International Journal of Management Research and Business Strategy

ISSN 2319-345X www.ijmrbs.com
Vol. 4, No. 2, April 2015

SMALL-SCALE AGRICULTURE AND IT'S HOPE TO FOOD SECURITY IN AFRICA: THE CASE OF KAMBA DISTRICT IN ETHIOPIA

Melkamu Mada[1]*

*Corresponding Author: Melkamu Mada ✉ melkamumada2002@gmail.com

Small-scale agriculture is main livelihood in Ethiopia and likely to solve food insecurity in the country. Deep knowledge on determinant factors is key step to shaping the direction of action for food self-sufficiency. Consequently, this study was done to reveal the seriousness of the food insecurity problem on small-scale agriculture and identify its determinant factors. The study collected biophysical, demographic and socio-economic data from 200 households following multistage random sampling process in Kamba district of Gamo Gofa Zone in South Nations Nationalities Peoples Region in Ethiopia. Descriptive statistics and logistic regression model were used for analysis. The study found that 60.5% households sampled were food insecure and that among 13 explanatory variables included in the logistic model, 10 of them were significant determinant. These were, family size, farm size, number of livestock owned, total annual off-farm income, educational level of household, technological adoption of household head, household head participation in public meeting, household head extension contact trend, number of months food purchased and quality of land. The study recommends that in selecting priority intervention areas, the food security strategy should consider statistically significant major variables as the most important areas of intervention.

Keywords: Binary logit, Coping, Ethiopia, Food security, Kamba

INTRODUCTION

Food insecurity is a crucial challenge in Africa. In Ethiopia, it has been seen as the most important feature of development challenges. Researchers and international organizations defined food security in different ways. As stated by Smith *et al.* (Maxwell and Smith, 1996), there are more than 200 definitions of food security, but the one, majority regularly used and this study focuses, is the one given by the Food and Agricultural Organization (FAO) which states that, "Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO,1996). This definition put together access to food, availability of food, and the biological consumption of food as well as the constancy of all these.

[1] Ph.D. Scholar (Agricultural Economics), College of Agriculture, SK Rajasthan Agricultural University, Bikaner- India.

Over the past ten decades, Ethiopia has been challenged by food insecurity problem. In Ethiopia, the trend in growth of domestic food production matched population growth only in the 1960s (Markos, 1997). In spite of the fact that Ethiopia has abundant natural resources, most of its socioeconomic indicators are extremely low and discouraging. Earlier studies have estimated small-scale producers in Ethiopia which are food insecure to be around 40-50% of total population. Small- scale production does not satisfy at least 50% of basic needs and most of them face a hunger season every year (Yohannes Mekonnen, 2002). In Ethiopia, every year, more than 4 million people, particularly in the rural areas have problems of getting enough food for themselves (Tassew Woldehanna, 2004).

Ethiopian rural areas are characterized by extreme poverty, poor crop and pasture production, poor access to infrastructure, livestock disease, lack of productive assets, and weaknesses in the marketing system like abnormal food price. The poor performance of the agricultural sector in the area directly creates supply problems and indirectly creates demand problems by contradicting the producer's access to sufficient income. The agricultural productivity in the area strongly depends on rain fed, which has poor distribution. Usually it is common to see below normal rain which leads farmers to poor crop and pasture harvest.

According to a regional baseline survey estimate, about 59% of the household's in the study region were tagged as food insecure (RDFS Section, 2009). Southern regional standard per capita calorie availability is about 1800 which is fewer than the international minimum average of 2100 calories and much less than the average for an sufficient diet of 2400 calories for normal body (Regional baseline survey, 2009). The study area is known with its infrastructure problem in the region. Before fifteen years, the district has faced serious drought and due to road problem life saving rations were dropped from air. Even nowadays no food crops are transported in to the woreda and out of the woreda. Households' in the area face unusual prices during normal time and producer farmers cannot get fair price for their products during good harvest seasons.

The main objective of this study is to examine the food security status of the rural farming households' and its determinants in the Kamba district of GamoGofa zone, Ethiopia. The specific objectives are to investigate how household level socio-demographic structures affect households' food security status and to identify ordinary coping mechanisms of households' during unfavorable covariant shocks in the study area.

METHODOLOGY

The Study Area and Sampling Procedures

This study was conducted in Kamba district. It is one of fifteen administrative districts of Gamo Gofa zone in Ethiopia. Gamo Gofa zone is located in the Southern part of Ethiopia. Wolayta and South Omo administrative zones border the zone in the north and south, respectively. Kamba district has 38 Peasant Associations (PAs) with total population of 155,748. Out of this, 5,612(3%) live in urban and 150,132 (97%) live in rural (Central Statistical Authority, 2007),). It has three agro-ecologies highlands (27%) (*dega*), midlands (28%) (*woinadega*) and lowlands (45%) (*kola).* The top of the elevation is approximated 3340 m.a.s.l and the lowest is 700 m.a.s.l. The study

area has an estimated with a total land of 118,054 ha of which only 50,787 hectares are arable. From arable land 40% used for annual crops 5% used for perennial crops and 55% arable land is not used yet and potential for the future. In the area 22,364 ha are forest covered, 27,664 ha are pasture land, and 5,300 ha are others. The district has nine big rivers of which three of them have been used as source of modern irrigation. Capital of the district is known as Kamba. It is about 635 km away from Addis Ababa, national capital and 105 km from Arbaminch, zonal town.

Sampling Procedures

All Kamba district farming household population considered as sample frame for this study. The study applied a three-stage random sampling technique in selecting the sample. At first stage, Kamba district was selected randomly out of the 15 GamoGofa districts. At first stage two, 13 peasant associations from the 38 peasant associations were selected randomly by considering their agro-ecological proportion. In the third stage, probability proportional to size sampling technique was employed to draw sample households from the selected sample peasant associations. From a total of 200 farming households were sampled and data obtained from 200 were found useful for this analysis.

METHODS OF DATA ANALYSIS

Food security at households' level is best measured by the direct survey of dietary intake (in comparison with appropriate adequacy norms). The level of, and changes in socioeconomic and demographic variables can be properly examined, and can serve as proxies to indicate the status of and changes in food security (Braun J von *et al.*,1992).

Measuring Food Security

A set of questions regarding food prepared for meals over a specified period of time, for this study for the last seven days, excluding interview day meals was asked to the person in the household most knowledgeable about this activity. The response on food consumption was changed to international unit (if local unit was used) and converted to calorie availability and compared with calorie demand or minimum calorie requirement. According to the government of Ethiopia, 2100 kcal per Adult Equivalent (AE) per day is used as the minimum acceptable weighted average calorie requirement. The determination of the adult equivalent takes into account the age and sex of each household's member (Gassmann and Behrendt, 2006). Therefore, for this study 2100 kcal per adult equivalent per day was employed as a cut-off value between food-secure and food-insecure households'. Thus, those households who have calorie per AE below the minimum subsistence requirement (2100 kcal) are deemed to be food insecure, and those who managed to attain more than 2100 kcal per AE per day are considered to be food secure households.

Determinants of Food Security

Once the groups wear categorized as food-secure and food-insecure based on calorie amount per adult equivalent, the next step was to identify the socioeconomic factors that are correlated with food security using analytical models. Results derived from linear regression analysis may lead to fairly unreasonable estimates when the dependent variable is dichotomous (Ayalneh Bogal and Shimelis, 2009). Therefore, the use of the logit or probit models is

recommended as a universal remedy of the drawback of the linear regression model (Gujirati, 1995). Which model to choose between logit and probit is, however, difficult for they are similar in most applications, the only difference being that the logistic distribution has slightly fatter tails. This means that there is no binding reason to choose one over the other but for its comparative mathematical and interpretational simplicity many researchers tend to choose the logit model (Hosmer and Lemeshew, 1989). Therefore, this study applied the logistic regression model. STATA10 package was also used to see the principal factors that significantly affect food security in the study area.

EMPIRICAL MODEL

To determine demand for calorie from both home-produced and market-purchased foods, we can now calculate the amount of calories (C_i) available in the individual food items. Then, the extent of households' food security is determined by the difference between caloric availabilities and recommended. Defining

$$C_i = C_{ai} - C_{ri} \quad ...(1)$$

where

C_i - is caloric availabilities for i^{th} household.

C_{ai} - is caloric availabilities in the individual food items for i^{th} household.

C_{ri} – *is* caloric recommended (2100 kcal per AE per day) for i^{th} household.

So, using the above formula for each household we can categorize a household as food secure, if $C_i \geq 2100$ while $C_i < 2100$ kcal indicates that the households' is food insecure.

Assuming a linear function, we can write the food security equation as the relationship between the binary food security status variable (food secure and food insecure (Z_i)) and its determinants X_i is specified as

$$Z_i = \beta_i X_i + \varepsilon_i \quad ...(2)$$

where

Z_i- is the conditional probability. It takes value 1 for food insecure household and zero otherwise;

β_i - vector of the respective parameter estimated using maximum likelihood method;

ε_i – error term.

$$P_i = F(Z_i) = F(\beta_0 + \Sigma \beta_i X_i = \frac{1}{1+e^{-(\beta_0+\Sigma\beta_i X_i)}} \quad ...(3)$$

where

e - is the base of the natural logarithm.

i - Represent the i^{th} explanatory variables.

P_i - is the conditional probability of food insecure (For P_i the cut-off value is 0.5).

X_i, α and β_i are regression parameters estimated.

$$Z_i = \ln\left(\frac{pi}{1-pi}\right) = \beta_0+\beta_1X_1+\beta_2X_2+...\beta_mX_m \quad ...(4)$$

$$\ln\left(\frac{pi}{1-pi}\right) = \beta_0 + \Sigma\beta_jX_{ij} + \varepsilon_i \quad ...(5)$$

The odds that an event will happen

$$= \frac{Prob.of\ event\ occuring}{Prob.\ of\ event\ not\ occuring}$$

In general, if the estimated probability of the event is less than 0.5, we predict that the event will not occur, If it is greater than 0.5, we predict that the event will occur. In the unlikely event that the probability is exactly 0.5, we can flip a coin for

our prediction.

VARIABLES HYPOTHESIZED

The following 16 independent variables wear selected to analyze the hypothesis whether they explain a household's food security status or not. Review of literature, past research findings, working as an expert in the agricultural office in the study area for long time, degree of attention given by the government policy, existence of chronic food security problem, unpublished local NGOs and local government reports were used as source to identify the potential variables in the study area

Z - has linear combination from the above and can be expressed as

$$Z = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + \beta_{11}X_{11} + \beta_{12}X_{12} + \beta_{13}X_{13} + \beta_{14}X_{14} + \beta_{15}X_{15} + \beta_{16}X_{16} \quad ...(6)$$

For this study, the event is food insecure household.

β_0 and β_i are the estimated coefficient of the parameters

X_1 = Family size

X_2= Farm size

X_3 = Livestock owned (TLU)

X_4 = Total off-farm income

X_5 = Education level of household head

X_6 = Amount of food aid received

X_7 = Technological adoption

X_8 = Access to infrastructure

X_9 = Participation in public meeting

X_{10} = Extension service adoption

X_{11}= Land quality (land quality measured by farmers' perception of the fertility of their farmland

X_{12} = Saving

X_{13} = Number of month food purchased

X_{14} = Age of household head

X_{15} = Sex of household head

X_{16} = Access to irrigation are identified potential variables that determines household food security problems in Kamba district.

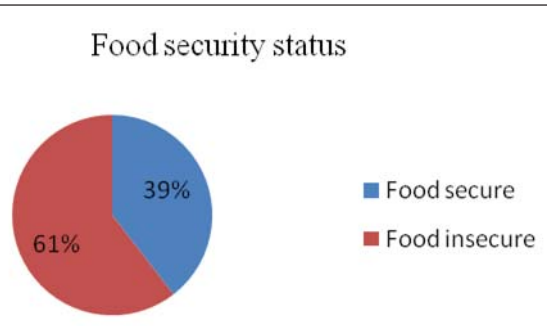
RESULTS AND DISCUSSION

Measuring Food Security Status of Households'

The data to categorize households' into food secure and insecure groups was obtained by comparing the total households' food or calorie acquisition per AE per day to the minimum level of consumption required to ensure survival per AE per day. Thus those households' who have calorie per AE beyond the minimum subsistence requirement (2100 kcal) are deemed to be food secure, otherwise food insecure.

Considering 2100 kcal as a benchmark, only 79 sample households' (39.5%) were found to be able to meet the minimum subsistence requirement and 121 households' (60.5%) were

Figure 1: Food Security Status



found to be unable to meet their minimum subsistence requirement.

Based on the Core Food Security Module analysis, households' were found to be grouped into four categories; food secure (above 2100 Kcal) (39.5%), mildly food insecure (1800 Kcal-2100 Kcal) (34.5%), moderately food insecure (1500 Kcal-1800 Kcal) (16.5%) and severely food insecure (less than 1500 Kcal) (9.5%) (Table 3). Majority of the respondents were mildly food insecure followed by moderately food insecure.

Coping Strategies

Farmers were asked about how they manage food shortage and how they can cope with food insecurity. Almost all (99%) respondents diversified their production by producing drought resistant crops. About 52% of all respondents and 49% of food secure and 54% of food insecure households' engaged in off-farm jobs. Even though, there was limited access to off-farm work opportunity in the district, resource poor family migrate (17%) either within district or outside the district for wage earned in kind or cash. Another important coping mechanism considered first by farmers was sale of livestock. Livestock, besides their complimentary relationship with crop production, provide hedging against risk of food insecurity. Pastorals in the study area begun to eat wild foods as vulnerability increasing, and they shift to the consumption of the cheapest and less quality food items. More than 87% of the households' in low land and mid- altitude in the study area encountered severe food shortages during the months of April, June and July and highlands in September, October and November.

Summary of Descriptive Analysis

Tables 2 and 3 below shows summary of descriptive statistics and score of sample household groups on the continuous and dummy variables included in the model. The study result depicted on Table 2 revealed, existence of significant difference between food secure and food insecure household groups. The two groups were significantly different with respect to mean of the variables like family size (FASZ), total farm size (FARMS), livestock holding in (TLU), total off-farm income (TOFFI), number of oxen households' own (NOXEN), number of months food item purchased (NUMFP) and access to irrigation (ACCIRR) at probability level less than 1%. On the other hand, Table 3 shows categorical variables with the chi-square value which shows the existence of significant relationship between food secure and food insecure sampled households. The survey result showed sex of households' head and food security statuses are unrelated. The possible reasons may be the female headed households' coudnot face any

Table 1: Core Food Security Module Based Classification

Level of food insecurity	Amount of calories	Amount of HH in that interval	Percentage
Food secure	Above 2100Kcal	79	39.5%
Mildly food insecure	1800Kcal - 2100Kcal	69	34.5%
Moderately food insecure	1500Kcal - 1800Kcal	33	16.5%
Severely food insecure	Less than 1500Kcal	19	9.5%
Total		200	100%

labour shortage problem due to capability of thire son for farming activeties. Sampled households technology adoption (TEC) and educational status (EDUC) has relation with its food security status.

Econometric Analysis of Determinants of Food Security

An econometric model, logistic regression, was employed to identify the determinants of household's food security. Before fitting the logit model, problem of multicollinarity, hetero-scedasticity and association existence among and between the potential continuous and discrete explanatory variables was checked. Variance Inflation Factors (VIF) and contingency coefficient were used to check association existence for continuous and discrete variables, respectively.

The variable food security (FODS) was used as a dichotomous dependent variable, with an expected mean value of 1, indicating the probability of being food insecure, 0 otherwise. Generally, there were 13 explanatory variables included in the model analysis. In order to identify the most important factors from the hypothesized potential variables to influence food security, binary logit model was estimated from the survey data. For the purpose, STATA Version 10 was employed. Codes, types and definitions of the variables; and the maximum likelihood binary logit estimates are presented in Table 5.

The likelihood ratio test statistics (250.74) exceeds the chi-square critical value (53.33) with 13 degree of freedom. The result is significant (p = 0.000) at less than 1% probability level representing that the hypothesis that the coefficient except the intercept are equal to zero is rejected. The count R^2, was also used as measure of goodness of fit for logistic regression, which indicates the number of sample observations correctly predicted by the model. The count R^2 is based on the principle that if the estimated probability of the event is less than 0.5, the event will not occur and if it is greater than 0.5 the event will occur (Maddala, G.S.1989).The Hosmer-Lemeshow test result also revealed that the model has H-L value of 1.00, which indicates convergence between expected and observed probabilities. This value is not statistically significant at less than 5% probability level; therefore the model is quite a good fit, or indicating that the model prediction does not significantly differ from the observed. More generally, the i^{th} observation is grouped as a food secure if the computed probability is greater than or equal to

Table 2: Coping Strategies Common in Kamba District

Type of coping	Over all(200)	Insecure(121)	Secure (79)	Rank
Reduced amount of food consumed	40%	63%	58%	2nd
Sale of livestock	74%	94%	73%	1st
Wage work and migration	52%	54%	34%	3rd
Sale of productive asset and jewelers	2%	85%	25%	5th
Food aid	23%	30%	7%	4th
Eating wild food(in pastoral kebele)	7.5%	85%	-	3rd

N.B percent does not sum up to 100, due to multiple response.

Table 3: Summary Statistics of Continuous Variables Included in the Descriptive Statistics

Variable	Food Insecure (121)		Food Secure (79)		t- value
	Mean	SD	Mean	SD	
FASZ	7.04	0.17	4.32	0.13	12.72 ***
AGE	46.32	11.25	45.83	12.00	0.28
NUMFP	3.7	1.15	1.5	1.13	-0.01***
FARMS	7.04	0.17	4.32	0.13	-3.38***
TLU	2.9	1.5	6.6	1.7	-15.3***
NOXEN	0.81	0.86	1.32	1.01	-3.68***
FAID	46.86	63.57	38.10	54.17	1.0
TOFFI	399	813.7	951	676.17	-5.01***
INFRA	3.28	3.5	3.66	4.44	-0.67
ACCIRR	0.74	0.26	0.18	0.39	-2.48***

Note: ***significant at 1% probability level.

Table 4: Descriptive Statistics Summary of Discrete Variables

Variable	Score	Food Insecure (121)		Food Secure (79)		Chi-square Value
		Number	Percent	Number	Percent	(χ^2)
SEX	1	111	91%	71	90%	
	0	10	9%	8	10%	0.2024
TEC	1	27	22%	64	81%	
	0	94	78%	15	19%	85.15***
EDUC	1	43	36%	33	42%	
	0	78	64%	46	58%	9.96***

Note: ***significant at 1% probability level.

0.5, and as a food insecure otherwise. The model outcome shows that, the logistic regression model correctly predicted 193 of 200, or 96.5% of the sample households'. The sensitivity (correctly predicted food secure) and the specificity (correctly predicted food insecure) of the logit model are 94.94% and 97.52%, respectively. Thus, the model predicts both groups accurately.

Discussion on the Significant Explanatory Variables

Out of the 13 variables hypothesized to influence households' food security, 10 were found to be statistically significant. The maximum likelihood estimates of the logistic regression model showed that family size (FASZ), cultivated land

size (FRMS), total livestock holding in (TLU), total off farm income (TOFFI), educational status of the households' head (EDUC), technological adoption of households' head (TEC), land quality (LNDQ), households' head participation in public meeting (PAPUM), extension service (EXTNS) and number of months food purchased (NUMFP) were important determinants identified to influence households' food security in the study area. That means, the coefficient of family size, Cultivated land size, total livestock holding, total off farm income, technological adoption of households' head, participation in public meeting and land quality were statistically significant at 1% probability level of significance whereas educational status of the households' head, extension service and number of months food purchased were statistically significant at less than 5% probability level of significance. Moreover, the results verified that except number of month's food purchased, almost all of the explanatory variables obtained in the model had the signs that

Table 5: The Maximum Likelihood Estimates of the Logit Model

Variable	Coefficient	p-Value	Wald Statistics	Marginal Effect (dF/dx)
FASZ	-5.442	0.000***	26.13	-0.033
FRMS	9.91	0.000***	13.42	0.06
TLU	1.62	0.000***	19.01	0.01
TOFFI	0.00	0.002***	10.05	0.000
EDUC	0.5	0.049**	3.87	0.003
FAID	0.00	0.657	0.20	0.000
TEC	6.47	0.000***	13.54	0.0475
INFRA	-0.07	0.087	2.94	-0.0005
PAPUM	7.18	0.000***	14.54	0.100
EXTN	5.27	0.010**	6.57	0.011
SAVG	0.00	0.106	2.61	6.12
NUMFP	0.82	0.031**	4.64	0.005
LNDQ	8.32	0.000***	13.31	0.85
Constant	-11.50	0.012		
Wald chi-square		53.33***		
-2Log likelihood		17.63		
Likelihood ratio test		250.74		
Sensitivity		94.94%		
Specificity		97.52%		
Percent correctly predicted (count R^2)		96.50%		
Sample size		200		

Note: *** Significant at less than 1% probability level; ** Significant at less than 5% probability level.

confirm with the prior expectations. In light of the above summarized model results possible explanation for some significant independent variable are given consecutively as follows:

Family Size (FASZ): Family size is found to be highly significant to determine households' food security in the study area. Households' size revealed inverse relationship with food security and statistically significant at 1 percent probability level. The inverse relationship indicates that the probability of being food secure decreases with an increase in the family size. The marginal effect of a unit change in family size, computed at sample mean of family size, the probability of food secure is –0.033. This means that the probability of food security decreased by –0.033(about –3.3%) for a one member increase in family size. The likely explanation is that in an area where households' depend on less productive agricultural land, increasing households' size results in increased demand for food. This demand, however, cannot be matched with the existing food supply so ultimately end up with food insecurity.

Cultivated Land Size (FRMS): Farm land size was hypothesized to influence food security positively. The results of the logit model indicated that sample households' which had larger farm size had more possibility of being food secure. This is assured by the positive coefficient of this variable indicating it is significantly influencing rural households' food security at 1% level of probability. The possible justification is that farm households' which had larger farm size had better chance to produce more, to diversify the crop they produce and also have got larger volume of crop residues. The marginal effect of a unit change in farm size, computed at sample mean of farm size holding in hectare, the probability of food secure is 0.06. This means that the probability of food security increases by 0.06 (about 6%) for a one hectare increase in farm size. This result is supported by the findings of Abebaw Shimelese (2003).

Total Livestock Holding (TLU): Household's livestock holding in tropical livestock unit and food security were positively related. The relationship is statistically significant at 1% probability level. This is an indication that ownership of livestock acts as a hedge against food security in the study area. Livestock, besides its direct contribution to subsistence need and nutritional requirement, is a vital input into crop production by providing manure and serves to accumulate wealth that can be disposed during times of need, especially when food stock in the households' deteriorates. The marginal effect of a unit change in livestock ownership in TLU, computed at average TLU owned by sample households', the probability of food secure is 0.01. This means that the probability of food security increase by 0.01 (about 1%) for a one unit increase in livestock number in TLU. This result was also supported by Abebaw Shimelese (Abebaw Shimelese**,** 2003).

Land Quality (LNDQ): This is because the increase in the fertility of the land is expected to contribute positively towards increase in crop output and consequently increase in farm income. Empirical findings indicate that land fertility problem has a relation with the level of food security. However, Mulugeta Tefera, 2002 has have shown that land fertility problem do not have significant effect on households' food security status. On the contrary to their result, this study revealed that this variable affects households' food security significantly. The marginal effect of a change of farmers land from poor land quality to good land quality, computed at mean farmers

perception on the fertility of their farmland quality by sampled households' increases the probability of food security by 84.7%. This gigantic response may be achieved after challenging and time consuming task of soil quality improvement in long period of time. It is not an easy task and the response is not automatically, it needs more time and actors commitment to get the above probability percent on food security.

CONCLUSION AND RECOMMENDATIONS

The analysis and findings in this study have shown clearly that food insecurity is a real problem in the study area. The study area can thus be classified as food insecure as more than 60% of the population is below the food security line which is 2,100 Kcal per adult equivalent. Five major factors like other factors were found to have positive and significant effects on practical food security in the study area; these are farm size, livestock number, average monthly off-farm income, household education and the use of modern technology. Thus, considerable increase in use of modern technology based on recommendation for the area and increase in allocation of farm land for food production may improve the availability of food. Also, an increase in the average monthly income means that there would be more money to purchase inputs which would allow enhanced production or stabilize their income and purchasing power. Producing enough food and achieving food security can be made possible through application of appropriate technology. Livestock's can be used as source of income and food consumption diversification to increase calorie availability.

In order to reduce the level of food insecurity among rural farming households in the study area, the following recommendations are made:

- Family size and food security are strongly and negatively related. Serious attention has to be given to limit the increasing population in the study area. This can be achieved by creating sufficient awareness to successful family planning through effective extension services and integrated development strategy in the rural households'. So family size control is the crucial concern in the rural area like in Kamba otherwise, the ever-shrinking productive resources in the study area coupled with increasing population would hamper any development intervention from achieving its objectives.
- Medium and longer-term food security strategy through increased food production must be introduced. In a medium or shorter term, distribution and allocation of cultivable land, which was not under cultivation, thereby increasing output, should be made. Strong and committed effort should be made to improve the production and productivity in the agricultural sector in the longer term.
- For households' to enhance their welfare in general and food security in particular, they must have diversified access to income alternatives to increase their purchasing power. In the face of this, provision of credit must be taken as a measure, though not the only one, to build the capacity of farmers to invest in the agricultural sector, such as purchase of fertilizer, pesticides, improved seed, live and productive animals.
- The fact that the climate of the district is dominantly semi-arid and the existence of a serious problem of frequent crop failure caused by drought and erratic rains clearly

suggest that one of the intervention options is promoting and increasing crop diversification to reduce crop failure that was happen due to rainfall shortage. Hence, seeds of different variety resistance to moisture stress, pests and adaptability that can increase productivity and yield of crops should be introduced.

- The study suggested also that absence of market and marketing infrastructure facilities are one of the problems of food security. In order to solve the problem attention should be given to the impact of factors like poor marketing infrastructure and transport facilities. In addition, government can improve rural infrastructure to boost households' income through the provision of households' water, electricity and telecommunications. This could increase the possibility for farmers to get right price.

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