DETERMINANTS OF FOOD SECURITY AMONG RURAL HOUSEHOLDS IN KENYA

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Abstract: *In Kenya, ensuring food security among rural households is pivotal for sustainable development and poverty alleviation. With about 71 percent of Kenya's population living in the rural areas and agriculture being the main economic activity, 36 percent of the rural population is experiencing food poverty. The main focus for this study is to establish the determinants of food security among rural households in Kenya. The study is grounded on the Engel Curve theory. Data for this study is obtained from the Kenya Integrated Household Budget Survey (KIHBS) 2015/16, covering 13,092 rural households. Logistic regression estimation technique was employed to meet the study objectives. The findings reveal that education status of the household head, access to credit, household size and income are significant determinants of food security among rural households in Kenya. The education status of the household head, access to credit and income have positive effects on household's food security while household size has a negative effect on household food security. The study recommends that credit facilities be made accessible for rural farmers to help them expand both on farm and off farm operations, thus enhancing household food security. The government should also prioritize expanding education access in rural areas and implement policies to boost household income by supporting agricultural value chains and improving market access. Additionally, policy measures focused on family planning should receive adequate attention to reduce household sizes to a level that household heads can manage effectively.*

Keywords: *Food Security, Food Insecurity, Kenya Integrated Household Budget Survey, Rural Households*

Introduction

Food security at the household level remains a significant issue in Kenya and many other developing countries, particularly those in Africa (Rono, Rahman, Amin, & Badruddoza, 2022). Despite concerted efforts to meet Sustainable Development Goal (SDG) 2, which aims to end hunger, ensure food security, improve nutrition, and promote sustainable agriculture, Kenya continues to face increasing difficulties in attaining food security (Welborn, 2018). Food security is defined as a situation where all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (FAO, 1996).

In 2022, Kenya ranked 82nd out of 113 countries in Global Food Security Index (GFSI) with food affordability and availability remaining the major challenges as they ranked at position 101 and 79 respectively (Economist Impact, 2022). In rural regions, food poverty affects about 36 percent of the population which is higher than the 29 percent in peri-urban areas and 24 percent in core-urban areas (Kihiu, 2021). Rural households spend around 65 percent of their income on food, which account for 74 percent of their total food consumption (Shibia

et al., 2023). This dependency on purchased food, coupled with the increasing reliance on food imports has deepened food poverty in these areas.

Article 43(1)(c) of the Kenyan Constitution guarantees every citizen the right to be free from hunger and to have adequate food of acceptable quality (Republic of Kenya, 2010). Building on these constitutional provisions, the Kenyan government has implemented various strategic initiatives, such as the National Agricultural and Rural Inclusive Growth Project and the National Accelerated Agricultural Input Access Programme, aimed at fast-tracking the attainment of national food security goal. While the aforementioned initiatives have recorded notable successes, challenges persist especially in rural Kenya.

Existing studies are limited in scope which limit broader applicability in Kenya's rural areas. There also exist scanty literature on how food prices and various shocks to household welfare affect food security, particularly in rural settings. While Mutinda (2015) explored the determinants of household food security in rural Kenya, the study used the Kenya Integrated Household Budget Survey (KIHBS) 2005/06 data employing an Ordinary Least Squares technique. This study aims to build upon that research by utilizing the latest KIHBS 2015/16 dataset employing a logistic regression approach.

Food security is influenced by various supply and demand-side factors spanning demographic, social, and economic dimensions (Ougo, 2022). Therefore, it is important to establish the determinants of food security among rural households in Kenya to provide proper policy guidance in achieving better outcomes in food security.

Literature review

Several studies on the determinants of household food security have been conducted across diverse regions revealing a wide range of findings. In Asia, Udaykumar, Umesh & Gaddi (2022) found that rural areas in the northern area of Belanguru had the lowest percentage of food-secure households (58.75%) compared to urban (76.25%) and peri-urban (63.75%) areas. Education, monthly household income, and urbanization were all significant drivers of food security. However, the study's reliance on caloric method as a measure of food security limited its ability to account for issues related to food accessibility, affordability and utilization.

In another study, Abdullah, Deyi, Sajjad, Waqar, Izhar Ud & Aasir (2019) analyzed factors affecting household food security in the rural northern hinterland of Pakistan. The study identified age, gender, education, remittances, unemployment, inflation, assets, and disease as critical determinants of household food security. However, the study was limited to a specific rural region in Pakistan and lacked analysis of the various shocks to household welfare that often disrupt household's food systems stability.

In Southern Africa, Omotayo & Aremu (2020) identified that age, gender, educational status, indigenous plants incorporation in diet, food expenditure, and study area accessibility as determinants of food security in South Africa's North West Province households. However, the applicability of these findings to rural Kenya may be limited due to various geographical, demographic and socio-economic disparities.

In Western Africa, Sidique & Muhammad (2019) investigated the determinants of food security among households in Nigeria. Food and non-food expenditures, education status of the household head, land size and the age of the household head were revealed as key determinants. However, the study was lacked a detailed analysis of various pertinent independent variables, such as food prices, shocks to household welfare and access to credit.

Additionally, Kolog, Asem & Mensah-Bonsu (2023) estimated the factors of food security in Ghana's Upper East region. Household size, access to infrastructure, access to formal cooperatives and jobs availability were found to be significant determinants of household food security as measured by the HFIAS while gender of household head and proximity to markets were found to be significant determinants of food security according to the HHS model. However, the study relied on subjective assessments and composite indices.

In Eastern Africa, specifically Kenya, Mutinda (2015) investigated the determinants of household food expenditure and food security in rural Kenya utilizing the KIHBS 2005/06 data. Findings revealed that the education level of the household head, household size, and household income significantly influenced food security. However, the study's reliance on an older dataset limited its scope. This study built on this research by analyzing the most current 2015/16 dataset to explore if any other factors influence food security in rural Kenya.

Similarly, Mutea, Bottazzi, Jacobi, Kiteme, Ifejika Speranza & Rist (2019) explored the link between food security and livelihood characteristics in the North-Western Mount Kenya Region, identifying key determinants like ownership of productive hand tools, off-farm income, consumption of self-produced food, agro-ecological zone, farm income, and several critical crops afflicted by pests. However, the study's findings may not be fully generalizable to the broader rural populations owing to variations in socio-economic conditions and demographic characteristics across different rural regions in Kenya. Therefore, the author included all rural regions in Kenya to fill this gap.

Research Methodology

This study was based on the Engel curve theory which illustrates how the demand for a particular good change as consumer income varies assuming all other factors, such as prices and consumer preferences, remain constant. Following Leser (1963) the basic engel curve equation is illustrated as follows;

$Q=f(Y)$…………………………………………………….. (1)

According to the Engel curve theory as household income increases the proportion of income allocated to food expenditures decreases, although the absolute expenditure on food may increase. Initially, households allocate a significant portion of their income to basic necessities such as food. However, as household income increases households tend to diversify their consumption patterns incorporating diverse and higher quality food items into their diets.

In this study quantity demanded proxied the demand for food items, while income served as a determinant factor influencing food demand and consumption behaviours.

The Engel curve for food expenditures is therefore expressed as follows;

$Q_f = f(y)$ …………………………………………………...(2)

Where Q_f represents the quantity of food demanded, y denotes household income and the functional form f(y) denotes how the quantity demanded for food changes as income varies across different income levels. While income plays a significant role in shaping food consumption patterns, other economic, demographic, and social factors contribute significantly to a household's food security status.

This study was guided by the Working-Leser Engel curve specification for food expenditures model which built upon the traditional Engel curve framework by incorporating additional variables to capture demographic

characteristics, regional variations, and other factors influencing food consumption behavior. To account for these factors, the Engel curve was extended to include demographic, economic, and social factors, all of which were denoted as M. The modified equation is represented as follows;

$Q_f = f(y, M)$ …………………………………………..(3)

Acknowledging the multidimensional nature of food security, this study considered a case where households have either demanded food or not. This distinction translated into a binary model that categorized households into food-secure and food-insecure groups based on their demand for food and food expenditure behaviours.

Therefore, the functional analytical model for this study is specified as follows;

$\Pr(Z_i=1) = F(\alpha + \beta X + \gamma W + \delta S)$ ………………………………(4)

Where:

Z = Household food security ($Z_i=1$ if the household is food secure and 0 if the household is food insecure)

X = a set of demographic factors such as age, gender, education level, marital status, and household size.

W = a set of economic factors such as income, food prices and access to credit.

S = a set of shocks to household welfare related variables.

α, β, γ, and δ = Parameters that capture the relationships between the predictor variables and the likelihood of households being food secure.

Model Specification

In this study the dependent variable, household food security status, is dichotomous in nature. Given the bounded nature of the dependent variable this study has two applicable models namely, the Probit and logit models. This study employed the logistic regression model, as it provides more stable results and valuable insights into the relationship between the predictor variables and the probability of a given outcome occurring (the likelihood of a household being food secure or insecure).

Thus, the binary logistic model for this study is specified as follows;

$Z_i = F(X_i \beta + \varepsilon)$ …………………………………………..(5)

From the logistic model above, the following empirical model is derived;

$Z_i = \beta_0 + \beta_1 inc_i + \beta_2 age_i + \beta_3 gender_i + \beta_4 educ_i + \beta_5 hsize_i + \beta_6 fprice_i + \beta_7 credit_i + \beta_8 marital_i + \beta_9\, shocks_i + \varepsilon_i$ ….(6)

Where;

Z_i = Household food security status (1=food secure; 0=food insecure)

β_0 = Constant

β_1-β_9 = regression coefficients

ε_i = Stochastic error terms

Table 1: Explanatory variables used in Regression Analysis

Variables	Definition
Income (inc_i)	This variable represented the household's total income, encompassing earnings from both labour-related activities and non-labour sources. It took the value of 1 if the household received labour and non-labour income and 0 if otherwise.
Age (age_i)	This variable captured the age of the household head in years (continuous variable).
Gender ($gender_i$)	This variable indicated the gender of the household head, taking the value of 1 if the household head is male and 0 if otherwise.
Education level ($educ_i$)	This variable captured the highest level of education the head of the household attained. Dummies were used to capture the level of education, that is, those with no formal education to primary, secondary, tertiary, graduate, and postgraduate levels.
Household size ($hsize_i$)	This variable represented the total number of individuals living within the household (continuous variable).
Access to credit ($credit_i$)	This variable indicated whether the household had access to credit formally through financial institutions or informally through community sources. Taking the value of one if the household could access credit and 0 if otherwise.
Marital Status ($marital_i$)	This showed the marital status of the household head. Dummies were used to represent those that are married, single and never married.
Shocks to household welfare ($Shocks_i$)	This variable captured unexpected events or incidents affecting the availability, affordability, or accessibility of food for the household. Dummies were used to capture social, economic and environmental shocks.
Food prices ($fprice_i$)	This variable captured the cost of food items or the general price level of food typically measured as the price of a food basket (continuous variable).

The 2015/16 KIHBS assessed food security using eight questions (qa1-qa8) related to food-related behaviors and experiences over the past 12 months, aligned with the FAO's Food Insecurity Experience Scale (FIES). Based on the responses for each question(qa1-qa8), households were grouped into four food security levels:

- Food secure: If respondents answered no to all questions (qa1 through qa8).

- Mildly food insecure: If respondents answered yes to any of the first three questions (qa1, qa2, or qa3).

- Moderately food insecure: If respondents answered yes to any of the questions qa4, qa5, or qa6, and no to qa7 and qa8.

- Severely food insecure: If respondents answered yes to either qa7 or qa8.

However, for this study only two classifications of household food security were used, food secure if classified by FIES as food secure or food insecure if classified by FIES as mildly food insecure, moderately food insecure, and severely food insecure since the statistical method applied was logistic regression and requires only binary groups of the dependent variable.

Results and Discussion

Descriptive Statistics

Table 2 and 3 present the descriptive analysis results of the study.

Table 2: Summary Statistics of Qualitative Variables

Variable	Observation	Mean
Marital status		
Marital status (Household head is married=1)	3,043	0.6960
Marital status (Household head is single=1)	3,043	0.2113
Marital status (Household head is never married=1)	3,043	0.0927
Education		
No education (Household head has no education=1)	2461	0.0081
Primary Education (Household head has primary education=1)	2461	0.5286
Secondary education (Household head has secondary education=1)	2461	0.2816
Tertiary education (Household head has tertiary education)	2461	0.1239
Graduate (Household head is a graduate=1)	2461	0.0488
Post graduate (Household head has postgraduate education=1)	2461	0.0089
Income (Household received labour and non labour income=1)	13,092	0.0499
Credit (Household could access credit=1)	13,092	0.0472
Shocks to household welfare		
Social shocks (Household experienced social shocks=1)	13,092	0.1632
Economic shocks (Household experienced economic shocks=1)	13,092	0.2644
Environment shocks (Household experienced environmental shocks=1)	13,092	0.5538

From table 2 above education level of the household head was explored and established that approximately 0.81 percent of household heads had received no formal education, while the majority, accounting for around 52.86 percent, had attained primary education. The higher attainment of primary education can be attributed to the accessibility of primary education in Kenya, bolstered by initiatives such as Free Primary Education (FPE) (Opata & Wesonga, 2016). Secondary education was prevalent among approximately 28.16 percent of household heads. This can be attributed to Kenya's government commitment to expanding access to education beyond primary level through initiatives like the Free Secondary Education (FSE) policy (Wanjala & Hussein, 2017).

Tertiary education accounted for about 12.39 percent of the sample. Additionally, approximately 4.88 percent of household heads were classified as graduates while roughly 0.89 percent had achieved postgraduate education. Pursuing graduate and post graduate education requires significant financial resources and can be more affordable when utilizing available financial aid options. However, limited knowledge regarding

financial resources available to pursue such studies limits access for the rural population (Kennedy et al., 2016). This lack of awareness about available financial aid options perpetuates the cycle of low graduate and post graduate education attainments among rural populations.

Marital status among household heads was explored and it was established that approximately 69.60 percent of household heads were classified as married, including those in monogamous and polygamous marriages, as well as those living together. The high proportion of married household heads may be due to the societal and cultural importance of marriage in rural areas (Lowe, Joof, & Rojas, 2020). Additionally, about 21.13 percent of household heads were identified as single, encompassing those who were separated, divorced or widowed. This can be attributed to the evolving and changing societal attitudes towards marriage and divorce which has made it more acceptable for individuals to separate or divorce where necessary. Furthermore, about 9.27 percent of household heads were categorized as never married. The relatively low rate of never married household heads in rural areas can be attributed to cultural expectations that view marriage is seen as a rite of passage and an essential part of adult life in rural communities (Lebese, Mothiba, Mulaudzi, Mashau, & Makhado, 2022).

Among 13,092 observations, it was found that approximately 4.99 percent of households received income from both labour and non-labour sources. This finding can be attributed to the fact that rural households have increasingly embraced diverse income generating activities to spread risk and enhance financial stability (Abera, Yirgu, & Uncha, 2021). Approximately 4.72 percent of the rural households were able to access credit facilities reflecting persistent challenges in rural financial inclusion in developing countries as highlighted by (Dienillah, Anggraeni, & Sahara, 2018). This can be attributed to limited financial literacy among rural residents, as many are unfamiliar with formal financial products and services (Cicchiello, Kazemikhasragh, Monferrá, & Girón, 2021).

Additionally, it was established that approximately 16, 26 and 55 percent of the rural households experienced social, economic and environmental shocks respectively. The relatively lower percentage of social shocks may be attributed to the presence of strong social networks and support systems among rural communities which buffer households against social shocks (Osabohien et al., 2024). The relatively low percentage of economic shocks could be as a result of diversified rural livelihood strategies which help them mitigate the impact of economic fluctuations (Gautam & Andersen, 2016). The higher percentage of environmental shocks can be attributed to lack of emergency preparedness measures and limited adaptive capacity of rural households in the event of environmental challenges (Blocher, Hoffmann, & Weisz, 2024).

Table 3: Summary Statistics for Quantitative Variables

Variable	Observation	Mean	Standard Deviation	Minimum	Maximum
Household size	13,092	4.65498	2.532963	1	28
Age (Household head)	3,042	44.95991	16.2934	15	98
Food prices	13,092	177.7096	433.9127	0	20833.33

From table 3 above it is observed that the least number of individuals in the households surveyed, was 1 while the highest was 28. The descriptive statistics further revealed that age of the household head deviated from its mean (44years) by 16.2934 with the majority of the respondents being about 45 years of age. The youngest household head was 15 years old while the oldest was 98 years. Further it was revealed that food prices deviated

from its mean (KES 177.7096) by 433.9127 with the lowest price being KES 0 and the highest price being KES 20,833.33.

Empirical Results and Discussion

Table 4: Logistic Regression Results on Determinants of Food Security among Rural Households in Kenya

VARIABLES	Logit Results	Marginal Effects
Household size	-0.0960***	-0.0159***
	(0.0229)	(0.0037)
Food prices	0.0000242	0.00000403
	(0.000117)	(0.000194)
Married	0.0381	0.00632
	(0.176)	(0.0292)
Single	0.00941	0.00156
	(0.212)	(0.0353)
Primary education	0.0238	0.00396
	(0.239)	(0.0397)
Tertiary education	0.179	0.0297
	(0.263)	(0.0436)
Secondary education	-0.0842	-0.0139
	(0.244)	(0.041)
Postgraduate	0.918*	0.153*
	(0.502)	(0.0833)
No education	0.186	0.0309
	(0.582)	(0.097)
Social Shocks	-0.0480	-0.0079
	(0.154)	(0.0255)
Environmental Shocks	-0.0992	-0.01649
	(0.117)	(0.019)
Credit access	0.437*	0.073*
	(0.224)	(0.037)
Age	-0.00228	-0.00037
	(0.00374)	(0.00062)
Income	0.847***	0.1407***
	(0.185)	(0.030)
Constant	-0.768**	
	(0.299)	
Observations	2,461	
Prob>chi^2	0.000	
Pseudo R^2	0.0210	

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

The logistic regression results, shown in table 4, revealed that all factors were jointly statistically significant in influencing food security status in rural Kenya as evidenced by a significant F statistic ($0.00<0.05$). The

results revealed a negative and significant coefficient of household size. Specifically, the marginal effects results revealed that the probability of a household being food secure decreases by 1.60 percent with a one-member increase in household size holding all other variables constant. This may be attributed to increased food demand in larger households which often result in difficulties purchasing sufficient food quantities to meet the dietary needs of all household members, thus worsening food security. This is in line with various previous studies, for instance Nyangasa, Buck, Kelm, Sheikh, & Hebestreit (2019) which found that larger households were more likely to experience food insecurity compared to smaller households.

Household food security status was also positively influenced by the education levels of the household heads. Specifically, postgraduate education level had a significant effect on food security. The marginal effects results revealed that holding other factors constant the probability of a household being food secure increased by 15.26 percentage points on average if the household head had postgraduate education, compared to graduate education. This can be attributed to better job opportunities, higher incomes, and improved decision-making skills associated with higher education levels. These findings are in concurrence with the previous findings by Gwada, Ouko, Mayaka, & Dembele (2020) who established that households led by individuals with higher education levels are more likely to be food secure.

The results revealed a positive significant relationship between access to credit and food security status. Specifically, the marginal effects results revealed that, holding all other factors constant, households with access to credit, on average, have a 7.3 percentage point higher probability of being food secure compared to those without access. This aligns with the permanent income hypothesis theory and previous findings such as Boltana, Tafesse, Belay, Recha, & M.Osano (2023) whose findings suggested that rural farming households with greater access to credit tend to have better food security outcomes since households are able to smooth out consumption during periods of low income and cope with unexpected expenses related to food acquisition or agricultural production.

Additionally, the results show that holding other factors constant, household income has a positive significant effect on food security status, indicating that household food security increases with higher levels of household income. The marginal effect indicated that, holding other factors constant, one Kenya Shilling increase in household income, on average, increases the probability of a household being food secure by about 14.07 percentage points. This is because increased income provide greater purchasing power, allowing households to buy more food quantities and access higher quality and more nutritious food products thus better food security outcomes. This finding agrees with that of (Worku, 2023).

Conclusion

Findings suggest that education status of the household head, access to credit, household size and income are important determinants of food security among rural households in Kenya. Specifically, education status of the household head, access to credit and income were found to be positive and statistically significant while household size was found to be negative and significant. Larger household sizes are associated with lower food security, as each additional member reduces the likelihood of the household being food secure. Higher education levels improve food security by improving job opportunities, income levels, and decision-making abilities. Access to credit emerges as a significant factor, enabling investment in food production and acquisition, thereby enhancing food security. Higher household income is strongly associated with increased food security, providing households with greater purchasing power to access sufficient and nutritious food.

Recommendation

The government should enforce policies directed towards reproductive rights to ensure universal access to family planning services, supported by public awareness campaigns to enlighten rural households about the significance of family planning in enhancing food and nutrition security as these will be essential steps toward achieving the goal of limiting household size to sustainable levels. Additionally, the government and financial institutions should enhance access to microfinance and agricultural credit schemes, tailored to the needs of rural households, and implement financial literacy programs to ensure responsible borrowing and effective use of credit for productive on-farm activities. Efforts should be put in place to increase rural households income through investments in agricultural development, improved market access and promotion of value-added activities in agriculture. Furthermore, the government should prioritize investments in the education sector to increase access to higher education, thereby increasing employment opportunities and promoting household food security through enhanced economic independence.

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