Table 9:- Results on Status of Food Security of Households in the Study Site.

Status	Household Head (n=117)		Extension Staff (n=11)	
	Frequency	Percentage	Frequency	Percentage
Very good	17	14.5	0	0.00
Good	34	29.0	2	18.2
Moderate	43	36.8	5	45.5
Poor	14	12.0	2	18.2
Very Poor	9	7.7	2	18.2

From Table 9, majority (80.3%) and (63.7%) of households according to the household heads and extension staff respectively had moderate to very good food security status implying that the indigenous diversified food security strategies enabled households to tackle the problem of food insecurity. Indigenous diversification strategies therefore addressed the basic components of food security of availability, access and stability enabling households to sustain their household food security. The blend of both indigenous and scientific knowledge practices as

diversification strategy perhaps reaped the benefits associated with the two knowledge bases in terms of knowledge, skills, innovations and technologies that boosted food production and storage.

Conclusion:-

Diversification is a survival mechanisms for climate change and food and nutrition security among the rural communities of Baringo County, Kenya. Diversification takes various forms from knowledge diversification, enterprise and diet, food sources, farming routines and storage and preservation strategies. Diversification is a strategic option for improving household food security status which is critical in the achievement of household food and nutrition security. Diversification is a strategy for reducing risks and uncertainties.

Recommendations:-

This study recommends policy implication on up scaling of best practices on indigenous diversification practices for integration and mainstreaming into the main agricultural extension service for the benefit of farming households.

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