

Determinants of Food Security in Tobacco and Sugarcane Production Zones, Migori County, Kenya



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Received: 29 April 2024 / Revised: 08 July 2024 / Accepted: 23 August 2024 / Published: 09 September 2024

ABSTRACT

At 34%, food insecurity in Migori County is considered alarming while its measurement has posed challenges to academicians and researchers whilst many studies exist on food security determinants, none has been done in Migori entailing tobacco producers, sugarcane growers and non-growers in Kuria and Migori sub-counties. The study examined food security determinants guided by a consumer theory and measured by means of HFIAS modelled in ologit model. Data collection was done using an open data kit pre-loaded with a questionnaire and analyzed using stata software wherein results depicted 38.89% as severely insecure, 33.33% moderately insecure, 9.26% mildly insecure and 18.52% food secure while household size, off-farm income, capital sourcing was significant at $p < 0.001$ in varying degrees and categories after ologit regression analysis. There is need for the national government to provide cash crop insurance and fixed contracts to prevent risks associated with price fluctuations as well as invest in innovative biotechnology research through formulation of policies to aid in ensuring capacity building through its stakeholders such as the national research institutes and other donor agencies.

Keywords: Food security, Household level, Demand and supply side

1 Introduction

National food security measurement data has had major inaccuracies in Kenya complicating frontiers and mitigations that would otherwise help reduce and solve incidences of food insecurity amongst its households. Planning for households in government budgetary allocations through the ministry of agriculture is therefore based on inaccurate data subjecting many households to food insecurity shocks hence the need to carry out a study involving the households to elevate factors and determinants that affect food security state (MoA 2023). According to MoA (2023) maize annual targets per region were 15 million bags in North Rift, 7 million bags in South Rift, 2.7 million bags in Central Kenya, 3 million bags in lower Eastern, 1.1 million bags in upper Eastern, 1.6 million bags in Coast region, 7.6 million bags in Nyanza and an inconclusive million bags for Western region. While these numbers seem impressive on Kenyan's

preferred staple food, it is not sufficient for over 50 million Kenyans who still rely on additional imports from neighboring countries like Uganda and Tanzania. Additionally, a five-year average of other crops like corn, wheat, sorghum, rice, millet and barley from 2019 to 2023 stood at 3492, 319, 216, 127, 103 and 51 respectively while a similar outlook for 2023-2024 production stands at 3700, 310, 225, 160, 100 and 60 in thousand tons showing varying changes in each crop category and still has left majority of Kenyans chronically insecure as Turkana leads with 54% food insecurity followed by Kisii at 41%, Migori at 34% and Isiolo at 29% as the most highlighted counties.

African Women Studies Center together with Kenya national bureau of statistics record that Migori county is affected with a combination of issues such as cattle rustling, land boundary conflicts between communities, droughts, floods, youths shifting away from agricultural production, land fragmentation, cultural practices and dwindling cash crop production and this amongst other factors affect food security on majority of the households (KNBS 2014). A study on determinants of food security is key as it offers facts that permits enactment of food measures and policy interventions in the county and as well acts in the expansion of food programs in Migori and furthermore, help policy developers to design projects and implement them based on characteristics of the regions hence stemming development from grassroots level and improving basic welfare of households. Moreover, additional information was availed to community based organizations such as Community for Agricultural and Rural Development Migori Branch to incorporate in their programs that aid to reduce instances of food insecurity. The purpose of the study, therefore, evaluated determinants on household food security in regards to demand and supply factors using consumer theory as a modelling basis based on supply and demand side factors with results revealing a significant influence from demand factors.

2 Methodology

2.1 Households

Households were engaged in Migori County (Kuria and Migori sub-counties) from Uriri and Kuria constituencies in which sugarcane and tobacco are grown. Thereafter, wards in each constituency were incorporated as Uriri and Kuria East as the target population consisted of select households who grow sugarcane, tobacco or both and non-growers who were in the age bracket of 18 years and above and have resided in the area before the study was done and overall gave their consent to be involved. Respondents were thus screened to ensure they met the age requirement, resided in the area of study and are the heads of their respective households meanwhile, a pre-test on questions in the questionnaire was given to each responded who inquired more about the topic of study and equally debriefed before and after the session. A total of 378 households were interviewed out of 396, the difference is because of non-response, multistage as a sampling technique was preferred and in the first stage two sub counties were selected purposively and that applied in the second stage as well while choosing two constituencies, county wards were randomly selected in third stage and household ratios used to determine households in each region: 251 for Uriri, 145 for Kuria East and further distribution done to county wards with five wards in Uriri and six wards in Kuria East using Kenya housing population census of 2019. The study was quantitative in nature with descriptive statistics emanating from open ended questions on the questionnaire and were

analyzed using stata in prevalence to demographic characteristics such as land size, education and age amongst others while inferential statistics was analyzed using stata to give marginal effects outlining the independent variable (HFIA) to a range of ologit categories ordered as (1) secure, (2) mildly insecure, (3) moderately insecure and (4) severely insecure.

2.2 Inclusion/Exclusion Criteria and Eligibility of respondents

This study included households who reside in Uriri and Kuria East in Migori County because those are the regions where tobacco and sugarcane are grown as cash crops. It encompassed select households of those who grow sugarcane and tobacco or both and non-growers where both males and females were included as household heads while maintaining an age bracket of 18 years and above herein referred to as adults in Kenya. The research excluded respondents who did not give consent and also households that had custodians considered as not head of household and also excluded hosted adults within the nuclear, extended family or visiting friends who had no right in decision making on expenditure or household budget as well as households that relocated to the study areas within the research period. In identifying potential households, we used the expertise of village elders and Nyumba Kumi Initiative agents as per who was available in which region. Potential households were screened in person and consent for participation sought after illustrations by the interviewer on the aim and need for the research. Verification was based on observation in regards to whether male or female while age was acknowledged as given by the respondent. Given that responses were given in person, completeness and consistency on data validation was cross-checked during the interview session and confidentiality and anonymity of responses were also reaffirmed by excluding names and pictures of respondents. In instances where responses or the question sounded ambiguous a manual review was quickly done to maintain quality of the responses while those that were captured in error by the interviewer were only included for final analysis after data cleaning by sorting out inaccuracies through stata software. The interviewers were trained and thus maintained ethical standards as required during the study: responses confidentiality was protected throughout the study period and as well as when reporting the findings.

2.3 Household Food Insecurity Access Scale (HFIA) calculation

It has a set of nine questions and tracks responses for up to four weeks as a score where the minimum is 0 and maximum 27 which then translates to frequencies such as rarely, sometimes and often summed as $Q1a + \dots + Q9a$ where its value is given as below:

$$\frac{\text{HFIA summation scores from the sample}}{\text{HFIA scores in numbers (n) from the sample}}$$

Further calculations are executed after coding the above average and results to

$$\frac{\text{Households with HFIA label category = 4}}{\text{Total households with a HFIA label category}} \times 100$$

Prevalence is thus augmented with ologit model as (1-secure, 2-mildly insecure, 3-moderately insecure and 4-severely insecure) to give marginal estimates

Therefore:

$$y_i^* = \beta x_i + \varepsilon_i \dots \dots -\infty < y_i^* < \infty$$

Where

y_i^* : FS

B_i : Estimated parameters

x_i : Independent non-random variables

ε_i : Disturbance

y_i^* a qualitative variable which displays orders of FS as 1;2;3;4:

3 Results

3.1 Households prevalence and characteristics in tobacco and sugarcane production zones

Prevalence of food insecurity results denote secure households at 18.52%, mildly insecure 9.26%, moderately insecure 33.33% and severely insecure at 38.89% which means the severity of food insecure household is alarming gaining an additional 4% from the chronic value (34%) reported by KNBS (2014). Food security prevalence per sub county in which Kuria and Uriri were food secure at 18.28% and 18.75%, mildly food insecure at 12.37% and 6.25%, moderately food insecure at 32.26% and 34.38% and severely food insecure at 37.10% and 40.63% therefore in comparison both counties are food secure at 18% with only the severity marking a difference with Kanyamkago being severely food insecure with 3% more.

Households who did not engage in cash crop production were 19.65%, 10.98%, 38.15% and 31.21% and cash crop producers were 17.56%, 7.80%, 29.27% and 45.37% food secure, mildly insecure, moderately insecure and severely insecure respectively implying that those who did not produce were 2% food secure than producers and 14% less severe than producers. Prevalence of food security per crop for tobacco, sugarcane, both crops and non-producers as food secure (15.73, 18.97, 0, 20) %, mildly food insecure (4.49, 10.34, 33.33, 10.59) %, moderately food insecure (33.71, 25.86, 66.67, 37.65) % and severely food insecure (46.07, 44.83, 0, 31.76) % where non-producer households were food secure by 20% more from the least ranked but severely food insecure by 31% from the least ranked who were producers of both crops.

From table 1, positive signs on location show that relocation shifts a household to an upper household food insecurity access category while a negative sign shows with relocation a household remains severely food insecure at $p < 0.05$ which is not statistically significant however, it reveals a slight progress in a household chances of improving food security. The positive signs imply that for such households shifting from one location to another increase their food access categories upwards due to better climatic conditions and improved social amenities and at the same time the negative signs disclose no changes in the households in that category as confirmed by Rashid *et al.* (2024) in Tanzania while investigating implications of food security and expenditure determinants. Negative signs on age 1, 2, 3 at $p < 0.05$ illustrates a downward movement as average age increases articulating a household drops to a lower category and it therefore suggests households with elderly occupant's experience severe insecurity compared to families with younger respondents however, it is a slight decrement hence the insignificance of the variable in the given categories. The positive sign at $p < 0.01$ on 4 mean an upward improvement to a high household food security access category and that the variable is statistically significant with a 0.06 increase per 1 year added. A study by

Alemayehu and Tesfaye (2024) about food determinants and coping strategies affirms the results as they found; as age increases by 1 year in households there is a probable risk of being food insecure.

Table 1: Marginal Estimates after regression

	1	2	3	4
Location	0.0030*(0.78)	0.00089*(0.77)	0.00054*(0.75)	-0.0044*(-0.78)
Social group	-0.0141*(-0.45)	-0.0044*(-0.45)	-0.0028*(-0.44)	0.0214*(0.45)
Other dependants	0.0013*(0.04)	0.0041*(0.04)	0.0027*(0.04)	-0.002*(-0.04)
Gender	0.40133*(1.37)	0.01249*(1.37)	0.08122*(1.20)	-0.0607*(-1.38)
Age-group	-0.046*(-1.95)	-0.0138*(-1.93)	-0.00839*(-1.64)	0.0686**(2.00)
Marital status	0.01683*(0.51)	0.05241*(0.51)	0.0341*(0.50)	-0.0254*(-0.51)
Education	0.025*(1.98)	0.00751*(2.04)	0.00456*(1.89)	-0.0373**(-2)
Food expense	0.00000387**(2.10)	0.00000115**(2.10)	0.000000699*(1.65)	0.00000571**(-2.5)
Credit access	0.050*(1.39)	0.0149*(1.32)	0.0090*(1.09)	-0.0739*(-1.36)
Extension	-0.0213*(-0.59)	-0.006*(-0.58)	-0.004*(-0.55)	0.0314*(0.58)
Land size	0.0023*(0.85)	0.0007*(0.85)	0.0004*(0.82)	0.0035*(0.86)
Fertilizer bought	0.0003**(2.62)	0.000088**(2.35)	0.000053*(1.63)	-0.0004**(-2.55)
Capital sourcing	0.0778*** (3.25)	0.0232*** (3.03)	0.0141** (1.99)	-0.115*** (-3.35)
Off-fam Income	0.0883*** (2.84)	0.02749** (2.73)	0.01787* (1.92)	-0.1336*** (-2.96)
House-hold size	-0.01829*** (-2.81)	-0.00569** (-2.68)	-0.0037** (-1.96)	0.0276*** (2.94)
1.Sugarcane	-0.197*** (-5.12)	-0.05*** (-4.15)	-0.0376** (-2.30)	0.284*** (5.35)
2.Tobacco	-0.186*** (-4.64)	-0.045*** (-4.38)	-0.029* (-1.88)	0.260*** (4.83)
3.Both	-0.136* (-1.84)	-0.0287* (-1.48)	-0.004* (-0.20)	1.69* (1.53)

Note: () *t* statistic, * $p < 0.05$, ** $p < 0.01$ and *** $p < 0.001$ level of significance

The positive signs on gender designate that a male headed household easily shift from a severe household food insecurity access category to one which is moderate while the negative indication specifies no change of household food insecurity access category at $p < 0.05$ given male as head of household which denotes a minimal difference hence the variable not statistically significant. In 3, 2, 1 positive stipulates male headed households are expected to increase in food security and the negative in 4 means that being a male headed household in that category does not increase or decrease likelihood of moving to a food secure state: this study was in line with Urmi *et al.* (2024) who found correlation between male headed households better at food security than female headed households while studying food security amongst university students. The positive signs on marital status reveal a shift to a higher household food security access category if they are married while the negative sign hints no change at $p < 0.05$ and therefore a minimal effect on food security state in the region hence variable not statistically significant. The positive signs also express that married households had an increased risk of being food insecure under certain instances while the negative sign implies no change whether a household is married or not; findings are similar to that of Naz *et al.* (2023) in their study.

The negative signs on household size articulate a downward movement to household food insecurity

access category as mean size increase at $p < 0.001$, $p < 0.01$ for 2 and 3 while a positive sign at $p < 0.01$ illustrates an upturn to a high food insecurity category and that household size had a strong effect on food security thus statistically significant. The negative signs explain an inverse relationship between food insecurity access categories to household size which imply large household were less food insecure compared to small households moreover, with large households' economies of scale come to play. The positive sign advances that an excessive increase in households' food insecurity is realized due to difficulty in management of such households' income and resources as revealed in a study by Alemayehu and Tesfaye (2024) about food determinants and coping strategies which gave a contrary result to this finding as theirs discovered households become food insecure.

3.2 Supply Side

The negative signs on social group postulate a downward shift to severe household food insecurity access category if a household is associated with a group while the positive enunciates an upward movement to a better category at $p < 0.05$ which is not statistically significant however, it mirrors a minor decrement in a household chances of reducing food security. The negative signs imply when households associate with a group they lose autonomy which affects independent decision making as well as resource competition in cases where many members belong in a social group thus benefits are not well distributed. The positive sign however, displays risk mitigation and improved knowledge power due to collective action and findings are similar to that of Bahiru *et al.* (2023) in Humbo southern Ethiopia while investigating food security determinants and coping strategies. Negative signs on extension services voice a household's downward shift from food secure access category to a mild category while the positive symbol articulates an upward shift to a higher household food insecurity access category after implementation at $p < 0.05$ which is not statistically significant however, it shows a small decrease in a household chances of reducing food security and vice versa for households in (4). The negative signs imply extension services offered to households increased incidences of food insecurity by increasing expenditure on purchase of new technology recommended and the positive sign, denotes that if the recommendations offered by the extension agents are less sophisticated, then a household will in the short term witness food security due to increase in production. This differs with findings of Adeyanju *et al.* (2023) who established that extension service access increase food security by 16% in their study done in three countries, Nigeria, Kenya and Uganda.

The positive signs on fertilizer purchase alludes that households who purchased and used fertilizers had access to a food secure category at $p < 0.01$ for 1 and 2 and $p < 0.05$ for 3 while negative imply whether households purchased and used fertilizers no improvement recorded at $p < 0.01$ which is statistically significant and showcase a strong enhancement in a household chances of improving food security for 3, 2, 1 while just a minor increment noted on (3) hence the variable not statistically significant. The positive signs mean purchase and usage leads to food security status improvement while the negative sign reveal that even with fertilizer purchase done, no shift in either food category is noted and can be attributed to incorrect application and other factors such as soil degradation from excessive applications and was augmented by findings of Awoke *et al.* (2023). Positive signs on dependency ratio point out that with one more additional member a household food security access category improves while the negative signals no

change at $p < 0.05$ which is not statistically significant however, it demonstrates a household chances of improving food security with an additional member in the household. The positive signs further designate that as households number increases it affects their ability to access quality food in their required quantities while the negative sign points to no significant effect with households' food insecurity as there are other factors such as income level that plays a role. Sarmin *et al.* (2024) findings support the latter part of the statement by acknowledging that if there are less breadwinners in such households then resources become constrained leading to food insecurity.

3.3 Demand Side

Positive signs on land size imply that as household land size increase in acres a household food security access category improves at $p < 0.05$ which is not statistically significant however, it points to a slight development in a household chances of improving food security. The positive signs indicate land size increase is associated with security of food but in decreasing and varied levels on the household food categories. A study by Alemayehu and Tesfaye (2024) about food determinants and coping strategies affirms the results similarly to Lolaso *et al.* (2024) who also found it increases food security 1.22 times. The positive signs on off-farm income means any additional income received in any form led to an increase in household food security access category at $p < 0.001$ for 3, $p < 0.01$ for 2 and $p < 0.05$ for 1 while on 4, negative sign shows no shift is noted at $p < 0.001$ which is statistically significant and confirms a strong development in a household chances of improving food security for 3, 2 and does not hold for household 1. The positive sign indicates that even with households doing other income generating activities and also receiving gifts and tokens the households' food insecurity state does not improve while the negative sign implies there is no observed change on the food insecurity level for such households. Lolaso *et al.* (2024) reaffirms that off farm income increases food security 4.55 times which supports this finding while a study by Alemayehu and Tesfaye (2024) about food determinants and coping strategies contradicts the results as they found a negative on off farm income.

The positive signs on education suggest that level of education causes an upward shift to an improved food security access category at $p < 0.05$ which is not statistically significant however, it shows a slight improvement in a household chances of improving food security while the negative point towards a drop to a lower food insecurity access category at $p < 0.01$ which is statistically significant however, it shows no improvement in a household chances of improving food security in that category in the short term. The positive signs additionally explain educated households were likely to move to a category where food insecurity is preventable while a negative symbol denotes a less educated household shall be in the severe food insecurity category due to less income and limited knowledge on food diversity. A study by Alemayehu and Tesfaye (2024) about food determinants and coping strategies using logistic regression affirms the results as they found an increase in education level by 1 year in households reduces the risk of being food insecure. The positive signs on credit access infers that access to capital stimulates food security state while a negative symbol reveal no shift to a better household food insecurity access category at $p < 0.05$ which is not statistically significant however, it deduces an insignificant improvement in a household chances of improving food security in 3,2,1 and does not hold for households in category 4. The positive sign indicates

that credit helps to solve food security in the short term for households but worsens over time due to over-reliance while the negative sign showed no response in improved food security which implies other factors affected it such as ineffective use of such credit. Adeyanju *et al.* (2023) in their study across Kenya, Uganda and Nigeria found a negative result contrary to this study while a study by Alemayehu and Tesfaye (2024) about food determinants and coping strategies affirms the results as they found that access to credit increases food security by 1.493.

Positive capital sourcing supposes that a household with access to additional capital shifts to a better household food security access category at $p < 0.001$ for 1 and 2 and $p < 0.01$ for 3 while negative presumes no change on the household even with additional capitation at $p < 0.001$ which is statistically significant and shows a major improvement in a household chances of improving food security in all categories except category 4. Further, the positive signs advance that when a household receives capital sourcing their food security state increases due to improved purchasing power while the negative signs reveals that for such households there is no shift upwards or downwards and only tends to manage severity of insecurity and the outcome is similar to Enilolobo *et al.* (2022) who found positive correlation on capital injection by banks on food security.

Negative sugarcane signs mean that such households are affected by its production and shift to a severe household food insecurity access category at $p < 0.001$ for 1 and 2 and $p < 0.01$ for 3 while the positive denotes no change in household state at $p < 0.001$ which is statistically significant and shows a major decrement in a household chances of improving food security except for households on category 4. The negative signs indicate that majority of households who engaged in sugarcane production experienced incidences of food insecurity while the positive sign indicates that for such households who produced sugarcane got access to improved food security. Negative tobacco signs designate such households are affected by its production and a shift to severe household food insecurity access category is noted at $p < 0.001$ for 1 and 2 and $p < 0.05$ for 3 while the positive depicts no change at $p < 0.001$ which is statistically significant and reveals a major decrement in a household chances of improving food security for 1 and 2 while only minor changes noted on category 3 hence its insignificance to the findings and lastly, for category 4, the p -value is significant and such households have a marked food security improvement. The negative signs mean that majority of households who engaged in tobacco growing experienced incidences of food insecurity while the positive sign stipulates that for such households who produced tobacco got access to improved food security. This study aligns with Hashmiu *et al.* (2024) who found out that farmers who only produced one cash crop without diversifying experienced high rates of food insecurity at 48% in the area of Forest Savannah in Ghana.

4 Discussions

The findings reveal that location factors such as diverse foods, soil quality and market access play crucial roles in reducing food insecurity and this is important to note because targeted interventions to improve Kuria East can be aimed at infrastructure to have a wider market access and also improve agricultural methods which imply more resource allocation as pointed out by Rashid *et al.* (2024) that location can hamper food security state if households are in more remote areas with limited access to

resources and those who entirely rely on agriculture for their livelihood. Households with older people tend to have stable income as a result of pension payments for those that are retired and monthly government payouts to old people dubbed Inua Jamii funds hence they are economically stable however, due to health related issues some older households had unstable food supply due to such conditions. On the contrary, younger household with young children were vulnerable due to increased dependency and diverse nutritional needs of such young children; the study conforms with Alemayehu and Tesfaye (2024) findings that age increase affects food security negatively and Rashid *et al.* (2024) who articulates in their study in Tanzania that as the age reaches 55, productivity reduces and therefore such households experience food insecurity.

Households headed by males are vulnerable to food security as most have no stable income due to irregular employment in the ever changing job landscape. Additionally, they do not get government aid to mitigate their food status and incase of additional responsibilities due to increase in household size, such households hardly become food secure in the long run and vice versa. Furthermore, certain households had more pronounced problems stemming from health issues and economic inequalities such that whether household head is male or female does not influence food security positively; findings are similar to Urmi *et al.* (2024) and Bahiru *et al.* (2023) with similar conclusions. The study showed that marriage had a mixed state in households wherein most household pooled their resources and reduced instances of food insecurity as well as having other coping strategies as ascertained by Naz *et al.* (2023) however, other households were affected by unique circumstances such as illnesses and loss of income hampered food security. Large households have more internal support and benefit from economies of scale by purchasing food items in bulk thus are likely to be food secure. It is also important to note household size on its own does not determine food security, income plays a key role together with other factors such as labor resources; the findings however, differ with Urmi *et al.* (2024) study who found out family size increase causes food insecurity but conforms with Rashid *et al.* study (2024) in Tanzania which disclosed that as more members of the household work and earn income more resources are availed thus purchasing power increases. It was expected that households who joined a social group had access to subsidized fertilizers, seeds and farm equipment at lower costs which increase productivity hence decreasing instances of food insecurity. Moreover, it is assumed that there is an increase in transfer of information during various trainings hosted by them as well as increasing market accessibility and in return helps such households have stable crop prices hence reducing on risk of losses to such households as confirmed by Rashid *et al.* study in (2024) which showed food security levels increased for such households by 16.3%. However, for other households who joined social groups and experienced food security, it was attributed to group dependency dynamics in terms of resource distribution and skewed benefit distribution from such groups as revealed by Bahiru *et al.* (2023) with similar findings.

Extension officers offer valuable information to farming households in regards to pest control, better crop varieties, innovative irrigation methods and this leads to better crop yields which increase food security. Moreover, they act as a source of information to households by detailing price and market trends of crops and educating on any new technologies that can be adopted to ease access to such information however, for this study their recommendations had a cost impact that negatively affected food security in most

households but Naz *et al.* (2023), Adeyanju *et al.* (2023) and Sarmin *et al.* (2024) contradicts this finding in their studies. Households that relied on fertilizer and purchased as recommended had an increase in crop yield and this results in surplus food production which can be consumed by the households or sold to earn income, such income can also be used to purchase other food items as required within the household hence improving food security and this was augmented by findings of Awoke *et al.* (2023).

Households with large land sizes were food secure and the assumption is such households have high income moreover, it means with large land sizes and high income, households mechanize their farms and hence improve agricultural production leading to surplus yields which are either consumed or sold and income used to purchase food items: the study is in line with Lolaso *et al.* (2024) and Alemayehu and Tesfaye (2024). This study also showed that with increased seasonal income from side economic activities households food security improved due to improved purchasing power while other households directed such income to food items, other households spent it on health and education. Market access by good roads also made it easy for some households to benefit from such increased income by accessing quality foods in the market: the findings are ascertained by Lolaso *et al.* (2024) who got similar results as well as Urmi *et al.* (2024) with same findings. Education is associated mostly with high incomes and for household heads with higher levels their purchasing power increased as well as knowledge of nutritious foods and moreover, they had access to more opportunities and social networks that come to the fore during harsh economic times notwithstanding the ability and skills that help them deal with unexpected shocks in the food system. Rashid *et al.* (2024) and Sarmin *et al.* (2024) confirm that such households are knowledgeable about nutritious foods and avoid convenience cooking hence maintaining high levels of food security.

Credit access acts to boost households when income stream fluctuates thus enabling them to maintain stable consumption levels reducing food insecurity severity moreover, it maintains food expenditures of such households on quality and quantity as required. However, the type of credit herein also matters as to whether households will suffer from debt burden. Credit access from banks have better reasoned interests' rates than credit from shylocks or other informal institutions, therefore, households who accessed informal credits suffered severe food insecurity in the medium term and this also depended on how such credit are used, either by way of investing in farm inputs or immediate consumption as alluded by Adeyanju *et al.* (2023). Capital sourcing adds to household income thus acted to improve on purchasing power hence consumption improved ensuring food security status for most household nevertheless, other households had no change even after sourcing out capital. This was attributed to unstable sources of income to such households or health and education related issues that shifts priority of decision to non-food items confirmed by findings by Enilolobo *et al.* (2022) who found positive correlation on capital injection by banks on food security.

Sugarcane requires land as a factor of production and mostly paid labor which essentially implies more resources from producing households and are diverted hence food insecurity is experienced in the medium term. Inasmuch, some households end up facing food insecurity in the long term due to price fluctuations associated with market risks of the commodity leading to losses thus decreased purchasing power from such households however, for certain households' income generated from its production increased access to food security. Tobacco farming for households should generate income which is then used amongst

others in purchases of quantity and quality foods for consumption, however, in this study the income was not sufficient for most farmers. It is additionally affected by competing resource allocation for its production which includes land (which degrades overtime) and labor with their effect felt on reduced subsistence food production which further affect nutritional aspect of the said households leading to food insecurity thus the findings align with Hasmiu *et al.* (2024) who while studying food-cash crop diversification in Ghana found out that cocoa cash crop production as an enterprise affected food security up to 48%.

5 Conclusion

This study finding reveal that Migori food insecurity issue is affected by the demand side factors and after in-depth inferential analysis the results show that food secure households (1) are 18.52%, mildly insecure households (2) 9.26%, moderately insecure households (3) 33.33% and (4) severely insecure households 38.89% and this outcome affirms by the closest of margins the chronic nature of food insecurity at 34% by the government hence the need for practical and working solutions through research. The applied approach HFIAS and thereafter marginal estimates provided a robust view of households' food security state per prevalence making it possible to be applied again in real world situations and finally offered recommendations that cut across various households and their levels of food status. There is need for the county government to have a functional cereals and produce board that allows purchases of food products in bulk as well as establish a milk plant in the form of a corporative society to serve the same purpose of economies of scale and follow up with educational programs on nutrition and budgeting to households through various stakeholders like county and private hospitals and community based organizations. There is also need for the county government to diversify sources of income away from the traditional agriculture by providing vocational training such as masonry and welding as well encourage small business enterprises by lowering start up taxes with the help of other stakeholders such as the national government and any other non-profit organizations within or outside the county government. There is further need for microfinance corporations to promote financial inclusion and literacy by providing financial education and trainings through the available agricultural finance corporation and select banks that offer farming loans to farmers. There is also need for the national government to provide cash crop insurance and fixed contracts to prevent risks associated with price fluctuations as well as invest in innovative biotechnology research through formulation of policies to aid in ensuring capacity building through its stakeholders such as the national research institutes and other donor agencies.

6 Declarations

6.1 Competing Interests

There is no conflict of interest to declare.

6.2 Publisher's Note

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How to Cite this Article:

Anino, E. O., Ngeno, V., & Serem, A. (2024). Determinants of Food Security in Tobacco and Sugarcane Production Zones, Migori County, Kenya. *Advanced Journal of Social Science*, 13(1), 59–70. <https://doi.org/10.21467/ajss.13.1.59-70>

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