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AGGREGATED AND DISAGGREGATED DATA ON FOOD SECURITY: EMPIRICAL EVIDENCE FROM TANZANIA

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ABSTRACT

A study to assess food security situation in Tanzania was done in Moshi Rural district in Kilimanjaro region. The study was done in three villages, namely Komakundi, Mbahe and Mawanjeni and employed a cross-sectional research design by which a total of 90 farmers 30 from each village were interviewed using structured questionnaire. The questionnaire focused on the size of farmers holdings, types of crops cultivated, amounts of crops harvested during good, bad and average years, other sources of food and cash, amount of food purchased from the market and the amount of food consumed within the household. Calculations of food and energy adequacy were done and the villages were compared both at village level and at household level. Although there were differences in food security situation between the villages, on aggregate terms the study area was found to be food secure as it was above the minimum requirement for each household. However, on disaggregating the data by village, households of Mawanjeni village were found to be seriously food insecure. Further disaggregation of the data showed statistically significant ($P < 0.01$) variations between households of the same village. Consideration of disaggregated data in rural development planning and time trend research in food security are recommended in the present paper.

1.0 INTRODUCTION

Food security can be addressed at different levels in any social system. It can thus be addressed at global, national, regional, community, household and individual levels. Regarding the present situation of global overproduction of food and the surprising food insecurity in many households of developing world, food security analysts have in recent years tended to move away from macro level analysis to micro-level analysis. Analysis of food security at macro-level presupposes a trickle-down effect to the households. Whereas concern with national food security (macro level) focuses on supplies of food within the country, ability to import as required and ability to distribute supplies to areas of need, concern with local food security (micro level) focuses on the household and the individual members of households having access to sufficient food for active and healthy life (Hubbard, 1995).

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The achievement of the goal of household food security depends mostly on three things; namely food availability/adequacy, food accessibility and stability of food supply (Maxwell and Frankernberger, 1992). Food availability refers to the food in stock plus what can be obtained from the fields, gardens as well as other sources such as purchasing from the market. Food adequacy reflects both the quantity and quality of food. Thus, there should be enough food (i.e. quantity) to meet daily requirement for all the members of the household, and the food should be of the right type (i.e. quality) to provide all essential nutrients (Mosha, 1990).

Stability of food supply on the other hand entails a continuous flow of food in the homestead either through quantity stored or from external sources. Access to food encompasses physical, economic and social aspects. It involves processes through which food reaches people. Physical access to food relates both to the adequacy of supply and the efficiency of the distribution system, including storage, preservation, transport, marketing and processing. Economic access relates to resources for the procurement of food, the ability to generate income, whether in cash or in kind and the proportion of income that is actually available for consumption purposes (Holmboe-Ottesen and Wandel, 1992). It should be noted that different households differ in their capacity to ensure food security. From few previous studies which have assessed household food security in Tanzania the proportion of households in rural areas which suffer from food insecurity is as high as 77 % (TFNC, 1992).

Time series information on household food security in the country is lacking, making it difficult to examine trends of interest to planners and policy makers. Most of the available information is on aggregate basis.

Consequently, the present study was conducted in Moshi Rural District, Kilimanjaro Region in Northern Tanzania to examine village and household food security in the area.

2.0 METHODOLOGY OF THE STUDY

2.1 Sampling procedure

The study was conducted in Moshi Rural District, Kilimanjaro region in Tanzania between July 1996 and January 1997. A random sample of 90 households, 30 from each village was drawn from 3 villages that were selected from two different agroecological zones (based on altitude along the slopes of Mount. Two villages were chosen from the upper slopes of the mountain. These were Komakundi village, which lies at 1400 m.a.s.l, and Mbahe village that lies at 1600 m.a.s.l. In the upper slopes rainfall pattern is predictable throughout the year thus allowing permanent agroforestry home gardens around the homeyards. Mawanjeni village was chosen from the plains (lowlands) at 850 m.a.s.l It represented a semi-arid area where rainfall is not predictable and has seasonal cropping pattern.

2.2 Data collection

Structured questionnaire was the main instrument used for data collection. The questionnaire focused on the size of farmers' holdings, types of crops cultivated, amounts of crops harvested on good, bad and average years, other sources of food and cash, amount of food purchased from the market and the amount of food sold. Information on the amount of food consumed within the household was also sought.

2.3 Measurement of Food and Energy Adequacy

Various sources of food crops raised per annum at household level were expressed as maize equivalent. Computation of the percentage food and energy adequacy was done to see whether the households met their daily food and energy requirements. The criterion of production only was used in order to measure the degree of food self-sufficiency in the villages surveyed. The amount of the available produced food was taken as an indicator of food security in the households of Moshi rural district because the households depended most on agriculture for their food availability.

Daily food production per capita (DFP), daily energy per capita (DE), per capita daily food adequacy (FA) and daily energy adequacy (EA) were calculated using the following formulae:

$$\text{DFP (kg/capita/day)} = \frac{\text{Food available (kg)}}{\text{Population x Time (365)}}$$

$$\text{DE (Kcal/capita/day)} = \text{DFP} \times 3450 \text{ Kcal}$$

$$\text{FA (\%)} = \frac{Tp \times 100}{P \times T \times R}$$

Where: Tp = Household total food production for consumption (kg), P = Total population, T = Number of days in one year (365 days), R = Recommended amount of food (0.7 kg/person/day)

$$\text{EA (\%)} = \frac{Tp \times K \times 100}{P \times T \times R}$$

Where: Tp = Household Total Food Production for Consumption (kg); P = Total population; K = Energy density of Tanzania maize edible portion (Kilocalories/ person/day); T = Number of days in one year (365 days) and R = Recommended amount of energy (2780 Kilocalories/person/day).

2.4 Data analysis

For quantitative variables, two way analysis of variance (ANOVA) was the tool used to assess the statistical variation among the three villages. Pair-wise comparison of village means was done using T-Test. Cross tabulation involving chi-square test was used to assess statistical association between village and energy consumption. The Null hypothesis of no significant difference in food security between the three villages with respect to food and energy adequacy was tested against an alternative hypothesis that, there was a significant difference.

3.0 RESULTS AND DISCUSSION

3.1 Household Food Availability

It was observed that most of the respondents in the area of the present study produce their own food but depended on the market mostly for food items, which they could not produce. Agricultural production was the mainstay of most households, so crop failure meant disturbed food security. From food production, households got food and extra income to buy foods they could not produce as well as other household needs. Table 1 shows the total food production per village based on quantifiable food produce expressed as maize equivalents in good, average and bad years.

Table 1: Total Food Production per Village based on Quantifiable Food Produce Expressed as Maize Equivalents

Village	Total food available (kg)		
	Good year	Average year	Bad year
Mawanjeni (n=30)	24976	10973	3035
Komakundi (n=30)	83009	43364	22300
Mbahe (n=30)	71079	36690	19741
Total (n=90)	179064	91027	45076

The ANOVA results show that there was a statistically significant ($P<0.05$) variation in food production among households of the villages studied. Significant ($p<0.05$) differences were observed between the three villages following T-test. comparison of village means. Mean food production for the three villages was 12995, 49558 and 42503 kg per year for Mawanjeni, Komakundi and Mbahe respectively.

The difference was also statistically significant ($p<0.05$) in good, average and bad years. The high level of food production in the upper slopes (Komakundi and Mbahe) can be explained by several factors. Climate in the uplands allows farmers to have permanent homegardens around their homeyards. Thus, the farmers in the uplands have two types of farms, namely "*Kihamba*" (land with permanent crops especially coffee and banana) and "*Shamba*" (land mostly for annual crops). Food crops produced in the Kihamba apart from banana were maize, beans, sweet potatoes, cocoyams, Irish potatoes, fruits and vegetables. Beans, maize, finger millet, sorghum and sunflower were raised in the "*shamba*". Whereas farmers in Mbahe and Komakundi made use of two types of farms and hence two different farming systems that is, banana/coffee and maize/beans farming systems in the upper slopes and lower slopes respectively, farmers in the plains (Mawanjeni village) relied mainly on a single farming system, which was predominantly maize/ beans inter-cropping.

However, the respondents contended that, the amount of food indicated in Table 1 was not all consumed by the household members. Part of it had to be sold to cater for other family needs.

3.2 Assessment of household food and energy adequacy

Household food balance sheets for Mawanjeni, Komakundi and Mbahe villages for good, average and bad years are presented in Tables 2, 3, and 4 respectively. Production during 1996/97 was considered a representative of a good year. The picture that emerges from these calculations is that, based on production alone, the villages taken together are not in food deficit in a good year. Village food production in 1996/97 was above food and energy requirements by about 17% and 2% respectively. When the villages are treated individually, the Mawanjeni village does not reach the food and energy requirement even in a good year and it has a deficit of 50% and 57% respectively. Komakundi and Mbahe villages are above the food and energy requirement by 57% and 37%, and 40% and 22% respectively on a good year. ANOVA results show that there is a significant difference ($p < 0.05$) on food and energy adequacy between the three villages. Also, there is a significant difference in food and energy adequacy between, bad and average years ($p < 0.05$). This is the situation at the village level and it must not be taken as what is happening at household level. Production by big farmers is likely to have inflated the figures and thus to obscure the true picture.

Table 2: Household Food Balance Sheet for Mawanjeni, Komakundi and Mbahe Villages for Good year based on Total Food Production only

Village	Population (1995)[1]	TFP (Kg)	DFP (Kg)	DE (kcal)	% adequacy per capita per day	
					Food	Energy
Mawanjeni	193	24976	0.35	1208	50	43
Komakundi	207	83009	1.10	3795	157	137
Mbahe	199	71079	0.98	3381	140	122
Total	**599**	**179064**	**0.82**	**2829**	**117**	**102**

[1] Total population of the surveyed area based on 1995 records, TFP = Total Food Production per capita(kg), DFP = Daily Food Production per capita (kg), D E = Daily Energy per capita (Kcal).

On an average year, all the three villages were in food and energy deficit. Mawanjeni, Komakundi and Mbahe villages had a deficit of 79% and 81%, 19% and 29%, and 29% and 38% food and energy requirement respectively. The situation was not good in bad year. Mawanjeni village was the most seriously affected in all years. In terms of food and energy requirement there was a deficit of 94% and 95%, 59% and 64%, and 61% and 66% in bad year, for Mawanjeni, Komakundi and Mbahe villages respectively (Table 4). Whether in a good or a bad year, Komakundi was the village with the highest level of both food and energy adequacy followed by Mbahe.

Table 3: Household Food Balance Sheet for Mawanjeni, Komakundi and Mbahe Villages on an Average year based on Total Food Production only

Village	Population (1995)	TFP (kg)	DFP (kg)	DE (Kcal)	% adequacy per capita per day	
					Food	Energy
Mawanjeni	193	10973	0.16	517	21	19
Komakundi	207	43364	0.57	1967	81	71
Mbahe	199	36690	0.50	1725	71	62
Total	**599**	**91027**	**0.42**	**1449**	**60**	**52**

Table 4: Household Food Balance Sheet for Mawanjeni, Komakundi and Mbahe Villages on a Bad year based on Total Food Production only

Village	Population (1995)	TFP (Kg)	DFP (Kg)	DE (Kcal)	% adequacy per capita per day	
					Food	Energy
Mawanjeni	193	3035	0.04	138	6	5
Komakundi	207	22300	0.29	1001	41	36
Mbahe	199	19741	0.27	932	39	34
Total	**599**	**45076**	**0.21**	**725**	**30**	**26**

It was convincing to hear from the respondents that they rarely had bad years. Most years were good or average except for some years when the area experienced serious drought.

Considering households with access to food of less than 2000 Kcal/capita/day energy level as severely affected, whereas those between 2000 and 2500 Kcal/capita/day moderately affected and above 2500 Kcal/capita/day less affected by

food deficit, households of Mawanjeni village could not meet the daily energy requirement even in a good year (Table 2). What is known today is that poverty rather than scarcity of food is the main reason for household food insecurity (Nyborg and Haug, 1995). This is mostly caused by low purchasing power of household members in most rural areas of Tanzania. Inadequate purchasing power is a result of insufficient opportunities for gainful employment. Sinha *et al.* (1989) argued that famines of jobs and the purchasing power are the primary causes of famines of food in poor households.

Mawenjeni village's daily food energy per capita in a good year was only 1208 Kcal while the levels for Komakundi and Mbahe were as high as 3795 and 3381 Kcal respectively, showing that the two villages were less affected. On the average and bad years all villages were affected, Mawanjeni most seriously as far as daily energy requirement is concerned.

On aggregate, the daily energy per capita was 2829 Kcal/capita/day for the three villages in a good year suggesting that there was no food deficit in the area. Even Mawanjeni village would be considered food secure while it was seriously affected by food deficit. This shows how aggregate data in food security can generalise a situation, which is only prevalent in one part of a geographical area.

3.3 Household food consumption

When the calorific values were calculated based on the individual households, it was found that some households consumed very high levels of calories while others consumed very little. The respondents were categorised into different status levels (rich, medium, poor and very poor) based on the daily per capita energy intake according to Brian (1994). The households consuming less than 1500 Kcal per capita per day were considered very poor; between 1500 and 1900 Kcal per capita per day, poor; between 2000 and 3000, medium and above 3000 Kcal per capita per day, were considered rich. This was based on the FAO recommendation of 2870 Kcal per capita per day for a farmer in the tropics.

Table 5 thus shows distribution of the respondents by the status of their households based on the daily calories available for the household. Chi-square has shown a highly significant ($p<0.01$) association between the status of the households and their villages suggesting a strong difference in food security between households of the three villages, Mawanjeni being the most food insecure. More than 50 % of the village's respondents were classified as being very poor while only 7 % were rich. More than 50 % of the respondents from Komakundi village were in the medium status while the proportion for Mbahe village was 40 %. The variation that was observed within each village confirms the differences existing among the households as far as available energy is concerned. This implies that

conclusions on food security based on aggregate data, even at village level can be quite misleading.

Table 5: The Status of the Households based on the Average Kcal per Capita per Day for the three Villages

	Mawanjeni		Komakundi		Mbahe	
Status	No.	%	No.	%	No.	%
Rich	2	7	6	20	6	20
Medium	5	17	16	53	12	40
Poor	7	23	6	20	9	30
Very poor	16	53	2	7	3	10

Evidence obtained during the survey demonstrates that some rich households could consume as much as 4500 Kcal/capita/day whereas the very poor could consume as low as 500 Kcal/capita/day in a good year.

4.0 CONCLUSION

This analysis has shown that the aggregation of food security data, even at lower levels such as a village, conceals the actual differences prevalent amongst households and individuals. The aggregation at a higher level (region, national) blurs the disparities even further. Different local conditions necessary for food security prevail in different localities. Moreover, it is shown that even within the same agro-ecological system, households differ in their food security situations depending on their asset portfolio, thus richer households are more secure than the poor ones. In terms of absolute quantities, a more recent study could come up with different findings in terms of food production and adequacy in the study area. However, the general observation on the masking effect of data aggregation would expectedly remain unchanged. Thus, findings of the present study are still relevant although the data have been collected more than three years ago.

There is a need to conduct household consumption and possibly individual consumption survey before concluding on the status of a country's food security. National Food Balance Sheets data should not be used to reflect the food security

situation of the villages, households or individuals. The data can be used to formulate agricultural policies concerned with food production, distribution and consumption thus forming a basis for monitoring changes and forecasting food consumption patterns.

As long as national food availability is not a problem, the attention should be towards how to address problems causing household food insecurity. Research should also go further to study the individual accessibility of food as some individuals may suffer from food insecurity despite the plentiful amounts of the available food shown in records.

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