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ENTITLEMENT TO FOOD SECURITY APPROACH EXPLAINING FOOD SECURITY IN THE SOUTHERN HIGHLANDS OF TANZANIA MORE THAN OTHER THEORIES

Dorah H. Mende
Principal Agricultural Research Officer; Socio-Economics, Agricultural Research Institute, Uyole (ARI-Uyole), Mbeya , Tanzania

Maulid W. Mwatawala
Associate Professor of Applied Entomology; Crop Science Department, Sokoine University of Agriculture, Morogoro, Tanzania

Kim A. Kayunze
Associate Professor of Rural Development; Development Studies Institute, Sokoine University of Agriculture, Morogoro, Tanzania

Abstract

Data for this paper were collected in Mbeya and Makete Districts, Tanzania, in 2012 from 233 households with the specific objectives to determine proportions of food secure and food insecure households; rank some indicators of entitlements and those of Malthusians, Anti-Malthusians and Woldemeskel's contentions with regard to their relationship with food security; and determine the impact of the above indicators on dietary energy consumed per adult equivalent per day, which was the dependent variable. The independent variables were household size, number of agricultural technologies used, number of cattle owned, income from non-agricultural activities, monetary values of household assets, farmer group membership, years of schooling of household head and kilograms of fertilizer used. The dependent variable was regressed on the eight independent variables to find the impact of each of them on it. Entitlement to food security in terms numbers of cattle owned, farmers' group membership and non-agricultural activities were found to be more important factors enhancing food security. Addressing these factors could improve food security in the study area. It is recommended that the government and policy makers should support farmers in other income generating activities besides agriculture to increase their purchasing power for higher food security.

Keywords: Entitlement, food security theories, Southern highlands, Tanzania

1. INTRODUCTION

More than 800 million people throughout the world and particularly in developing countries do not have enough food to meet their basic nutritional needs (FAO, WFP, IFAD, 2012). Even though food supplies have increased substantially, constraints to food access and continuing inadequacy of household and national incomes to purchase food, instability of supply and demand, as well as

Corresponding author's
Name: Dorah H. Mende
Email address: *dlisso@yahoo.com*

natural and man-made disasters prevent basic food needs from being fulfilled. Food security as a concept is a complex issue which is still undergoing evolution, with other authors trying to adopt a multi-disciplinary approach to link the subject with different fields of specialization. In 1996 the World Food Summit in Rome defined food security as follows: "Food security at the individual, household, national, regional and global levels exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO, 1996). This definition implies that food security is a broad concept that is more than food production and food accessibility. While developed countries of Europe, North America and Northern Asia have no problem of food insecurity, most developing countries especially in sub-Saharan Africa (SSA), South-Eastern Asia and the Pacific have it. Tanzania, like most other sub-Saharan African countries, is faced with a challenge for maintaining sustainable food security to all the people at all times. Although agriculture is central to reduction of food insecurity in Tanzania, the progress has been slow relative to the pace required for meeting the Millennium Development Goal (MDG) number one target by 2015 (URT, 2010). General causes of food insecurity in Tanzania which are also the same in most other developing countries are little acreage; dependency on rainfall; use of low level technologies for tillage, crop and livestock husbandry, processing of crop and livestock products; financial inability to use improved seeds, fertilizers, pesticides and herbicides; poor markets for agricultural and livestock products; poor division of labour at the household level; climate change; and poor transport means that constrain inputs supply and products delivery to market places (URT, 2010).

While the above factors are well known, the extent to which theoretical contentions on determinants of food security explain insecurity in Mbeya and Makete Districts is not known. Therefore, the research from which this paper is based was to analyse, among other things, the extent to which the entitlement to food approach by Sen (1981), Woldemeskel (1990) contentions, and Multhusian and Anti-Malthusian theories explain food insecurity in Mbeya and Makete Districts. The specific objectives of the study were to: (1) Determine proportions of food secure and food insecure households in the study area, (2) Rank some indicators of entitlements and those of Malthusians, Anti-Malthusians and Woldemeskel's contentions with regard to their relationship with food security, and (3) Determine the impact of the above indicators on dietary energy consumed per adult equivalent per day. The empirical knowledge generated might inform strategies to improve food security in Mbeya and Makete Districts and probably elsewhere in Tanzania.

2. CONTENTIOUS THEORETICAL ISSUES EXPLAINING FOOD SECURITY

2.1. Malthusians and anti-Malthusian contentions

Malthusians contend that food insecurity is due to the presence of too many people compared to the amount of food produced. This contention began during the time of a famous British Reverend called Thomas Robert Malthus who lived from 1766 to 1834. He wrote his first essay titled *An Essay on the Principle of Population* that was published in 1798 arguing as follows: "Population when unchecked increases in a geometrical ratio while subsistence food production increases only in an arithmetical ratio". Subsistence (i.e. food production) increases only in an arithmetical ratio... By that law of our nature which makes food necessary to life of man, the effects of these two unequal powers (of population and food) must be kept equal. This implies a strong and constantly operating check on population from the difficulty of subsistence. This difficulty (of providing sufficient food) must fall somewhere and must necessarily be severely felt by a large portion of mankind" (Malthus, 1798, cited by Dyson, 1996). The core principle of Malthus was that food is necessary for human existence even if human population tends to grow faster than the power on the earth to produce subsistence. Malthus was specific on the negative impact of population growth on food production. People who believed in the above contentions were classic Malthusians; those who believe so until today are Neo-Malthusians; and those who have contrary beliefs are Anti-Malthusians. Classic Malthusianism was the dominant thinking about the relationship between population growth and food security until the early 1960s.

In the late 1960s Classic Malthusianism became less popular after Ester Boserup, a Danish Economist who lived from 1911 to 1999, argued successfully that technological development could boost food production enough to keep up with population growth for many years. She was mainly reacting against Malthus's model of the relationship between population growth and food security. Contrary to Malthus, she argued that population growth is a major factor determining agricultural development hence food security. Ester Boserup's theory is known as an optimistic theory, and she based her theorisation on the following indications: a) If population increases, there is larger workforce and hence more food is produced; b) If population increases, mechanization occurs; more food is produced as more effective means of producing high yields of crops using mechanization are devised; and c) If population increases there will be increase in fertilizers use and more food production for the growing population, hence more food security (Boserup, 1993).

Boserup's arguments are shared by other anti-Malthusians, for example, Julian Simon (cited by Dyson, 1996) who argues: "The ultimate resource is people; skilled, spirited, and hopeful people who will exert their will and imaginations for their own benefit, and so inevitably, for the benefit of us all." Another anti-Malthusian scholar before Malthus wrote the first essay was Marquis de Condorcet (1743) who argued that "with high population increase, a very small amount of ground will be able to produce a great quantity of supplies of greater utility or higher quality" (Dyson, 1996). In addition, Condorcet argued that education would bring lower birth rates as rational human beings would see the value of limiting family size, giving their children the prospect for longer and happier lives.

2.2. The entitlement to food security theory

Unlike the above pessimistic (Malthusian) and optimistic (anti-Malthusian) theories that focus almost exclusively on food supply, the entitlement to food theory focuses more on possession of wealth materials which can be exchanged for food or can be used to get food through other means. The Entitlement approach concentrates on each person's entitlement to commodity bundles, including food, and views starvation as resulting from failure to entitlement to a bundle including enough food. Entitlements are defined as "...the set of alternative commodity bundles that a person can command in a society using the totality of rights and opportunities that he or she faces" (Sen, 1984, cited by Leach *et al.*, 1999).

The pessimistic and optimistic contentions about the relations between population growth and food security reviewed above have been challenged by Sen (1981) who argues as follows: "People do not usually starve because of insufficient supply of food at local, national or international level, but because of insufficient resources, including money ('entitlements') to acquire it." Sen classified entitlements into three categories: (i) endowments, which are all legal resources that can be used to obtain food, including money, land, machinery and animals, but also more abstract resources such as labour power, 'know-how', kinship and citizenship; (ii) entitlement mapping (or E-mapping), which includes terms of trade between endowments and food, goods, and the ratio between money wages and the price of food, or the input-output ratios in farm production; and (iii) entitlement-set, which represents the basket of food, goods, and services that a person can obtain using his/her endowments. Food security is more pronounced when some or all of the above entitlement categories are attainable to the individual or household.

2.3. Composite theories on food security

Woldemeskel (1990) opposed Sen's analysis of food security in terms of food access through entitlements rather than food availability. He argued that the entitlement approach is narrow because it dwells on only possession, while food security attainment is contingent upon four determinants: (a) availability, (b) institutional elements, (c) market forces and (d) possessions. According to Woldemeskel (1990) the entitlement approach recognises the contribution of food availability to food security but dismisses it, and completely ignores institutional elements and

market forces. Examples of institutional elements include access to extension services, credit facilities and/or financial institutions, farmer groups and or associations. Moreover, market forces include food prices in market places and prices offered to farmers for their agricultural produce.

3. METHODOLOGY

3.1. Geographical location of the study area

The research on which this paper is based was conducted in Mbeya and Makete Districts in Mbeya and Iringa regions respectively. Mbeya and Makete Districts have good climate and high agricultural potential, which provide for good economic development for they enable people to undertake various farm and non-farm activities. Mbeya District is among the eight districts of Mbeya Region. The district covers an area of 2,432 square kilometres of which 1,898 square kilometres is arable land ideal for agricultural production (URT, 2003). The district is administratively divided into three divisions namely Tembela, Isangati and Usongwe having 25 wards, and 148 villages, but the research was confined to two divisions, Tembela and Isangati from which two wards namely Tembela and Santilya were selected. Four villages, two from each of the two selected wards, were selected for the research. The villages were Ilembo Usafwa, Shibolya, Sanje and Mpande.

Makete District is one of three districts in Njombe Region. The region was established in October 2013. The district covers an area of 5,800 square kilometres of which 4,195 square kilometres is arable land ideal for agricultural production (URT, 2008). The District is administratively divided into six divisions namely Ikuwo, Ukwama, Lupalilo, Bulongwa, Magoma and Matamba having 17 wards and 97 villages. In Makete District, the research was confined to two divisions, Bulongwa and Lupalilo, from which two wards namely Isapulano and Kipagilo were selected. Four villages, two from each of the two selected wards, were selected for the research. The villages were Ivilikinge, Isapulano, Kitula and Iyoka.

3.2. Indicators used for contentious theoretical factors affecting food security

The dependent variable for this research was food security in terms of Dietary Energy Consumed (DEC) per adult equivalent (AE) per day. The independent variables whose impact on food security were analysed were (i) Household size (Malthusian school of thought); (ii) The use of improved agricultural technologies (anti-Malthusian school of thought); (iii) Involvement in non-agricultural activities, ownership of assets and livestock ownership (entitlement approach); and (iv) Farmers groups and or farmers' association membership (Woldemeskel's contentions).

3.3. Research design

The target population was all households in areas where agricultural production and other economic activities are conducted in Mbeya and Makete Districts. A cross-sectional research design and a multistage sampling procedure were adopted in the selection of respondents. The first stage involved selection of two divisions per district based on the number of major food and cash crops grown. The second stage involved purposive selection of one ward from each division from each of the two divisions per district, making four wards. The third stage involved random selection of two villages from each ward making a total of eight villages. That means four villages per district were selected. The last stage was sampling of households. The sampling frame was households which were involved in agricultural production and other economic activities.

3.4. Data collection

Primary data were the main source of information for this study and were collected through interviews using a structured questionnaire. Both quantitative and qualitative information were collected. Key informant interviews were held with people who had in-depth understanding and knowledge on various entitlement indicators to food security in the respective districts. Key informants included District Agricultural and Livestock District Officers (DALDOs), village and

ward extension officers, village government leaders, leaders of farmer groups and traditional elders. Secondary information for the study was obtained from published and unpublished documents and reports, from different sources as follows: Ministry of Agriculture, Food and Cooperatives; District Agricultural and Livestock Development Offices (DALDOs) in Mbeya and Makete Districts; Agricultural Research Institute–Uyole, Mbeya; Sokoine National Agricultural Library (SNAL); and websites.

3.5. Data processing and analysis

The primary quantitative data collected were analysed using the Statistical Package for Social Sciences (SPSS) software. Data were analysed by computing descriptive statistics to determine frequencies, percentages, statistical means, and standard deviations of individual variables. Multiple linear regression was used to assess impacts of independent variables on the dependent variable that was food security in terms of dietary energy consumed per adult equivalent per day. The dependent variable and the independent variables were first checked for normality and multicollinearity. Normality was checked by computing distribution curves of all the variables and observing them visually to find whether any of them was skewed. Income from non-agricultural activities, number of cattle owned and monetary values of household assets were found to be skewed. Therefore, they were transformed into normal distributions using $\log_{10}$ transformations. Multicollinearity was checked by computing tolerances and variance inflation factors (VIF). According to Landau and Everitt (2004), tolerance values of more than 0.1 and VIF values of not more than 10 show that there is no multicollinearity. None of the tolerances or VIF value was less than 0.1 or greater than 10 respectively, hence there was no multicollinearity.

3.6. Adult equivalent units' computation

Cognisant of the fact that if variables such as income and dietary energy consumed are expressed per capita they do not reflect good comparative figures in households with different sizes and composition by age and sex, dietary energy consumed was expressed per adult equivalent following the procedure used by Collier *et al.* (1990). In order to calculate adult equivalent units, the sex and age of every household member were recorded. A two-step procedure was followed whereby in the first step adult equivalent scales for East Africa by age and sex were added up for all household members to get all the household members in terms of adult equivalents. The equivalent scales are presented in Table 1. The second step involved adjusting the above adult equivalents for economies of scale due to the fact that larger households need fewer resources per person due to sharing some facilities. The economies of scale are taken into account by multiplying the adult equivalent units by the average cost (Table 2) corresponding to the number of people in the household. The adjusted adult equivalent units were used as denominators for calculating values per adult equivalent in particular households.

Table 1: Adult equivalent scales for East Africa

Age group	Sex	
	Male	Female
0 - 2	0.40	0.40
3 - 4	0.48	0.48
5 - 6	0.56	0.56
7 - 8	0.64	0.64
9 - 10	0.76	0.76
11 - 12	0.80	0.88
13 - 14	1.00	1.00
15 - 18	1.20	1.00
19 - 59	1.00	0.88
Above 60+	0.88	0.72

Source: Latham (1965), cited by Collier *et al*. (1990)

Table 2: Household economies of scale constants

Household size (Number of adults)	Marginal costs	Average costs
1	1.000	1.000
2	0.892	0.946
3	0.798	0.897
4	0.713	0.851
5	0.632	0.807
6	0.632	0.778
7	0.632	0.757
8	0.632	0.741
9	0.632	0.729
Above 10+	0.632	0.719

Source: Deaton (1980), cited by Collier *et al*. (1990)

3.7. Dietary energy consumed computation

Quantities of all food items consumed were recorded. Quantities of dietary energy in all the food items were computed using Tanzania Food Composition Tables (Lukmanji *et al*., 2008). The quantities of dietary energy consumed by all household members were expressed per Adult Equivalent Units (AEU). Dietary Energy Consumed per AEU was computed to DEC per capita and per adult equivalent per day based on all foodstuffs eaten for thirty days. In this case households were said to be food insecure if they had consumed less than 2100 kCal per capita or less than 2200 kCal per adult equivalent per day.

4. RESULTS AND DISCUSSIONS

4.1. Indicators of the contentious issues explaining food security

Household size was used as an indicator of population based on the level of analysis that was a household and the study being a cross-sectional one. The results showed the mean household size was 4.39 persons with the minimum and the maximum of 1.0 and 10.0 persons respectively. The major improved technologies used in the study area were fertilizer, pesticides and improved seeds. However, very few households used at least one of the improved technologies. The total number of the improved technologies per household as a composite measure of technology was used so that more households could be included in the analysis. The results showed that the greatest proportion (49.4%) of the sampled households used two technologies and few (1.7%) did not use any technology (Table 3). The reasons given for none use of technologies were inadequate knowledge of improved technologies and lack of capital to purchase inputs such as fertilizers and pesticides. Involvement in non-agricultural activities by the households was used as an indicator of entitlement because households which were involved in non-agricultural activities were more likely to be food secure. The results showed that 54.5% of the sampled households were involved in non-agricultural activities. During key informant interviews and focus group discussions, the respondents argued that they were constrained by shortage of land for agricultural activities and therefore they were obliged to be involved in non-agricultural activities to supplement income from agriculture.

Table 3: Total technologies used per household

Number of technologies	Frequency	Percentage
0	4	1.7
1	30	12.9
2	115	49.4
3	84	36.1
Total	233	100

Household assets ownership was used as an indicator of entitlement because they can be converted into cash during food insecurity crises. Assets are also regarded as stocks or a base of wealth that reflects the accumulation and use of economic value and income over time. Membership to farmer groups or associations was used as an indicator of institution because in rural areas farmer groups or associations are vehicles for development. For example, access to credit or other financial institutions depends on individual membership to groups or associations. Access to credit will increase household income, food production and hence improved food security. Years of schooling of household head was used as an indicator of institution because education attainment by the head of household could lead to awareness of the possible advantages of modernizing agriculture and diversification of household income sources, which in turn would enhance household's food supply. Dietary energy consumed per adult equivalent per day was used as a measure of food security because it is a universal measure of food security and the actual indicator of the same, which is recommended and used by FAO.

4.2. Proportions of food secure and insecure households

The results from dietary energy consumed per adult equivalent per day showed that a minimum of 792 and a maximum of 21,100 kCal had been consumed. They also showed a mean of 3,368.6 kCal and a standard deviation of 1, 1728.1 kCal per adult equivalent per day. The dietary energy consumed per adult equivalent per day was divided into two groups of food secure and food insecure households based on the cut-off point of 2,200 kCal per adult equivalent per day, as stated above (Section 3.7). Food secure households were 79% while food insecure ones were 21%. The respondents were asked to mention major factors that affected food security in their households. Several factors (Table 4) were mentioned by the respondents to affect food security. A high proportion of the respondents reported low use of improved technologies (12.5%), which they said was due to inadequate knowledge of improved technologies. The respondents' argument was supported by observation from key informant interviews and focus group discussions. They argued that they rarely had access to extension services which are a channel for dissemination of new and improved technologies. Moreover, the respondents reported large family size as compared with level of food production, low use of fertilizers due to high prices and small plot sizes per household for crop production. A small proportion of the respondents reported destruction of crops by vermins, laziness and sickness of household members as minor factors affecting food security**.**

Table 4: Factors affecting food security (n=1513)

Variable	Frequency	Percentage
Over sale of food crops	126	8.3
Low production due to low capital	128	8.5
Climate change	130	8.6
Small plot size	172	11.4
Low use fertilizers due to high prices	173	11.4
Low use of improved technologies	189	12.5
Destruction of crops by vermin	33	2.2
Low soil fertility	55	3.6
High prices of food in markets	162	10.7
Laziness	72	4.8
Sickness of household members	100	6.6
Large family size as compared to level of food production	173	11.4
Total	1513	100

4.3. Independent sample t-test comparing levels of food security between theoretical indicators

An independent sample t-test was conducted to compare the levels of food security between different theoretical indicators (Table 5). The indicators included household size, number of improved technologies used, cattle ownership and farmers groups and or association membership.

Levels of food security in terms of amount of food produced per capita were compared between households with at most 4 people and those with 5 and more people, those who had used at most two agricultural technologies and those who had used three and more agricultural technologies, those who owned cattle and those who didn't, and those who were members of farmers groups and or associations and those who were not. As seen in Table 5, it was found that there were significant differences in amounts of food produced per capita between households with at most 4 people and households with 5 and more people ($F = 9.197$, $p \leq 0.01$), households which used at most 2 improved technologies and those which used 3 and more technologies ($F = 14.999$, $p \leq 0.001$) and households which owned cattle and those which did not own cattle ($F = 5.889$, $p \leq 0.05$). The results imply that household size, uses of improved technologies and cattle ownership have big relationships with the amount of food produced per capita.

Table 5: Independent sample t-test comparing levels of food security between theoretical indicators

Variables compared	n	Mean	F-value	p-value
Amount of food produced per capita in households with at most 4 people	105	10.7681	9.197**	0.003
Amount of food produced per capita in households with 5 and more people	128	14.0486		
Amount of food produced per capita in households which use at most 2 technologies	149	10.8985	14.999***	0.000
Amount of food produced per capita in households which used 3 and more technologies	84	15.5356		
Amount of food produced per capita in households which own cattle	209	13.1878	5.889*	0.016
Amount of food produced per capita in households which do not cattle	24	7.1930		
Amount of food produced in households whose their heads are members in institutions	217	12.4280	0.348	0.556
Amount of food produced in households whose their heads are not members in institutions	16	14.5000		
Monetary values of food eaten per adult equivalent in households with at most 4 people	105	49163.9303	5.557*	0.019
Monetary values of food eaten per adult equivalent with 5 and more people	128	27446.4375		
Monetary values of food eaten per adult equivalent in households which use at most 2 technologies	149	29890.5421	7.246**	0.008
Monetary values of food eaten per adult equivalent in households which used 3 and more technologies	84	50257.9274		
Monetary values of food eaten per adult equivalent in households which own cattle	209	37547.8942	0.238	0.626
Monetary values of food eaten per adult equivalent in households which do not own cattle	24	34493.6165		
Monetary values of food eaten per adult equivalent in households whose their heads are members in institutions	217	37043.4936	0.000	0.990
Monetary values of food eaten per adult equivalent in households whose their heads are not members in institutions	16	39807.4106		
Dietary energy consumed per adult equivalent in households with at most 4 people	105	4001.1225	4.275*	0.040

Dietary energy consumed per adult equivalent in households with 5 and more people	128	2849.6692		
Dietary energy consumed per adult equivalent in households which used at most 2 technologies	149	3131.9897	2.433	0.120
Dietary energy consumed per adult equivalent in households which used 3 technologies and more	84	3788.2030		
Dietary energy consumed per adult equivalent in households which own cattle	209	3414.8076	0.201	0.654
Dietary energy consumed per adult equivalent in households which do not own cattle	24	2965.8640		
Dietary energy consumed per adult equivalent in households whose their heads are members in institutions	217	3366.4112	0.270	0.869
Dietary energy consumed per adult equivalent in households whose their heads are not members in institutions	16	3397.7679		

*Significant at the 5% level (2-tailed); **Significant at the 1% level (2-tailed); ***Significant at the 0.1% level (2-tailed)

Regarding monetary value of food eaten per adult equivalent per day, significant differences were observed between households with at most 4 people and those with 5 and more people ($F = 5.557$, $p \leq 0.05$) and households which used at most 2 improved technologies and those which used 3 and more technologies ($F = 246$, $p \leq 0.01$). The results imply that household size and use of improved technologies have big relationships with monetary value of food consumed per adult equivalent. Also there was significant difference in dietary energy consumed between households with at most 4 people and those with 5 and more people ($F = 4.275$, $p \leq 0.04$). The result implies that household size has a big relationship with food security level.

4.4. Impact of some of independent variables on food security

The dependent variable, food security, was regressed on eight independent variables which were thought to account for more of variation in household food security (Table 6). The independent variables were household size, number of technologies used per household, number of cattle owned, income from non-agricultural activities, monetary value of household assets, farmers' group membership, years of schooling of household head and amount of fertilizer used. The coefficient of determination, R^2, was 0.367, which means that the eight independent variables that were entered in the multiple linear regression models accounted for 36.7% of variation in the dependent variable, food security. The remaining 63.3% was probably due to other independent variables not included in the model and errors in the research (Mendenhall and Beaver, 1991). The statistical tests of the model itself showed that the explanatory power of the model was highly significant ($p \leq 0.001$). With regard to influence of independent variables on food security, the results in Table 5 indicate that three out of the eight independent variables had significant positive impacts on the dependent variable. The levels of significance were as follows: household size ($p \leq 0.001$), farmers' group membership ($p \leq 0.05$) and number of cattle owned ($p \leq 0.05$).

Table 6: Impact of some of the independent variables to dietary energy consumed per adult equivalent unit

Model	n	Unstandardized Coefficients		Standardized coefficients	t	Sig	Collinearity tests	
		B	Std Error	Beta			Tolerance	VIF
Constant		5385.396	1843.247		2.922	0.005		
Household size	233	-394.183	71.273	-0.580	-5.531***	0.000	0.959	1.042
Number of technologies used	229	-214.181	224.112	-0.148	-0.956	0.344	0.441	2.267

Number of livestock kept	209	858.991	437.926	0.225	1.961*	0.050	0.804	1.243
Income from non-agricultural activities	125	361.864	221.850	0.209	1.706	0.094	0.783	1.277
Household assets values	233	-1.540E-5	0.000	-0.105	-0.857	0.395	0.702	1.425
Farmer group membership	16	858.185	391.331	0.255	2.193*	0.033	0.783	1.277
Education of household head	233	-206.748	107.252	-0.216	-1.928	0.059	0.843	1.186
Amount of fertilizers used	163	-410.061	383.113	-0.169	-1.070	0.289	0.423	2.366

Dependent variable: Dietary Energy Consumed per adult equivalent unit R^2 adjusted = 0.367, *** $p \leq 0.001$, ** $p \leq 0.01$, * $p \leq 0.05$

Household size showed negative significant impact ($p \leq 0.001$) on food security. This implies that as household size gets larger household food security decreases. This result is in conformity with Malthusian and neo-Malthusian contentions that population has negative influence on food security. It is also consistent with results of a study conducted by Aidoo *et al.* (2013) in Ghana. The plausible explanation of the findings is that, where households depend on less productive land, low use of agricultural technologies and poor implements to cultivate land, increasing household size results in increased demand for food. This demand, however, cannot match with the existing food supply from own production, and this ultimately ends up with the household becoming food insecure. However, some previous researches elsewhere have shown positive impact of household size on household food security. For example, Kayunze (2000) found positive impact of household size in Mbeya Region. Kamuzora (2001) found less poverty in larger households in Kagera Region. In both cases the authors said that the likely explanations for the findings were that it happens more where households have more labour force in terms of bigger proportion of adult members who work either on-farm or otherwise. Kayunze (2000) argues that in households with higher dependency ratio or where households depend on one or few members who are working, the bigger the household size the less the food security.

Number of cattle owned showed positive significant ($p \leq 0.05$) impact on food security. This might imply that households that own larger numbers of cattle are likely to be more food secure. The results are in conformity with the entitlement approach to food security by Sen (1981) who argued that "people do not usually starve because of an insufficient supply of food but because they have insufficient resources including money to acquire it." Cattle ownership is a good entitlement for gaining access to food since cattle and their products are sold to get cash to buy food. Observations from the key informant interviews and FGDs showed that, among livestock types owned, cattle contribute to households' economy in different ways. They mentioned major benefits obtained from cattle as a source of draught power, cash income, supplementary food, and manure, which is used as fertilizer. Moreover, they added that for them cattle and other livestock are a living bank and are considered as a means of security and a coping strategy against crop failure and other calamities.

Farmer groups and or farmer association membership showed positive significant ($p \leq 0.05$) impact on food security. This implies that households whose heads are members of farmer groups and or farmer associations are more likely to be food secure. The result supports Woldemeskel (1990) suggestions that institutions contribute to household food availability. In most rural areas farmer groups or associations are regarded as institutions which play a vital role in development and livelihood of people. Active participation of household heads in these institutions tend to attract benefits in terms of helping members in mobilizing resources within society for agricultural operations and marketing, access to inputs at cheaper prices, enabling members to take advantage

of economies of scale in production, processing and marketing of agricultural produce. It is expected that as the level of participation increases the probability of being food secure increases.

Monetary values of assets owned had negative impact (Beta = -0.105) on food security, but which was not significant ($p > 0.05$). This is contrary to prior expectations that assets ownership affect food security positively. According to Sen (1981) the entitlement to food theory focuses more on possession of wealth materials which can be exchanged for food or can be used to get food through other means. The negative impact on food security found could be due to the fact that in the sample most of assets owned were not productive. Most of assets owned in the sample included houses for household members' shelter, bicycles, hand hoes, radio and mobile phones which were not productive.

Income from non-agricultural activities showed a positive significant impact (Beta = 0.209) on food security. Although the impact was not significant, this indicates that households which are involved in non-agricultural activities are more likely to be food secure than those which do not have such activities. This result is in conformity with Sen's entitlement approach to food security under endowment set category which are all legal resources that can be used to obtain food. During key informant interviews and focus group discussions it was revealed that most households in the study area had one or more additional sources of income other than agriculture. Other studies, for example by Reardon *et al.* (1998) and Asogwa and Umeh (2012), found that income from non-agricultural activities is potentially important for long term food security because it can increase the use of farm inputs and hence farm productivity and ability to intensify production. Moreover, income from non-agricultural activities enhances a household's economy and food security by giving additional income and reducing food deficit when agricultural production falls short and also avoiding grain sales.

Amount of fertilizer used in kilograms had negative impact (Beta = -0.169) on food security, albeit it was not statistically significant. This is contrary to prior expectations that use of fertilizers results in more food security as stated by Ester Boserup. Although the results do not support Boserup's (1993) contention that fertilizer use can improve food security status of the household it does not mean that she was not right. These results might imply that in the sample those households which used fertilizers used small amounts per unit area, which could not make significant change in food security status of the household. The results show that the proportion of the sampled households which used fertilizer was 70%. However, among the households which used fertilizers the majority (68.6%) used 50 kg and fewer kg/acre. Moreover, the negative impact does not mean that use of fertilizer results in food insecurity, but this might imply that, since fertilizer is expensive, a farmer might use all household cash meant for food and purchase fertilizer which could not make much change in crop yield and leave the household to be food insecure. The number of technologies used had negative impact (Beta = -0.148) on food security, but which was not significant ($p > 0.05$). This result is contrary to anti-Malthusians' contention that use of improved technologies improves productivity and increases food supply. However, this does not mean that Ester Boserup (1993) and other Anti-Malthusians were not right, but in the sample 49.4% of households used at most two technologies while 36.1% used three technologies, 12.9% used 1 technology and 1.7% did not use any technology. The negative impact of the number of technologies used on food security might imply that those households which used the technologies did not use them as per recommendations due to inadequate knowledge.

5. CONCLUSION AND RECOMMENDATIONS

It was found that, of the sampled households, 79% were food secure. This proportion is not so good since the study area is potential for various agricultural and non-agricultural activities. These findings might imply that the productivity potential of the study area was not fully utilized. On the basis of this conclusion, Mbeya and Makete people are urged to utilize the productivity potential of

their area to improve their food security status. It was also found that population in terms of household size was the most important factor influencing food security negatively in Mbeya and Makete Districts. Therefore, it is concluded that household size is a factor with the highest negative effect on food security in the study area based on the sample. On the basis of this conclusion, the government and policy makers are urged to introduce training programmes on health and birth control measures to be directed to the people of Mbeya and Makete Districts. This should be aimed at controlling family size in the long run, which could have positive effects on households' food security.

The most important theory explaining food security in the study area is entitlement to food, particularly income from non-agricultural activities and livestock, especially cattle. On the basis of this conclusion, Mbeya and Makete Districts people are urged, besides crop production, to look for profitable non-agricultural activities in order to increase their income and get more access to food. Policy makers and NGOs are urged to support other income generating activities in Mbeya and Makete Districts so as to increase income and hence increase their purchasing power and get access to food. Since livestock ownership is a good entitlement for gaining access to food, people of Mbeya and Makete Districts are also urged to keep more cattle and other livestock types especially goats, sheep and local chicken so that they can get income to buy food and other needs. The Ministry of Livestock and Fisheries is urged to give more support to people keeping livestock in Mbeya and Makete Districts.

Institutions in terms of farmer groups and associations membership also play a considerable role in enhancing food security, although very few respondents from the sample were found to be members of such groups and associations. Given the role of farmer groups and associations in rural development generally and agricultural development specifically, the introduction and promotion of groups and associations of farmers should be given adequate priority by the government and policy makers. Moreover, Mbeya and Makete people are urged to form farmer groups and or associations for easy access to extension services, agricultural inputs and other services related to improved agricultural production and improve their food security status.

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