

Examination of Socio-Economic Determinants of Household Food Insecurity in Juba Valley Region, Somalia

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ABSTRACT

Despite much evidence showing that Somalia used to be food sufficient in the 1960s and 1970s, and there is every indication that it has the potential to be food secure, 70% of its households remain hungry in the 21st century. Studies on the subject have attributed this to decades of severe climate shocks and political instability. However, the underlying causes of food insecurity among households in Somalia are an under-researched topic. Thus, the broader objective of this study was to examine socio-economic determinants of household food insecurity in Juba Valley Region of Southern Somalia once regarded as the breadbasket of the country. Further, the influence of family structure and income dynamics of the households on food insecurity was investigated. The study employed interviews among households, key informant interviews, Focus Group Discussions, literature review as well as direct field observation methods to collect data. Determinants of Socio-economic food insecurity in the area were analyzed using mixed regression methods. The gender of household head, age, and marital status (p-value < 0.05) contributed as the key to determine household structure variables. The study found that credit acquisition for food, main source of food, and seed shortage were significant variables (p-value < 0.05). The study concludes that the main socioeconomic factors that influence food insecurity among households are the gender of the household head, age, marital status, and households' weak income base. Despite their importance, factors such as occupation, household size, and number of dependents, land size, river access, irrigation and seed type were not really significant according to the fitted model.

Key Words: Food security; Food insecurity; Food Sufficient, Household Food security, Socio-Economic Determinants, Household Food Insecurity

Introduction

Despite much evidence supporting the fact that Somalia used to be food sufficient in the 1960s and 1970s, and that there is every indication that it has the potential to be food secure, 70% of its vulnerable households remain hungry, surprisingly, in the 21st century. Paradoxically, the largest food-insecure households are the residents of the Juba Valley Region, an area generally regarded to be the bread basket region of Somalia. This is happening in the presence of irrigation water sources, rain-fed farming lands, large numbers of live animals available for export and multi-sector intervention programs by the humanitarian community. Both chronic and transitory issues of household food insecurity remain severe. Households facing chronic food insecurity do not have secure livelihoods to cover their basic needs. Such households are vulnerable to shocks that affect food stability as they lack robust coping mechanisms in the face of adversities, leading to severe hunger and acute malnutrition.

Statement of the Problem

The study was conducted in Juba Valley Region (JVR) in Southern Somalia between January and April, 2015. The region consists of three provinces: Lower Juba, Middle Juba and Gedo, with a population of about 1.3 million (UNDP Somalia, 1997). Its name 'Juba' is derived from the Juba River, which runs through all the three administrative provinces. The region's topography is composed of plains, coastal and semi-desert. The population is classified under five main categories: pastoralists, agro-pastoralists, agriculturalists, fishing community and urban sedentary. The JVR is known to have vast natural resources which contain the best agricultural land in the country, excellent grazing land, vast unexplored ocean resources, unexplored deposit of minerals and two main rivers - *Juba* and *Dawa*. It is also widely believed, though not yet substantiated that the area is rich in natural gas and oil. The fertile agricultural lands in the region are either rain-fed or irrigated. Despite these attributes, JVR is food insecure and its people remain perpetually hungry.

Significance of the Study

The study area was chosen because it has been the bread basket of Somalia through both irrigated and rain-fed agriculture. It is also as a hub of Somalia's cattle production, which were the backbone of the Somali economy. It should be noted that 70% of the country's population derive its livelihood from agriculture and related activities. Livestock as a sector has been the major dominant of the Somali economy with job opportunities creation of about 60% and generating about 40% of the country's GDP, besides 80% of foreign currency earning¹. Both sectors play a crucial role in ensuring food security, job creation, income generation and foreign exchange earnings. Moreover, JVR is where all major production factories and water dams for power generation, irrigation and water conservation, capable of supplying the whole Somalia are based.

¹ These are pre-war figures

For a country that once fed itself becoming a net recipient of food aid is very disturbing. According to the FSNAU Report (2013), agriculture, which has been the main economic activity in Somalia not only in meeting the food needs but also generating income to rural livelihoods, to be in a state of neglect and underdevelopment, is disturbing. This situation has widely been attributed to the prolonged civil strife, which seems to have exacerbated the food insecurity situation (Watts and Bohle, 1993). It is suggested that among the proximate causes are fluctuations of seasons which affects directly the access to key foods, limited diversity of diet, poor practices of early feeding of children and very limited contact for young children and women of reproductive age with health services (FSAU, 2004a). The vulnerability of households has increased considerably as the household asset base has become depleted, a fact the study confirmed. Allen and Thomas (2000) argue that in the 1960s and 1970s, the country was self-sufficient in grain and livestock production for both exportation and domestic consumption. However, during the thirty years, rapid rising food deficit have been experienced. While per capita food consumption has been reflected to increase rapidly, the country has on the other hand experienced a decline in regard to per capita food production. This equation has forced the country to over-rely on imported food as well as food aid. Observably, civil strife and harsh weather conditions being factors attributing to household food insecurity, socio-economic factors are perhaps the most crucial determinants, and hence, the most urgent to address especially at the micro- economic level. An analysis of the impact of economic activities and social processes as key determinants to household food security become a key variable to this study.

In the absence of adequate physical, economic or social access to food, people will experience existence of food insecurity (Clay, 2002). Existence of food security is manifested when all people acquire the ability to access sufficient, safe, and nutritious food at all times thus, leading to maintenance of a life that may be classified as healthy and active (FAO, 1996b). Although the humanitarian describes Somalia's food situation as a complex emergency from time to time, much of the existing literature suggests that the country's food security is dependent on financial aid. For instance, between 1980 and 1989, the country had received \$1 billion from the government of Italy as bilateral economic aid to fund 114 projects (Ali, 2011). A close examination of the food security situation in Somalia, whether locally generated or externally provided, reveals little evidence of improved universal supply and availability of food in the country.

The study sought to identify and quantify the magnitude of the effect of factors related to socio-economic that contributed to household food insecurity in JRV, Southern Somalia. Particularly, the study focused on household structure and income and the dynamics surrounding the two towards food insecurity. These two broad factors are ideally the most immediate socio-economic determinants of a household's food insecurity. They are likely to vary from one household to another, whereas the intervening variables can be looked at as general conditions facing all households in the study area. Other variables that may influence or play a significant role in determining household food insecurity among them political, environmental and climatic factors were treated as intervening and were not discussed in depth in this study. Literature reviewed

indicated that underlying causes of household food insecurity in JRV were under-researched. The few studies that have been done drew a general problem tree which does not have specific coverage of the JRV; yet the region had produced much of Somali's food in the past. A study of the causes that forms the basis of food insecurity in households was therefore critical as the outcome provides result-based evidence to food security programs in Somalia.

Materials and Methods

This study combined both quantitative and qualitative approaches that included 360 household surveys, Key Informant interviews, Focus Group Discussions, Review of related literature and Observation check lists as data collection methods. The study used a mixed research design: causal and/or correlational in nature especially in the determination of the factors that contributed to household food insecurity. The study was also exploratory to some extent since there is currently limited scholarly literature on Somalia's food security. Partly the study was also historical in nature especially in verifying the assumptions of Somalia geo-politics on food insecurity.

The socioeconomic determinants of food insecurity in households were identified using regression analysis procedure, having investigated and identified the outcome variables and the corresponding appropriate predictor (explanatory) variables. Thus, the three binary variables of the Household Food Insecurity Access Scale (HFIA) domains were each regressed against socioeconomic ones to investigate the most influencing of the multiple predictors. Logistic regression analysis was utilized to determine how factors that are socioeconomic in nature contributed to insecurity of food in the area of study. Logistic regression uses transformation logarithms on the variable that are the outcome and which allows the modelling of a nonlinear association in the context of a linear way. In other words, it expresses the linear regression equation in logarithmic terms. Households were the main unit of analysis. Finally, to ensure that there was adequate abstraction of local perspectives on food insecurity, triangulation was used during data collection.

Logistic Regression Analysis

Given that each of the three outcome variables of the HFIA-related Domains are dichotomous (i.e. whether a household falls into that specific food insecurity category or not), the study adopted the survey logistic regression in STATA software to arrive at the household socio economic determinants of food insecurity. Moreover, the main interest of this study was not on the associations in the outcome variables, but rather on individual effects of each explanatory/independent socio economic variable to the respective HFIA-related Domains i.e. Anxiety and Uncertainty, Quality that is not sufficient, Food intake that is not sufficient and its Physical Consequences. The survey logistic regression approach was chosen to determine the socio economic factors leading to insufficient food security in the study area. Several studies have used the survey logistic regression model as the customary approach to analyze the relationship between the binary dependent variable and a set of explanatory variables (Greenlund et al., 2004; Kim and Beckles, 2004).

Logistic regression was used to model response variables that have a binomial distribution.

$p = y/n$ (1) Where **y** is number of successes out of **n** independent ‘trials’. The study modeled the probability of an event that occurs as a function of predictor variables. The aim was to analyse the relationship:

Data = pattern + residual (2) However, instead of analysing p , as for a continuous variable, we analysed logit (p) = $\log_e (p/1-p)$ (3) logit (p) is the link function.

The logit(p) link function was one way of guaranteeing that the predicted values will be between 0 and 1. The logits of the unknown binomial probabilities were modelled as a linear function of the predictor variables.

$$\text{logit}(p) = \ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_kx_k \dots\dots\dots(4)$$

$$\text{Logit}(p) = \log_e (p/1-p) = \beta_0 + \beta_1X_1 + \dots\dots\dots + \beta_nX_n \dots\dots\dots(5)$$

Where:

p = probability that the event occurs i.e. success

1-p = probability that event does not occur i.e. failure

p/1-p = odds of success e.g chance of household being food insecure (success) to household not being food insecure (failure).

The odds of success can be estimated from the data as:

$$\mathbf{y/(n-y)} \dots\dots\dots(6)$$

The logit ‘transformation’ of p is the natural log of this odds:

$$\mathbf{\log_e(p/1-p)} \dots\dots\dots(7)$$

While a probability always ranges from 0 to 1, an odds ranges from 0 to infinity.

A relative measure of the odds of success in one data set relative to that in the other one in a comparison of two sets of binary data is the odds ratio (ψ)

If p_1 and p_2 are probabilities of success in two sets of data, then the ratio of the odds of a success in one set relative to the other is:

$$\psi = \frac{p_1/1-p_1}{p_2/1-p_2} \dots\dots\dots(8)$$

ψ is equal to one in the event the odds of success in two data sets are identical

In the values of $\psi < 1$, the first set of data has the odds of a success less than in the second,

Values of $\psi > 1$ suggest the first set of data being greater than the second one in the odds of success.

A measure of the difference between two probabilities of success which can take any value that is positive is the odds ratio while on other hand the range $(-1, 1)$ is restricted to the difference between two probabilities of success $(p_1 - p_2)$.

The estimated probability for the logistic model is:

$$p = \frac{\exp(\beta_0 + \beta_1 x_1 + \dots)}{1 + \exp(\beta_0 + \beta_1 x_1 + \dots)} \dots \dots \dots (9)$$

To fit the model to the data the unknown parameters $\beta_0, \beta_1, \dots, \beta_n$ have to be estimated by the use of the Maximum likelihood method.

The likelihood function is given by:

$$L(\beta) = \prod_{i=1}^n \binom{n_i}{y_i} p_i^{y_i} (1 - p_i)^{n_i - y_i} \dots \dots \dots (10)$$

Model Specification

In this study, the survey logistic regression model was adopted for the regression analysis in STATA statistical software. All continuous predictor variables were transformed to categorical variables in the analysis for purposes of interpretation of the estimation of the conditional probabilities i.e. odds ratios. The model used is therefore specified as below:

$$\log \left(\frac{\hat{\pi}}{(1 - \hat{\pi})} \right) = \beta_0 + \beta_1 x_1 + \dots + \beta_p x_p$$

$$Y \sim \text{Binomial}(\hat{\pi}) \dots \dots \dots (11)$$

Where:

$\hat{\pi}$ = Predicted probability that $Y = 1$, given the values of $X_1 \dots X_p$.

Y_1 = Anxiety and Uncertainty (0 = No 1= Yes)

Y_2 = Insufficient Quality (0=No, 1=Yes)

Y_3 = Insufficient Food Intake (0=No, 1=Yes)

X_1 = Sex of HH head (0 = Male, 1 = Female)

X_2 = Age group of HH head (0 = below 60 years, 1= over 60 years)

X_3 = Marital Status of HH head (0 = Married, 1= Single)

X_4 = Occupation of HH head (0 =Agro pastoralist/pastoralist, 1= Farmer)

X_5 = Disability condition of HH head (0 = Healthy, 1= Disable person)

X_6 = HH size (0 = less or equal to 6 members, 1= more than 6 members)

- X₇= Dependents (0 = less or equal to 3 members, 1 = greater than 3 members)
- X₈= Actual and potential income (0 = above \$3000 , 1 = below or equal to \$3000)
- X₉= Active labor proportion (0 = greater or equal to 50%, 1 = below 50%)
- X₁₀= Land owned (0 = greater or equal to 5 acres, 1= less than 5 acres)
- X₁₁= Main food source (0 = from farm, 1= from market)
- X₁₂= Incurred debt for food (0= no debt, 1= indebted)
- X₁₃= River distance from household location (0= less or equal to 1km, 1= more than 1km)
- X₁₄= Farm irrigation (0= irrigated, 1= unirrigated)
- X₁₅= Seed type (0= used improved seed lastest season, 1= used local seed last season)
- X₁₆= Seed shortage last planting season

Findings, Interpretation and Discussion

Socio -Economic Determinants of Household Food Insecurity

The analytical inquiries into the socio-economic determinants as regards food insecurity in the study area were broadly conceptualized into two broad clusters as illustrated in the conceptual model namely: household structure and income. The outcome variable (food insecurity) chosen for the regression analysis is the household food insecurity access-related domain variables. Each indicator level of the HFIA-domains was independently regressed against the hypothesized socio-economic determinants. Model diagnostics were conducted to assess any specification error and check the appropriateness of using multiple tests. All the models were found to be appropriate and therefore their findings presented in Table 1 below. Findings have been discussed into two broad themes: Household Structure and Income.

Table: Socio Economic Determinants of Food Insecurity in JRV

Categorical Variable	Anxiety & Uncertainty			Insufficient Quality			Insufficient Food Intake		
	Odds ratio	95% Conf. int.		Odds ratio	95% Conf. int.		Odds ratio	95% Conf. int.	
Gender	3.52***	1.51	8.17	3.57**	1.34	9.47	3.55**	1.31	9.59
Age	0.16***	0.07	0.38	0.17***	0.07	0.40	0.12***	0.05	0.31
Marital status	0.48*	0.21	1.14	0.37**	0.14	0.96	0.54	0.20	1.45
Occupation	0.85	0.36	1.97	1.19	0.46	3.08	0.82	0.30	2.22
Disability condition	2.82	0.76	10.42	3.25	0.69	15.40	7.40*	0.90	60.77
Household size	0.78	0.31	1.97	0.75	0.23	2.43	0.59	0.18	1.93
Dependents	0.98	0.39	2.48	1.45	0.44	4.75	1.55	0.46	5.20
Income	1.22	0.48	3.13	1.23	0.43	3.51	1.26	0.43	3.69
Labor	0.75	0.33	1.70	1.08	0.45	2.61	0.86	0.35	2.11
Land size	0.76	0.30	1.94	0.97	0.35	2.68	0.88	0.31	2.48
Food source	0.40**	0.16	0.99	0.50	0.17	1.49	1.09	0.33	3.58
Debt for food	3.94***	1.92	8.06	3.85***	1.73	8.54	3.76***	1.66	8.53

River access (km)	1.20	0.47	3.05	1.14	0.41	3.17	0.91	0.32	2.55
Irrigation	0.71	0.30	1.67	1.01	0.38	2.67	1.01	0.38	2.72
Seed type	1.05	0.29	3.85	1.00	NA		1.00	NA	
Seed shortage	11.75***	2.24	61.67	1.00	NA		1.00	NA	
Model summary:									
Log likelihood	-119.18			-92.62			-89.18		
LR Chi-square	(16) 105.43			(14) 70.87			(14) 72.29		
Prob > Chi-square.	0.00***			0.00***			0.00***		
Pseudo R ²	0.31			0.27			0.29		
Diagnostic tests:									
Linktest:									
_hat (p-value)	0.00***			0.00***			0.00***		
_hat sq. (p-value)	0.30			1.39			0.31		
Hosmer-Lemeshow									
Chi-sq. (8)	3.68			4.76			8.22		
Prob > Chi-sq.	0.89			0.78			0.41		
Fitstat:									
AIC	0.78			0.87			0.85		
BIC	-1698.70			-1107.7			-1114.6		
Count R ²	0.85			0.84			0.85		

*** ($\alpha = 1\%$) ** ($\alpha = 5\%$) * ($\alpha = 10\%$)

Household Structure and its Influence on Food Insecurity

a. Anxiety and Uncertainty

The first binary outcome – anxiety and uncertainty domain – regressed against the hypothesized household structure variables estimated the following conditional probabilities as shown in Table 1 above. The odds ratio for gender of household head is 3.5, indicating that the probability of a female headed household to fall into the food insecure domain category one is 3.5 times more likely compared to that headed by a male. This odd ratio was significant at (p-value < 0.001) level. The odds ratio for the age of household head was 0.16 suggesting that the chances of an elderly-headed household to become anxious and uncertain about food are 0.2 times slimmer compared to a household headed by the other group (below 60 years). This conditional probability was significant at 1% critical level (p-value < 0.001). This could be attributed to agricultural experience and resource endowments of the elderly household heads. They also have grown-up children who would probably add their share of food to the household, possible explanations for the disparity between the two groups; a finding seemingly deviating from the theoretical expectation. Although the study did not identify the exact explanation behind this, one can speculate that it could be influenced by low household size or resource distributional advantage of such households which would probably find it easy to cope with household's food demands. However, the odds ratio was significant only at 10% critical level (p-value < 0.1).

The odds ratio for occupation was 0.85. This means that households that are engaged in farming as their main economic activity are only 0.85 times likely to fall into food insecurity bracket over those that are either agro- or purely pastoralists. However, this conditional probability was not significant (p-value > 0.05). The model estimated a conditional probability of 2.8 for household head's disability status suggesting that such are 2.8 times likely to become food insecure compared to their counter parts. Despite this finding, the odds ratio was not as significant (p-value > 0.05).

The odds ratio for household size was 0.78 implying that those with more members² are less likely to fall into food insecurity than their pairs. This could be attributed to the fact that the additional household member in an agricultural family means an extra hand for producing extra food, not forgetting the law of diminishing returns. Despite this fact, the conditional probability estimate was not significant in the model (p-value > 0.05).

Finally, the odds ratio for the number of children under 18 years was estimated to be 0.98. This suggests the odds of a household which is food insecure at 0.98 times (for households with more than half the average household size) compared to those with fewer children. This difference however turned out not to be significant according to the model (p-value > 0.05).

Therefore, in terms of anxiety and uncertainty about food to eat due to lack of resources, the most influencing factors of the household structure are the gender and age of households' head (p-value < 0.05), whereas factors such as marital status, occupation, disability, household size and number of children are not very significant variables in terms of households' state of anxiety and uncertainty about food (p-value > 0.05).

b. Insufficient Quality

The second binary outcome – insufficient quality – regressed against the hypothesized household structure variables estimated the following conditional probabilities as seen in Table 1 above. The odds ratio for household head's gender amounted to 3.6. Similarly, like in the first domain, households headed by female are 3.6 times more likely to become food insecure than their male counterparts. The estimate was significant (p-value < 0.001).

On the other hand, the odds ratio for age category was 0.17, and was significant (p-value < 0.001). This indicates that the odds of finding a household headed by an elderly person and is food insecure are very minimal compared to those who are 59 or less. Although this may also be a striking surprise given the age bracket, it does make sense because the mature adults have experience in growing food over years and have mastered how to preserve it for survival when it's scarce.³

² The current average Somali household size is 6.

³ The field work for this study was done during such a time.

The odds ratio for marital status was 0.37 (p-value < 0.001). This implies that the single household heads are better off than their married counterparts when it comes to experiencing difficulties of food insecurity. Like discussed earlier, these heads may have less worries about food possibly because their smaller family sizes mean they have fewer mouths to feed, or they have a sufficient resource- base to cater for food for the better part of the month.

Compared to the rest of the variables, factors such as household head's occupation, disability status, household size and number of children below 18 years were found to be insignificant in explaining household variations in terms of food insecurity (p-value < 0.05). The key determining variables, therefore, attributable to household food insecurity measured as insufficient quality are gender and age of the household head.

c. Insufficient Quantity and its Physical Consequences

The third binary outcome – insufficient quality – regressed against the hypothesized household structure variables estimated the following conditional probabilities as shown in Table 1 above. Almost synonymous with the previous findings of the first two categories of HFIA domain, the study identified that the odds ratio for gender is 3.55 (p-value < 0.001) and that of age is 0.12 (p-value < 0.001). These findings further imply that households headed by female are more likely to suffer food insecurity as compared to male headed families. Similarly, elderly headed household heads are much safer.

Based on the classification of the households according to category 3 of the HFIA domain, another significant variable, but at a higher critical level, was the disability condition, with an odds ratio of 7.4 (p-value < 0.1). However, the reported conditional probability was widely varied given the 95% confidence limits. These findings tally with the theoretical expectation that households headed by disabled persons ought to be more vulnerable to food insecurity. Based on this fitted model, the study noted that despite their importance, factors such as occupation, household size and number of dependents, are not very significant in influencing household food insecurity.

Effects of Income on Household Food Insecurity

a. Anxiety and Uncertainty

Income and its effects on household food insecurity were examined against the dependent variable (anxiety and uncertainty). Income, as an economic factor, is one of the most hypothesized variables influencing food insecurity among households. In this study, it was however found not to be a significant factor (p-value > 0.05) in determining household food insecurity (Table 1). With an estimated odds ratio of 1.2, households whose income are below or equal to \$3000 (including worth of disposable assets such as land and animals) are 1.2 times more likely to worry and get anxious about food than those with higher income levels. Since the actual income levels of these households is extremely low (average = \$ 22 with a standard deviation = 36.17), and the fact that fixed assets

such as land are also not easily liquidated for food purposes, the difference between the two odd ratios was not significant despite the income brackets assigned to these two groups.

Aware that income is derivative of multiple macro-economic and micro-economic factors, some of the confounding micro-economic factors beyond household structure were investigated for their influence on food insecurity. These included; household head's occupation, labour proportion, land size for production, main food source, credit access for food, and location of river radius from the household, irrigation, seed variety used in previous season and seed sufficiency at the time of planting.

The conditional probability of labour force was 0.75, indicating that the odds of a household with lesser number of working adults (< 50% of average HH size) (either employed on-farm or elsewhere) are 0.75 times likely compared to households with more working adults. This finding contradicts the theoretical expectation. However, possible explanations would be that since food production in the study area is constrained by many factors other than labour availability, and that labour employment opportunities are rarely available given the ill-fated socio-economic status of most households, the effect of surplus labour is not realized in terms of household food insecurity. Having more adults in the household therefore, means more mouths to feed, yet there is inefficient use of this available production factor, *ceteris paribus*. However, despite this observation, the reported odds ratio (0.75) is insignificant (p-value > 0.05).

The odds ratio for land owned by the household is 0.76 and implies that the chances of a household with less than 5 acres of land are likely to fall into food insecurity. This outcome contradicts the theoretical expectation. The reason for this situation could possibly be because the farmers and agro-pastoralists are not making full use of the available land resources efficiently. If they were, then the reverse side of the odds ratio could be estimated. However, despite this finding, the conditional probability was not significant (p-value > 0.05).

The model estimate of the odds ratio for household main source of food is 0.4 and was found to be significant (p-value < 0.05). This implies that households whose main source of food is the market are only 0.4 times likely to get trapped into insecurity compared to those who rely entirely on own farm produce. Considering the situation in Somalia and especially in this study area, this finding demonstrates that farming is currently practiced on minimal subsistence scale, due to the risks amidst which these households live, and the limitations faced. Consequently, households that have the money to purchase food are much more food secure compared to those that lack the necessary income and purely rely on food from their own farms.

The odds ratio for food credit is 3.9 and estimated to be significant by the model (p-value < 0.001); implying that the chances of a household falling into food insecurity are almost 4 times more likely for those who accessed credit for food than their peers. The explanation for this is simple and

straight forward. It reflects the poor socio-economic status of these households, which are unable to cope with food needs leading them to access credit as a result. Most definitely, this group becomes more vulnerable to food insecurity than their counterparts. It may also be a bit confusing to fully gauge the situation in terms of the above scenario as to whether those who did not access credit could not do so as a result of not having the opportunity or they were actually able to cope with the food demands. This argument is raised in light of the fact that these households generally lacked the necessary resources to provide for food needs.

The conditional probability for access to a river (distance in km) is 1.2, but it was found to be insignificant according to the model (p -value > 0.05). Those who are located more than 1 kilometre from the river are 1.2 times more likely to experience food insecurity than those closer. This finding collaborates the theoretical expectation. It is believed that those closest to the river have reliable access to such natural resources such as fish, and/or farm on its banks thereby managing drought effects. Consequently, households close to the river are more advantaged.

The odds ratio estimate for irrigation was 0.7, and was found to be insignificant in influencing food insecurity (p -value > 0.05). It was found that the chances of a household falling into food insecurity are 0.7 times more likely compared to those using irrigation in food production. It is rather interesting to see such an observation as it contravenes theoretical expectation. However, this could have happened because of random chance as there was really no empirical justification for this reported observation at the time of study.

The conditional probability for seed variety used in past season was 1.05, and was not significant (p -value > 0.05). In other words, the odds ratio estimate suggests that the chances of those using local seed varieties are slightly higher (1.05 times) in terms of facing food insecurity than those using improved ones. This finding tallies with theoretical expectation as improved seeds yield much better and can withstand stress conditions (such as drought, diseases) a lot more than local varieties. Households using improved seed varieties are more likely to remain food secure because they register better yields.

Lastly, the odds ratio for seed shortage was found to be 11.8. This indicated that chances to find a household food insecure when they lacked seed during the past planting season are 11.5 times higher than those who accessed. This also agrees with the theoretical expectations because those who were able to plant all their allotted plots harvested according to what they needed. Their counterparts were constrained by seed shortage. However, despite the high odds ratio reported, the estimate was not significant in the model (p -value > 0.05).

b. Insufficient Quality

The second binary outcome – insufficient quality – when regressed against income and confounding variables that surround it and food production in general, yielded the following results, as shown in

Table 1. Similar to the HFIA Domain 1 finding, the odds ratio for income was estimated at 1.2, and found to be insignificant by the model (p -value > 0.05). The interpretation would similarly hold that those with lesser amounts of income have slightly higher chances of falling into food insecurity than their counterparts. In evaluating the confounding factors, it was found that the odds ratio for credit accessibility for food was 3.9 with a significant p -value (< 0.001). This highlights the fact that households that are economically poor and access credit for food have higher chances of low quality, not preferred or monotony as a result of constrained resources for purchasing quality foods.

However, the analysis revealed that the following confounding variables contributed but their effect was insignificant (p -value > 0.05) in explaining household food insecurity in the study area namely: labour ratio, land size, main food source, and distance to the river and access to irrigation. On the other hand, variables such as seed type and seed shortage were found to have exactly a conditional probability of 1; meaning that the odds of finding a food insecure household in one group is exactly the same for the other pair.

c. Insufficient quantity and its physical consequences

The third binary outcome – insufficient quantity and its physical consequences – when regressed against income and confounding variables, showed the following results, as seen in Table 1. The odds ratio for income turned out to be 1.26 but insignificant according to the model (p -value > 0.005). The implication is still that poorer households have a higher likelihood (1.26 times) of falling into food insecurity. With constrained resource capabilities, they suffer more consequences of hunger than those that are a little wealthier. Among the confounding factors, the only variable that turned out to be significant in explaining household food insecurity was credit acquisition, with an odds ratio of 3.76 (p -value < 0.001). A similar justification would be raised based on this finding. Households that lacked resources but were made to acquire credit for food are 3.8 times more prone to food insecurity than their colleagues. This clearly explains the finding on income despite the fact that it was insignificant.

Conclusions

This study examined socio-economic determinants of household food insecurity in the JVR of Somalia focusing on effects of household structure and income on food insecurity. It was found that gender of the household head; age and marital status were significant (p -value < 0.05). Income as a standalone variable was not significant in influencing household food insecurity (p -value > 0.05), but its confounding variables such as households' main source of food, credit acquisition and seed shortage were significant (p -value < 0.05) in influencing household food insecurity. The study concludes that the main socio-economic factors influencing household food insecurity were household head's gender, age, marital status, households' main source of food, disability condition and weak income as manifested through its derivative – credit for food – as well as seed shortages experienced at the time of planting. Income, as an economic factor, is one of the most hypothesized variables influencing food insecurity among households. In this study it was found to be

insignificant (p -value > 0.05) in determining household food security. Despite their importance, factors such as Occupation, Household size, Number of dependents, Labour, Land size, and Food source, Debt for food, River access, Irrigation and Seed type were not really significant according to the fitted model. Beside the above, intervening variables that have been found to greatly contribute to food insecurity were political instability and/ or the frequent and severe climate shocks which ended up causing failure of crops, livestock depletion, increasing of food prices and weakening power of purchasing food commodities, lack of access to the market due to destroyed physical infrastructure such as roads and bridges, destruction of irrigation infrastructure, lack of social services delivery, and lack of improved seeds.

Recommendations

The household head's gender, age, main source of food, credit for purchasing food and seed shortages were the main socio-economic factors negatively influencing food insecurity. Based on the findings of this study, the possible areas of intervention are discussed below:

- a. **Gender:** Forty five percent of the respondents to this study were female-headed households. The results show that the odds ratio of a female-headed household to fall into the food insecure is 3.5 times more likely compared to a male, with a significant level of (p -value < 0.001). Women in the study area engage in small-scale and subsistence farming which include preparing farming land, weeding and harvesting. They sell farm produce to cover the cost of feeding, clothing, paying school fees for their children and other family needs. The effect of female-headed household on food insecurity confirms the significant role that gender plays on food security. The results show that more female-headed households are food insecure. With this in mind, it is obvious that to ascertain food security at the household level in Somalia, livelihood assets and options for women should be improved. This can be achieved by promoting and investing in women's income generating activities (IGAs) as well as providing micro-finance credits. Access to micro loans can create opportunities for women to invest in and enhance their economic activities. This would consequently generate income not only for meeting family needs that compete with food purchase but also enhance food generation base. That way, food security would be guaranteed.
- b. **Main food source:** The model estimate of the odds ratio for household main source of food is 0.4 and was found to be significant (p -value < 0.05), implying that households whose main source of food is the market are 0.4 times likely to get trapped into food insecurity compared to those who rely entirely on own farm produced food. Considering the situation in Somalia and especially in the study area, this finding demonstrates that farming is currently practiced on minimal subsistence scale, due to the risks amidst which these households live, and the limitations faced. Therefore, households that have the money to purchase food are much more food secure compared to those that lack the capacity and thus rely on farming. Availability and access to credit for the households by the Somali Government should be seriously considered.

- c. Access to credits:** The odds ratio for food credit is 3.9 and estimated to be significant by the model (p -value < 0.001); implying that the chances of a household falling into food insecurity are almost 4 times more likely for those who accessed credit for food than their peers. The odds ratio for a household whose main source of food is the market is 0.4 and was found to be significant (p -value < 0.05). The results show that the age of household head was a significant variable on the household food insecurity. This means that households headed by older people are more likely to suffer food insecurity than their counterparts. The Somalia Government should therefore be more attentive to capacity building among households headed by old people.
- d. Seed Shortages:** Lack of access to agricultural inputs negatively impacted food security in the study area. Improving the livelihoods of the people through the following is inevitable: agricultural research, adoption of relevant technology and dissemination of extension and advisory services, provision of resistant crop varieties and high yielding seed varieties, establishment of farmer early warning systems, improving plant and animal genetic resources. The aim is to provide good seed varieties easily accessible to farmers. This should be urgently a priority for the Somali Government.

Finally, the government of Somalia should establish an agricultural national plan outlining institute policies that are supportive of food local producers. The government should organize farmers in groups in order to encourage bulk purchase of inputs and marketing, create national silos for grain storage to distribute back to the communities at affordable prices in case of food crises, and set annual targets to produce food that is sufficient to feed the nation. Efforts must be intensified to support these households through the provision of farm inputs and credit facilities with minimal interests.

A strategy to commercialize agriculture in the area is crucial and urgent. In addition, irrigation schemes and general infrastructure need to be restored in order to support food production in the JVR. Equally critical is the infrastructure. As such, roads need to be reopened, broken bridges repaired, markets refurbished and new ones constructed. Agricultural value chain management practices and post-harvest techniques should be taught in adult literacy programs so that communities can fully participate in value addition as income activities are currently limited. Business loan schemes and grants should be identified and made accessible to the communities, especially women groups. These should be able to augment the limited resources people have and thus enable them engage more productively in farming.

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