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Household food insecurity and associated factors in rural communities: A case of Kilosa District, Tanzania

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Food insecurity continues to be a major contributing factor to nutrition insecurity in developing countries. A nine item Household Food Insecurity Access Scale (HFIAS) was administered twice to 307 households among three agro-ecological zones in rural communities of Kilosa District-Tanzania to measure food security. Households were surveyed once during the rainy season (February–May) and once immediately post harvest (September–October) in the year 2011. The mean HFIAS score was the highest during the rainy season (8.15±6.06) and ranged from 0 to 26. During the harvest season, the mean HFIAS was 6.76±5.88 and ranged from 0 to 24. Using the categorical measure of food insecurity, the proportion of food secure households was higher during harvest season (31.3%) than was the case 19.9% during the rainy season. Similarly, 31.6% of the surveyed households were classified as being most food insecure during the rainy season as opposed to 26.1% during the harvest season (P=0.01). Food insecurity persisted among 39.2% of the surveyed households during the rainy season and period after harvest. The households in which at least one member offered casual labour such as the clearance of the farm fields, had 2.1 higher odds (95% CI: 1.05 to 4.29) of being food insecure. A substantial proportion of the surveyed households were food insecure across agricultural seasons and in various agro-ecological zones.

Key words: Household food insecurity, Household Food Insecurity Access Scale (HFIAS), associated factors, rural, communities, seasons, agro-ecological zones, Tanzania.

INTRODUCTION

Food insecurity continues to persist among the rural households in developing countries despite the several efforts that have been directed to rural areas to reduce food insecurity. Higher levels of food insecurity have detrimental effects on nutritional status, overall health and the national wellbeing. Food insecurity is associated with a multifaceted shift in nutrient status and intakes with implications for increased risk of diet-sensitive chronic

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diseases (Egeland et al., 2011). Approximately, 1 in 2 children in rural areas of Tanzania is stunted (NBS and Macro, 2011). A survey was conducted in Kilosa District-Morogoro Region – in Tanzania (Figure 1). Stunting reflects failure to receive adequate nutrition over a long period of time and is affected by recurrent and chronic illness (UNICEF, 2007). Reports show that, 23% of the Tanzanian households consume unacceptable diets (URT, 2010). When food becomes scarce, children and women are most affected and mother employs a sequence of strategies to manage increasingly severe situations with an overall function of protecting children from hunger (Fram et al., 2011). Higher food prices, weather changes and use of inadequate farm inputs are some of the reasons reported to compel households to consume unacceptable diets (Brinkman et al., 2010). Minimal resources to buy food, energy sources and cooking utensils pose an additional challenge in attaining food security at the household level (Shepherd et al., 2011). On the other hand, developing countries are still experiencing difficulties in assessing the levels of food insecurity and in addition most of the available data makes global comparisons difficult (Swindale and Bilinsky, 2006). This calls for a need to have food security indicators and data collection methods that are methodologically rigorous, cross culturally valid, cost effective and user friendly (Coates et al., 2007).

Therefore, the purpose of the present study was to assess the level of food insecurity and associated factors among the households in rural communities of Kilosa District-Morogoro-Tanzania in an attempt to alleviate food insecurity.

METHODOLOGY

Description of the study area

A survey was conducted in Kilosa District- Morogoro Region – in Tanzania (Figure 1). The district lies between 6° and 8°S, and between 36° 30' and 38°E (Kilosa District Council Profile, 2010). The district has a total population of 438 175 persons (NBS, 2012). The district is endowed with an abundant agricultural land suitable for crop production which is a major economic activity for almost 84.2% of the total labour force (URT, 2012). Recently, the area has been awash with persistent land conflicts especially between pastoralists and crop farmers who are fighting for the same piece of land. The main sources of water are piped water (22.7%), protected wells (26.9%) and surface water (29.4%) (URT, 2012).

Majority of the households use charcoal and firewood as a major source of energy for cooking whereas most of rural dwellers use kerosene lamp, firewood or wick lamp as a source of light. The district is divided into three physio–geographic units, which also constitute three different agro–ecological zones: mountainous and uplands, plateau (cultivation steppe), and flood plains (Kilosa District Council Profile, 2010). Mountains and Uplands zone consists of the mountain ranges running from north to south and are part of the Eastern Arc system and comprise pre–Cambrian metamorphic rocks covered with coarse soil. With altitudes up to 2200m, cultivation of temperate crops (such as wheat) is possible in the small pockets of agricultural land available. The plateau zone (Cultivation steppe) is situated in the north of the district around Gairo and stretches towards Dodoma (Kilosa District Council Profile, 2010). At an altitude of around 1100 m, the zone is characterized by plains and dissected hills with moderate fertile and well–drained soils which comprise sandy (clay) loams. Although these soils are highly susceptible to erosion, the area is intensively used for maize production and livestock keeping (agro–pastoralism). The combination of land use intensity and vulnerability of the soil to erosion leads to severe soil degradation. Floodplains zone comprises both flat and undulating plains extending to the foothills in the West. Altitude is typically 550 m, many rivers, principally the Wami and Ruaha systems, incise the plains. The soils comprise poorly drained, black, cracking clays and in the central plains the zone is subject to seasonal flooding. Some intensive rice production also takes place. The peripheral loamy soils are better drained and allow the cultivation of a range of crops including maize, cotton, and sisal (Kilosa District Council Profile, 2012).

The average annual rainfall in the District varies between 600 and 1800 mm from year to year and from one agro–ecological zone to another. The plateau zone is one of the areas experiencing the least rains in the area. A wide range of crops such as maize, paddy, sorghums, millet, beans, mangoes, oranges, lemons, coffee, banana, sunflower, cotton, soy beans, sesame, sisal and different varieties of vegetables including onions, cabbages, tomatoes, egg plants, carrots and peppers are grown in the area (URT, 2012). Maize is the leading crop planted occupying 98185 ha (42.3% of the total agricultural land with 83 102 (30.5%) households growing maize (URT, 2012). Sunflower is an important food (for oil) and cash crop for majority of the households.

Study design

Cross sectional study design was used. Repeated measurements were performed whereby same households were interviewed in two rounds of the surveys across agricultural seasons. The first survey was conducted during the long rainy season (February–March) and a second survey was done during the post-harvest season (September–October) in the year 2011.

Sample size and study population

A total of 307 households were recruited. The sample size was calculated using Fischer's formula from a prevalence of 23% of households with non acceptable (borderline and poor) food consumption and 13% attrition rate (URT, 2010). The data was collected among 307 rural household in Kilosa District–Morogoro Region, Tanzania.

Data collection

Assessment of household food insecurity

Household food insecurity was assessed using the 9 item Household Food Insecurity Access Scale (HFIAS). The HFIAS is used to measure the access components of food security (Becquey et al., 2010). Current field validation studies to measure food insecurity have demonstrated the feasibility and usefulness of the HFIAS in rural areas of the developing world (Knuepell et al., 2009). In addition, the HFIAS validation study in Addis Ababa, Ethiopia found that the scale performed well in the field and had high consistency (Maes et al., 2009).

A person responsible for meal preparation was interviewed to provide information about the modifications a household made in the diet or food consumption patterns due to limited resources of acquiring food. HFIAS was used to assess whether households

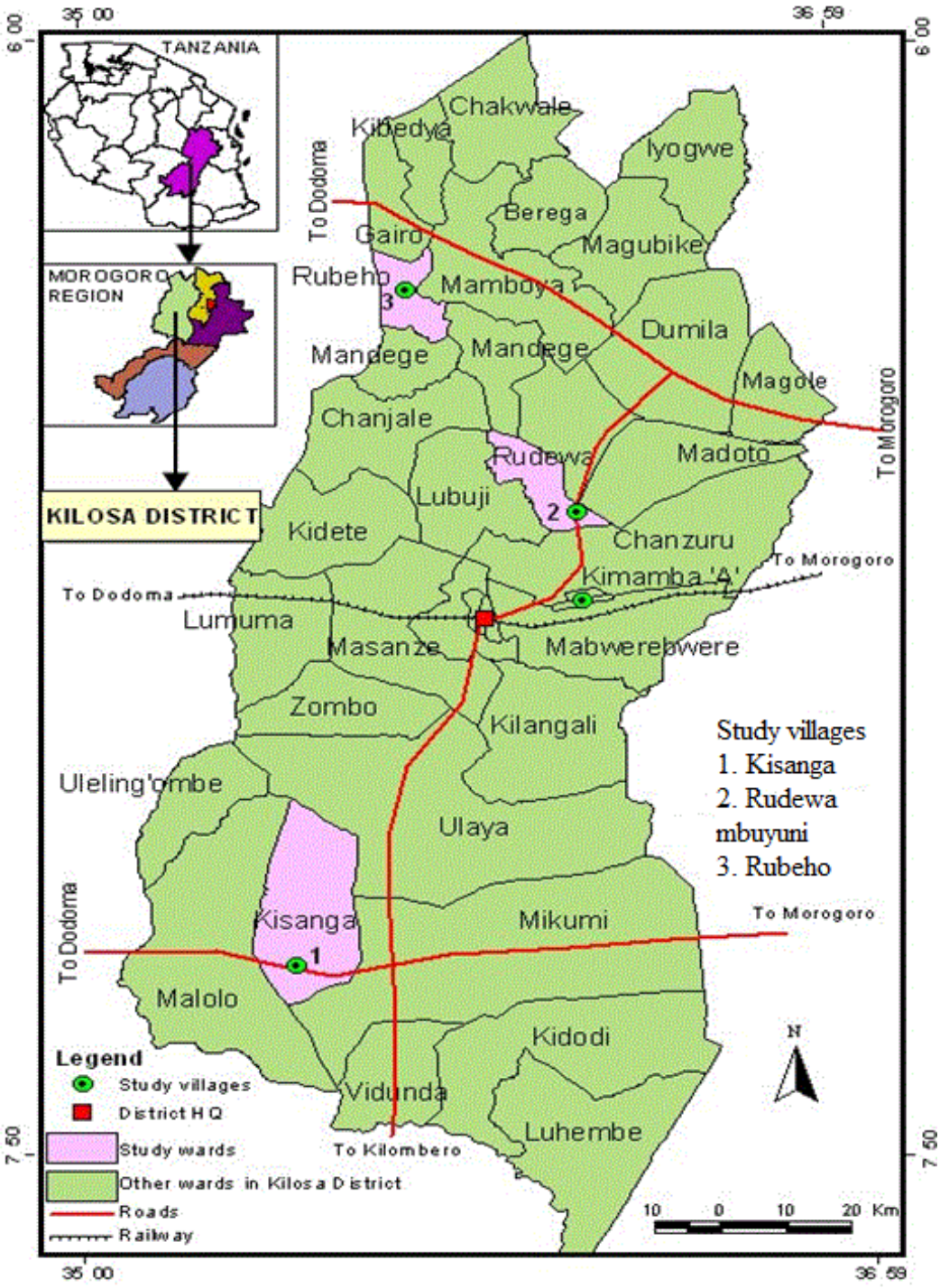

Figure 1. Map showing Kilosa District and study wards.

experienced problems in accessing food. The reference period was 30 days prior to the survey date (Coates et al., 2007). Three themes were covered by the tool: (i) experiencing anxiety and uncertainty about the household food supply; (ii) altering quality of the diet; and (iii) reducing quantity of food consumed. A household was given a score of 0 if it did not experience any of the nine items of the HFIAS, 1 if it rarely did (once or twice in the past 4 weeks), 2 if it sometimes did (three to ten times in the past 4 weeks) and 3 if it often did (more than 10 times in the past 4 weeks). Thereafter, a household food insecurity score was computed based on the responses of nine items of the HFIAS. Categories of food insecurity were created using the HFIAS scores. A higher HFIAS score is indicative of poor access to food and greater household food insecurity. Three categories of food insecurity were created. These

Table 1. Subjects characteristics.

Variable	Mean	Standard deviation
Age (Years)	43.31	15.08
Years of schooling	6.28	1.54
Household size/family size	5.35	2.58
Number of income generating activities	2.07	0.70
Acres of land cultivated	3.53	2.77
Number of farm plots cultivated	1.84	0.82
Number of crops planted	1.92	0.71
Number of crops cultivated in a single plot	1.69	0.75

included: a score of 0 to 2, 3 to 10, and a score of 11 to 27 indicating least food insecure, moderate and most food Insecure, respectively.

Data analysis

Data analysis was carried out using the Statistical Product and Service Solution (SPSS) version 17 (Nie et al., 1968). For each of the nine questions of the HFIAS; a frequency of occurrence score over the past 30 days was given: 0=never, 1=rarely, 2=sometimes, 3=often. Scores for each question were added so that the overall score of a household ranged from 0 to 27. The higher mean score indicated that the household experienced more food insecurity and the lower the score indicated that the household experienced lower food insecurity. Cut off points of household food insecurity were used to compare the classification of food insecure households. FAO has established cut off points of 0-2 to indicate less food insecure, 3-10 to indicate moderate food insecure and 11-27 to indicate severe food insecure household (Coates et al., 2007). Descriptive statistics were determined and the student t-test statistic was used to compare the means of the HFIAS score between the agricultural seasons. Chi-square test was used to check for the significance of the association between variables. Determinants of household food insecurity were identified using bivariate correlation analysis, Principal Component Analysis and logistic regression analyses were used to draw inferences. The dependent variable was household food insecurity and the independent variables were age of mother, education level of the mother, economic activity of the father and or mother, agro-ecological zone, acreage, amount of maize harvested, household sold sunflower, household sold paddy, kept animals such as chicken, sold a chicken and owning a cow.

RESULTS

Subjects characteristics

Household's heads characteristic are presented in Table 1. There were (213) 69.4% males and (94) 30.6% females. The mean age of the household heads was 43.31±15.08 years. The survey households had an average of five members per household. The mean (6.28±1.54) year of schooling of the participants was less than seven years. Households had on average 2.07±0.70 sources of incomes and the majority engaged in crop cultivation and livestock keeping. Farming characteristics showed that the households farmed on average 3.53±2.77 acres and planted approximately two crops.

Affirmative responses (% yes) to individual items of the household food insecurity scale

Overall, the perception about food insecurity varied significantly between agricultural seasons (Table 2). About 63% of the surveyed households were worried that they would not have enough food to eat during the rainy season and 49.8% of the households showed similar concerns during the harvest season ($P<0.001$). The surveyed households reacted to food insecurity by compromising with both quality and quantity of the diet. The proportion of the households that consumed foods which they did not prefer due to lack of resources was relatively higher (67.1%) during rainy season as opposed to harvest season (63.2%). About 71% of the surveyed households reacted to food insecurity by consuming limited varieties of foods due to limited resources during rainy season as opposed to 55% of the surveyed households who reported the same during harvest season ($P=0.00$). Data on meal sizes revealed that, 58% of the households surveyed ate smaller sized meals during the rainy season and 33% of the households surveyed did the same during the harvest season ($P<0.001$).

Q1 In the past four weeks, did you worry that your household would not have enough food?

Q2 In the past four weeks, were you or any household member not able to eat the kinds of food you preferred due to lack of resources?

Q3 In the past four weeks, did you or any household member have to eat a limited variety of foods due to lack of resources?

Q4 In the past four weeks, did you or any household member have to eat some foods that you really did not want to due to lack of resources to obtain other types of foods?

Q5 In the past four weeks, did you or any household member have to eat a smaller meal than you felt you needed due to insufficient food?

Table 2. Affirmative responses (% Yes) to individual items on the household food insecurity scale across agricultural seasons.

QN	Rainy (February–March)		Harvest (September–October)		P–Value
	n	%	n	%	
Q1	192	62.5	15	49.8	<0.001
Q2	206	67.1	194	63.2	0.31
Q3	218	71.0	169	55.0	0.00**
Q4	187	60.9	202	65.8	0.21
Q5	180	58.6	102	33.2	<0.001
Q6	172	56.0	105	34.2	<0.001
Q7	161	52.4	103	33.6	<0.001
Q8	80	26.1	58	18.9	0.03*
Q9	33	10.7	0.0	0.0	<0.001

*Significant at the 0.05 level (2–tailed); **Significant at the 0.01 level (2–tailed).

Q6 In the past four weeks, did you or any other household member have to eat fewer meals in a day due to insufficient food?

Q7 In the past four weeks, was there ever no food of any kind to eat in your household due to lack of resources to get food?

Q8 In the past four weeks, did you or any household member go to sleep at night while hungry due to insufficient food?

Q9 In the past four weeks, did you or any household member go a whole day and night without eating anything due to insufficient food?

Household food insecurity according to the agricultural seasons

The mean HFIAS score was highest during the rainy season (8.15±6.06) and ranged from 0 to 26. Using the categorical measure of food insecurity, the proportion of food secure households was higher during the harvest season (31.3%) than was the case 19.9% during the rainy season (Figure 2). Similarly, 31.6% of the surveyed households were classified as being most food insecure during the rainy season as opposed to 26.1% during the harvest season. These values were significantly different (P=0.01).

Persistent food insecurity

Thirty-eight out of 97 households (39.2%) identified as most food insecure during the rainy season were also identified and classified into the most food insecure category during the period after harvest (Figure 3). Only 21 out of 97 households (21.6%) surveyed during the rainy season improved from the most food insecure category during the rainy season to a food secure category during the harvest season.

Household food insecurity by agro-ecological zone

Household food insecurity varied across agro-ecological zones. The proportion of households experiencing food insecurity differed significantly (P<0.05) among the surveyed households in the three surveyed agro-ecological zones during both the rainy and the harvest seasons (Table 3). The mountainous and upland zone was found to have a relatively higher proportion (29.6%) of households categorised as food secure in both rainy and harvest season compared to other two zones. Households with highest level of food insecurity (42.7%) were observed during the rainy season in the plateau whereas the flood plain zone had the highest proportion (35.4%) of its surveyed households categorised as the most food insecure during the harvest season.

Factors responsible for the observed food insecurity status

Factors associated with household food insecurity during harvest season

*(*a) Approach I – Factor analysis: Four factors emerged from the rotated principal component factor analysis. These included the amounts of maize harvested, the age of the father, per capita household expenditure and maize price (Table 4).

(a-1) Total variance explained by the rotated component matrix during harvest season. All factors explained 67.2% of the total variance (Table 5). The difference in the level of food insecurity was explained more by the difference in

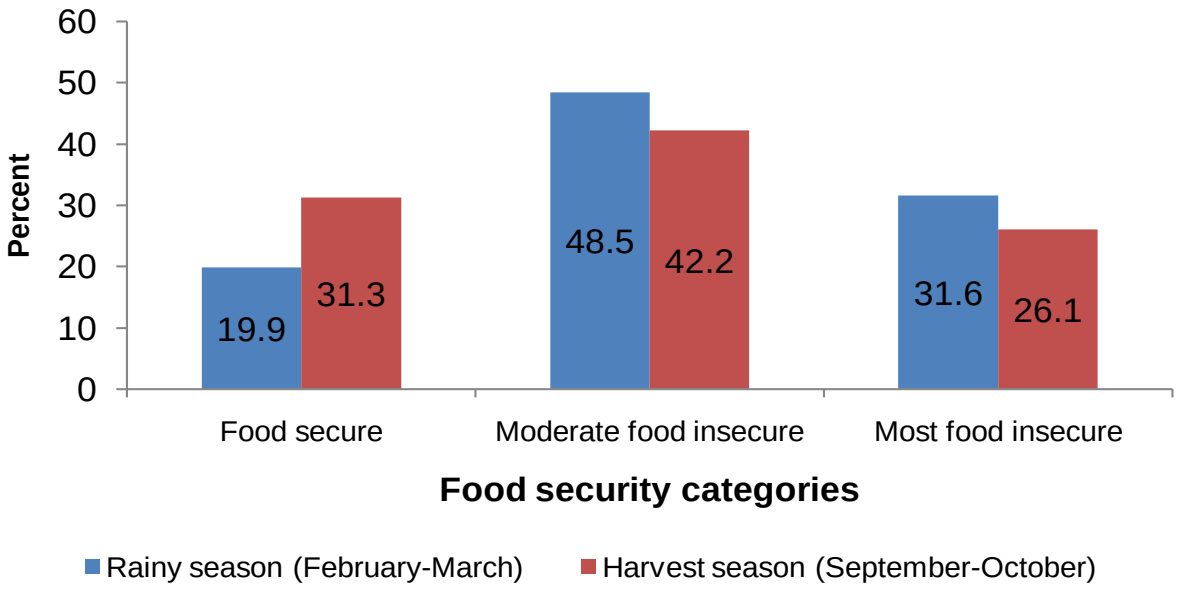

Figure 2. Household food insecurity according to agricultural seasons.

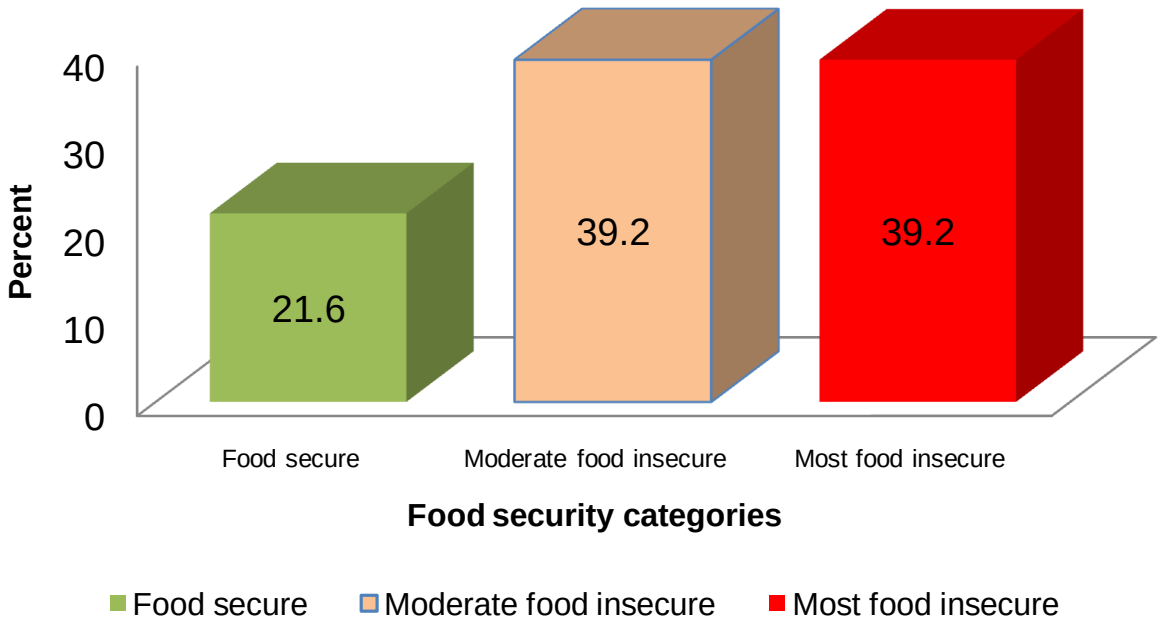

Figure 3. Proportion of households which were persistently food insecure for both seasons.

terms of the amount of maize harvested and number of farm acres owned by the household.

(b) Approach II – Correlation analysis: Food insecurity was positively correlated with the age of the father and or mother.

(c) Approach III – Predictors of household food insecurity during the harvest season using binary logistic regression analysis: During the harvest season; age of the mother, involvement of the mother in farming as a single economic activity, agro–ecological zone and the amount of maize harvested were the best predictors of household food insecurity (Table 7). Furthermore, individuals who belonged to productive age group (15 to 49 years) had 0.3 lower odds (0.16 to 0.69 95% CI) of being food insecure compared to non-productive age group (>49 years). Households that depended on farming as the only source of income for the household had 7.5 extra odds

Table 3. Household food insecurity by agro-ecological zone.

Agricultural season	Food insecurity category	Food insecurity score	Agricultural zone						P-Value
			Flood plain		Upland and mountainous		Plateau		
			n	%	n	%	n	%	
Rainy season (February-March)	Food secure	0 to 2	14	14.1	29	29.6	18	16.4	0.00
	Moderate food insecure	3 to 10	63	63.6	41	41.8	45	40.9	
	Most food insecure	11 to 27	22	22.2	28	28.6	47	42.7	
Harvest season (September-October)	Food secure	0 to 2	22	22.2	29	29.6	45	40.9	0.01
	Moderate food insecure	3 to 10	42	42.4	49	50.0	40	36.4	
	Most food insecure	11 to 27	35	35.4	20	20.4	25	22.7	

Table 4. Rotated component matrix.

Variable	Component			
	1	2	3	4
Amount of maize harvested	0.77	0.05	–0.10	0.16
Acreage	0.74	0.04	0.29	–0.01
Crop diversity score	0.72	–0.03	0.08	–0.24
Household food insecurity score	–0.52	0.18	0.08	–0.42
Income diversity score	0.29	–0.16	0.26	0.02
Age of the father	–0.03	0.95	0.01	–0.01
Age of the mother	–0.02	0.94	0.05	–0.04
Per capita household expenditure	–0.01	–0.07	–0.89	–0.02
Household size	0.09	0.04	0.88	–0.07
Maize price	–0.04	0.00	0.00	0.91

[1]Extraction Method: Principal Component Analysis, Rotation Method: Varimax with Kaiser Normalization, Rotation converged in 5 iterations.

(1.93–29.39 95% CI) of being food insecure as opposed to households with more diversified sources of income. A place of residence had an influence on the variation in food insecurity status.

Households located in the flood plain had 3.7 higher odds (1.90 to 7.35 95% CI) of being food insecure, whilst households in the mountainous zone had 2.3 higher odds (1.22 to 4.43 95% CI) of being food insecure. The amount of maize harvested did not have any positive influence in reducing household food insecurity; instead households that harvested more than five bags of maize had 3.4 higher odds (1.97 to 5.98 95% CI) of being food insecure as opposed to households that harvested less than five bags.

R^2=0.881 (Hosmer and Lemeshow), 0.149 (Cox and Snell), 0.208 (Nagelkerke). Model X^2 (5) = 48.229, p<0.001 *p<0.01, **p<0.05. The overall accuracy of the model to classify the food insecure households: When only the constant was included, the model correctly classified 68% of households as food insecure, but now with the inclusion of the predictor variables, this has risen to 70.7.

Variable(s) entered into the model on Step 1: The age of the mother, education level of the mother, economic activity of the father, economic

Table 5. Total variance explained.

Component	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	2.25	22.45	22.45	2.25	22.45	22.45	2.01	20.13	20.13
2	1.97	19.69	42.14	1.97	19.61	42.14	1.86	18.61	38.74
3	1.48	14.75	56.89	1.48	14.75	56.89	1.76	17.57	56.31
4	1.04	10.35	67.24	1.04	10.35	67.24	1.09	10.93	67.24
5	0.93	9.28	76.52						
6	0.81	8.10	84.62						
7	0.59	5.85	90.47						
8	0.48	4.78	95.25						
9	0.31	3.05	98.30						
10	0.17	1.70	100.00						

Extraction Method: Principal Component Analysis.

activity of the mother, agro-ecological zone, acreage, amount of maize harvested, household sold sunflower, household sold paddy, kept animals such as chicken, sold a chicken and own a cow.

Factors associated with household food insecurity during the rainy season

The exploration of the factors that predict the level of food insecurity during the rainy season revealed that households in which at least one member offered casual labour such as clearing of farm fields, had 2.1 higher odds (95% CI: 1.05 to 4.29) of being food insecure as opposed to household which did not offer casual labour (Table 8). Again, as it was for the harvest season; the residents in the flood plains had 1.1 extra odds (95% CI: 0.51 to 2.45) of being food insecure as opposed to households in other agro–ecological zones. Households in the upland and mountainous zone had 0.48 lower odds (95% CI: 0.24 to 0.94) of being food insecure as opposed to residents in other agro–ecological zones.

R^2=0.94 (Hosmer and Lemeshow), 0.058 (Cox and Snell), 0.091 (Nagelkerke). Model X^2 (4) = 18.236, P=0.001 * p<0.01, **p<0.05. The overall accuracy of the model to classify the food insecure house-holds: When only the constant was included, the model correctly classified 80.1% of households as food insecure, but now with the inclusion of the predictor variables, this was 79.2.

Variable(s) entered on Step 1: At least one member of the household offered casual labour, agro-ecological zone, amount of maize harvested, sold sunflower, sold beans.

DISCUSSION

Our findings have revealed that only 20% and 31% of the households surveyed during the rainy and harvest seasons respectively were food secure. This proportion is somewhat similar to the observation made in Iringa rural, where 20.7% of the surveyed households were categorised as food secure (Knuepell et al., 2009). Similar observations were reported in a study done in the dry Savanna of Nigeria in which 25% of the surveyed households were found to be food secure (Bamire, 2010). In addition, lowest level (11.1%) of food secure households has also been reported in rural areas of Kwara state in Nigeria (Obayelu, 2012). The proportion of food secure households observed in our study and that of Knuepel et al., and Bamire, are lower than 67.6% observed in Northern Jordan (Bawadi et al., 2012). A large proportion of food insecure households were observed during the rainy season. The observed seasonality pattern in food insecurity was consistent with our expectations. Thus, our findings reaffirm earlier the research findings that have documented on seasonal prevalence of household food insecurity.

The number and proportion of food insecure households decreased during rainy and harvest seasons. A very strong seasonality difference in

Table 6. Correlation matrix for the factors correlated with food insecurity score during the harvest season.

Variables	Household Size	Acreage	Maize price	Incomes diversity score	Per capita household expenditure	Crop diversity score	Age of the father	Age of the mother	Household food insecurity score	Amount of maize harvested (Kg)
Household size	1									
Acreage	0.32 (0.00**)	1								
Maize price	–0.10 (0.05*)	0.02 (0.35)	1							
Incomes diversity score	0.13 (0.02*)	0.13 (0.02*)	0.01 (0.41)	1						
Per capita household expenditure	–0.65 (<0.001)	–0.20 (<0.001)	0.02 (0.39)	–0.14 (<0.001)	1					
Crop diversity score	0.08 (0.09)	0.46 (<0.001)	–0.06 (0.18)	0.21 (<0.001)	–0.12 (0.02*)	1				
Age of the father	0.04 (0.24)	0.02 (0.382)	–0.02 (0.35)	–0.1 (0.05*)	–0.07 (0.13)	–0.05 (0.20)	1			
Age of the mother	0.06 (0.16)	–0.02 (0.39)	–0.06 (0.16)	–0.05 (0.19)	–0.11 (0.04*)	–0.02 (0.36)	0.82 (<0.001)	1		
Household food insecurity score	0.01 (0.41)	–0.21 (<0.001)	–0.12 (0.03*)	–0.13 (0.02*)	–0.01 (0.42)	–0.15 (0.01**)	0.17 (<0.001)	0.13 (0.02*)	1	
Amount of maize harvested (Kg)	0.05 (0.21)	0.43 (0.00**)	0.05 (0.20)	0.09 (0.07)	0.03 (0.32)	0.31 (0.00**)	–0.00 (0.49)	–0.03 (0.34*)	–0.36 (<0.001)	1

*Correlation is significant at the 0.05 level (2–tailed). **Correlation is significant at the 0.01 level (2–tailed).

Table 7. Predictors of household food insecurity during the harvest season.

Variable	B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I. for EXP(B)	
							Lower	Upper
Age of the mother	–1.09	0.37	8.67	1	0.00**	0.33	0.16	0.69
Mother is involved in farming only	2.02	0.69	8.45	1	0.00**	7.52	1.93	29.33
Flood plain zone	1.32	0.35	14.59	1	0.00**	3.74	1.90	7.35
Mountainous zone	0.84	0.33	6.51	1	0.01**	2.32	1.22	4.43
Harvested more than five bags of maize	1.23	0.28	18.87	1	0.00**	3.43	1.97	5.98
Constant	–1.75	0.79	4.86	1	0.03*	0.17		

*Significant at the 0.05 level (2–tailed). **Significant at the 0.001 level (2–tailed).

food insecurity has also been observed using the HFIAS in a study that was done in Burkina-Faso rural and in Iran (Frongillo and Nanama, 2006;Salarkia et al., 2011). Iran (Frongillo and Nanama, 2006; Salarkia et al., 2011).

The authors' observations also reveal that a substantial proportion of household members engaged in casual labour for cash to cope with food insecurity to meet food needs for the household especially during the rainy season. The offered labour force is likely to deny most of the household members an opportunity to work on their own fields and hence perpetuating a food insecurity cycle. This could also be a contributing factor to the observed high prevalence of food insecurity during the harvest period. The high prevalence rate of food insecurity during the rainy season is likely to jeopardize the ongoing efforts that have been put forth by the developing countries in eradicating food insecurity especially among the households challenged by most severe forms of food insecurity. Similar observations have shown that during the rainy season households struggles a lot to obtain food as evidenced by persons seeking loans from others, selling their labour for food and complaining of their children going to bed hungry (Hadley et al.,

Table 8. Factors associated with household food insecurity during the rainy season.

Variables	B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I. for EXP(B)	
							Lower	Upper
At least one household member do a casual labour	0.75	0.36	4.44	1	0.04*	2.13	1.05	4.29
Flood plain	0.11	0.40	0.08	1	0.78	1.12	0.51	2.45
Upland and mountainous zone	–0.75	0.35	4.53	1	0.03*	0.48	0.24	0.94
Amount of maize harvested	0.73	0.30	5.99	1	0.01**	2.07	1.16	3.71
Constant	0.62	0.40	2.33	1	0.13	1.85		

*Significant at the 0.05 level (2–tailed). **Significant at the 0.01 level (2–tailed).

2007). The observations from the present study provide strong evidence that the household food insecurity access scale is reliable and valid for determining seasonal differences in household food insecurity at any given agricultural season and in measuring changes in household food insecurity overtime.

The pattern of affirmative responses to the HFIAS showed a decreasing trend from the first to the last question. The progression of the severity of food insecurity was marked with a decrease in the percentage of responses from the first to the last question. A decrease in the response in the severity of food insecurity is a key inherent feature of the HFIAS. The pattern of response has revealed that most of the surveyed households have the limited access to nutritious diets as indicated by a higher proportion of households consuming less preferred foods, limited food varieties in their daily meals and consume fewer numbers of meals hence less diversity in diets and meals.

The findings from the present study compare well with the findings by the World Food Programe (WFP) from a study that was done in 2009 whereby the reductions in the quality and amount of food consumed due to food insecurity was observed (Sanogo, 2009). Similarly, in a National Demographic and health survey of 2010; a sizeable proportion (51%) of households in rural mainland Tanzania was found to consume less than three meals a day (NBS and ICF Macro, 2011). Current dietary guidelines recommends for at least three meals per day that are highly diversified to be able to maximize on nutrient intake for the human body to function well. Available literature show that food insecure individuals are more likely to have less than the estimated average requirements for nutrients and have significantly lower physical and mental development (Eicher-Miller et al., 2011). Deterioration of household food security has been found to lead into consumption of cheaper, nutrient deficient and less preferred food and may result into poor nutritional status (Darnton-Hill and Cogil, 2010). Changes in food consumption have been associated with poor nutritional status and overall health (Victora et al., 2008). Developing countries therefore need sound and practical approaches to curtail the prevailing food insecurity scenario and revert the prevailing nutrition burden.

The relationship between food insecurity and number of crops planted, acres cultivated, amount of maize harvested, agro-ecological zone, income diversity and education level were significant ($p<0.05$). This implies that an increasing crop number and diversity, access to land and education attainment are capable of improving food security situation. The relationship between education level and food insecurity has been studied; low level of education was associated with high food insecurity status (Bawadi et al., 2012). Farm size and education level have also been found to significantly predict household food insecurity (Bamire, 2010; Amaza et al., 2006). Available literature shows that food insecure individuals are more likely to have less than the estimated average requirements for nutrients and have significantly lower physical and mental development (Eicher-Miller et al., 2011). The difference observed in the proportion of food insecure households across agro-ecological zones could probably be due to diversity in the type of crops and vegetation. Agro-ecological zones have different sets of farming practices and natural biological resources use under the given agro-ecological setting, and natural biological resources play a crucial role in household food security in terms of providing an important source of cash income, particularly for poor households (Yamada et al., 2004; Bahiigwa, 1999). A significant correlation coefficient between household food insecurity score and food variety score which is a measure of food biodiversity

suggests a need to conserve the biodiversity and sustainable utilization. In addition, efforts such as improved processing of agricultural crops and awareness creation in the consumption of some of the underutilized foods which have long been considered as inferior foods may help to boost the level of food and nutrition security (Mongi et al., 2011; Mamiro et al., 2011). A few limitations which were encountered include difficulty in collecting the information especially during the rainy season given that the villages and households were highly dispersed. This made it difficult to accomplish some activities on time. Heavy rains made it difficult to access some of the households for which most of the simple constructed roads were not passable using bicycles which were the only possible means of transportation. Our analysis have shown that it is high time to guide communities in a participatory way to diversify their crops and livestock and to revive the usage of some of the indigenous foods locally available in their areas.

Conclusion

A substantial proportion of the surveyed rural households were food insecure across agricultural seasons and in various agro-ecological zones. Despite the fact that food insecurity is high during the rainy season compared to harvest season, the levels of food insecurity remains unacceptably high throughout the year. Agro-ecological zones have significant impact on food security status of households, the households living in the mountainous and upland zone had a relatively higher proportion of households categorised as food secure in both rainy and harvest season compared to other two zones. The pattern of response in the HFIAS has indicated that the households have the limited access to nutritious diets as indicated by the higher proportion of the households consuming the less preferred foods, low dietary diversity in their daily meals and fewer numbers of meals.

Conflict of Interests

The authors have not declared any conflict of interests.

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