

## **Effect of Household Income and Water Access on Food Security in Baringo County, Kenya.**

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**Abstract:** *Alleviating food insecurity remains one of the key challenges in many developing countries. The United Nations Sustainable Development Goal number two of 2017 is to end hunger, achieve food security and improve nutrition, and promote sustainable agriculture. About 11% of the population at risk of facing food insecurity globally, according to the World Food Programme. The number amounts to 124 million people across 51 countries. Kenya, like other countries in Africa, looks towards achieving the Sustainable Development Goals by 2030. Towards this, the government of Kenya, through the Big Four Action Plan, 2018, has food security as one of the critical issues of development focus. Approximately 2.6 million people are acutely food insecure in Kenya despite the government policies and efforts. Baringo County is one of the counties in Kenya that faces the threat of food insecurity. The government estimates that 19.7% of the population is at risk of facing hunger in Baringo County, which is a very worrying level compared to other counties in the country. Primary cross-sectional data on food security, household income, and water access was collected from a representative sample of households using structured questionnaires and interviews. Based on the findings, this study concluded that household income has a positive and significant effect on household food security in Baringo County. The study also concluded that water access has a significant and negative effect on household food security. It is incumbent upon the Kenyan government (both national and county level) to put proper policies in place, that aim at boosting household income and water access in able to realize food security. Given that agriculture is a devolved government function, the county government of Baringo should come up with policies that include the provision of subsidies to farmers and training them so that they utilize their farms by diversifying what they produce. More importantly, both the national government and county government of Baringo should increase investments in water projects especially irrigation schemes in dry parts of the county since water access contributes to food security.*

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### **I. Introduction**

Kenya, like other countries in Africa, looks towards achieving the Sustainable Development Goals (SDGs) by 2030. Sustainable goal number two is to end hunger. The government of Kenya, through the big four focus, 2018, has food security as one of the critical issues of development focus. The Constitution of Kenya, 2010, in Article 43, sub-section 6, dictates that every individual has the right to be free from hunger and to have enough food of acceptable standard. But according to the World Food Program (WFP) report of 2017, 2.6 million people are acutely food insecure in Kenya. The full implementation of this provision of the constitution means that the government must put in place structures and strategies to achieve and institutionalize food availability to all in a sustainable way. Food security is a great issue of dignity, and therefore, no citizen should go to bed hungry for any justification.

The worries of over 30% of Kenyans about hunger has a significant impact on individual development—the health of their families and communities, and consequently on national development as a whole. At least 7.1 million Kenyans perpetually face the threat of hunger, KNBS (2013). The Kenyan government's efforts to declare zero tolerance to starvation have not been able to yield fruits. Food and nutrition insecurity is one of the current problems affecting development in Kenya. It is closely linked to the high level of poverty in the country, a situation that has severe implications on food security as the chronically food insecure suffer from acute poverty (the Republic of Kenya, 2010). It was estimated that at any one time, about two million people require assistance to access food.

High levels of malnutrition afflict the poorest people in the country. While 26 percent of children are stunted nationally, according to the Demographic and Health Survey (2014), the rate in Baringo County is slightly higher at 29.5 percent. According to a household baseline survey report conducted by the Agricultural Sector Development Support Programme (ASDSP) in 2014, 63% of the households were found to be food insecure. In 2011 deaths caused by starvation elicited organizations such as the Kenya Red Cross Society and

the Media to launch the Kenyans for Kenya appeal for donations. By the end of August 2011, about 700 million had been raised to buy food for the affected especially school children and the vulnerable, and also disburse funds to those at risk in arid and semi-arid parts of the country such as Baringo, Turkana, and other affected rural areas, KFSSG (2011).

Staple food crops are significant sources of both food security and earnings for most of the households in Kenya, USAID (2010). Maize is a staple food crop in Baringo and has always been taken to measure household food security. Eating diverse foods lack in the county, the residents do not engage in different economic activities which can help in boosting food security by diversifying sources of food and also earning more income to sustain household needs.

Household incomes play a significant role in determining the capability of households to be food secure. Off-farm activities have the potential of cushioning pastoralists from the adverse effects of droughts or prolonged dry seasons on livestock production. Access to a broad portfolio of livelihood activities is beneficial for households living in risky environments because it reduces the chances of income failure by spreading the risk across different economic activities, Amwata and Mganga, (2014). The more a household is engaged in activities that show no correlation amongst themselves, the more successful it is at averting food security and income failure. Sources of livelihoods can be an indicator of household income levels, Heckle et al. (2018). Bisung and Elliott (2015) show that less than 60% of the Kenyan rural population has access to water despite the government's aggressive and ambitious Water Act of 2002, which purported to ensure the availability of potable water within a reasonable distance to all households by the year 2010. Today, 30% of the urban population in Kenya's cities and towns remains unconnected to the existing water supply systems. In comparison, up to 52% of the rural population is not connected to any water supply system. About 10 million people (30% of Kenya's population) live in the ASALs, and over half of these live below the poverty line (the Republic of Kenya, 2015). Baringo County is classified as one of the ASAL areas. The government of Kenya has proposed the introduction of or scaling up irrigation in such areas as a way of boosting food security. Most households and institutions in the county lack the capacity of purchasing materials and equipment for water harvestings such as tanks, pipes, water pumps, borehole drilling machinery, and gutters that ensure enough water is harvested.

Adequate access to safe water and improved sanitation services is central to the achievement of better health and wellbeing of Kenya's population (ACTED, 2010). These services facilitate the prevention of waterborne diseases, which in turn may reduce mortality rates and health expenditure. Adequate availability of water is also critical for sustainable food security, economic growth and reduction of poverty – currently estimated at 36.1% of Kenya's population – as the water supports vital economic activities such as agricultural, industrial, and energy production.

## **II. Literature Review**

The theoretical analysis in this study was focused on three theories namely Neo-Malthusian Theory, Foster, Greer, and Thorbecke (FGT) Theory and Triple-S Theory. Thomas Malthus (1806) was the first theory to address food scarcity as an issue and defended the hypothesis that a growing global population will eventually eclipse the Earth's capacity to feed it. "The power of population is indefinitely greater than the power in the earth to produce subsistence for man." Malthus distinguishes between two categories, the preventive check and the positive one. The preventive check consists of voluntary limitations of population growth. Individuals make rational decisions based on the income they expect to earn and the quality of life they anticipate to maintain in the future for themselves and their families. The positive check to the population is a direct consequence of the lack of a preventive check. When society does not limit population growth voluntarily, diseases, famines, and wars reduce population size and establish the necessary balance with resources.

For the second theory of FGT, 1984, the group of economists, Foster, Greer, and Thorbecke, developed an FGT poverty measure which has been found manageable in presenting information on poverty. It is an Index that summarizes information on the incidence, intensity, and severity of poverty for any poverty line, food, overall or hardcore poverty. The poverty index has been used by various researchers to measure poverty. The three economists defined a measure of poverty using the FGT Index:  $P(y,z) = (\sum_{i=1}^n \frac{z - y_i}{z})^2$ , where  $z$  is a pre-determined poverty line,  $y = (y_1, y_2, \dots, y_n)$  is household incomes vector in increasing order.  $g_i = z - y_i$  is the shortfall of income of the  $i$ th household,  $q = q(y, z)$  is the number of poor households (those with income not greater than  $z$ ), and  $n = n(y)$  is the total number of households.

Triple-S (Sustainable Services at Scale), the third theory, it was a six-year (2009–2015), multi-country learning initiative to improve water supply to the rural poor. It is led by IRC (IRC) and funded by the Bill & Melinda Gates Foundation. The initiative is working in Ghana, Uganda, and in 2012, Mozambique. Triple-S seeks to achieve water services for rural people that meet appropriate levels and are sustained over time. The nature of the water sector in a specific country determines how, by whom, and through which partnerships the change required to achieve this vision will occur, and what kind of innovations, training, research, and information is needed. Although context has a determining role, Triple-S informs and guides the change process

in two ways: Foremost, with a strong vision of what a rural water sector capable of delivering sustainable services looks like. Secondly, with a set of tools and approaches to catalyze and support a national search for solutions that work.

### **Empirical Literature.**

The subjects of food security, household income, and water access have been areas of sustained empirical assessment in recent years. Njeru and Njoka (2003) analyzed poverty and food security in Kenya using thematic and historical approaches. Based on the linkages they found to exist between the two, they recognized the fact that however many policies have been in place to avert both poverty and food security, they both seem to remain unchanged since Kenya became independent in 1963. Moreover, they were of the view that most poverty analyses have been dimensional. This implies that the analysis showed dimensions of poverty concerning deprivations of access to consumption and food security. More focus was on the food security and household income link but water access.

Maxwell et al. (2008) focused on coping strategies as to how Kenyan households adapt to the presence or threat of food shortages, and the person within the household who has primary responsibility for preparing and serving meals is asked a series of questions regarding how households are responding to food shortages. The impact of household food insecurity can be minimized post its occurrence through coping strategies. Among coping strategies are relying on less preferred/inexpensive food; borrowing food, or relying on help from friends or relatives; gathering wild food, hunting or harvesting immature crops; consuming seed stock held for the next season; sending household members to eat elsewhere; limiting portion size at mealtimes; restricting adult consumption in favor of small children; reducing the number of meals eaten in a day; skipping entire days without eating and begging from neighbors or friends.

In the last three decades, to increase accessibility to water, the government sank boreholes, constructed catchment dams, and provided conveyance infrastructure Ogendi and Ongoia (2009). Nevertheless, water scarcity remains the number one ranking issue among most people in Kenya today. This is partly because most of the dams and boreholes in arid and semi-arid lands (ASALs) were built without input from local communities. Little consideration was given to the cultural setting of the surrounding communities, which are mostly pastoralist communities that move from one place to another in search of pastures for their livestock.

Decreased food production in less developed countries, food price increase, and growing production of bio-fuels are causes of current rates of food scarcity, Magadoff, and Tokar (2009). Decreased food production is associated with developing countries adopting the neoliberal paradigm of letting the free market govern food production and distribution. Global warming, crop diversity loss, and urban sprawl also affect agriculture production. The current per capita grain production seems to be decreasing worldwide. The situation is particularly distressing in Africa, where grain production is down 12% since 1980. Africa only produces 80% of what it consumes.

Mjonono et al. (2009) investigated the food security coping strategies of households belonging to a farmers' association and representative sample of control households in Embu, Kenya, and Kwa-Zulu-Natal, South Africa. The study found out that households with lower involvement in agriculture engaged in more erosive strategies such as selling off assets than farming households. This study shows some of the coping strategies which are short-term in nature and fails to show how household income can be improved.

Rufino et al. (2013) estimated the contribution of crop and livestock activities to incomes, food security, and poverty. The study hypothesized that sedentary farmers in zones that may become warmer and drier in the future might be forced to increase their reliance on livestock vis-à-vis cropping in the future. The study found no direct evidence for the hypothesized extension of production across study sites. Human diets have changed considerably in the last 40 years, as cropping has been taken up by increasing numbers of pastoral households, even in marginal places. Households were found to be self-sufficient in securing adequate dietary energy from food production.

Olielo (2013) focused on food security problems in various income groups of Kenya, the case study of Nairobi. A sample of 130 households was studied. The average household had five people. The results were that Ugali (thick porridge) was the main staple food and was consumed by 88% of the households, while vegetables were consumed by 92 %. The meat was consumed by 46 % of the households and fruit products by 17 %. It was found that the low-income group could not purchase adequate food, and the amounts they consumed did not meet the FAO recommended levels for foods and nutrients. Low incomes and poverty were found to be the main causes of food insecurity in Kenya.

Ogello and Munguti (2016) used time-series data to investigate promising solutions for food insecurity, poverty, and malnutrition in Kenya. The study showed that the Kenyan agricultural sector has failed to either eliminate or reduce malnourishment for poor populations as the annual national production for both staple food and livestock products falls short of national consumption levels. The study suggests that the increased food production challenges such as dwindling capture fisheries and impacts of climate change are becoming more eminent, food insecurity, and malnutrition solutions should sort out food availability by stimulating more own-

food production. The study advocates for more empirical evidence, from poor households, on household income, employment, and food consumption levels within poor households.

Chebets (2016) investigated factors contributing to food insecurity in Kenya, specifically in the Tiati constituency, Baringo County. The study used a descriptive approach using a cross-sectional survey method. The study found out that climate change, low household income, and dependency on livestock production were among the top factors causing food insecurity in the area. The constituency and neighboring regions have perennially faced food crises over the years.

Nadeiwa and Koring'ura (2017) used randomly sampled small-scale household farmers living within and around the Perkerra Irrigation Scheme in Baringo to investigate the effect of small irrigation schemes on the livelihoods of rural farm households. The research established positive effects on the livelihoods of farmers belonging to the scheme. Many households were found to be able to provide food for their families and grow crops for consumption. Most of the households were able to take three meals a day together with their families, and their families no longer rely on relief food. However, the study pointed out the need for household income boosting opportunities other than relying only on farming.

### III. Research Methodology

**Study Design:** A non-experimental cross-sectional research design was adopted for this study. The design was chosen because the study wanted to get information on water access and household income levels and how they affect food security. The design is used to describe what is in existence with respect to conditions or variables that are found in the given situation without intervening. Data on food security in Baringo County is scantily available, which would be tedious if the study was to be conducted using time-series focused research. This makes it possible to measure the exposure and outcome for the targeted variables at the same time in a study. Secondly, the cross-sectional design allows for the use of multiple variables, thereby improving the reliability of a study. The cross-sectional design allows the participants to be involved in a study based on a predetermined inclusion and exclusion criteria, Connelly (2016).

**Variables:** The following table No.1 summarizes the study's dependent and independent variables

**Table No. 1 Definition and Measurement of Variables**

VARIABLE	DEFINITION	MEASUREMENT	VARIABLE TYPE
Food Security	The experience of food security is characterized by certainty regarding food access and changes in the quality of the diet, such as a well-balanced, less monotonous diet. With increasing security, the quantity of food consumed increases as portion sizes increase, and no meals are skipped.	It is measured using the FAO FIES metric. The FIES is a metric of the severity of food insecurity at the household or individual level that relies on people's direct yes/no responses to eight brief questions regarding their access to adequate food. The weighted proportions of cases with each raw score in the population are used as weights, i.e., for four questions answered Yes will be assigned weight i.e.5/8= 62.5% Food insecure and 37.5% Food secure Levels for the HH	Dependent
Household Income	It is income generated by a household engaging in economic activities of production, consumption, and accumulation of assets. Includes wage income, rental income, farm income, and cash transfers of the householder and all other people 15 years and older in the household, whether or not they are related to the households	Measured in KE shillings by calculating the total amount of income (employment, cash transfers/trade/aid, and farming that households generate within a specific period, it is a month for this study.	Independent
Household Water Access	A household can access and benefit sufficient, safe, acceptable, physically accessible, and affordable water supply continuously, whether for domestic uses or irrigation.	It is measured using the distance to the nearest main water point/source.	Independent
Household Size	The number of persons who make common provision of food, shelter, and other essentials for living	Measured in terms of the number of people sharing income and consumption (headcount).	Control
Land Size	The size of land owned by the household that is used for crop production, livestock production, or any other kind of economic activity	Measured in Acres	Control

**Study Area:** The area for the study is Baringo County. The county has six sub-counties, namely Baringo Central, Baringo North, Baringo South, Mogotio, Eldama-Ravine, and Tiaty. The total population is 754,014, according to the Baringo County profile of 2018 by the Baringo county government. The following table no.2 summarizes the population statistics of the study area

**Table No 2: Population Statistics of Baringo County**

Sub County	House Holds	The area in Sq.KM <sup>2</sup>	Population Density	Total population	Sub-county % of total county pop
Baringo Central	26,320	589	188	110,586	14%
Baringo North	26,783	1704	75	127,292	17%
Baringo South	12,432	1985	55	109,759	15%
Mogotio	17,093	1304	63	82,734	11%
Eldama-Ravine	38,649	954	150	142,878	19%
Tiaty	28,896	4540	40	180,766	24%

**Sampling technique and size:** To facilitate the drawing up of the study sample, the county was already stratified into the six sub-counties, namely: Baringo Central, Baringo North, Baringo South, Mogotio, Eldama-Ravine, and Tiaty. 100 respondents were then be randomly apportioned proportionately between the six sub-counties with respondents from each sub-county. Based on the Baringo County population statistics, respondents were selected as follows: 14 from Baringo Central, 17 from Baringo North, 15 from Baringo South, 11 from Mogotio, 19 from Eldama-Ravine, and 24 from Tiaty. However, according to Heinrich et al. (2010), PSM is a "data-hungry" method in both the covariates and sample size, and as such, the study can expand purposively the sample size in the five wards in proportions nearly equivalent to their ratios. The representative sample of 100 respondents to be selected is based on the method suggested by Cochran (1963) given as;  $n = N / [1 + N (e^2)]$

**Research Instrument:** The data for this study was collected through structured questionnaires using close-ended questions. Close-ended questions are the types of inquiries where the participants are limited to the types of responses they give in a survey, Friberg, and Rosenvinge (2013). It was expected that closed questionnaires would facilitate the interpretation of the data to be collected. These questions restrict respondents to a given line of thought, which made the analysis of data more efficient.

**Data type and sources:** The study used primary cross-sectional data that was obtained from households in Baringo County in Kenya.

**Data collection procedure:** The process of collecting data for this research commenced after clearance by the Graduate School of Kenyatta University. A letter from the Graduate School facilitated the application for a research permit from the National Commission for Science, Technology, and Innovation (NACOSTI) in the Ministry of Education. Upon obtaining the research permit, data was gathered from the targeted population. The permit was presented to local authorities in requesting their support in accessing those who participated in the study. The exercise involved issuing questionnaires to the consenting participants. The purpose of the study was explained to the volunteering participants to ensure that they understood the benefits the study might add. It involved clarifying the questions of the study to encourage the participants to provide meaningful responses. In the event of literacy challenges in the field, the respondents were helped in reading and clarifying the questions.

**Data processing and analysis:** Quantitative and qualitative data were collected from close-ended questions and analyzed based on the objectives of the study. Data were analyzed using STATA software version 14. The individual regression beta coefficients were checked to see whether they significantly influence the food security of households in Baringo County. The study tested for multicollinearity and heteroscedasticity. Multicollinearity assessment among the independent variables was carried out using statistical software Variance Inflation Factor (VIF). The VIF identifies the correlation between independent variables and the strength of that correlation. The null hypothesis is that there is no multicollinearity. VIF value above 10 is an indication of the presence of multicollinearity. Heteroscedasticity occurs when the variance for all observations in a data set are not the same. It is a violation of the ordinary least square assumption. Breusch-Pagan Test was carried to test for the presence of Heteroscedasticity. The null hypothesis in the test is that error terms have constant variance (should be homoscedastic). The error terms are said to be homoscedastic if the p-value is greater than the conventional p-value 0.05, otherwise the error terms are said to be heteroskedastic.

#### IV. Findings and Discussions

##### Descriptive Analysis

**Table No.3 Education Level of Households**

Education Level	Frequency	Percentage
None	15	15.00
Primary	19	19.00
Secondary	41	41.00
Tertiary/University	25	25.00
Total	100	100

Table No.3 above indicates that the majority of the respondents have attained secondary and tertiary or university education levels, 41% and 25% respectively. Those without any educational qualification accounted for 15% of the households and another 19% only had primary education qualifications. The literacy level of Baringo County households can be considered above average. Since Kenya abolished school fees in 2003, most children in Kenya now enroll in primary schools and progress to upper levels of secondary to tertiary levels (World Bank, 2014). The study found many of the households with secondary and tertiary education had better food security levels. Educational training can equip individuals with various skills that can be used to access employment hence contributing to the household income. Eventually, higher income may improve household food security levels.

**Table No. 4: Gender of Households.**

Gender	Frequency	Percentage
Female	40	40.00
Male	60	60.00
Total	100	100

The female and male household heads who responded in the study were 40% and 60% as respectively as indicated in the table above. The gender of households did not have an effect on food security levels of households since both male and female households faced various challenges in catering food for their household members.

**Table No.5: Age of Household Heads (Respondents)**

Age Brackets	Frequency	Percentage
18-25	3	3.00
26-35	23	23.00
35-50	39	39.00
50-65	20	20.00
65 and Above	15	15.00
Total	100	100

The majority of the household heads fell on the 36-50 age bracket as shown in Table no.5 above, accounting for 39% of the respondents. It was closely followed by respondents falling in the age bracket of 26-35 at 23% and 50-65 at 20%. The oldest and youngest respondents accounted for 15% and 3% respectively. The study found out that the older the household head the dire the food security situation. Those with 50 years and above are at high risk of facing food insecurity.

**Table No.6: Occupation of Households**

Occupation	Frequency	Percentage
Employment	33	33.00
Farming	39	39.00
Cash Transfers of Aid	6	6.00
Trade and other businesses	22	22.00
Total	100	100

From Table No.6, farming was ranked first at 39% of the Baringo households depended on it as their main source of income, followed by employment at 33%, trade or other businesses at 22%, and finally cash transfers or aid at 6%. The study found that majority of the households that relied on cash transfers or aid to put food on the table were heavily affected by food insecurity compared to households that engaged in farming and employment.

**Table No. 7: Size of Land owned by Households**

Size of Land in Acres	Frequency	Percentage
0-5	34	34.00
6-10	30	30
11-15	14	14
16-20	13	13
12 and Above	9	9

Table No.7 shows that the majority of the households owned less than 15 acres of land that is 0-5, 6-10, and 11-15 at 34%, 30%, and 14% respectively. A smaller percentage, 13%, and 9%, of households, owned huge parcels of land of 16 acres and above. A positive relationship between the size of land a household owns and food security. Many households that had a large number of acres were in a better position to provide food for their family members. Households with smaller sizes of land were at a higher risk of producing inadequate food or livestock to boost food security.

**Diagnostic Tests**

The study used variance inflation factors (VIF) to test for Multicollinearity. According to Field (2009), VIF values above 10 are an indication of the presence of Multicollinearity. The results in Table 4.1 present variance inflation factor results and were found to be 1.37 which is less than 10, hence there is no multicollinearity.

**Table No. 8: Multicollinearity Results using VIF**

Variable	VIF value
Household Income	1.39
Water Access	1.40
Household Size	1.49
Size of Farm	1.43
Mean VIF	1.43

The Ordinary Least Squares (OLS) assumption states that the residuals should be homoscedastic. The Breusch-Pagan test for heteroscedasticity test was used in the study where the null hypothesis was that error terms have constant variance (homoscedastic). The results in Table no.8 show that the error terms are homoscedastic, given that the probability value is more than 0.05.

**Table No.9: Breusch-Pagan Test for Heteroscedasticity Test**

Breusch-Pagan test for heteroscedasticity test
Ho: Constant variance
chi2(1) = 5.04
Prob > chi2 = 0.080

**Empirical Results**

The following Table No.10 presents the ordinary least square regression results of the individual effect of household income, water access, household size, and farm size on household food security in Baringo County.

**Table No. 10: Effect of Independent Variables on Household Food Security**

Statistical Tests	Household Income	Water Access	Household Size	Farm Size
<b>Adjusted R-Squared</b>	0.375	0.318	0.0165	0.0149
<b>Constant</b>	12.809	53.876	48.619	38.930
<b>B</b>	7.243	-3.355	-1.007	0.373
<b>T</b>	7.460*	6.87*	1.63*	1.22*
<b>F</b>	55.66*	47.24*	2.66*	1.48*
<b>N</b>	100	100	100	100

The values marked with an asterisk are significant at 5% level of significance. The adjusted R-squared shows the explanatory power of the model for each of the variables,  $\beta$  is the beta-coefficient for the individual effect of the independent variables; T is the t-statistic which shows the significance of each of the independent variables, F is the f-statistic which also shows the overall significance of the model; n is the number of observations.

**Effect of Household Income on Food Security**

The first objective of the study was to establish the effect of household income on food security in Baringo County. The dependent variable was represented by the food security data obtained using the FAO FIES module that generated raw scores for each household. On the other hand the independent variable,

household income was represented by total monthly income generated by households from farming, employment, cash transfers/aid, and trade/other businesses.

Results in Table no. 10 indicate that household income has a significant effect on the food security of households at a 0.05 level of significance as supported by a calculated t-value of 7.46, which is greater than the critical t-value of 1.96. A beta value of 7.243 implies that household income has a positive effect on household food security. A unit increase in the amount of household income will increase the level of household food security by 7.243 units and vice versa. This finding is in line with (Olielo, 2013) that studied food security problems in various income groups of Kenya and found that there is a positive relationship between household income and food security.

Foster, Greer, and Thorbecke's theory postulated that food insecurity or deprivation depends on the distance between the household's real income and the least possible income (poverty line). The empirical finding of household income and food security has confirmed the theory. Adjusted R-squared = 0.375 means that household income accounts for 37.5% of variations in food security while the other 62.5% is explained by other variables that affect food security but are not captured in the model. The f-statistic of 55.66 indicates that the model is a good fit for the data.

The findings point to the fact that poverty and food security is intricately interlinked. Without resources or income to grow or buy food households are at a higher risk to be food insecure, become ill, and fail to work to produce food or earn income. Low income is also associated with poor quality dietary intake. Households with higher income are in a better position to consume high quality, nutritional food compared to lower income households.

#### **Effect of Water Access on Household Food Security**

The second objective of the study was to establish the effect of water access on food security in Baringo County. The dependent variable was represented by FAO FIES food security raw scores for each household. On the other hand the independent variable, water access was represented by distance to the nearest water source or point.

Results in Table No.10 indicate that water access has a significant influence on the food security of households at a 0.05 level of significance as supported by a calculated t-value of 6.87, which is greater than the critical t-value of 1.96. Beta value of -3.355 implies that inadequate water access has a negative effect on household food security. A unit increase in the distance to a water point will decrease the level of household food security by 3.355 units. This finding is in line with (Nadeiwa and Koringura, 2017) that focused on factors affecting the food security of farmers living near the Perkerra Irrigation scheme in Baringo and found that the farther a household stays from a water source the lower level of food security.

Adjusted  $R^2 = 0.318$  means that water access accounts for 31.8% of variations in food security while the other 68.2% is explained by other variables that affect food security but are not captured in the model. The f-statistic of 47.24 indicates that the model is a good fit for the data.

Water is the lifeblood of ecosystems on which food security and nutrition of future and present generations depend. Water of appropriate quantity and quality is necessary for food production which entails crop farming, fishing, and livestock rearing. Water is also used in food processing, transformation, and preparation. When it comes to what human beings consume, many do not appreciate the role that water plays in producing it. To sustain the world's population, 52.8 million gallons of water per second are required. Of the world's total water consumption, food accounts for approximately 66% (71Percent Organization, 2017). Water scarcity can reverberate through important systems, affecting the production, availability, and prices of food.

#### **Effect of Household Size and Size of Farm on Household Food Security**

The two variables are control variables that are not of primary concern to the study but can influence the non-experimental results. The variables household size and size of land are commonly natural factors in rural society and can allow the relationship between the dependent variable and predictor variables being analyzed to be better understood.

The results in Table No.10 indicate that indicate household size had no significant influence on the overall model at a 0.05 level of significance as supported by a calculated t-value of 1.63, which is less than the critical t-value of 1.96. Beta value of -1.007 implying that larger household size has a negative effect on household food security. A unit increase in the size of the household will decrease the level of household food security by 1.007 units. On the other hand, land size also had no significant influence on the overall empirical model at a 0.05 level of significance as supported by a calculated t-value of 1.22, which is less than the critical t-value of 1.96. Beta value of 0.373 implying that a larger size of land has a positive effect on household food security. A unit increase in the size of the land will increase the level of household food security by 0.373 units.



## V. Conclusion

From the findings, the study concluded that household income has a positive and significant effect on household food security in Baringo County. This means that households with a stable and higher level of income are more food secure compared to households that have lower and unstable levels of income. Further, the study concluded that water access has a significant and negative effect on household food security. This means that households that live far from water points/sources are more likely to experience food insecurity compared to households living near water points or sources. A combination of both higher income and better water access boosts food security among households in Baringo County, Kenya.

**Policy Implications:** One of the Kenyan government objectives is to achieve food security, and households have been identified to play a key role in propagating food security. Hence it is incumbent upon the Kenyan government (both national and county level) to put proper policies in place, that aim at boosting household income and water access in able to realize food security. The study recommends that the national government, county government, non-governmental organizations, and other stakeholders should come up with income-generating activities which are more beneficial to households and particularly the unemployed in order to reduce the food security gap between the employed and the unemployed. The study also recommends that farming households should be encouraged to utilize their farms and available farming resources accordingly in order to produce enough for the household and even surplus to earn income from. The study recommends that households who practice farming should not only depend on it but rather diversify for them to earn extra income to sustain their food security levels. Extension officers from the county government and other institutions working in Baringo County should also train farmers on which type of farming activities are more profitable or sustainable and suitable modern technology required. The study also recommends that cash transfers by both government agencies and non-governmental agencies should be disbursed based on the available demographic statistics so to ensure vulnerable groups are cushioned against food insecurity. Finally, the study recommends that more investments in water projects should be given the first priority by both the national and county government of Baringo. The study recommends that a water dam or irrigation schemes be constructed in at least three more sub-counties, Tiaty, Baringo North, and Mogotio, given that these sub-counties are severely affected by drought, and floods almost every year.

## References

- [1]. Alinovi, L., D'errico, M., Mane, E., & Romano, D. (2010, June). Livelihoods strategies and household resilience to food insecurity: An empirical analysis to Kenya. (pp. 28-30).
- [2]. Amwata, D. A., & Mganga, K. Z. (2014). The African elephant and food security in Africa: experiences from Baringo District, Kenya. *Survival*, 22.
- [3]. Beddington, J. R., Asaduzzaman, M., Fernandez, A., Clark, M. E., Guillou, M., Jahn, M. M., & Scholes, R. J. (2012). Achieving food security in the face of climate change: Final report from the Commission on Sustainable Agriculture and Climate Change. *hgfh*
- [4]. Biermann, F., Kanie, N., & Kim, R. E. (2017). Global governance by goal-setting: the novel approach of the UN Sustainable Development Goals. *Current Opinion in Environmental Sustainability*, 26, 26-31.
- [5]. Bisung, E., & Elliott, S. J. (2018). Improvement in access to safe water, household water insecurity, and time savings: A cross-sectional retrospective study in Kenya. *Social Science & Medicine*, 200, 1-8.
- [6]. Chebet, W. (2016). Factors that contribute to food insecurity in Kenya: A case study of Tiaty, Baringo County.
- [7]. Connelly, L. M. (2016). Cross-sectional survey research. *Medsurg nursing*, 25(5), 369.
- [8]. Davis, B., Di Giuseppe, S., & Zezza, A. (2017). Are African households (not) leaving agriculture? Patterns of households' income sources in rural Sub-Saharan Africa. *Food policy*, 67, 153-174.
- [9]. Deaton, A. (2005). Measuring poverty in a growing world (or measuring growth in a poor world). *Review of Economics and statistics*, 87(1), 1-19.
- [10]. Dile, Y. T., Karlberg, L., Temesgen, M., & Rockström, J. (2013). The role of water harvesting to achieve sustainable agricultural intensification and resilience against water-related shocks in sub-Saharan Africa. *Agriculture, ecosystems & environment*, 181, 69-79.
- [11]. Elhadi, Y. A., Nyariki, D. M., Wasonga, V. O., & Ekaya, W. N. (2012). Transient poverty among pastoral households in the semi-arid lowland of Baringo district, Kenya. *Ozean Journal of Social Sciences*, 5(1), 9-19.
- [12]. Friborg, O., & Rosenvinge, J. H. (2013). A comparison of open-ended and closed questions in the prediction of mental health. *Quality & Quantity*, 47(3), 1397-1411.
- [13]. FSIN, F. (2018). Global report on food crises 2018. World Food Programme.
- [14]. Hecklé, R., Smith, P., Macdiarmid, J. I., Campbell, E., & Abbott, P. (2018). Beekeeping adoption: A case study of three smallholder farming communities in Baringo County, Kenya.
- [15]. Heinrich, C., Maffioli, A., & Vazquez, G. (2010). A primer for applying propensity-score matching. Inter-American Development Bank.
- [16]. Israel, M. (2014). Research ethics and integrity for social scientists: Beyond regulatory compliance. Sage.
- [17]. Itabari, J. K., Kwena, K., Esilaba, A. O., Kathuku, A. N., Muhammad, L., Mangale, N., & Kathuli, P. (2011). Land and water management research and development in arid and semi-arid lands of Kenya. In *Innovations as key to the green revolution in Africa* (pp. 427-438). Springer, Dordrecht.
- [18]. Juffe-Bignoli, D., Burgess, N. D., Bingham, H., Belle, E. M. S., De Lima, M. G., Deguignet, M., ... & Eassom, A. (2014). Protected planet report 2014. UNEP-WCMC: Cambridge, UK, 11.
- [19]. Kenya National Bureau of Statistical Survey, (2018). Economic Survey
- [20]. Kristjanson, P., Mango, N., Krishna, A., Radeny, M., & Johnson, N. (2010). Understanding poverty dynamics in Kenya. *Journal of international development*, 22(7), 978-996.

- [21]. M'Kaibi, F. K., Steyn, N. P., Ochola, S., & Du Plessis, L. (2015). Effects of agricultural biodiversity and seasonal rain on dietary adequacy and household food security in rural areas of Kenya. *BMC Public Health*, 15(1), 422.
- [22]. Maxwell, D., Caldwell, R., & Langworthy, M. (2008). Measuring food insecurity: Can an indicator based on localized coping behaviors be used to compare across contexts?. *Food Policy*, 33(6), 533-540.
- [23]. McGuire, S. (2015). FAO, IFAD, and WFP. The state of food insecurity in the world 2015: meeting the 2015 international hunger targets: taking stock of uneven progress. Rome: FAO, 2015.
- [24]. Michael, C. N. (2015). Factors influencing food security in Kenya; A case of Bungoma South sub-county, Bungoma County.
- [25]. Mjonono, M., Ngidi, M., & Hendriks, S. L. (2009). Investigating household food insecurity coping strategies and the impact of crop production on food security in Embu, Kenya and KwaZulu Natal South Africa, using coping strategy index (CSI). In 17th International Farm Management Congress, Bloomington/Normal, Illinois, USA.
- [26]. Mugenda, O., & Mugenda, A. G. (2003). Research methods: Quantitative and Qualitative methods. Revised in Nairobi.
- [27]. Nadeiwa, K., & Koring' ura, J. (2017). Influence of Small-scale Irrigation Schemes on Improving Livelihood of Rural Farm Households; A Case of Perkerra Irrigation Scheme, Baringo County. *American Scientific Research Journal for Engineering, Technology, and Sciences (ASRJETS)*, 38(2), 200-213.
- [28]. Njeru, E. H., & Njoka, J. M. (2003). Poverty and human security in Kenya.
- [29]. Ogello, E. O., & Munguti, J. M. (2016). Aquaculture: a promising solution for food insecurity, poverty and malnutrition in Kenya. *African Journal of Food, Agriculture, Nutrition and Development*, 16(4), 11331-11350.
- [30]. Ogendi, G. M., & Ong'oa, I. M. (2009). Water policy, accessibility and water ethics in Kenya. *Santa Clara J. Int'l L.*, 7, 177.
- [31]. Olielo, T. (2013) Food security problems in various income groups of Kenya. *African Journal of Food, Agriculture, Nutrition and Development* 13, no. 4: 1-13.
- [32]. Oluoko-Odingo, A. A. (2011). Vulnerability and adaptation to food insecurity and poverty in Kenya. *Annals of the Association of American Geographers*, 101(1), 1-20.
- [33]. Oyugi, L. N., Mwabu, G., & Masai, W. (2000). The determinants of poverty in Kenya. Unpublished MA Thesis, Department of Economics, University of Nairobi.
- [34]. Rufino, M. C., Thornton, P. K., Mutie, I., Jones, P. G., Van Wijk, M. T., & Herrero, M. (2013). Transitions in agro-pastoralist systems of East Africa: impacts on food security and poverty. *Agriculture, ecosystems & environment*, 179, 215-230.
- [35]. Simatele, M. C. (2006). Food production in Zambia: The impact of selected structural adjustment policies. AERC.
- [36]. Steduto, P., Hoogeveen, J., Winpenny, J., & Burke, J. (2017). Coping with water scarcity: an action framework for agriculture and food security. Food and Agriculture Organization of the United Nations Rome, Italy.
- [37]. Tokar, B., & Magdoff, F. (2009). An overview of the food and agriculture crisis. *Monthly Review*, 3, 5-6.
- [38]. Walters, J. P., & Javernick-Will, A. N. (2015). Long-term functionality of rural water services in developing countries: a system dynamics approach to understanding the dynamic interaction of factors. *Environmental science & technology*, 49(8), 5035-5043.
- [39]. WHO, U. (2017). WHO/UNICEF joint monitoring programme for water supply and sanitation.
- [40]. Young, S. L., Boateng, G. O., Jamaluddine, Z., Miller, J. D., Frongillo, E. A., Neilands, T. B., ... & Stoler, J. (2019). The Household Water InSecurity Experiences (HWISE) Scale: development and validation of a household water insecurity measure for low-income and middle-income countries. *BMJ global health*, 4(5), e001750.

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