Assessing the Status of Food Security of Subsistence Paddy Farming Households in the Kegalle and Gampaha Districts in Sri Lanka

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ABSTRACT

Food security can be defined as "the access by all people at all times to enough food for an active, healthy life". This study evaluates the applicability of United States Department of Agriculture (USDA) food insecurity instrument in the households in Sri Lankan context based on the case of status of food security of subsistence paddy farming households in the Kegalle and Gampaha districts. It uses the primary data collected through questionnaire based survey conducted in these districts over the period of June to August 2006 with 120 randomly selected households. One Parameter Logistic Item Response Model (Rasch model) was used to analyzed data. The Food Insecurity Scale was developed, where the households were classified as "food secure", "food insecure without hunger", "food insecure with moderate hunger" and "food insecure with severe hunger". The results highlight that the USDA approach were not compatible to evaluate the food security status of households. It reveals that the emergent conceptualization of food insecurity from the USA differs from that found in these districts in Sri Lanka, thus cannot be used as a sophisticated instrument for measuring household food security of subsistence paddy farmers.

KEYWORDS: Food Security, Rasch model, Rural households, Subsistence Paddy Farming.

INTRODUCTION

Food security is an inherently unobservable concept that has largely eluded precise and operational definition. The most common definition of food security is "access by all people at all times to enough and appropriate food to provide the energy and nutrients needed to maintain an active and healthy life" (Barrett, 2002). It has many facets and dimensions such as food availability (sufficient quantities of appropriate, necessary types of food from domestic production, commercial imports or donors), food accessibility (adequacy of incomes or other resources to purchase or barter to obtain levels of appropriate food needed to maintain consumption of proper diet) and food utilization (food is properly used, proper food processing and storage techniques are employed, adequate knowledge of nutrition and child care techniques exist and is applied and adequate health and sanitation services exist) (Anon,2004).

Food security both at national and household level is the most essential basic need to ensure the standard of living of the people (Anon,2004). Its status is the basic factor, which serves to determine all other issues, policies and strategies in relation to nutrition, health and development. Accurate measurement of food security level is important for program planners and policymakers to assess the effectiveness of their programs in meeting the intended objectives. Food security causation and survival mechanisms may be different for different population segments at different areas. Therefore, great deal of investigation is needed to get more evidences on food security to implement possible remedies.

In Sri Lanka, food availability at national level has been maintained at a satisfactory level by increasing the domestic food supply; mainly rice production, combined with imports. The efforts to increase domestic food production have been continuing since independence and the achievements have been significant in the rice and vegetable sub sectors. Sri Lanka had produced only 38% of its total requirement of rice in 1953, when the population was only 8 million; but achieved near self sufficiency level in 2002 with the population increased to 18.7 million (Anon, 2004). The availability of adequate food at the aggregate level is an essential precondition to achieve food security at household level. However, even though sufficient food is available at the national level, household food security will not be achieved if some households are unable to obtain their basic food requirements. To ensure household food security, therefore may require social, political and economic interventions to the poorest households therefore to get access to the basic food requirements.

To date, there is no a national instrument which assesses the household food security in Sri Lanka. Food accessibility, a measure of the population's ability to acquire available food during a given period is one of the important dimensions of food security. An appropriate measure of household food access is useful for several reasons: to identify the food insecure; to characterize the nature of their insecurity; to monitor changes in their circumstances; and to assess the impact of interventions.

While measures like consumption and income are considered by many to be the gold standard, they are proxy indicators for an unobservable underlying phenomenon (food insecurity) that cannot be measured directly. Consumption and income indicators are both time consuming to collect and require more human and financial resources (FAO, 2004). Consumption and dietary intake surveys typically capture the households' status at either a single point in time, in the case of a 24-hour recall of food consumption, or over the previous week or month. Anthropometric indicators reflect past insecurity of food deprivation, but without additional data on health/hygiene and caring practices they are not sufficient to permit reliable conclusions about the role of food deprivation or the prior risks of food insecurity in influencing current behaviors. Hence, there has been a convergence of interest on the part of academics and practitioners in producing scientifically developed and validated, cost-effective approaches to capture the multiple dimensions of food insecurity that are largely missing from conventional measures.

USDA food security instrument is also based on the idea that the experience of food insecurity (access) causes predictable reactions and responses that can be captured and quantified through a survey and summarized in a scale. United States of Department of Agriculture (USDA) has used core module of food security since 1995. Several countries expressed an interest in adopting it for assessing household food insecurity such as Indonesia, Venezuela, Brazil, and Canada and among different demographic groups in the United States. As rice is the staple food in Sri Lanka, a special attention should be paid to optimize the conditions and factors that will have an impact on paddy cultivation. Among the few studies have been carried out on food security in Sri Lanka, no study attempted to visualize it's potential on food security level of subsistence paddy farmers and their households. In this study, main attention has been given to evaluate the applicability of USDA food security measuring system in Sri Lanka and to develop food security index for Sri Lankan subsistence paddy farming families.

METHODS

This section presented the methods used to analyze the problem and it described the theoretical framework, data collection and analysis.

Theoretical Framework

The statistical model used for estimating household food security was one parameter logistic item response model, also referred to as the Rasch model. The terminology used here referred to the survey questions as items and to the respondents as individuals, with the underlying variables to be measured called the "item difficulty" and the "respondent ability". In this study, ability corresponded to the severity of the food insecurity experienced by the respondent household and difficulty was the severity of food insecurity that was implied by an affirmative response to the survey question.

The objective was to estimate each individual's ability as well as each item's difficulty based on individual responses. To formalize, let θ_j be the j^{th} individuals ability parameter for J=1...N and let β_i be the I^{th} items difficulty parameter for I=1...n where a sample of N individuals were administered a set of n dichotomous items, with each individual receiving the whole set of n items. If μ_{ij} was an indicator random variable that gave the dichotomous answer of person j to item I, then its distribution was

$$P(\mu_{ij}/\theta j, \beta i) = \frac{\exp(\mu ij(\theta j - \beta i)}{1 + \exp(\theta j - \beta i)}$$

It was assumed that the indicator variables μ_{ij} were independent of each other, conditional on the parameters (θ_j, j =1...N and β_i, I=1...n).

The model implied the existence of a continuous scale on which the items could be placed based on their difficulty levels and on which individuals could be placed based on their ability levels. The main objective of using Rasch model was to estimate where individuals fall on the scale.

Instrument Validation

The USDA food security core module was consisted of 18 questions, which provided the indicator variables that underlie the standard measurement scale to measure severity of food insecurity and hunger in United States (U.S.). It covered the full range of severity observed under current living conditions in the US.

This core module was translated into sinhala and it was subjected to a question-by-question review and appropriate modifications were done considering the Sri Lankan condition. After conducting 10 initial interviews as the pilot survey, understanding of the questionnaire items by respondents was confirmed and the ease of application of the instrument.

Data Collection and Analysis

Primary data were collected using the pre-tested modified questionnaire from 120 randomly selected subsistence paddy farming households in Kegalle and Gampaha districts over the period of June to August 2006. Interviews were conducted during the late daytime to get the target respondent (i.e. Person in charge of food preparation).

All of the responses were coded into two categories (Affirmative vs. Negative) and missing items were imputed using direct method. All the data were analyzed using Microsoft Excel.

Determination of Household Food Security Status

Food security scale was simplified into four categories, each one representing a meaningful range

of severity on the underlying scale. They were food secure, food insecure with out hunger, food insecure with moderate hunger and food insecure with severe hunger. The statistical classification of household depends on the number of affirmative answers the respondents have given and whether there were children in household (Table 1).

Nutritional status among household members is a key variable in measuring food security (Hoddinot and Yohannes, 2002). Food security is a major cause of poor nutritional status (Anon, 2004). Hence, food security status was determined according to the percentiles (<5 percentile for Body Mass Index for age taken as food insecure) for children and BMI (<18.5 taken as food insecure) for adults. Results of both approaches (USDA approach and BMI approach) were compared to see whether there is any incompatibility.

Table1 - Food security status levels corresponding to number of affirmative responses:

Number of Affirmative Reponses		Food Security Status Level	
(Out of 18) Households with Children	**(Out of 10) Household without Children**	**Code**	**Category**
0 1 2	0 1 2	0	Food secure
3 4 5 6 7	3 4 5	1	Food insecure without hunger
8 9 10 11 12	6 7 8	2	Food insecure with hunger (moderate)
13 14 15 16 17 18	9 10	3	Food insecure with Hunger (severe)

RESULTS AND DISCUSSION

Questions Used in the Scale

Although food security measurement scale was originally developed for 12 months time frame, this paper emphasized the 6 months scale, which was relevant to the one paddy cultivation season. It is possible that food insecurity and hunger are subjected to significant seasonal patterns. All the questions were asked considering previous paddy cultivation season.

Table 2 lists the questions asked from paddy farming households, which captured four kinds of situations or events such as anxiety or perceptions that the household food budget or food supply was inadequate (Q1, Q2), perceptions when the food eaten by adults or children was inadequate in quality and quantity (Q3, Q6, Q11, Q12, Q13), reported instances of reduced food intake or consequences of reduced intake for adults in the household (Q4, Q7, Q8, Q9) and reported instances of reduced food intake or its consequences for children (Q14, Q15, Q16, Q18).

Although the USDA food security core module questions cover the key central dimensions of household food insecurity, they do not represent all aspects of the phenomenon (Hamilton *et al,* 1997). The questions focus on whether the household has enough food or money to meet its basic food needs and on the normal behavioral and subjective responses to that condition. Other elements of food security such as food safety, nutritional quality of diets and social acceptability of food sources including the unusual and sometimes coping behaviors that food insecure households may undertake to augment their food supply are not measured by the food security scale. Similarly, other possible sources of food insecurity apart from financial constraint are not captured by the measure.

Diet of Paddy farming household was predominantly based on starchy staples and often included little or no animal products, few fresh fruits and vegetables. In general, they had enough quantity of rice to consume for their family members. Majority of them used to consume rice three times per day with no snacks in between meals. No household was self sufficient in any of these items and households depended to some extent on either barter or purchased. Hence, they regularly purchased a proportion of food commodities, which they did not produce themselves. But, poor financial condition was not a major constraint for them. Because they tried to satisfy themselves with less food groups and they did not bother about dietary diversity and balanced meals. Empirical findings were consistent with this idea. (Figure 1 and 2). Higher percentage of yes responses for Q3 had proved that majority of respondents did not obtain balanced meal.

The majority concerned about only balanced meals of the child and did not concern about adults diet quality. Majority considered the quantity of the

Table 2 - Food security questionnaire items, English back translation from Sinhala:

Item	During the last season
1	I /we worried whether our food would run out before we got money to buy more. Was that often, sometimes, or never true for you?
2	The food that I/we bought just didn't last, and we didn't have money to get more. Was that often, sometimes, or never true for you?
3	I/we couldn't afford to eat balanced meals." Was that often, sometimes, or never true for you?
4	Did you or other adults in your household ever cut the size of your meals or skip meals because there wasn't enough money for food?
5	How often did this happen- almost every month, some months but not every month, or in only one or two months?
6	Did you ever eat less than you felt you should because there wasn't enough money to buy food?
7	Were you ever hungry but didn't eat because you couldn't afford enough food?
8	Did you lose weight because there wasn't enough food?
9	Did you or other adults in your household ever not eat for a whole day because there wasn't enough money for food?
10	How often did this happen - almost every month, some months but not every month, or in only one or two months?
11	We relied on low cost food to feed the children because we were running out of money to buy food. Was that often, sometimes, or never true for you?
12	We couldn't feed the children a balanced meal because we couldn't afford that. Was that often, sometimes, or never true for you?
13	The children were not eating enough because we just couldn't afford enough food. Was that often, sometimes, or never true for you?
14	Did you cut the size of the children's meals because there wasn't enough money for food?
15	Were the children ever hungry but you couldn't afford enough food?
16	Did any of the children ever skip meals because there wasn't enough money for food?
17	How often did this happen - almost every month, some months but not every month, or in only one or two months?
18	Did any of the children ever not eat for a whole day because there wasn't enough money for food?

diet. Some households in Kegalle did not show any idea about the balanced meal.

Relative Severity of Questions

The item calibration score indicates the relative severity of the food insecurity or hunger condition represented by each question. Table 3 shows the patterns of relative question severity under USA and Sri Lankan subsistence paddy farming household condition. Questions representing less severe levels of food insecurity and hunger are located on the top of the list, and those measuring more severe levels are at the bottom.

US households go through different behavioral stages as food insecurity becomes more severe. In the first stage, households experience inadequacy in food supplies and food budgets, feel anxiety about the sufficiency of their food to meet basic needs and make adjustments to their food budgets and types of food served. As the situation becomes more severe, the food intake of adults is reduced and adults experience hunger, but they spare the children this experience. In the third stage, children also suffer reduced food intake are more dramatic (Bickel *etal*, 2000). Although it seems to be consistent with Sri Lankan Context

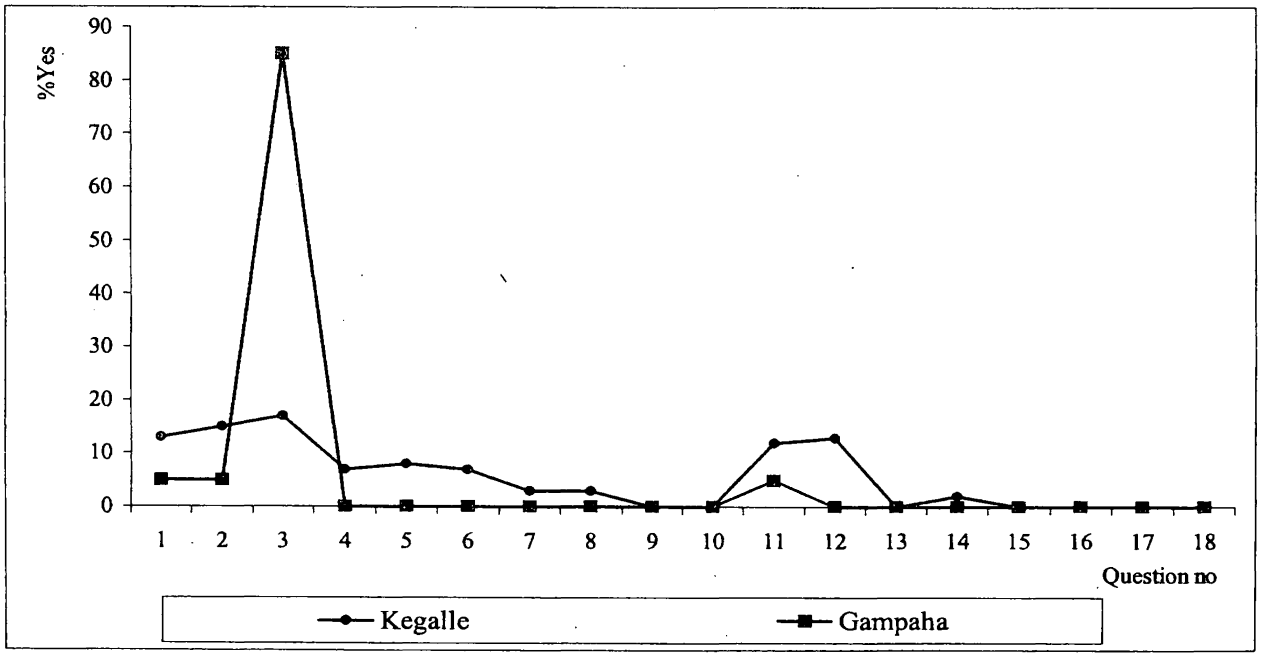

Figure 1 - Response patterns of households with children in Kegalle and Gampaha districts:

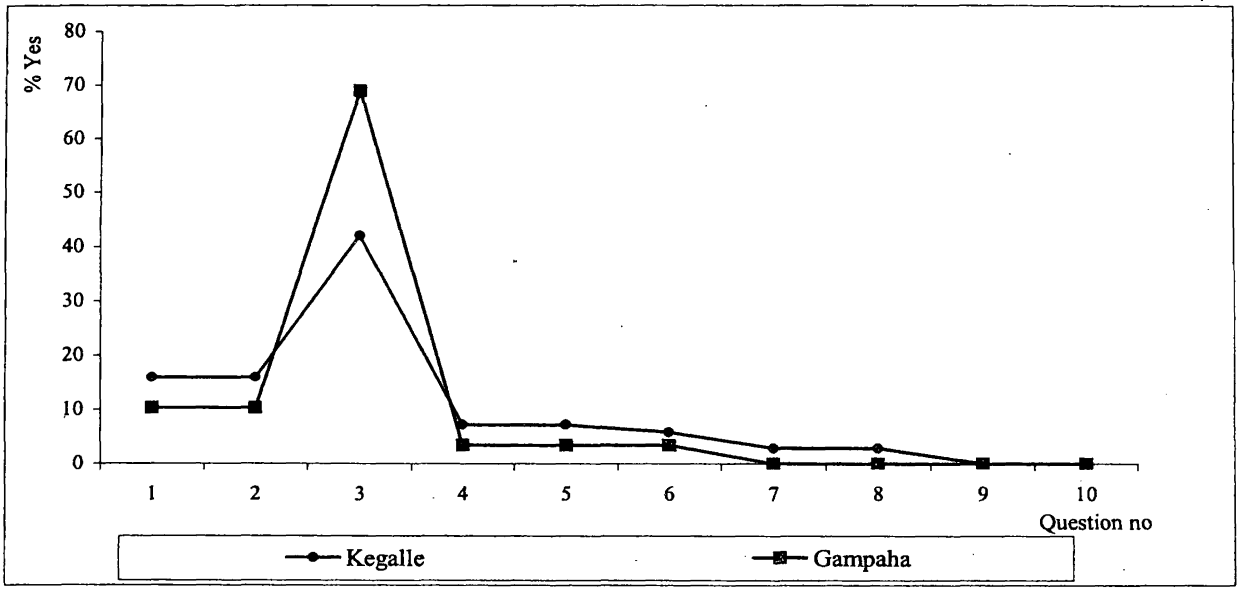

Figure 2 - Response patterns of households without children in Kegalle and Gampaha districts:

empirical findings do not agree with that due to the sub culture which they have adopted. Hence, their food security behaviors, food management practices and challenges in acquiring food are different. Therefore, the item severity structure is different from the USA context.

Measurements of Food Security Status

The overall prevalence of food secure, food insecure without hunger, food insecure with moderate hunger and food insecure with severe hunger of households in Kegalle district were 68.3%, 18.3%, 13.3% and 0%, respectively. The prevalence of food secure, food insecure without hunger, food insecure with moderate hunger and food insecure with severe hunger of households in Gampaha district were 95%, 3.3%, 1.7% and 0%, respectively (Figure 3).The households were also grouped as food secure (68.3% in Kegalle, 95% in Gampaha) and food insecure (31.7% in Kegalle, 5% in Gampaha) (Figure 4).

But food security status measured using Body Mass Index (BMI) in both districts did not consistent with results of Rasch Model approach. The prevalence of food security in Kegalle and Gampaha was 16.7% and 55% respectively (Figure 5).

Food security prevalence rates obtained by USDA food security measurement scale reflect the greater degree of food security among rural subsistence paddy farming household in Kegalle and Gampaha districts. But, examination of BMI showed lighter degree of poor nutritional status.

Table 3 - Relative severity of questions under USA and Sri Lankan condition:

Sequence of questions answered affirmatively by USA households	Sequence of questions answered affirmatively by Sri Lankan households	Food Security Status
None Q01 Worried food would run out Q02 Food bought didn't last	None Q03 Adult not eat balanced meals Q02 Food bought didn't last	Food secure
Q03 Adult not eat balanced meals Q11 Child fed low-cost foods Q04 Adult cut size or skipped meals Q12 Couldn't feed child balanced meals Q06 Adult eat less than felt they could	Q01 Worried.food would run out Q12 Couldn't feed child balanced meals Q11 Child fed low-cost foods Q24 Adult cut size or skipped meals Q25 Adult cut size or skipped meals, 3+ months	Food insecure
Q05 Adult cut size or skipped meals, 3+ months Q13 Child not eating enough Q07 Adult hungry but didn't eat Q08 Respondent lost weight Q14 Cut size of child's meals	Q06 Adult eat less than felt they could Q07 Adult hungry but didn't eat Q08 Respondent lost weight Q14 Cut size of child's meals Q09 Adult not eat whole day	Food insecure with hunger evident
Q09 Adult not eat whole day Q15 Child hungry Q10 Adult not eat whole day, 3+ months Q16 Child skipped meal Q17 Child skipped meal, 3+ months Q18 Child not eat for whole day	Q10 Adult not eat whole day, 3+ months Q13 Child not eating enough Q15 Child hungry Q16 Child skipped meal Q17 Child skipped meal, 3+ months Q18 Child not eat for whole day	Food insecure with severe hunger

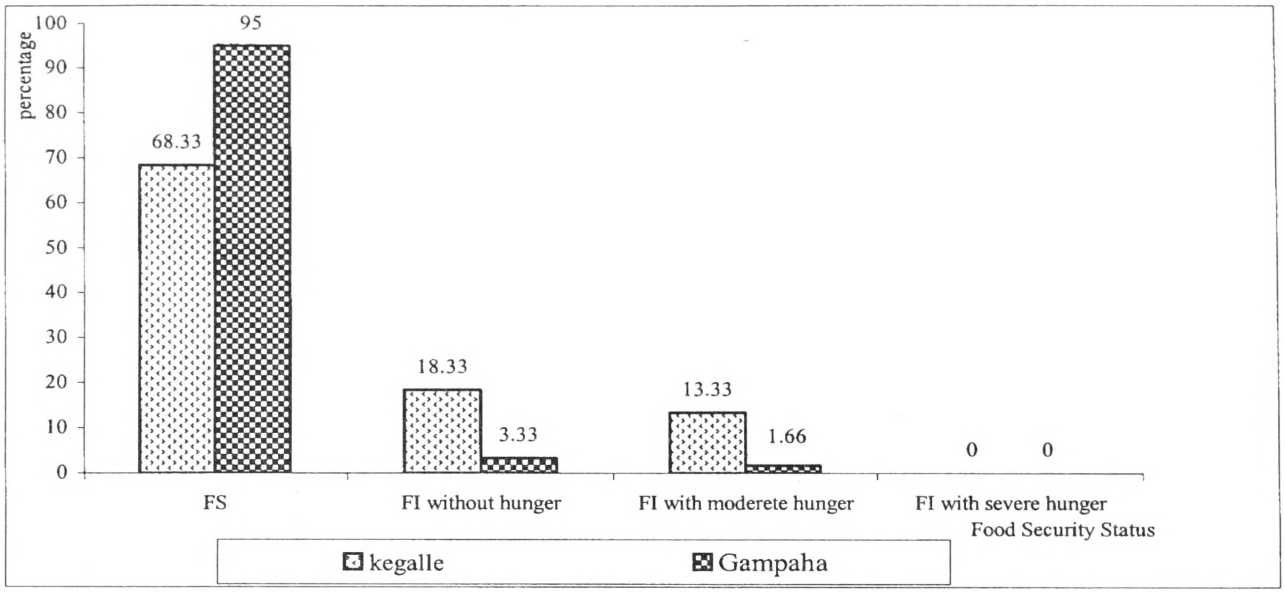

Figure 3 - Prevalence of food insecurity and hunger in Kegalle and Gampaha districts:

Therefore, the results obtained from USDA food insecurity instrument are questionable, because malnutrition is a potential consequence of food insecurity.

As discussed earlier, the scale uses in this study does not capture all possible dimensions of food insecurity such as food safety, nutritional status, social acceptability of food channel and community level factors like nature and sources of the available food supply. This measure reflects the household's situation over the 6 months before the interview. Hence, the results may not be reflecting the food security status at the time of the interview. Determination of specific boundaries that used to identify food security categories may be changed according to the population category, culture and so on. And also, USDA food security core module has not yet been proven reliable for assessing the status of an individual household and it develops to assess the Food security status of household as a whole.

The specification of the Rasch model likelihood function and its estimation procedure depends critically on the assumption of independence between questions and individuals, given the difficulty and ability parameters. But resulting set of responses (Q4-5, Q9-10, and Q16-17) continues to violate the conditional independence assumption. There may be an information loss, when the polychotomous answers were transformed to dichotomous answers.

Food security is a multi-dimensional concept as it is experienced by different people in different sets of circumstances. Rasch model assumes that the ability of individuals is a one-dimensional quantity that is present to varying degrees in the population. Recent work by Nord and Bickel (1999) shows that this scale underestimates food insecurity

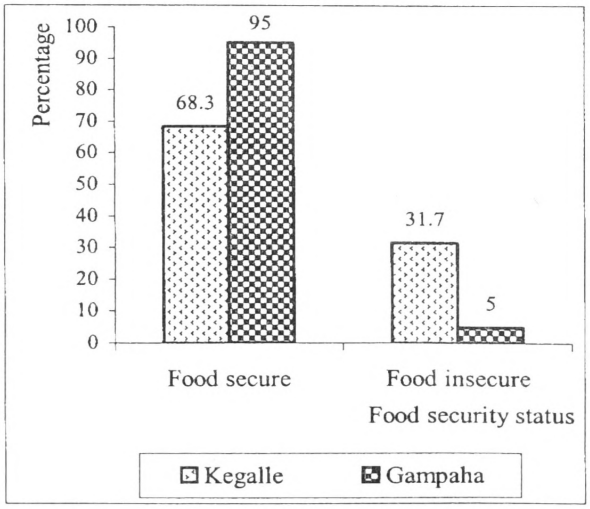

Figure 4 – Food security status in the Kegalle and Gampaha districts based on USDA approach:

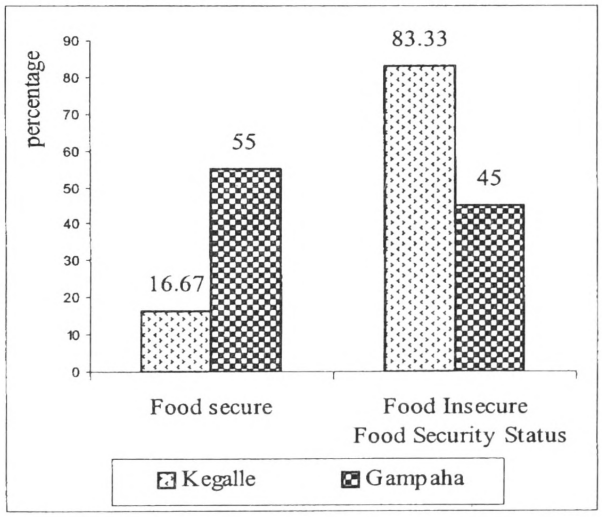

Figure 5 - Food security status in the Kegalle and Gampaha districts based on BMI:

for households with children. They postulate that this effect arises because food insecurity questions address more than one dimension of hunger, with child hunger representing a second dimension.

CONCLUSIONS

The results highlight that the USDA approach were not compatible to evaluate the food security status of households. It reveals that the emergent conceptualization of food insecurity from the USA differs from that found in the Kegalle and Gampaha districts in Sri Lanka, thus cannot be used as a sophisticated instrument for measuring household food security of subsistence paddy farming households.

Direct and experience-based measure by concerning all the social and cultural situations for assessing household food security in Sri Lanka is needed rather than translating and adapting questions developed elsewhere. Clearly, further researches are essential to capture all the facets of food security in Sri Lanka.

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