MEASURING AND VALIDATING FOOD INSECURITY IN EMBO, USING THE FOOD INSECURITY SCALE AND INDEX

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ABSTRACT

Measurement of household food insecurity is needed to identify the magnitude of food insecurity and assess the impact of development interventions. However, there is no commonly agreed measure of household food insecurity. While researchers continually experiment with new measures, the resultant measures are often complex and include numerous variables that still do not distinguish clearly between the food secure and the food insecure. This study set out to prepare a quick and convenient tool to measure household food security, using common household demographic and socio-economic variables commonly collected through a variety of household surveys. This has minimised data collection costs and assisted national food security units to continually measure and monitor household food insecurity. Food insecurity levels were estimated using data from a baseline survey conducted in a community in KwaZulu-Natal, South Africa. Food security was estimated using a number of measures, including food quantity (adequacy), dietary diversity, dietary quality, coping strategies employed and the Coping Strategies Index.

The study found that household food availability varied across the two seasons over which data were collected. Only the percentile of sample households with adequate food intakes (one third of the samples) consumed enough food during the lean period when agricultural production was low. Households with inadequate food intakes also had consumed insufficient energy and lower micronutrient intakes during the period when agricultural produce was more abundant. Energy, iron and protein consumption was positively related to the consumption of adequate food. Energy intake was a relatively good indicator of protein and micronutrient intakes during the leaner period.

Consumption of foods from three food groups, namely cereals, legumes and vegetables and fruits were necessary for adequate food intake. Cereals were the most important foods, forming the base of most meals, while fats and animal sourced foods were not widely consumed. Diversifying consumption through fruits and vegetables contributed significantly and positively to improved household food intakes. Household dietary diversity and dietary quality improved during the period of plenty.

The application of coping strategies was strongly related to household food intake and diversity. Engaging in more coping strategies and having resultant higher Coping Strategy Index scores was strongly associated with household food inadequacy intakes and low food diversity scores. As expected, sampled households employed more coping strategies during the lean season. The strong and significant relationships between the Coping Strategies Index scores, the number of coping strategies practised by households and the household food intake indices (the Household Food Intake Index and Nutrient Adequacy Ratios) show that food intake is a strong indicator for household food security.

The Household Food Insecurity Index and the Household Food Insecurity Scale were developed using 13 potential household demographic and socio-economic variables to identify the food-insecure households. The results of these two new measures

were correlated with the results of the common measures reported above and found to be useful determinants of food security. The study found that while the Household Food Insecurity Index explained the influence of demographic and socio-economic variables in household food insecurity, the Household Food Insecurity Scale is more convenient in application (easy data management and computation process), and it is strongly related to the Coping Strategies Index scores. Both the Household Food Insecurity Scale and the Household Food Insecurity Index were useful tools to measure household food security and differentiate between food security and food insecure households in Embo Community. More research is recommended to further test the usefulness of the proposed measures in various settings.

DECLARATION

I, Mark Mapendo Msaki, declare that:

- The research reported in this thesis, except where otherwise indicated, is my original research
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Name: Prof Sheryl Hendriks

As Research Co-supervisor, I agree to submission of this dissertation/thesis for examination.

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DEDICATION

This work is dedicated to our beloved son, the late Emmanuel Imani (2004 – 2007) who arrived shortly after I joined the project and did not live to see the finished product. Emmanuel, the light you brought to our family will never die (Isaiah 66: 8-24). We, your parents, and your young sisters trust that we are still united as you are praying for us from a distance. You are our guardian angel. Despite your very young age, everyone who knew you loved you, but the Almighty God loved you more! Though we miss you, we do not regret that the Almighty God knew that you will serve him better up there (Mark 10:13 -16; Revelation 14:1 – 5).

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LIST OF ABRREVIATIONS

AFE	Adult Female Equivalent
AFRISCO	Africa's Farms Certified Organic
AIDS	Acquired Immune Deficiency Syndrome
ANOVA	Analysis Of Variances
CHD	Coronary Heart Diseases
CHS	Community Household Surveillance System
C-SAFE	Consortium for South African Food Emergency
CSI	The Coping Strategies Index
DHS	Demographic and Health Survey
EFO	Ezemvelo Farmers' Organisation
FANTA	Food and Nutrition Technical Assistance
FAO	Food and Agriculture Organization of the United Nations
FBDG	Food Based Dietary Guideline
FIVIMS.ZA	South African Food Insecurity Vulnerability Mapping System
GHI	Global Hunger Index
HFAI	Household Food Adequacy Index
HFIAS	Household Food Insecurity Access Scale
HFII	Household Food Insecurity Index
HFIS	Household Food Insecurity Scale
HIV	Human Immunodeficiency Virus
IFAD	International Fund for Agricultural Development of the United Nations
IFPRI	International Food Policy Research Institute
IFSS	Integrated Food Strategy Paper for South Africa
LARP	The Livelihood Recovery through Agriculture Programme
MDGs	Millennium Development Goals
MDQI	Mozambique Diet Quality Index
NAR	Nutrient Adequacy Ratios
PCA	Principal Component Analysis
RDA	Recommended Dietary Allowance
SADC	South African Development Cooperation
SADC FANR-VAC	South African Development Cooperation Food Agriculture and Natural Resources Vulnerability Assessment Committee
SAP	Structural Adjustment Programme
SPSS	Statistical Package for Social Sciences
UNCED	United Nations Conference on Environment and Development
UNICEF	United Nations Children Fund
USD	United States Dollar
VAC	Vulnerability Assessment Committee

VAM	Vulnerability Analysis and Mapping unit of the World Food Programme
WFP	World Food Programme of the United Nations
WHO	World Health Organizations of the United Nations
ZAR	South African Rand

CHAPTER 1: THE PROBLEM AND ITS SETTING

1.1 Background and rationale for the study

Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food for an active and healthy life and meet their food preferences (FAO, 1996). Food security encompasses three related dimensions: food availability (the presence of food for all within a given geographical area); food access (the capacity of households and individuals to obtain appropriate foods); and food utilization (the biological capacity of individuals to effectively use the food consumed) (Riely *et. al.* 1999). Food security is a broad, interdisciplinary concept that deals with food production, distribution and consumption vis-à-vis food entitlement for all household members (Koda, 2002). Therefore, factors that influence production, distribution and consumption of food influence food security.

Between 2003 and 2005, 750 million (89 per cent of the total) hungry people lived in Asia, the Pacific and sub-Saharan Africa (FAO, 2008). Sub-Saharan Africa and south Asia share the highest regional Global Hunger Indexes (GHI), scoring 23.3 and 23.0 respectively (Grebmer *et. al.*, 2008). The GHI is a measure of hunger and malnutrition that combines three equally weighted indicators, namely: the proportion of undernourished as a percentage of the population; the prevalence of underweight in children under five years of age; and the mortality rate of children under five years of age (Grebmer *et. al.*, 2008). The high GHI in Sub-Saharan Africa may be attributed to low government effectiveness, conflict, political instability, high rates of HIV/AIDS, high child mortality and inadequate energy intakes (Grebmer *et. al.*, 2008).

Between the early 1990s and 2003-2005, the population in Sub-Saharan Africa grew by 200 million to 700 million (FAO, 2008). While the overall number of undernourished people in the region increased by 43 million (from 169 million to 212 million) in this period, the proportion of people suffering from chronic hunger reduced from 34 to 30 per cent (FAO, 2008). However, FAO estimates that, with the recent food price increases, an additional 24 million people in Sub-Saharan Africa may be plunged into hunger (FAO, 2008). The United States Government Accountability Overseas (2008) mentions that chronic undernourishment in Sub-Saharan Africa persists, primarily due to low agricultural productivity, limited rural development, government policy disincentives and poor health, resulting in low human productivity. Increasing rates of HIV infections, rising global commodity prices and erratic weather patterns due to climate change further exacerbate food insecurity in the region.

Food adequacy at the national level does not necessarily mean adequacy at the household level. For example, in India, surpluses at the macro level (even supporting food exports) coexist with increasing rates of household food insecurity (Srinivasan, 2003). Therefore, according to Devereux and Maxwell (2003) food security is no longer seen as a failure of food production at the national level, but as a result of unsustainable livelihoods and livelihood failure. A sustainable livelihood is one that can deal with and recover from shocks and stresses either through coping or adaptation. Susceptibility of households to livelihood failure results in vulnerability to hunger, poverty and food insecurity (Mzibule, 2004a). Household food security

levels are principally influenced by access to food production and food markets, but also by a household's economic wellbeing (Srinivasan, 2003); inadequate income and lack of assets are major hindrances to food access among the rural and urban poor. HIV/AIDS affects all aspects of rural and urban livelihoods (Haddad and Gillespie, 2001), including the ability of a household to cope with shocks and stresses. Rugalema (1999a) has argued that HIV/AIDS-affected households never fully cope (acting in accordance with a previously formulated plan or strategy), in the sense that they cannot simply return to some semblance of normality following a shock. This erodes livelihood bases and plunges the already struggling household further into poverty.

Research has indicated that many food-insecure populations (including subsistence farmers) in developing countries are net purchasers of food (Riely *et. al.* 1999). Expenditure on food is a function of income (Diao, 1997). An increase in rural non-farm economic activities is important to provide income, and allow greater access to food by rural households (FAO, 1998), particularly for households that face production constraints due to limited or no land, labour and capital. Food security is therefore a development issue. While increased incomes and employment are economic objectives of rural development, household social goals are usually broader than economic goals (Gordon, 1990). Social goals include the provision of adequate nutrition, health, housing and education, and require a broader view, beyond economic objectives (Gordon, 1990). Increased income and employment are important means for simultaneously achieving social goals (Gordon, 1990). The lack of knowledge of how rural people cope with poverty and food insecurity has led to the failure of many development programmes. Policy interventions are needed to support livelihoods and coping strategies to protect poor households in times of stress, and increase resilience (Fraser *et. al.,* 2003).

Rothchild (2001) admits that, while for many years food security has been measured at national level, measurement at the household level is also necessary to meaningfully assess the impact of development interventions on target populations. Hoddinott (1999) recommends that household food security measurement is necessary at the outset of any development project to identify the food insecure, assess the severity of food shortfalls, and characterise the nature of food insecurity. This provides the basis on which to monitor progress and assess the impact on project beneficiaries.

Although early warning and national surveillance systems have made great strides in monitoring national food security, little agreement exists internationally regarding the most appropriate indicators of household food security (Devereux and Maxwell, 2003). The choice of household food security estimators are determined by their purpose and cost-effectiveness regarding time, personnel and logistics (Riely *et. al.*, 1999). Dietary adequacy, quality and diversity are often used to measure food consumption at household level (Ruel, 2003, Rose and Tschirley, 2000). Providing relevant and timely information in a cost-effective manner requires easy to implement and reliable alternative indicators that complement each other (Migotto *et. al.,* 2005). Chung *et. al. (*1997) have stated that many "benchmark" or "gold standard" indicators (such as household income or dietary intake) are too cumbersome to be of practical use, while Wolfe and Frongilo (2001) suggest that improved measures of household food security should complement existing measures, assuring an in-depth

understanding of food insecurity at the household level. Chung *et. al.* (1997) suggest that an ideal food security indicator should be non-location specific, statistically reliable and straightforward to collect and analyse.

While food security is a cross-cutting, complex and multifaceted phenomenon, indicators have traditionally focused on specific, narrowly measured aspects, such as current food supply, individual energy intake, and so on, often without capturing the complexity of the concept. Having no single indicator that captures all aspects of food insecurity and at the same time provides relevant and timely information in a cost-effective manner has led to efforts to find easy-to-implement and reliable alternative indicators.

Finding an appropriate measure for household food security has been a challenge to both international and national agencies. This study set out to prepare a quick and convenient tool to measure household food security. To prepare such a tool, the study was divided into four sub-problems (see section 1.3). The motive behind having such sub problems was to assure a common understanding of household food adequacy, quality, coping strategies to address food shortages in the community under study before the development of the Household Food Insecurity Index and Household Food Insecurity Index Scale.

1.2 Statement of the problem

This study set out to develop and test the new tools to measure household food insecurity namely the Household Food Insecurity Index (HFII) and the Household Food Insecurity Scale (HFIS) using commonly available indicators, and to validate the new measures by comparing them with conventional food security measures.

1.3 Study sub-problems

Sub-problem 1: To determine household food adequacy among the sampled households using the Household Food Adequacy Index.

Sub-problem 2: To establish if there is a relationship between household food adequacy and dietary quality among sampled households.

Sub-problem 3: To relate household food adequacy and dietary quality to the Coping Strategy Index for the sampled households.

Sub problem 4: To develop and validate the Household Food Insecurity Scale and Index using commonly available household, socio-economic and demographic variables.

1.4 Outline of the thesis

This chapter introduced the concept of household food security and defined concepts related to the study problem. In chapter 2, knowledge gaps in household food security measurement are identified through a review of related literature. The core methodology of the study is presented in chapter 3. Chapter 4 is an introduction to and description of the study area and sample. The results of analyses, using commonly applied household food security indicators, are presented in chapters 5 to 7. The Household Food Insecurity Scale and Index are developed in chapter 8. A general discussion and the study conclusions and recommendations are presented in chapter 9.

CHAPTER 2: LITERATURE REVIEW

This chapter reviews various aspects which have been related to food insecurity. Such aspects have been employed as determinants of household food insecurity. The links between household food intake, household dietary quality, household coping strategies to mitigate food shortage and food insecurity are discussed in this chapter. Potential relationships between household characteristics and household food insecurity are also discussed in this current chapter. Various alternative measures suggested in international literature are presented.

2.1 Introduction

Most of the world's poorest countries are found in Africa. Many of these countries face problems of chronic poverty and food insecurity, i.e. an inability to meet their basic food needs even in good years. The Millennium Development Goal one sets out to halve the number of people living below the poverty line and those suffering from hunger between 1990 and 2015. However, progress towards these targets in sub-Saharan Africa is not what it should be. In fact, poverty has been rising rather than falling in recent years (DFID, 2005), with 298 million people (31 per cent of Africa's population) living on less than a dollar a day, compared with 241 million people in 1990. Economic growth is not necessarily reaching the poor as rising food prices push the poor further into poverty.

Household food security is the capacity of a household to procure a stable and sustainable basket of adequate food (IFAD, 1992) and is determined by a household's current food supplies, past food supply and potential future supply (Gittelsohn *et. al.*, 1998). Potential future food supply is a function of the household's available resources, such as capital (e.g., land), labour and time (Gittelsohn *et. al.*, 1998). Vulnerability to food insecurity may be defined as people's propensity to fall or stay below a predetermined food security threshold (Løvender *et. al.*, 2004). Vulnerability may also refer to a measure of resilience against a shock i.e. the likelihood that a shock will result in a decline in well-being (World Bank, 2001; Calvo and Dercon, 2005; Løvender *et. al.*, 2004). Vulnerability, poverty and food insecurity, although they may be used interchangeably in the short-run, are different concepts in the long run. Poverty and food insecurity usually describe livelihood status at a particular point in time, whereas vulnerability is forward looking. It describes the probability of facing an acute loss in the ability and capacity to acquire food (Alwang *et. al.*, 2001).

Many methods have been suggested to estimate household food security. However, no consensus has been reached as to which are the most appropriate and accurate measures. Despite the ever-increasing need for convenient household food security measures (Rothchild, 2001; Wolfe and Frongillo, 2001), the challenge to produce a concise set of household food security indicators has not yet been met (Løvender *et. al.*, 2004). Conventional measurement and assessment of food security is typically classified into three categories: dietary energy availability or intake; nutritional outcomes; and perceptions of hunger (FAO, 2002). Current measures of food availability are often inadequate for decision-making and intervention planning

because they focus on food availability, while neglecting food access and food supply uncertainty at the household level (Wolfe and Frongillo, 2000). Some food security measures have associated estimation problems. For example, estimating the distribution of nutrient intakes in population surveys using self-reported dietary instruments, particularly 24-hour recall, is prone to both under- and over-estimation (Freedman *et. al.,* 2004), and food balance sheets have been found to inflate per capita food intake (Steyn *et. al.,* 2003; Patnaik, 2004). In recent years, awareness of the role of sustainable livelihoods, as crucial elements in future household food self-sufficiency, has emerged. This has sparked interest in the development of household-focused food security measures and methods (Hendriks, 2005) while many national food security systems report national level stocks that neglect the access and availability of food by vulnerable households.

The purpose of this chapter is to review and compare currently available food security measures. The review begins by relating food intake, its measurement and its relationship to household food insecurity. Following this is a discussion of the measurement of dietary quality, coping strategies and the Coping Strategy Index. Also included in this chapter is a discussion of the various household variables potentially related to household food insecurity and vulnerability. The results of South African food security studies are summarized to provide a basis for comparison of the results of the analysis of the data for this study. Lastly, the need for new and innovative simple measures of household food insecurity is presented.

2.2 Household food intake and food insecurity

In many food security studies, energy - indicated by kilo calories/joules consumed per capita per day - is used as a proxy of total per capita food intake (Barbara *et. al.*, 2003). A good quality diet can be defined as one that includes adequate amounts of energy, macronutrients and micronutrients to meet individual nutritional needs (Arimond *et. al.,* 2008). There is a correlation between the intakes of energy and micronutrients, particularly minerals and B vitamins (Barbara *et. al.,* 2003). Therefore, household food intake and quality may be used to determine food adequacy.

Developing countries have widespread energy and protein deficiencies which lead to stunting and high infant mortality rates (Ayele and Peacock, 2003; Bruinsma, 2003; Bharghava, 2001; Rose and Tschirley, 2000; World Health Organisation, 2000), partly because of low intakes of protein-rich animal products that are often unaffordable by the poorest households (Bhargava, 2001). The extremely low consumption of animal products may also contribute. A comprehensive food intake analysis should include per capita measures of energy, protein and key micronutrients. However, no fixed criteria exist on which nutrients should be included in food and nutrition security studies (Ruel, 2003; Rose and Chalton, 2002a). Some studies may include many nutrient requirements, while others may select important elements. For example, a study in Mozambique by Rose and Tcshirley (2000) selected nutrients pertinent to nutrition problems (protein-energy malnutrition, vitamin A and iron deficiencies) prevalent in the study area.

In South Africa, dietary diversity and nutritional adequacy studies should focus on energy, vitamin A, iron and iodine intakes – which have been reported as deficient. Little attention has been paid to vitamin E deficiencies. Recent studies have shown that lower plasma vitamin E levels combined with low levels of vitamins A and B12 are related to faster HIV/AIDS disease progression (Fawzi *et. al,* 2005).

In South Africa, a household food and nutrient availability survey by Rose *et. al.* (2002) 1995 revealed that the availability of protein per Adult Female Equivalent in rural and urban areas was 54.4 and 73.3 g/day, respectively. This was adequate and in accordance with the (46 g/day) Recommended Dietary Allowance for adult females (National Academy of Sciences, 1989). Similarly, energy intake in the study group was adequate at 9219 and 10957 kj/day (compared to 9211 kj/day) for rural and urban areas respectively (Rose *et. al.,* 2002). Despite this, over half the sampled children did not consume adequate energy (Department of Health, 2000b).

The 1999 South African National Food Consumption Survey of children between the ages of 1- 9 years found that over half the children were inadequately nourished, and had energy and micronutrient-poor diets (Jinabhai, 2003). However, kwashiorkor and marasmus are uncommon in KwaZulu-Natal (Vella, 2003). The nutrient intake of children living in rural areas was considerably poorer than that of children living in urban areas (Department of Health, 2000b). Oelofse *et. al.* (2003) reported a prevalence of anaemia and marginal vitamin A deficiencies in KwaZulu Natal. Vitamin A, iron and iodine deficiencies are frequently reported in studies in rural areas of KwaZulu-Natal (Vella, 2003; Stuijveberg, 2001; Oelofse *et. al.,* 1999). Lower plasma levels of vitamin E, vitamin A and B12 have been related to quicker HIV/AIDS disease progression (Fawzi *et. al.,* 2005; Tang *et. al.,* 1997).

Following the recommendation by the team conducting the South African National Food Consumption Survey), maize (sifted, special and super) and white and brown wheat flour have since 2003 been fortified (Grobbelaar *et. al.,* 2004). Fortification of biscuits with beta–carotene was found to maintain serum retinol concentration in school children in KwaZulu-Natal (Stuijvenberg, 2001). In another study, children from households with gardening projects that produced beta-carotene-rich fruits and vegetables had significantly higher vitamin A intakes than children from households without project gardens in KwaZulu-Natal (Faber *et. al.,,* 2002). This suggests that sustainable access to nutrient-rich foods should be given priority in food security interventions.

2.3 Dietary quality as a measure of household food security

A good quality balanced diet contains a mix of nutrients for optimal physical and mental growth, development and physical activity relative to gender, occupation and human physiological needs at all stages of the life cycle (FAO, 1999). Dietary diversity refers to the number of different foods consumed over a given reference period and indicates an element of the quality of dietary intakes (Ruel, 2002; 2003). Increasing dietary diversity is recommended by most international dietary guidelines (WHO/FAO 1996) to ensure an adequate intake of essential nutrients and promote good health (Ruel, 2002).

Household food insecurity is central to the relationship between economic growth and nutritional status (United Nations Children's Fund (UNICEF), 1998). In many countries, improved income leads to increased consumption of more diverse diets and higher-quality foods - often rich in protein and micronutrients (UNICEF, 1998). Hoddinot and Yohannes (2002) have proposed food diversity as a good measure of household food access. However, few studies have been conducted in developing countries to highlight the positive correlation between dietary diversity and nutrient adequacy (Arimond *et. al.,* 2008).
Lack of dietary diversity is prevalent among poor populations in the developing world. The diets of the poor are predominantly based on starchy staples and often include few or no animal products and fresh fruits and vegetables (Ruel, 2003). In resource-poor environments across the globe, poor quality monotonous diets are the norm (Arimond *et. al.,* 2008). For farming families, dietary diversity is related to crop diversity and, ultimately, adequate nutritional intakes (Kreb–Smith *et. al.,* 1987). However, seasonality of supply affects availability and prices, and so influences consumption (Ali and Tsou, 1997).

To assess household dietary quality, researchers include a variety of foods and food group classification systems with varying reference periods, ranging from one to 15 days. In developed countries, dietary diversity scores often consider the number of food servings (Ruel, 2003; Guthrie and Scheer 1981). In developing countries, the most popular measurement approaches for dietary diversity are food counts (Food Variety Score) and/or food group counts (Dietary Diversity Score), which do not consider the frequency of intake (Arimond and Ruel, 2002; Hatløy *et. al.,* 1998; Ogle *et. al.,* 2001; Taren and Chen, 1993). Analyses for food intake, using either Food Variety Scores (food counts), Dietary Diversity Scores (group food count) or both methods, have shown positive associations between food diversity and food intakes (Hatløy *et. al.,* 1998; Olge *et. al.,* 2001; Onyango *et. al.,* 1998; Tarini *et. al.,* 1999).

There is still, however, a lack of consensus on how to measure dietary diversity (Ruel, 2003). Ruel (2003) recommends that the methodology needs to be revised to consider the following: the range of foods and food groupings; portion sizes and the frequency of intake; and scoring systems, cutoff points and reference periods. These will ensure the validity and reliability of the diversity indicators for the specific purposes for which they are intended (Ruel, 2003). Research is still needed to validate and compare dietary diversity indicators derived from different methodological approaches (Ruel, 2003). Ruel (2003) has recommended that it would be useful to continue exploring whether indicators based on food groups (a simpler approach) perform as well as those based on single foods in predicting outcomes of interest (Ruel, 2003).

The failure of nutrient-based guidelines to substantially influence dietary patterns of different populations triggered an initiative by FAO and the World Health Organisation (WHO) to establish food-based dietary guidelines that relate to practices and prevailing nutrition-related public health problems (WHO, 2003; Vorster *et. al.,* 2001). Food Based Dietary Guidelines are qualitative, action-oriented statements (Love, 2002) which take into account considerable epidemiological data linking

specific food consumption patterns with low incidence of certain diseases, without the need for a complete understanding of the underlying biological mechanisms (WHO, 1998). Continuous monitoring is essential to evaluate the success of the Food Based Dietary Guidelines (Gibney and Vorster, 2001). Given the unique food security situation in countries, it is recommended that Food Based Dietary Guidelines be country-specific. This will also increase their effectiveness as a nutrition education tool (WHO, 1998). In South Africa, Food Based Dietary Guidelines (FBDGs) were first introduced in 1998 (Vorster *et. al.,* 2001) and consist of 10 short, clear and simple messages. These have been tested for comprehension, appropriateness and applicability to both rural and urban consumer groups of different ethnic backgrounds (Vorster *et. al.,* 2001). As listed by Vorster *et. al.,* (2001) they are:

- Enjoy a variety of foods
- Be active
- Make starchy foods the basis of most meals
- Eat plenty of fruit and vegetables
- Eat dry beans, peas, lentils and soya often
- Meat, fish, chicken, milk and eggs can be eaten every day
- Eat fats sparingly
- Use salt sparingly
- Drink lots of clean, safe water, and
- If you drink alcohol, drink sensibly.

Following on from this, a campaign has been ongoing for the increased dietary diversity and fortification of staple foods in South Africa (Globbelaar *et. al.,* 2004; Maunder *et. al.,* 2001) because a large proportion of the South African population consume diets that are low in vitamin A, thiamine, riboflavin, niacin, folic acid, vitamin B6, iron, zinc and calcium (Grobbelaar *et. al.,* 2004). Although vegetables and fruits are important sources of many vitamins, minerals and fibre, they are often unaffordable, unavailable and unpalatable to many households (Love and Sayed, 2001).

Legumes are rich and economical sources of good quality protein, carbohydrates, soluble and insoluble dietary fibre and a variety of minerals and vitamins. They are also low in energy, fat and sodium (Venter and van Eyssen, 2001). Legumes have been recommended as part of a health-promotion diet to improve the nutritional status of under- and over-nourished South Africans, while at the same time reducing the risk of chronic diseases (Venter and van Eyssen, 2001, Scholtz *et. al.,* 2001). Animal products are a rich source of high quality nutrients but are often unavailable and inaccessible by the poor, because they are relatively expensive compared with plant-derived foods. (Ruel, 2003; Scholtz *et. al.,* 2001). Dietary fat plays an important role in the health and functioning of the human body. However, it must be consumed in moderation to avoid health complications.

As suggested earlier, research is required to test the association between household dietary diversity and food security as defined in the term *dietary quality* – i.e. using the adequacy of multiple nutrients as opposed to energy only, as in traditional food security measurements. To properly understand household food insecurity, the

empirical relationship between household dietary diversity, dietary quality and food adequacy is necessary to understand household food insecurity.

2.4 Coping strategies and their relation to household food insecurity

It has been widely acknowledged that mechanisms to cope with risks and shocks are a central part of people's livelihoods (Dercon, 2005). Shocks may manifest differently but often lead to a substantial loss of income or wealth, or a reduction in consumption (Dercon, 2005). Coping strategies are the mechanisms that households employ in the wake of shocks, stresses and/or crises to avoid hunger, meet their food requirements and protect their livelihoods (Hendriks, 2003). Ellis (2000) defines *ex ante* risk management as "forward planning to spread risk across a diverse set of activities, in the context of subjective evaluations about the degree of risk attached to each source of risk". *Ex post* coping strategies are defined as "the methods used by households to survive when confronted with unanticipated livelihood failure" in either a gradual or a sudden sense (Prowse, 2003). Adger (1996) describes coping strategies as sequential actions taken by people when faced by food production or exchange failures. These actions may include eating less preferred foods, gathering wild foods, the sale of non-productive and productive assets, and migration. CARE and WFP (2003) defined coping strategies as people's response to conditions under which they do not have enough to eat. CARE and WFP (2003), go on to say that there are three basic types of coping strategies to food shortages: the immediate and short-term alteration of consumption patterns; the longer-term alteration of income earning or food production patterns; and one-off responses such as asset sales.

The capacity of a household to cope varies with the intensity of the shock. According to Rugalema (1999b) the use of coping strategies is appropriate in such circumstances as drought and famine, but not for the impact of HIV/AIDS, which not only changes communities and demographic patterns, but also agro-ecological landscapes with long term implications for recovery. The fact that households employ coping strategies to ensure future income generating capacity, rather than maintain the existing consumption levels, suggests that household coping strategies are linked to various livelihood security elements (Maxwell and Frankenberger 1992; Haddad *et. al.,* 1994; Corbett 1988).

2.4.1 The Coping Strategy Index

The Coping Strategy Index (CSI) was developed by CARE and WFP (2003) as an early warning indicator of an impending food crisis to determine food aid needs and evaluate whether food aid has been targeted to the most food insecure households. It identifies changes in household conditions in the context of emergency food aid operations, and combines experience of hunger with coping strategy assessments. The CSI was first developed in a study in Uganda, Ghana and Kenya, but is now widely used for early warning and food security monitoring and assessment (CARE and WFP 2003).

The CSI measures behavioral responses used to manage household food shortages (CARE and WFP, 2003). When tracked over time, the CSI can monitor long-term trends in food insecurity and help identify the causes of malnutrition (CARE and WFP, 2003). The CSI specifically measures the number and frequency of application of consumption reduction responses used by households facing real, perceived and anticipated food shortages. According to Owubah *et. al.,* (2005), the CSI generates the following information:

- types, severity and frequency of coping mechanisms
- changes in coping strategies within communities
- comparison of coping strategies among vulnerable groups
- levels of food stress in a community

The CSI is highly sensitive to short-term influences such as seasonality and the effects of minor or major shocks over time (Food Aid Management, 2004). Shoham (2005) reported that, in Eritrea, the CSI was influenced by geographical patterns, administrative zones, local food production and humanitarian interventions. The areas with the greatest agricultural potential (high rainfall and high elevation) had the highest index scores, while the drier and lower-elevation zones had lower scores. This finding was consistent with the hypothesis that the households most strongly affected by the drought are in the areas where agriculture is the major livelihood activity. In a study by Collins (2004) access to external markets was found to be negatively related to the CSI. The CSI has been employed by the WFP to monitor changes in the food security status of refugees in the Democratic Republic of Congo, Burundi and western Tanzania in their response to shocks, such as market closures, movement restrictions and ration reductions (Collins, 2004).

As shown by the Consortium for South African Food Emergency and the World Food Programme's (C-SAFE/WFP) Community and Households Surveillance System reports for Malawi, Zambia and Zimbabwe, higher CSI scores were associated with higher household vulnerability to livelihood insecurity (Mzibule 2004a; 2004b and 2004c). Comparative studies have shown the CSI to be a good proxy for food intake (or energy adequacy), food budget shares, food frequency, income status and the presence or absence of a malnourished child in the household (Food Aid Management 2004; Maxwell *et. al.,* 1999).

Maxwell (1995) developed the first CSI. This CSI was revised by CARE and WFP in 2003. Collins (2004) revised it further in 2004. The CSI developed by CARE and WFP (2003) is the most widely used instrument (Mzibule, 2004a), although slight adjustments are made to the CSI in various food security studies to suit the objectives. The differences between CSIs prepared by Collins (2004) and Maxwell (1995) are outlined in Table 2.1.

A comparison of the CARE and WFP (2003), Maxwell (1995), and Collins (2004) methodologies shows that the CARE and WFP (2003) protocol as the most convenient tool for the following reasons:

- The CARE and WFP (2003) protocol uses the weekly averages as the relative frequency that coping strategies are employed (see Table 2.1). For example, a household that employs a coping strategy 3 to 6 times a week will have a relative frequency of 4.5. The Collins (2004) protocol uses a two week average (see Table 2.1), thus a household reported to undertake a coping strategy 6 to 12 times in two weeks would have a relative frequency of 9. The CARE and WFP (2003) and Collins (2004) protocols produce codes for relative frequencies as compared to the Maxwell (1995) protocol where just a simple scale of codes for relative frequencies (4, 3, 2, and 1) is proposed.
- The CARE and WFP (2003) and Collins (2004) protocols capture and record relative frequencies more precisely than the Maxwell (1995) protocol (see Table 2.1 under frequency assigning criteria).
- Both Collins (2004) and CARE and WFP (2003) award high CSI scores to households that are more food insecure i.e. the greater the food insecurity in a household, the higher the CSI score. Maxwell (1995) uses the reverse relationship. Having positively correlating data avoids confusion while interpreting data adding strength to CARE and WFP (2003) protocol.
- The CARE and WFP (2003) protocol uses a recall period of one month. The disadvantage with this is that relatively long recall periods may lead to under-reporting (Owubah *et al*. 2005). Although, the Collins (2004) and Maxwell (1995) protocols use relatively shorter recall periods (one week), providing more accurate with regard to recall, they do not provide the average trend of employing the coping strategies.

Table 2.1: Comparison of CSIs prepared by CARE and WFP (2003), Collins (2004) and Maxwell (1995)

Frequency assigning criteria[§]			**Severity rank for coping strategies**
Collins (2004) (Period studied = 2 weeks)	CARE and WFP (2003) (Period studied = 1 week)	Maxwell (1995) (Period studied = 1 weeks)	CARE and WFP (2003), Collins (2004) and Maxwell (1995)
0 = never "0 */2 weeks"	***0*** = never (0/week)	***4*** = never (0/week)	***1*** = least severe
1 = hardly at all "1* / 2 weeks"	***0.5*** = hardly at all (<1 */ week)	***3*** = rarely (once / few times/week)	***2*** = somewhat(?) severe
3.5 = once in a while "2 – 5 */ 2 weeks"	***1.5*** = once in a while (1-2 */week)	**absent (1 – 2*/ week)**	***3***= intermediate severe
9 = pretty often "6 – 12*/2 weeks"	***4.5***= pretty often (3-6 */week)	***2*** = sometimes (2 – 5 * / week)	***4*** = most severe
		Absent (6 * / week)	
13.5 = all the time "13 – 14*/ 2 weeks"	***7***= all the time Every day, (7*/week)	***1*** = frequently (almost every day)	

EXPECTED OUTPUT	
Collins 2004	Relatively higher Coping Strategies Index implies relatively higher household food insecurity
CARE and WFP 2003	Relatively higher Coping Strategies Index implies relatively higher household food insecurity
Maxwell 1995	Relatively higher Coping Strategies Index implies relatively low household food insecurity

Note: § = Difference to be noted. The numbers in bold and italics represent the relative frequency.

In a Community and Household Surveillance Survey in Malawi, Zambia and Zimbabwe, CSI was useful to determine livelihood vulnerability (Mzibule 2004a,b,c). The CSI scores for survey rounds across two seasons were compared. In Zambia, the mean CSI in October 2003 and March 2004 were 109.9 and 70.0, respectively, reflecting a relatively high level of food aid demand in October 2003 relative to March 2004 (Mzibule 2004b).

Senefeld and Polsky (2005) employed the CSI to investigate the relationship between household food insecurity and the number of chronically ill persons in a household. A chronically ill person was defined as any member of a household that was ill for three months or longer to capture long-term illness such as HIV/AIDS or cancer (Caldwell, 2005). Households with chronically ill members had higher CSI scores in Zambia, Zimbabwe, Lesotho and Malawi (Mzibule; 2004a, b, c; Caldwell, 2005). This suggests that households with chronically ill members engage in more behavioural adjustments to meet food needs than households without chronically ill members (Caldwell, 2005).

After the provision of food relief, CSI scores were reported to decline among sample households in this study. This suggests that food aid reduces the households' need to adopt consumption reduction strategies, and allows the beneficiaries to enjoy more diverse diets during food emergencies (Caldwell, 2005). The application of the CSI in Zimbabwe led to the realisation that most consumption-reducing coping strategies have a negative impact on dietary quality (Caldwell, 2005) and lead to the provision a "full basket" ration, including cereals, cooking oil and pulses to beneficiaries (Owubah *et. al.*, 2005).

The baseline food security analysis and the malnutrition study in Iraq related CSI scores to poverty and malnutrition levels in various districts (World Food Programme, 2004). Collins (2004), compared the CSI scores of refugees in western Tanzania to the districts where refugees were camping; nationality (whether Congolese or Burundian); market access (whether inside or outside the refugees camp); household head education level and source of income and found these characteristics to be related to the CSI scores.

Maxwell (1995) compared CSI scores to anthropometric measures and dietary adequacy. The results showed that the CSI was not highly correlated to anthropometric measures. This may be because food security is a household-level measure, while children's nutrition status is an individual-level measure, capturing intra-household allocation issues, while coping strategies are applied at household level.

The CSI has been important in informing decision making on the timing, impact and redesigning of food aid interventions. During the Nigerian Food Consumption and Nutrition Survey (2001 – 2003), the frequency of application of coping strategies was used to determine the impact of food shocks among communities residing in various agro-ecological zones (Dixon *et. al.*, 2004). Food availability varied across agro-ecological zones, mirroring variations in the frequency of application of coping strategies.

The results of the CSI studies cannot be compared between studies because the methodology includes contextual data and coping strategies vary from place to place (Food Aid Management, 2004; Maxwell *et. al.*, 2003). When compared with other food security assessment tools, CSI is unique in that its design requires community participation (Owubah *et. al.*, 2005). C-SAFE combines the CSI with other approaches, such as asset ranking techniques, in order to allow for a more robust understanding of food insecurity (Owubah *et. al.*, 2005). Very often, tools such as Asset Ranking and the Food Consumption Index are integrated into one monitoring and evaluation system, as is done for the Community and Household Surveillance System (Owubah *et. al.*, 2005). Tracked over time, the CSI provides information on changes in the food security situation of a particular community (Owubah *et. al.*, 2005).

2.5 Household characteristics related to household food insecurity

Traditional approaches to food security have typically focused on assessing aggregate levels of food supply, agricultural production and the balance of agricultural trade (Reutlinger and Knapp, 1980). Sen (1981) highlighted that food access by households and individuals may be constrained by economic, social and cultural factors, and is not directly related to national level food supply. Deolalikar and Behrman (1987) and Poleman (1981) have shown that, in developing countries, aggregate increases in income do not necessarily lead to substantial improvement in individual nutrient intakes, but may lead to increased consumption of higher-quality foods that are rich in protein and micronutrients (UNICEF, 1998). Low income is a major contributory factor to food insecurity in developing countries. Riely *et. al.* (1999) has reported that low incomes, and not only food availability, contribute to food insecurity in developing countries, as food availability is not the only factor necessary for a household to be food secure. Consistent access to income is important as smallholder farmers often struggle with food shortages between harvests (Benson, 2004).

Vulnerability to household food insecurity is a function of socio-economic and demographic variables such as headship, health status and disabilities of household members, orphanage, dependency ratios and assets ownership (Mzibule, 2004a, b, c). According to Chambers (1989), there are two sides to vulnerability: an external side consisting of risks, shocks and stress to which an individual is subject; and an internal side which is defencelessness i.e. lack of means to cope without incurring damaging asset losses. Sinha and Lipton (1999) reviewed risks relating to the internal and external sides of vulnerability. They are:

- disease or injury
- violence, including domestic, criminal and war related
- natural disasters
- harvest failure
- terms of trade deterioration, especially affecting the price of food relative to labour
- reduced access to productive or income earning work

Population dynamics has been identified as one of the five main areas in studying vulnerability and disasters, for which an empirical set of descriptive research questions: "the 5 W's:- who, what, when, where, and why/how of vulnerability" was developed (Teller, 2005). Identifying the hungry includes understanding who the vulnerable are, where they live, why they are hungry, for how long they have been hungry and how the vulnerable people can benefit from various emergency relief and development interventions (de Salvo, 2004). The World Food Programme (WFP) and the Consortium for Southern Africa Food Security Emergency (C-SAFE, cited by Mzibule, 2004a,b,c), have defined vulnerable households as typically having:

- female heads
- chronically ill members
- disabled persons
- orphans
- high dependency ratios
- very poor or few assets
- male and female heads with two or more vulnerability characteristics

Aliber (2001) adds the rural poor, elderly, retrenched or evicted farm workers, AIDS orphans and households with HIV sufferers, cross-border migrants and the 'street homeless' to the list.

Poverty has serious effects on food and nutrition security in that it contributes to poor agricultural productivity, and reduces the ability of poor consumers to purchase food (Rosegrant *et. al.,* 2005). In a Lesotho study, 60 per cent of the sampled households were above the poverty line in 1993, while only 46 per cent were above its equivalent level of income in 2002, indicating an increased incidence of poverty (CARE and Lesotho Ministry of Agriculture and Food Security, 2004).

There is a strong link between gender and food insecurity (Løvender *et. al.,* 2004). Women contribute 70 to 80 per cent of household food production in sub-Saharan Africa (Brown *et. al.,* 2001). However, women's roles in providing a healthy and secure environment for their families are often overlooked in development (Rosegrant *et. al*., 2005). Løvender *et. al.* (2004) reported that changes in household headship and *de jure* female headship are associated with poverty and impoverishment. In Lesotho, in 1993, chronically poor households had the highest proportion of *de jure* female-headed households (31% of the sample) (CARE & Lesotho Ministry of Agriculture and Food Security, 2004; Ishani, 2004). A study in Egypt found that, as mothers' education levels increased to at least the completion of primary school, the incidence of poverty reduced by 33.7 per cent (Qinsumbing *et al.,* 2004). Using data on individual nutrient intakes from India, Deolalikar and Behrman (1990) reported that estimated price and wage elasticities of food intake were significantly higher for females than for males. This suggested that women and girls carried a disproportionate burden when prices rose. Dercon and Krishnan (2000) examined risk sharing by rural households in Ethiopia and observed that, in poor households in the south, husbands and wives do not practice risk sharing. Women bear the brunt of adverse shocks (Decorn and Krishnan, 2000). According to Gross *et. al.* (1998) children's food availability and intakes are influenced by the following: the household members' economic activities; parents' time for child care; mother's control over

household income; household food production; household wages; family and cultural values and norms; food choice and acquisition; food storage, food preparation; and intra household food allocation practices.

A high dependency ratio exacerbates household vulnerability to food insecurity (CARE and Lesotho Ministry of Agriculture and Food Security, 2004; Mzibule, 2004a, b, c). Age dependency is defined as the ratio of children (0 – 15 years old) and older persons (65 and older) to the productive members of a household (16 – 64 years old). The C- SAFE and WFP consortium define an effective dependency ratio as the number of non-productive members of the household to the productive members, regardless of age (Mzibule, 2004a, b ,c).

Seasonality also influences food intakes. A stable and adequate food supply is vital for household food security (Gittelsohn *et. al.,* 1998). Seasonal analysis, using panel data, revealed large seasonal fluctuations in food consumption (Dercon and Krishnan; 2000). In an Ethiopian study on economic reform, Dercon (2004) showed that although shocks mattered, the main factors driving consumption changes were relative price changes. These price changes affect returns to land, labour and human capital. No relationship was observed between household food security and consumption of vegetables and fruits. However, the availability of these foods is highly seasonal, which undoubtedly reduced the probability of finding significant associations in a single survey (Gittelsohn et. al., 1998). Safety nets are necessary to mitigate the effect of seasonality in developing countries. Townsend (1995) reported that income variability remained high in International Crops Research Institute for Semi Arid Tropics (ICRISAT) villages in southern India, where diversification and other income strategies were not employed (Dercon 2004).

Saving in good times and depleting assets when necessary are commonly observed consumption smoothing strategies (Dercon, 2004). Households with self insurance (savings) cope better where the credit market is imperfect (Deaton, 1991). Variations in assets, or the ability to deploy them productively, are important for identifying vulnerable groups (e.g. the elderly, widowed, divorced, disabled, chronically ill, etc.) (Ellis, 2003).

2.6 Alternative measures of household food insecurity

Food security is a cross-cutting, complex and multifaceted phenomenon (Migotto *et. al.,* 2005). Despite this, food security indicators have traditionally focused on specific, narrowly measured aspects, such as current food supply, individual energy intake - often without capturing the complexity of the concept (Gittelsohn *et al.*, 1998). There is, therefore, a need to capture the factors that impact household food security at a livelihood level, and not only from a food production perspective (Misselhorn 2005). The lack of a single indicator to capture all aspects of food insecurity, while at the same time providing relevant and timely information in a cost-effective manner, has hastened efforts to find easy to-implement and reliable alternative food security indicators (Migotto et. al., 2005).

The complexity and interrelatedness of food security causes and symptoms has frustrated attempts to develop agreed on comparable measures (Hendriks, 2005). In South Africa, the FIVIMS.ZA Consortium took up this challenge and conducted a pilot study to develop a monitoring system that incorporated appropriate indicators (Hendriks & Maunder, 2006). However, the FIVIMS.ZA pilot did not achieve its purpose because too many variables were included and there was a lack of consensus on measurement approaches. Hendriks and Maunder (2006) recommended the identification of a clear set of easily accessible, understandable and less costly indicators available from other data sets to enable the full roll out of the programme.

Food security indicators can potentially be extracted from already existing survey and census data available in South Africa (de Haen, 2002a). Census data has been used successfully to provide information towards poverty mapping and measuring deprivation (Noble *et. al.*, 2006; Alderman *et al.*, 2001). The extent to which national survey and census data can be exploited to facilitate measuring and monitoring of household food insecurity is yet to be determined (Alderman *et al.*, 2001). Hartwig (2006) has shown that 65 per cent of the FIVIMS.ZA indicators could be obtained from South African surveys and census data (Hartwig 2006).

There are numerous advantages to using household survey and census data for food security assessments. As discussed by Hartwig (2006) these are:

- survey and census data cover a wide range of diverse indicators
- geographic coverage results in national representativeness
- data supplies a variety of policy-relevant and valid measures
- data allows for multilevel monitoring and targeting, particularly in assessing changes over time
- permits analysis of the causal factors necessary to identify appropriate interventions to curb food insecurity
- household expenditure estimates can be used to calculate total expenditure and energy intakes

According to Hartwig, (2006), secondary data obtained from household surveys and census is disadvantageous in that:

- national surveys may exclude subgroups of the population due to limited resources and coverage
- questions could be misinterpreted
- systematic, non sampling errors may introduce a bias
- recall and measurement errors are possible sources of error
- data is based on households and not individuals
- questionnaires may have a limited number of questions relevant to food security assessments. Results may not be comparable across countries and regions
- certain questions can be influenced by social desirability, i.e. respondents guessing what the researchers want to hear rather than providing honest answers.

Experience has shown that the qualitative and quantitative methods to measure food security are increasingly complementary (Migotto *et. al.,* 2005; Chung *et. al.,* 1997). Subjective food security questionnaires can complement other data, particularly energy consumption (Migotto *et. al.,* 2005). The current study sets out to develop a demographic and socio-economic tool to measure household food insecurity. The use of commonly available demographic and socio-economic variables (widely used variables in various surveys whether food or non-food related), will enable overcoming weaknesses related to using household and census data in food security assessments.

Chapter two showed the links between household food intake, household dietary quality, household coping strategies to food shortage and food insecurity. Potential relations between household characteristics and household food insecurity have been discussed in the current chapter. In the same line, the strength and weaknesses of various measures of food insecurity have been discussed. The review provides a necessary benchmark for eth development of a new empirical measurement of food insecurity.

Chapter three presents and discusses the general research methods used in the study. In response to research problems described in chapter one, the food security status of sample households was derived from secondary data collected and analysed using a number of common food security analysis methods. Chapter three presents the sampling process, data collection and analysis of data. While general research methods are discussed in Chapter three, the specific methods for each sub-problem are detailed in the respective chapters.

CHAPTER 3: RESEARCH METHODOLOGY

This chapter presents and discusses the general research methods used in the study. The specific methods for each sub-problem are detailed in the respective chapters. Based on the research problems described in chapter one, the food security status of sample households derived from secondary data was explored using a number of common food security analysis methods. The results of these analyses were used to test two new measures developed, namely the Household Food Adequacy Score and Household Food Adequacy Index.

3.1 Data collection

The study from which data were drawn was carried out in two phases in the Embo community in the Umbumbulu district in KwaZulu-Natal. The study drew on a census survey of 48 fully certified Ezemvelo Farmers' Organisation (EFO) members, 103 partially certified EFO members and 49 non-EFO farmers. The sample included 200 individual member respondents from 176 households. Fully certified members had adopted organic production systems and were certified by AFRISCO in 2000. Partially certified members were those who had applied for and were in the process of converting to certified production. Fully and partially certified respondents were selected from certification records held at the University of KwaZulu-Natal and a list maintained by EFO's Executive Committee. The non-EFO respondents represented randomly selected households whose members did not join the EFO (non-adopters), but reside on the same tribal ward as EFO members.

The first survey round, which was carried out in November 2004, because November is the planting season, and hence a period when less food is available gathered information on household demographics and socio-economic characteristics, food availability, household consumption patterns and the frequency of application of coping strategies. A focus group discussion was conducted by the researcher in November 2004 to identify the main coping strategies applied by households facing food shortages. The group consisted of nine people, selected with the help of the EFO committee from diverse areas within Embo. Fifty-six per cent of the group was made up of women as women tend to know more about household consumption than men. The second survey was conducted in March 2005. The survey collected repeat data on household expenditure with a focus on the application of coping strategies. March is a harvest period characterized by the abundance of maize and major summer crops. During the two consecutive household surveys, expenditure, volume and weight data for a total of 39 food items consumed in the previous month were collected.

3.2 Data analysis

Reported monthly expenditure on each of the 39 food items was converted into masses and volumes using average prices obtained from informal local stores and formal shops in Isipingo (the nearest commercial centre). Following the methodology applied by Rose *et. al.* (2002), food volumes and masses were converted

into energy (kj), protein (g), iron (mg), vitamin A (µg Retinol equivalents) and vitamin E (mg) using food composition tables (Langenhoven *et. al.*, 1991). Food items were grouped into 12 categories to estimate the energy and nutrient per capita intake per household over study period. These food categories were: cereals and cereals products; legumes; vegetables; fats, oils, salad dressings and ice cream; nuts and seeds; milk, dairy products and breast milk substitutes; sugars and sweets; baby foods; meat, meat products and poultry; eggs and eggs dishes; fish and seafood; and fruit and fruit juices.

It was assumed that all foods purchased were consumed by households. Nutrient losses in food preparation were not taken into account as the purpose of the study was not to investigate dietary intake, but compare potential nutrient intakes among households. To control for household size, age and gender variations between households, energy and nutrient intake and requirements were estimated for female adult equivalents (15 and 50 years) based on Recommended Dietary Allowances (National Academy of Sciences, 1989; Rose *et. al.* 2002). For example, if a two year old girl has an energy requirement of 5440 kj/day as a recommended energy requirement, her adult female equivalent is calculated by dividing 5440 kj/day with 9207 kj/day, the recommended energy intake for an adult female. The per capita intake energy, protein and micronutrients (female adult equivalents) requirements and intakes were estimated for each household.

Qualitative and Quantitative information gathered during the field work was coded and analysed using the Statistical Package for Social Sciences (SPSS) computer software, version 13.0. Descriptive statistics, such as frequencies, percentages and means, were employed to determine central tendencies for variables. Cross tabulations involving Chi-square tests (χ^2) were used to test associations between variables. Correlation (r) tests were used to determine trends. Several regression functions were also performed. Analysis of Variance (ANOVA) was used to compare the means of variables. The Duncan Multiple Range test was employed to test the homogeneity of variances. Principal Component Analysis (PCA) was employed to derive categorical variables and develop the Household Food Adequacy Index and The Household Food Insecurity Index.

Being well informed of the sample and the study area is key in understanding the options and choices available to the respective population. Chapter four presents the description of the study area, characteristics of the participants, household socio economic characteristics, demographic characteristics and household head characteristics. Lastly, household budget analysis with respect to food and non food expenditures is done to compare household budget shares across November 2004 and March 2005 which is the period of less and plenty respectively.

CHAPTER 4: DESCRIPTION OF THE SAMPLE AND THE STUDY AREA

4.1 Description of the study area

The study was conducted in the Embo Community, which is located in the Umbumbulu District, in the province of KwaZulu-Natal (KZN). KwaZulu-Natal is on the east coast of South Africa, and is characterised by sub-tropical and savannah vegetation (Government Communication and Information System**,** 1998**).**

The Umbumbulu District is situated $29^{'}56^{00}$ E and $30^{'}30^{00}$ N, and has an altitude ranging from 394 to 779 m high above sea level. Although there is rainfall throughout the year, the main rainfall is between November and March. The annual mean rainfall in Umbumbulu is 956 mm. The mean, minimum and maximum temperatures for the place are 18.6 ^{0}C, 24.0 ^{0}C and 13.4 ^{0}C respectively (Camp, 1995). The area is located in a moist coastal hinterland region. Only 15 per cent of the total Umbumbulu Bio-resource Unit has high potential for annual cropping (Camp, 1995). Another nine percent of the Bio-resource Unit is arable, but less favourable for annual cropping (Camp, 1995). The climate is favourable for a wide range of adapted crops and the area has a year-round growing season (Camp, 1995). Agriculture in this communal area is predominantly rain-fed.

The Embo Community is located in Umbumbulu - a former homeland area. Embo has five traditional authorities: Embo, Embo-Kwakhabazela, Embo-NkishisiMahla, Embo-Timuni and Embo-Vumakwenza. Following current district municipal boundaries, the study area is at the confluence of four magisterial districts; Ugu, eThekwini, Sisonke, and Umgungundlovu. Figure 3.1 presents the site of study. The population of Embo area is estimated at 160 755 people. In 2005, 20 208 of the inhabitants in the area were employed, while 20 943 were unemployed (Municipal Demarcation Board, 2006).

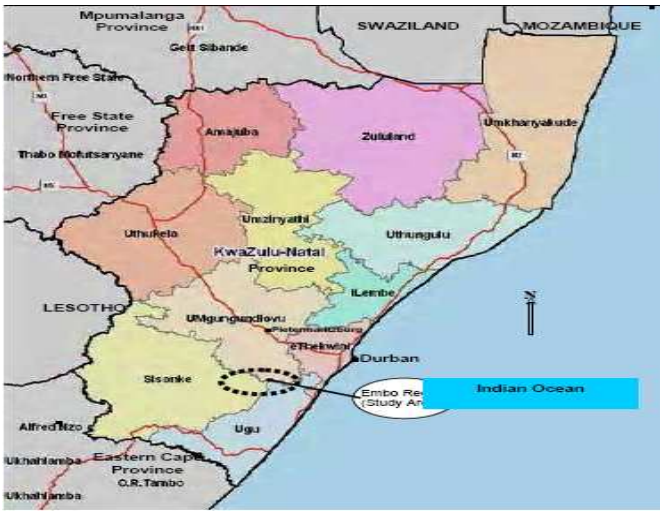


Figure 4.1: Location of study site in KwaZulu-Natal (Municipal Demarcation Board, 2006).

4.2 Description of the survey participants

Members of EFO grow green beans, baby potatoes, sweet potatoes and *amadumbe (taro)* individually on their farms, but market the produce collectively (Gadzikwa, 2008). Through collective action, members of the community are able to reduce unit transaction costs associated with marketing, and can mitigate some risks, such as low farm prices. The EFO has been providing a viable opportunity for improving agricultural production in the area (Agergaard and Birch-Thomsen, 2006).

Forty-five per cent of the survey respondents in both surveys were female. Household size ranged from one to 25 members, but on average, households consisted of eight members. At the time of the study, the mean monthly household income was R 2351 (USD 361.70). Average non-farm income at the time of the study was R 2310 (USD 355.38) per month. Non-farm income sources included: wages from employment, remittances, hiring out of accommodation, catering services, building houses, hawking, shop keeping, furniture making, sewing, hair braiding and taxi operating. Hawking was the most predominant non-farming activity performed. Current findings showed that 17 per cent of all households had members engaged in hawking, followed by building (3.5 %), hiring accommodation and running spaza shops (2.5 %), making handcrafts (2 %), catering, and sewing and braiding (1.5 %). Operating taxis was not a common livelihood activity (with only 0.5 per cent of the surveyed households). Poverty in Embo was higher in 2005 than in 1998 (May 1998). The proportion of households receiving less than one dollar a day per person was 35.4 per cent of the sample.

Farm size varied from 0.01 to 8.90 hectares, with a mean of 0.70 hectares. The average farm size, for non-members, partially certified members and fully certified members, was 0.48, 0.77 and 0.75 hectares respectively. Farm activities generated R499 per annum. The average annual income, from farm activities for non-members, partially certified members and certified EFO members, was R357, R339 and R988 ($p \leq 0.05$), respectively. Farm income contributed only 1.4, 1.2 and 3.2 per cent to household income of non-members, partially certified and certified households, respectively. The low proportion of income generated from farming, and the importance of non farming income, implies that households do not rely heavily on farming income. Cross (2001) characterised rural black communities in South Africa as 'functionally urbanized' which refers to their low dependence on subsistence agriculture, but on income from activities in urban areas.

4.3 General demographic characteristics of surveyed population

The age of the household heads ranged from 27 to 85 years, with a mean household head age of 57 years. Just under 60 per cent of the sample was between the ages of 17 and 64, 36.03 per cent were below 17 years, while only 4.26 per cent of the population was 65+ years (Table 4.1; Figure 4.2).

Table 4.1: Age and gender characteristics, Embo, November 2004 and March 2005 (n = 1584)

Age	Gender		
	Males (n = 715)	Females (n = 869)	Total (n = 1584)
Under 17 years old	18.0 %	18.01 %	36.03 %
17 – 64 years old	26.54 %	33.16 %	59.71 %
65+ years old	1.59 %	2.67 %	4.26 %
Gender ratio			82
Age dependency			67

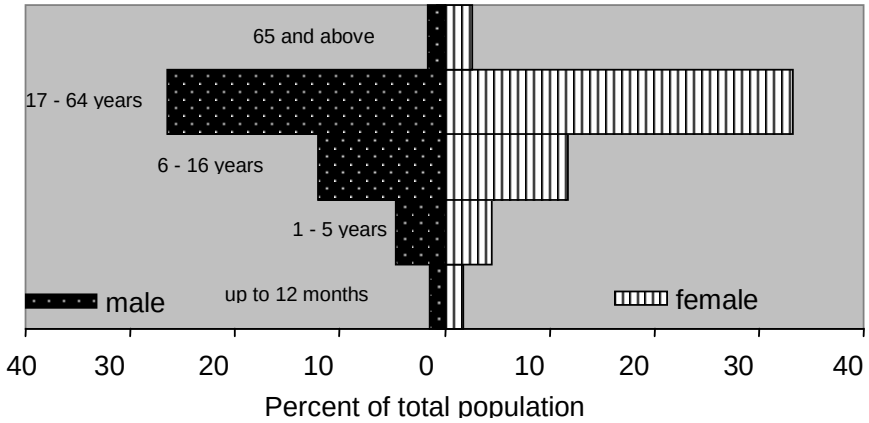


Figure 4.2: Age – gender structure for Embo, November 2004 and March 2005 (n = 1584)

The South African census in 1998 revealed that the percentage of adults, children and old people in the country was 62.8, 31.7and 5.5, respectively (STATS SA, 1998). The age structure of the population has important implications for resource demand and dependency burdens, such as education expenses for children and health care and support for the elderly (UNCED, 1992). Comparing the 1998 census results to the current survey, the survey had proportionally more adults and older people and fewer children.

The age to gender ratio for Embo and South Africa is different from other sub-Saharan African countries, where children compose over half of the population. Approximately half of all household members in sub-Saharan Africa are under 15 years of age (Mohammed *et. al.*, 1997). Children make up more than 40 per cent of the developing world's population and half the population in the least developed countries (UNICEF, 2006). The population census (STATS SA, 1998) showed an increase in the national adult population from 56.3 to 60.2 per cent and a decrease in the number of children from 37.9 to 33.9 per cent of the total population (STATS SA, 1998).

The gender ratio (ratio of males to females) in Embo was 82:100. This means that for every 100 women in the Embo community, there are 82 males. The Embo gender ratio is lower than the national ratio that stood at 92:100 at the time of the survey. With regard to the percent of households with disabled persons, 16.5 per cent of the Embo households had one disabled person, while three per cent of households had more than three disabled persons.

The overall age dependency ratio was 0.67. The age dependency ratio is the ratio of persons in the ages defined as dependant (under 15 years and over 64 years) to persons in the ages defined as economically productive (15-64 years) in a population (United Nations Population Division, 1995). This means that there are 67 age dependents to every 100 active aged persons in Embo. Two thirds (65.6%) of households had at least one age dependant member, while 8.2 per cent of households did not have age dependents. During the 1998 Demographic Household Survey for South Africa, the age dependency ratio for the country was 59.24 (STATS SA, 1998).

4.3.1 Household head characteristics

As reported before, 45 per cent of households were headed by women. Household size, as well as per capita income in households headed by males was higher than in households headed by females. The absence of able-bodied males to perform heavy duties such as agricultural production may have affected the welfare of households (Makhanya, 2005). As shown in Table 4.2, households headed by males cultivated relatively larger areas (0.61 hectares (ha) on average) compared with female headed households (0.42 ha on average).

Table 4.2: Gender of household head as related to income and size of land cultivated, Embo, November 2004 and March 2005 (n = 200)

Indicator	Household head gender		
	Male	Female	P value
Household size	8.52	7.24	0.034*
Per capita income ($ / day)	2.39	2.29	0.833
Land used (ha) for crop production	0.61	0.42	0.188

** = significant at P≤0.05.*

Gender specific labour specialisation has implications for household productivity in prevailing patriarchal Zulu society (Makhanya, 2005). It is often argued, with some measure of justification, that rural women in KwaZulu-Natal perform essential functions in the household e.g. crop production, raising children, feeding the family, fetching firewood and water, while they are also involved in heavy agricultural labour (Makhanya, 2005).

The analysis showed that the share of food from own production increased in March 2005 compared with November 2004. Female headed households received more food as gifts, while male headed households more frequently purchased food. Obtaining food as payment for labour was not common among sampled households, regardless of the gender of the household head. Household food supplied from own production

was higher among male headed households during both survey periods. The proportion of food from own production was significantly higher ($P \leq 0.05$) among households headed by males compared to female headed households during the second round.

Household expenditure on food was more consistent across the two survey periods in households headed by females compared with households headed by males. While the difference between total food purchased between the two seasons was R 74.27 and R 22.68 for males and female headed households, respectively, the difference between total food expenditure was 314.01 and 160.27 for households headed by males and females respectively. During the period of relative plenty (March 2005), the male headed households had significantly ($P = 0.042$) higher food consumption from own production compared with households headed by females (Table 4.3).

Food expenditure per person was calculated using two methods; first, by dividing total expenditure by Adult Equivalent units and second, by dividing total food expenditure by the total number of persons in the household (household size). Overall, there was increased consumption of food during the second round, compared with the first round. Using Adult Equivalent units, the differences between per capital expenditure on food between the female and male headed households was found to be R 18.84 and R 9.00 during November 2004 and March 2005 respectively. Female headed households had higher food expenditure per person than male headed households during both rounds. During November 2004, the mean per capita expenditure was found to be significantly different ($P = 0.017$) between households headed by males and females.

Twenty-seven per cent of household heads had not attended school. Only one per cent of household heads attended more than nine years of formal education. In general, the household head had an average of two years of education.

4.4 Socio-economic characteristics of sample households

On average, each household owned three assets. Of 15 domestic assets listed in the survey, radios were the most commonly owned asset, available to 67.3 per cent of the households. Other assets included: wheelbarrows (38.7 % of the sample households), cell phones (37.7 %), televisions (33.2 %), fridges (19.1 %), ploughs (15.6 %), landline telephones and motor vehicles (13.6 %), sewing machines and Hi-Fi's (13.1 %), bicycles (4 %), generators (3.5 %), DVD/VCRs (2 %), motorbikes (1 %) and planters (0.5 %). A number of households (12.6 % of the sample households) did not own any of the listed assets, while 0.5 per cent owned 10 of the listed assets (the highest number of assets owned by any household). The number of rooms per household ranged from one to eight with a mean of three.

Table 4.3: Gender of Household head in relationship to household food expenditure, Embo, November 2004 and March 2005 (n = 200)

Survey period	Household headship	ZAR Expenditures for food (number of households)				
		Purchased	Gift	Payment	Own production	Total
Nov. 2004	Male headed	651.78 (110)	55.56 (23)	39.00 (4)	85.08 (65)	717.48 (110)
	Female headed	676.83 (90)	228.52 (20)	25.00 (1)	81.34 (57)	780.55 (90)
	ANOVA	0.611	0.058	0.400	0.838	0.316
March 2005	Male headed	762.05 (110)	69.30 (36)	18.05 (10)	280.15 (98)	1031.49 (110)
	Female headed	699.51 (90)	100.23 (31)	16.50 (6)	226.02 (85)	940.82 (90)
	ANOVA	0.324	0.315	0.771	0.042*	0.237
ZAR Food expenditure per capita						
		November 2004		March 2005		
		R/ Adult Equivalent	R / household member	R/ Adult Equivalent	R / household member	
	Male headed	137.17	105.37	206.52	146.18	
	Female headed	156.01	139.82	197.45	162.86	
	ANOVA	0.294	0.017	0.788	0.289	

** = significant difference at P ≤ 0.05 level of confidence*.

A large proportion of Embo households (70.5 % of the sample) obtained water for household consumption from unprotected sources. The study showed that 22.3 and 48.2 per cent obtained drinking water from streams and unprotected springs, respectively. Approximately 15 per cent obtained water from stand pipes, 9.6 per cent from protected springs, three per cent from boreholes and 2.5 per cent from rain tanks. The study also showed that 93.4 per cent of households did not have electrical power. Of households with electrical power, 4.6 per cent had Eskom power (the national electricity distributor), 1.5 per cent used solar energy and 0.5 per cent used generators.

Only one per cent of the surveyed households did not practise any of the listed income shock coping strategies, while ten per cent practised all the listed income shock strategies. The mean number of income coping strategies practised by the households was 6.65. Among the surveyed households, 96.0 per cent used their own savings to mitigate income shocks, 88.0 per cent reduced spending, 76.0 per cent received help from friends or relatives, 73.0 per cent performed additional work for pay or food, 66.0 per cent reduced or stopped paying debts, 65.5 per cent borrowed money from relatives, 54.0 per cent lowered food consumption, 53.5 per cent sold livestock, 46.5 per cent sold other domestic assets and 46.0 per cent borrowed money from money lenders. Borrowing money was the least used strategy. However, almost half the surveyed households (46.0 %) borrowed money from *stockvels* (rotating credit clubs).

According to the survey, only 10.5 per cent of all households had loans at the time of the survey. Friends offered 38.1 per cent of all loans, followed by local money

lenders and *stockvels* (19.0 %), shops (14.3 %), pension and burial clubs (4.8 %). Financing education was the main reason for households taking loans - accounting for 38.1 per cent of all loans, followed by building roads (19.0 %), buying furniture (14.3 %) and purchasing food (9.5 %). Financing festivals, household items and car repairs each accounted for 4.8 per cent of all loans. About 64 per cent of households had no savings at the time of the survey.

Mean household expenditure increased from R 1429.55 in November 2004 to R 1666.66 in March 2005. The study revealed that food made up 61.46 and 67.09 per cent of the households' total expenditure for the two surveys, respectively. Transport costs made up 12.95 and 11.20 per cent, while education consumed 9.81 and 8.06 per cent of household budgets in November 2004 and March 2005, respectively. Energy, water, and municipal rates, personal items, household items, dressing, health and care, and life and property insurance were allocated 15.78 and 13.65 per cent of household budgets for the first and second rounds respectively.

A paired sample t - test conducted to compare the household budget share for food and non-food items showed that food and non-food budgets were similar during November 2004, but not in March 2005 (Table 4.4). While household food expenditure rose from R 748.42 to R 985.53, non-food expenses rose from R 674.12 to R 681.21 over the two survey periods. As discussed in the previous chapters, the greater the proportion of a household's budget allocated to food, the poorer the household. As expected, households that allocated higher expenditure to food had fewer assets.

Table 4.4: Paired sample t-test for household food and non-food budget, Embo, November 2004 and March 2005 (n = 200)

November 2004			March 2005		
(R) Food cost	(R) Non food cost	t–test	(R) Food cost	(R) Non food cost	t–test
748.42	674.12	0.910*	985.53	681.21	4.209

** = significant difference at 5 % level of significance*

During November 2004, households employed more coping strategies compared with March 2005. Since March 2005 was the time of the harvest, households consumed produce from their own gardens, with fewer food shortages and lower food expenditure. As expected, larger households had higher proportional expenditure on food.

Chapter five is set to determine household food adequacy among the sample households using the Household Food Adequacy Index. Both micronutrients, energy and protein intake has been considered in the analysis in Chapter five. While energy intake has traditionally been used to specify intake, relationships between energy, micronutrient and protein intakes have not yet been comprehensively confirmed. Chapter five is therefore expected to relate the intake of energy, micronutrients and protein in Embo community.

CHAPTER 5 DETERMINATION OF HOUSEHOLD FOOD CONSUMPTION THOUGH DEVELOPMENT OF A HOUSEHOLD FOOD ADEQUACY INDEX

5.1 Introduction

Micronutrients are vital elements needed by the body in minute amounts for the production of enzymes, hormones and other substances; growth regulation; and the development and functioning of the immune and reproductive systems. In Section 2.2, it was discussed that energy intake has traditionally been used to specify the quantity of food consumed and correlated to macronutrient intake. However, the relationships between energy and micronutrient intakes have not yet been comprehensively confirmed. Although macronutrients are important indicators of malnutrition, many nutritional disorders may not manifest through measurement of macronutrient intake, but may be early indicators of malnutrition way before it manifests, and is measurable as stunting.

The Mozambique Diet Quality Index has been a successful tool for rapid assessment of household dietary quality. It categorises households as those with: acceptable diets, low quality diets, and very low quality diets (Rose and Tschirley, 2000). The Mozambique Diet Quality Index considers the nutrients consumed, and estimated the mean adequacy ratios for specific nutrients. The Household Food Adequacy Index developed here estimates the consumption of per capita household adult female equivalents. The household food adequacy is then compared with individual nutrient intakes per capita.

The Household Food Adequacy Index (HFAI) – a new indicator - was developed using Principal Component Analysis to estimate variation in household food intake, group households into food intake categories, and identify the nutrients that contributed significantly to variation in intake.

5.2 Methodology

Principal Component Analysis (PCA) has been widely used to estimate household wealth, using socio-economic indicators such as assets owned, access to household amenities and income levels (Booysen, 2003; Mwageni *et. al.,* 2002). In household food security studies this formula has been used to identify households' socio-economic status when regressed against food availability (Lorenzana and Sanjur, 1999; Rose and Charlton, 2002b). In this analysis, PCA was used to estimate household food adequacy and the strength of the variables (nutrients) causing intake variations amongst the sampled households.

PCA involved converting per capita household energy, protein and micronutrients into female adult equivalents (see Section 3.3) and weighted categorical or interval variables. The results obtained from the first principal component analysis explained most of the variability. These were used to develop the Household Food Adequacy Index based on Filmer and Pritchett's (1998) formula shown in Equation 5.1.

$$Aj = f_1 \times (aj_1 - a_1)/(s_1) + \ldots\ldots f_N \times (faj_N - a_N)/(s_N) \qquad (5.1)$$

Where: *Aj* represent Household Food Adequacy Index,

f_1, represents scoring factors for each set of nutrient items (diversity, energy, protein, iron, vitamin A and E);

a, household score (quantity of intake) in the particular nutrition item

aj is the value for the nutrition item

a_1 represents the mean of the nutrient item

s_1 represents the standard deviation of the nutrient

To obtain food intake indices, the sample was divided into three household food intake quintiles using the 33.3 and 66.6 percentiles as cut-offs. The use of cut offs at such percentiles assures three equal proportions of households. Having equal proportions of households is essential for unbiased analysis. Households with indices below 33.3 percentile had the lowest score, while the opposite was true to households with their indices above 66.6 percentile. The lowest, middle and highest quintiles represented inadequate (below the 33.3 percentile), moderate (from 33.3 up to 66.6 percentile) and adequate food intakes (above 66.6 percentile), respectively. The resultant classifications were then tested against food counts (number of food items taken) to test the hypothesis that increased diversity was associated with both higher dietary quantity (energy intake) and quality (micronutrients). Both single foods and food group counts have been the most popular measurement approaches for dietary diversity in developing countries (Ruel, 2003). However, a single food count was employed in this analysis.

Analysis of Variance (ANOVA) was used to compare mean intake of energy, protein, iron, vitamin A and E with food diversity with respect to adequacy index. The Duncan Multiple Range test, conducted at the one per cent level of significance, was used to categorise the means of the regressands (food quantity, food quality and diversity), and the households in their respective categories of household food adequacy (regressors). Confidence bands were used to estimate the limits with which food quantity, food quality and diversity within the food adequacy categories of households were bound. Using confidence bands mitigates underestimation of the mean and overestimation of the standard deviation for intake distribution that is typical in such analyses (Freedman *et. al.*, 2004; Rose and Charlton, 2002b).

5.3 Discussion

Seventy-nine per cent of sampled households purchased food, 17 per cent produced their own food and three per cent received food as gifts, while one per cent received food in return for labour. Purchases and own production accounted for 88 per cent and seven per cent of all the food available for households in the first survey round, while in the second survey round, they accounted for 70 and 26 per cent, respectively. Cereals and legumes were the key sources of energy and protein in the first and second rounds. Cereals and vegetables were key sources of iron in both first and second rounds. Vegetables and fats were the major source of vitamins A and E in both rounds, as shown in Table 5.1. Seasonal availability explained the variation in consumption patterns, i.e. more food was consumed from own production in the second survey round than in the first round.

The per female adult equivalent nutrient intakes are presented in Table 5.2. The mean household food diversity count for the first and second rounds was 20 and 24, respectively.

Table 5.1: Source of food energy and nutrient, Embo, November 2004 and March 2005

Item	Percentage contribution of each food category to the household energy/nutrient values (%)												
	Round	**Cereals**	**Legumes**	**Vegetables**	**Fats**	**Nuts**	**Milk**	**Sugars**	**Baby foods**	**Meat**	**Eggs**	**Fish**	**Fruit/ juices**
Energy	Nov.04	61.58	6.16	4.62	9.13	0.86	1.58	8.91	2.14	3.11	0.57	0.49	0.83
	Mar.05	29.60	51.77	5.90	4.71	0.45	0.57	4.23	0.13	1.81	0.23	0.08	0.50
Iron	Nov.04	28.25	24.02	24.07	0.15	0.56	0.31	8.06	8.16	2.50	1.68	1.27	0.97
	Mar.05	22.62	31.15	34.30	0.12	0.46	0.17	5.88	0.79	2.24	1.04	0.33	0.91
Vitamin A	Nov.04	0.00	0.25	86.32	2.94	0.00	3.39	0.01	4.33	0.04	0.85	0.55	1.33
	Mar.05	0.00	2.90	90.50	2.88	0.00	1.62	0.01	0.39	0.04	0.48	0.13	1.06
Vitamin E	Nov.04	8.33	0.00	7.96	72.95	2.01	0.19	0.00	2.01	1.45	4.02	0.05	1.03
	Mar.05	7.69	0.00	15.29	68.70	1.97	0.14	0.00	0.23	1.78	2.97	0.09	1.14
Protein	Nov.04	59.93	15.46	5.32	0.41	0.16	3.89	0.02	0.50	11.72	1.56	0.58	0.45
	Mar.05	16.57	72.61	4.53	0.12	0.05	0.90	0.00	0.12	4.21	0.51	0.18	0.19

Table 5.2: Households per capita intake Embo, November 2004 and March 2005

Nutrient	Mean adult female equivalent units	Per capita intake				
		Recommended intake to an adult female	Round 1		Round 2	
			Mean nutrient intake	Mean per capita status	Mean nutrient intake	Mean per capita status
Energy (kj/day)	8.03	2200	2007.50	-44.03	3658.82	+348.67
Protein (g/day)	7.86	46	53.88	+7.88	180.68	+134.68
Iron (mg/day)	6.02	15	11.28	-3.66	54.33	+39.33
Vitamin A (µg RE/day)	7.97	800	612.72	-187.33	921.48	+121.48
Vitamin E (mg/day)	8.26	8	9.61	+1.61	10.60	+2.60
Diversity (food count)	-	-	20	-	24	-

Note: *A positive sign for mean per capita status value indicates consumption beyond RDA requirements.*

The study found that in November 2004, 75 per cent of households had inadequate energy intakes, 58.4 per cent had inadequate protein, 78 per cent consumed an inadequate amount of iron, 76 and 47 per cent of households had an inadequate intake of vitamin A and E, respectively. These percentages were much lower in the second round: 31, 8.6, 13, 58 and 45 per cent, respectively for each nutrient. Mean iron, vitamin A and energy intakes were inadequate in the first survey round. During the second round, mean intakes of vitamin A, vitamin E and energy improved. The mean intakes of vitamin E and protein were adequate for most households in both rounds. The ratios of mean per capita intake to recommended intakes per adult female equivalent showed that iron was the most deficient nutrient, followed by vitamin A and energy.

PCA was employed to group households into food adequacy categories. The summary of the output is presented in Table 5.3. In both rounds, energy, iron and protein influenced most nutrient intake variation among the sampled households. Food diversity and vitamin A had the least influence on nutrient intake variation. To obtain household food adequacy strata, the sampled households were segmented into three equal categories using 33.3 and 66.6 percentiles as cut-offs (Table 5.4).

Table 5.3: Summary statistics for the Principal Component Analysis, Embo, November 2004 and March 2005 (n = 200)

Survey round	Nutrient	Per cent variation accounted for	Coefficient Factor	Mean	Std. deviation δ
Round 1	Iron (mg/day)	66.46	0.241	11.28	9.92
	Protein (g/day)	17.01	0.240	53.65	53.50
	Energy (kj/day)	10.95	0.239	8399.38	8232.61
	Vitamin E (mg/day)	3.62	0.229	9.61	8.35
	Vitamin A (µg RE/day)	1.65	0.159	612.72	789.10
	Diversity (food count)	0.21	-0.024	20.27	6.47
Round 2	Energy (kj/day)	59.189	0.276	15308.50	11610.18
	Iron (mg/day)	23.37	0.264	54.33	50.14
	Protein (g/day)	12.60	0.258	180.68	159.38
	Vitamin E (mg/day)	3.970	0.228	10.60	7.87
	Vitamin A (µg RE/day)	0.45	0.131	921.48	989.04
	Diversity (food count)	0.39	-0.002	24.11	6.23

Table 5.4: Household food intake adequacy Embo, November 2004 and March 2005 (n =200)

Quintiles	November 2004		March 2005	
	Number of households	Percentage of households	Number of households	Percentage of households
3rd quintile (adequate)	66	33.0	67	33.5
2nd quintile (moderate)	68	34.0	67	33.5
1st quintile (inadequate)	66	33.0	66	33.0
Total	200	100	200	100

Using cross tabulation, the consistency of intake with respect to food adequacy categories across the two rounds was found to be significant. As Table 5.5 displays, only 9.1 per cent of households with inadequate food intakes in the first round had adequate food intakes in the second round. It was also found that 10 per cent of households that had adequate food intake in the first round had inadequate intakes in the second round.

Table 5.5: Consistency in households in respect to food adequacy, Embo, November 2004 and March 2005 (n = 200)

Household food adequacy in round one	Second round			Per cent of total	χ^2 (2 sided)
	Household food adequacy				
	Per cent Inadequate FIH	Per cent Moderate FIH	Per cent Adequate FIH		
Per cent inadequate intake	59.1	31.8	9.1	100	
Per cent moderate intake	30.9	39.7	29.4	100	
Per cent adequate intake	10.0	28.5	61.5	100	0.000*

Note: indicates significant relationship at the 95 per cent level of statistical significance.*

Food purchases, followed by own production, were the most common methods to acquire food. Food obtained as payments (in-kind) for labour offered on farms made the least contribution to household food procurement patterns. Households with adequate food intakes did not obtain food as payments in the first round. In the first round, food purchases, own production and total food expenditure determined the food intake classification of households. During this round, expenditure for total food procured and food purchased was higher among households with adequate intakes. Consumption of food from own production was relatively higher among households with adequate food intakes than other households. The amount of food received as gifts was similar across categories.

The mean values for energy and vitamins available for households in the respective household food adequacy strata were compared with the standard requirements for an adult female as published by the National Academy of Sciences (1989) (Table 5.7). Households with mean energy and nutrition intake per capita values greater than or equal to an adult female equivalent were identified as consumers of nutritionally adequate diets. The Duncan Multiple Range test showed that, with the exception of food diversity, the mean nutrient intakes were significantly different between quintiles in the first round. Yet, food diversity was similar across quintiles in both rounds. Households with adequate intakes also fulfilled their energy, protein and micronutrients requirement in both rounds. Households with moderate food intakes did not consume sufficient energy, protein, iron, vitamin A and E in the first round, but did meet requirements for energy and micronutrients in the second survey. Households with inadequate food intakes did not meet energy and nutrition requirements in the first round and did not meet requirements for protein and iron in the second survey round.

Table 5.6: The relationship between food sources and household food intake strata, Embo, November 2004 and March 2005 (n = 200)

Household food adequacy categories		Central tendencies for household food procurement				
		Purchases	**Gifts**	**As payment**	**Own production**	**Total**
November 2004						
Inadequate	Mean	446.12[a]	44.23[a]	33.67	48.65[a]	447.43[a]
	Standard Error of Mean	22.43	9.28	8.17	7.30	23.39
	95 % Lower boundary	401.27	24.00	1.49	33.61	430.66
	95 % Higher boundary	490.98	64.46	68.82	63.70	524.20
Moderate	Mean	667.93[b]	64.24[a]	40.00	56.76[a]	719.06[b]
	Standard Error of Mean	36.69	14.30	10.00	8.61	38.45
	95 % Lower boundary	594.70	33.36	0.00	39.38	642.30
	95 % Higher boundary	741.16	95.12	167.06	74.14	795.82
Adequate	Mean	866.22[c]	267.00[a]	.	122.33[b]	1033.22[c]
	Standard Error of Mean	45.81	109.33	.	18.02	38.45
	95 % Lower boundary	774.72	39.21	.	86.16	902.79
	95 % Higher boundary	957.72	498.79	.	158.50	1163.66
	P-value	0.000*	0.064	0.658	0.001*	0.000*
March 2005						
Inadequate	Mean	660.55[a]	32.34[a]	1.30[a]	253.76[a]	947.95[a]
	Standard Error of Mean	48.77	95.53	0.57	19.21	59.18
	95 % Lower boundary	563.16	8.86	0.16	215.38	829.77
	95 % Higher boundary	757.95	55.82	2.45	292.13	1066.13
Moderate	Mean	760.35[a]	23.78[a]	1.54[a]	254.13[a]	1039.81[a]
	Standard Error of Mean	51.43	5.02	0.70	24.73	62.20
	95 % Lower boundary	657.66	13.77	0.14	204.75	915.62
	95 % Higher boundary	863.04	33.80	2.95	303.51	1164.00
Adequate	Mean	746.54[a]	27.97[a]	1.34[a]	192.40[a]	968.26
	Standard Error of Mean	62.94	11.94	0.73	23.39	76.07[a]
	95 % Lower boundary	620.88	4.14	0.157	145.70	816.39
	95 % Higher boundary	872.20	51.80	2.79	239.11	1120.13
	P-value	**0.381**	**0.836**	**0.963**	**0.087**	**0.589**

*Note: In the Duncan Multiple Range test performed at one per cent level of significance, a and c indicate the lowest and highest expenditures. * indicates a significant difference. The test was not done for the variable (food obtained from payment) in the first round since only two strata (poor and average) were involved.*

In the first survey round, only households with adequate intakes had confidence limits above adult female equivalent requirements for energy, protein and micronutrient requirements. In the second survey round, the lower 95 per cent confidence limit values for protein and iron were above adult female equivalent requirements for all strata.

Table 5.7: The relationship between diversity, energy/nutrition availability and household food adequacy, Embo, November 2004 and March 2005 (n = 200)

		Central tendencies for the energy/nutrition selected parameters					
				95 per cent Confidence Interval for Mean			
		Mean	Standard error of mean	Lower	Upper	Analysis of Variance Probability	Household intake situation
Round 1	**Energy**						
	Inadequate intake	789.70[a]	44.28	701.27	878.17		Not Sufficient
	Moderate intake	1486.79[b]	41.89	1403.15	1570.42		Not Sufficient
	Adequate intake	3833.95[c]	319.62	3195.24	4472.67	0.000*	Sufficient
	Protein						
	Inadequate intake	20.98[a]	1.10	18.78	23.19		Not Sufficient
	Moderate intake	39.98[b]	1.29	37.40	42.55		Not Sufficient
	Adequate intake	102.35[c]	8.80	84.75	119.96	0.000*	Sufficient
	Iron						
	Inadequate intake	4.22[a]	0.21	3.79	4.64		Not Sufficient
	Moderate intake	8.57[b]	0.24	8.09	9.05		Not Sufficient
	Adequate intake	21.57[c]	1.46	18.66	24.49	0.000*	Sufficient
	Vitamin A						
	Inadequate intake	143.78[a]	18.64	106.57	181.01		Not Sufficient
	Moderate intake	440.73[b]	43.80	353.27	528.18		Not Sufficient
	Adequate intake	1276.00[c]	128.70	1019.02	1533.38	0.000*	Sufficient
	Vitamin E						
	Inadequate intake	3.95[a]	0.36	3.22	4.68		Not Sufficient
	Moderate	7.62[b]	0.29	7.04	8.21		Not Sufficient

		Central tendencies for the energy/nutrition selected parameters					
				95 per cent Confidence Interval for Mean			
		Mean	**Standard error of mean**	**Lower**	**Upper**	**Analysis of Variance Probability**	**Household intake situation**
	intake						
	Adequate intake	17.54 [c]	1.24	15.05	20.03	0.000*	Sufficient
	Dietary diversity						
	Inadequate intake	20.00 [a]	0.82	18.84	21.10		
	Moderate intake	19.00 [a]	0.73	18.98	21.87		
	Adequate intake	20.00 [a]	0.88	17.67	21.18	0.588	
Round 2	**Energy**						
	Inadequate intake	1859.11 [a]	90.79	1677.79	2040.43		Not Sufficient
	Moderate intake	2978.09 [b]	91.90	2794.59	3161.58		Sufficient
	Adequate intake	6227.41 [c]	436.86	5354.45	7100.38	0.000*	Sufficient
	Protein						
	Inadequate intake	86.99 [a]	6.62	73.78	100.20		Sufficient
	Moderate intake	134.22 [a]	6.40	121.43	147.00	0.000*	Sufficient
	Adequate intake	325.93 [b]	25.08	275.82	376.04		Sufficient
	Iron						
	Inadequate intake	27.32 [a]	2.55	22.23	32.43	0.177	Sufficient
	Moderate intake	38.96 [a]	2.16	34.66	43.26		Sufficient
	Adequate intake	98.27 [b]	7.98	82.33	114.22		Sufficient
	Vitamin A						
	Inadequate intake	737.46 [a]	82.27	573.16	901.76	0.000*	Not Sufficient
	Moderate intake	998.26 [a]	126.64	776.55	1282.24		Sufficient
	Adequate intake	1029.39 [a]	148.08	702.40	1294.13		Sufficient
	Vitamin E						
	Inadequate intake	6.15 [a]	0.36	5.43	6.87	0.692	Not Sufficient
	Moderate intake	10.17 [b]	0.61	8.94	11.40		Sufficient

		Central tendencies for the energy/nutrition selected parameters					
				95 per cent Confidence Interval for Mean			
		Mean	**Standard error of mean**	**Lower**	**Upper**	**Analysis of Variance Probability**	**Household intake situation**
	Adequate intake	15.65 [c]	1.31	13.02	18.27		Sufficient
	Dietary diversity						
	Inadequate intake	24.22 [a]	0.87	22.47	25.96		
	Moderate intake	24.21 [a]	0.72	22.79	25.66		
	Adequate intake	23.38 [a]	0.77	21.86	24.92		

*Note: The Duncan Multiple Range (DMR) test was performed at one per cent level of significance. a and c indicate the lowest and highest mean intakes. * indicates significant differences. There is no standard set for sufficiency for food diversity.*

In the second round, almost all households (≥ 95 per cent) with adequate and moderate intakes showed adequate intakes of vitamin E. Although the mean intake of vitamin A for all categories was sufficient in the second round, the adult female equivalent requirements for all strata were below the lower 95 per cent confidence limit. Vitamin A requirements were only met by five per cent of households in March 2005.

5.4 Synthesis

Cereals were the key sources of energy, and iron and legumes were the main source of protein. Vegetables were key sources of iron and Vitamin A. Fats were the major sources of vitamin E in both survey rounds. Seasonal availability affected consumption patterns, with more food sourced from own production in the second than the first survey round. Vitamin E intake was constant across the two surveys.

While energy, iron and protein led to higher intake variation among households, food diversity contributes the least to consumption variation. Using per capita nutrient intakes and a simple food count (diversity), PCA categorised households with respect to food intake and nutritional availability. In the first survey round, only households with adequate food intakes had adequate energy and nutrient intakes. In the second round, households with inadequate food intakes experienced inadequate intakes of energy and vitamins A and E. More households showed inadequate intakes of energy, protein and micronutrients during the first than the second round. Purchasing and own production were important in sourcing food. Improved food accessibility reduced expenditure variation during the second survey round. Dietary intake for households with inadequate and moderate food intakes improved over the two successive survey rounds. Daily per capita energy and nutrient intake was positively related to household food expenditure.

A simple food count (indicative of dietary diversity) showed the least influence in household food intake variation. More research is required to link food quantity and quality to develop a better understanding of household food security.

CHAPTER 6: RELATING HOUSEHOLD DIETARY DIVERSITY AND QUALITY TO DIETARY ADEQUACY

6.1 Introduction

Relating food adequacy, diversity and quality is a key aspect in understanding household food security (Ruel, 2003). Traditionally, Nutrient Adequacy Ratios (NAR's) have been used to determine household food adequacy. Relating the findings of the Household Food Adequacy Index to dietary diversity enables validation of the results obtained for the Household Food Adequacy Index. In chapter 5, household food diversity estimated through the food count method showed weak relationships to household food intakes. Therefore, estimating dietary diversity through counting specific food groups is recommended.

6.2 Methodology

Foods were classified into groups in accordance with the South African Food Based Dietary Guidelines. These groups were: starchy foods (cereals and grains), fruit and vegetables, legumes (dry beans, peas, lentils and soya), animal foods (meat, fish, chicken, milk and products and eggs) and fats (Vorster *et. al.,* 2001). This chapter provides an evaluation of dietary quality using the Nutrient Adequacy Ratio (NAR). The NAR is defined as the ratio of consumption of a particular nutrient to Recommended Dietary Allowances (Ruel, 2003). The NARs for individual nutrients (e.g. energy, protein and micronutrients) were truncated at 100 per cent of the Recommended Dietary Allowance for female adult equivalents to avoid high consumption levels of some nutrients and to compensate for lower levels of others (Kreb-Smith *et. al.,* 1987). The truncated values of NARs for energy (cut off at 9205 kj/day), protein (cut off at 46g/day), iron (cut off at 15mg/day), vitamin A (cut off at 800μg RE/day) and vitamin E (8mg/day) were summed to provide the Household Food Adequacy Intake index (HFAI). The highest score for each intake was one. Therefore, a household that consumed sufficient nutrients in all five food groups scored an index of five.

Using scientific judgment and practical policy concerns, Rose and Tschirley (2000), used two cut-offs, at 75 and 60 per cent of recommended dietary intakes, to divide households into three groups: acceptable quality, low quality and very low quality diets. In this study, households were categorised into three equally sized groups using 33.3 and 66.6 percentiles based on the Household Food Adequacy Indexes developed in the previous chapter. The three groups represented households with inadequate, moderate and adequate food adequacy intakes. The consistency of the two tools (HFAI and NAR) in segmenting households into their respective intake categories was validated using cross-tabulation. HFAR and NAR were later regressed against the five food groups (starches, vegetables and fruits, legumes, animal foods and fats) to explore the relationship between food adequacy and diversity.

It has been clearly reported that broad-based international cut-off points to define high and low dietary diversity are likely to be meaningless (Ruel, 2003). Cut-off points, to define varying levels of diversity, have to be defined in the context in which they are used, taking into account local food systems and dietary patterns (Ruel, 2003). Therefore, it is important to define the set of foods and food groups that can contribute towards improving dietary quality in each context. Rose and Tchirley (2000) created 11 food groups, considering representative availability throughout the country and homogeneity of nutrient content of foods - the latter for analytical convenience. Analysis of Variance (ANOVA) was used to compare mean household food counts (the Food Variety Score) from each of the five food groups with respect to the household food adequacy categories (inadequate, moderate and adequate). The Duncan Multiple Range test, conducted at the one per cent level of significance, was used to explain homogeneity across food intake categories.

Dietary quality was determined by calculating proportions (per cent intake of energy, protein and micro nutrients) for the households, per food group. This was useful in evaluating the extent to which the diets of Embo community are consistent with the South African Food Based Dietary Guideline.

6.3 Results and discussion

The results of the HFAI) study were compared with NAR. The 33.3 and 66.6 per cent cut-off values for the first round were 0.4695 and 0.0044 for HFAI, while they were 2.64 and 4.06 for NAR index (see Table 6.1). Similarly, the cut-off values were -0.8004 and -0.61 for the HFAI, while they were 4.19 and 4.91 for NARs index in the second round.

Table 6.1: Cut-offs for household food intake strata, Embo, November 2004 and March 2005 (n = 200)

Percentile cut offs	Methodologies employed			
	November 2004		March 2005	
	Household Food Adequacy Index	Nutrient Adequacy Ratio	Household Food Adequacy Index	Nutrient Adequacy Ratio
33.3	0.4695	2.64	-0.8004	4.19
66.6	0.0044	4.06	-0.6090	4.91

For both the HFAI and NARs, higher scores indicated more available food. The difference between the Household Food Adequacy Index and Nutrient Adequacy Ratios is that, while household scores developed through the Nutrition Adequacy Ratio are easily scaled in terms of food adequacy (a scale of 0 for insufficient and 5 for sufficient), the Household Food Intake Index indicates an aggregate indication of overall nutrient adequacy (i.e. inadequate, moderate and adequate).

As illustrated in Table 6.1, the Nutrient Adequacy Ratio cut-offs indicated that households whose intakes fell below the cut-offs of 2.64 and 4.19, had inadequate intakes in both the first and second rounds. Given that the cut-offs were percentiles, the cut-off value for inadequate intakes was higher during the second round. These

findings correspond with the results obtained in chapter five, i.e. food intake improved in the second round (March 2005).

Converting displayed figures into percentages, using the Household Food Adequacy Index, showed that, in the first round, 95.5, 86 and 90.9 per cent of households had inadequate, moderate and adequate food intakes, respectively. This was confirmed by the Nutrient Adequacy Ratio, which established similar results.

Table 6.2: Comparison of Household Food Adequacy Index and Nutrient Adequacy Ratios, Embo, November 2004 and March 2005 (n = 200)

Survey round	**Household Classification with respect to Household Food Adequacy Index**	**Households classification with respect to Nutrient Adequacy Ratio**			Total
		Inadequate FIH	Moderate FIH	Adequate FIH	
Nov. 2004	Inadequate FIH	63	3	0	**66**
	Moderate FIH	2	59	7	**68**
	Adequate FIH	1	5	60	**66**
	Total	**66**	**67**	**67**	**200**
	χ^2				**0.000***
March 2005	Inadequate FIH	37	19	10	**66**
	Moderate FIH	16	23	28	**67**
	Adequate FIH	13	25	29	**67**
	Total	**66**	**67**	**67**	**200**
	χ^2				**0.000***

*Key: FIH = Food Intake Households, * indicated significant relationship.*

During the second round, (37*100/66), (23*100/67) and (29*100/67) being 56, 34 and 43 per cent of the sampled households, were identified as having inadequate, moderate and adequate food intakes using the Household Food Adequacy Index and Nutrient Adequacy Ratios. The relationship between the Household Food Adequacy Index and the Nutrient Adequacy Ratios was statistically significant ($P \leq 0.000$).

The number of foods consumed in each food group per month was estimated for each household. In all food groups, diversity increased in the second round compared with the first round. As shown in Table 6.3, starches were the most diverse food group in both survey rounds, with households' consumption of, on average, seven and nine different food items for the first and second survey rounds, respectively. Rice, potatoes, sugar, bread, and maize meal were the most frequently consumed starchy foods. Dry beans were the most popular legume consumed. Animal products and fats were not influenced by seasonal availability. On average, households reported consumption of between two and five animal products and fats in each round. Chicken, meat, milk powder and eggs were popular sources of animal proteins/products and were consumed in both rounds. Cooking oil (typically sunflower oil) was the most frequently consumed fat. Fruits and vegetables were not influenced by seasonal availability and more consistently consumed. Tomatoes and wild vegetables were the most frequently consumed items in this category. Breakfast

cereals, tinned fruits, fresh fish, peanut butter and peanuts were consumed by a few households.

Table 6.3: Diversity in food group consumption, Embo, November 2004 and March 2005 (*n*=200)

Survey	Food group (diversity)	Proportion (%) of households consuming each food item
November 2004	Starch (6.80)	Rice (97.5), potatoes (93.5), sugar (97), bread (89), maize meal (86), stamped maize (69), wheat flour (63), sweet potato (29.5), *amadumbe* (24.5), breakfast cereal (11), green mealie (5),
	Vegetables/fruits (4.95)	Tomato (82), wild vegetables (69.5), banana (61), citrus (59.5), apple (57), carrot/beetroot (45), green vegetable (42.5), yam (38.5), pumpkin (25), tinned fruits (4.1),
	Animal foods + Fish (5.00)	Chicken (92),meat (74.5), milk powders (73), eggs (69), processed meats (40), offal (38), packed fish (25.5), sour milk (38.5), milk (33.5), cheese (12.5), fresh fish (4.5),
	Fats (1.63)	Cooking Oil (84.5), margarine (68.5), peanut butter (31),
	Legumes (0.91)	Dry beans (85), peanuts (10.5)
March 2005	Starch (8.67)	Rice (97.5), potatoes (96.5),maize meal (97), Sugar (96), bread (94.5), wheat flour (85.8), stamped maize (74.5), green mealie (73), *amadumbe* (70), sweet potato (48), breakfast cereal (13.5)
	Vegetables/fruits (5.78)	Tomato (89), wild vegetables (83), apple (77), banana (68), pumpkin (60), yam (54), citrus (51), carrot/beet root (45), green vegetable (42.5), tinned fruits (9),
	Animal foods+ Fish (5.33)	Chicken (92.5),meat (85), milk powders (77.5), eggs (66), sour milk (52), processed meats (45), milk (41.5), packed fish (31.5), offal (27.5), cheese (11.5), fresh fish (3),
	Fats (2.17)	Cooking Oil (96.5), margarine (86.5), peanut butter (34),
	Legumes (1.05)	Dry/green beans (84.5), peanuts (21)

Using the Analysis of Variance test, the food intake categories, the Household Food Adequacy Index and Nutrition Adequacy Ratios were regressed against dietary diversity for each round. The results are presented in Table 6.4.

No significant variation in diversity was observed amongst the food intake categories during the first round. Both the homogeneity of variances (Duncan Multiple Range test) and the ANOVA test showed that food diversity was not significantly different across food adequacy categories. The lack of significant difference between food group diversity across household food adequacy categories, derived by both Household Food Adequacy Index and Nutrition Adequacy Ratios, explains the similarity of the two food intake indices and their ability to classify similar households.

Vegetables and fruits influenced variation the most. This influence was rated by examining the significantly different coefficients in the ANOVA and the Duncan Multiple range tests. There was a significant positive relationship between household food adequacy and nutritional benefits from vegetables and fruits. During the first round, vegetables and fruits contributed significantly higher proportions of vitamin E to households with adequate food intakes, while vegetables and fruits contributed

significantly higher proportions of all nutrients assessed, with the exception of vitamin A in the second round. Counting the recurrence of significant values, vegetables and fruits scored the highest (5), in favour of the adequate food intake households (the significant difference is related to the analysis of variances values of probability equal or less than 0.05). Vegetables and fruits contributed the least energy, protein and micronutrients for households with inadequate food intakes.

Table 6.4: Relationship between food adequacy and dietary diversity, Embo, November 2004 and March 2005 (n = 200)

Period	Classification criteria/ intake categories	Food groups				
Nov. 2004		Starch	Legume	Veg/fruits	Fats	Animal foods
	Household Food Adequacy Index (HFAI)					
	Inadequate FIH	7.05[a]	0.97[a]	4.80[a]	1.65[a]	5.24[a]
	Moderate FIH	6.90[a]	0.96[a]	4.94[a]	1.69[a]	5.10[a]
	Adequate FIH	6.47[a]	0.93[a]	5.13[a]	1.59[a]	4.67[a]
	P-value	0.191	0.940	0.743	0.612	0.343
	Nutrient Adequacy Ratios					
	Inadequate FIH	6.94[a]	0.97[a]	4.66[a]	1.67[a]	5.14[a]
	Moderate FIH	6.85[a]	0.97[a]	4.95[a]	1.64[a]	4.93[a]
	Adequate FIH	6.63[a]	0.93[a]	5.24[a]	1.60[a]	4.96[a]
	P-value	0.618	0.836	0.382	0.837	0.857
March 2005	Household Food Adequacy Index (HFAI)					
	Inadequate FIH	8.95[b]	1.18[a]	6.27[a]	2.05[a]	5.20[a]
	Moderate FIH	8.82[b]	1.00[a]	5.63[a]	2.25[a]	5.49[a]
	Adequate FIH	8.23[a]	0.99[a]	5.44[a]	2.21[a]	5.30[a]
	ANOVA	0.280	0.112	0.183	0.179	0.740
	Nutrient Adequacy Ratios					
	Inadequate FIH	7.97[a]	1.02[a]	4.67[a]	1.89[a]	4.64[a]
	Moderate FIH	8.73[b]	0.99[a]	5.88[b]	2.16[b]	5.22[b]
	Adequate FIH	9.30[c]	1.16[a]	6.78[c]	2.45[c]	6.12[c]
	p-value	0.000*	0.185	0.000*	0.000*	0.000*

*The Duncan Multiple Range (Homogeneity of variances) test was performed at 1 per cent level of significance. The symbols a and c indicate the lowest and highest mean diversity and * indicates a statistically significant difference.*

In the second round, the analyses of variation for food diversity across the food intake categories developed by the Household Food Adequacy Index showed that households with inadequate and moderate food intakes consumed relatively more diverse starches, but diversity was not high for vegetables and fruits in both survey rounds

ANOVA for the Nutrient Adequacy Ratio Index showed that consumption diversity for starch, vegetables and fruits, fats and animal foods was significantly different

among the food adequacy categories. Households with adequate food intakes were found to have the highest diversity of consumption within food groups, followed by moderate and inadequate food intake households respectively.

The analysis revealed several patterns regarding food consumption. First, dietary diversity did not vary much over the two study periods. This may imply that during the first round, households may have managed adequate food intakes by consuming relatively more food or eating more nutrient-rich, but not diverse, diets. Low and limited household food diversity was related to inadequate intakes in the first survey round (chapter 5). The same trend was also observed in the second round where food adequacy was directly related to food diversity.

Apart from legumes (that showed low diversity), increased within-group diversity of all the other food groups has the potential to increase intake adequacies. In order to assess dietary quality and its relationship to food intake, the proportion of energy, protein, iron, vitamin A and E obtained from each food group was determined (Table 6.5).

As previously mentioned, the Household Food Adequacy Index was as efficient as the Nutrient Adequacy Ratios in analysis of household food adequacy and its relationship to diversity during the period of lower food availability (November, 2004). During March 2005, the Nutrient Adequacy Ratios were more sensitive to food diversity than the Household Food Adequacy Index.

Table 6.5: Proportion of household energy/nutrient derived from food types, Embo, November 2004/ March 2005

Nutrient	November 2004					March 2005				
	Starches	Legume	Veg/fruit	Fats	Animal	Starches	Legume	Veg/fruit	Fats	Animal
Energy										
Inadequate FIH	77.99 [a]	5.88 [a]	1.44 [a]	12.60 [a]	1.11 [a]	49.96[a]	39.34 [a]	1.02 [a]	6.54 [a]	3.15 [a]
Moderate FIH	78.83 [a]	5.91 [a]	1.52[a]	11.37 [a]	2.37 [a]	43.86 [a]	46.63 [a]	1.02[b]	5.47 [a]	3.02 [a]
Adequate FIH	80.16 [a]	6.11 [a]	1.63 [b]	9.46[a]	2.64 [a]	46.39[a]	41.77 [a]	1.85 [b]	6.24 [a]	3.75 [a]
	p-value									
	0.573	0.000*	0.938	0.000*	0.744	0.203	0.201	0.000*	0.176	0.129
Protein										
Inadequate FIH	60.03 [a]	15.66 [a]	2.34 [a]	0.34 [a]	21.73 [a]	33.56[b]	56.49 [a]	1.09 [a]	0.17 [a]	8.68 [a]
Moderate FIH	62.18 [a]	15.89 [a]	2.70[a]	0.55 [a]	18.68 [ab]	24.01[a]	67.67 [b]	0.92 [a]	0.16 [a]	7.24 [a]
Adequate FIH	64.25 [a]	15.71 [a]	2.47[a]	0.45 [a]	17.12 [a]	28.54 [ab]	60.51 [ab]	1.79[b]	0.14 [a]	9.03 [a]
	p-value									
	0.219	0.989	0.401	0.353	0.059	0.044*	0.084	0.006*	0.802	0.374
Iron										
Inadequate FIH	55.62 [a]	27.14 [a]	15.84 [a]	0.16 [a]	1.24 [a]	29.08[b]	62.73 [a]	5.99 [a]	0.05 [a]	2.15 [a]
Moderate FIH	53.83 [a]	22.77 [a]	20.89[a]	0.21 [a]	2.30 [a]	19.81 [a]	73.86 [a]	4.74 [a]	0.05 [a]	1.53 [a]
Adequate FIH	54.96 [a]	23.40 [a]	18.91[a]	0.16 [a]	2.57 [a]	23.44 [ab]	64.96 [a]	9.71 [b]	0.04 [a]	1.85 [a]
	p-value									
	0.833	0.196	0.115	0.585	0.201	0.072	0.094	0.020*	0.687	0.292
Vitamin A										
Inadequate FIH	26.19 [a]	1.71[b]	48.89 [a]	22.04 [b]	1.17 [a]	33.62[a]	15.16 [b]	33.26 [a]	8.21 [b]	9.75 [b]
Moderate FIH	37.82[b]	1.64[b]	42.85[a]	13.25[a]	4.44 [a]	39.30[a]	5.82 [a]	45.43 [b]	5.18 [a]	4.27 [b]
Adequate FIH	46.24[b]	0.74 [a]	41.91[a]	7.97 [a]	3.13 [a]	50.59[b]	3.21 [a]	40.69[ab]	2.87 [a]	2.64 [a]
	p-value									
	0.003*	0.035*	0.533	0.002*	0.169	0.008*	0.000*	0.064	0.000*	0.000*
Vitamin E										

Nutrient	November 2004					March 2005				
	Starches	Legume	Veg/fruit	Fats	Animal	Starches	Legume	Veg/fruit	Fats	Animal
Inadequate FIH	14.94 [a]	0.00 [a]	5.46[b]	68.01 [a]	11.59 [b]	16.68[a]	0.76 [a]	2.38 [a]	75.22 [b]	4.96 [a]
Moderate FIH	17.19 [ab]	0.22 [b]	3.07 [a]	74.29 [a]	5.24 [a]	20.62 [ab]	0.14 [a]	3.24[ab]	70.39 [ab]	5.61 [a]
Adequate FIH	20.80 [a]	0.32 [b]	2.87[a]	70.81 [a]	5.20 [a]	23.84[b]	0.70 [a]	3.93[b]	66.48 [a]	5.05 [a]
	ANOVA									
	0.104	0.008*	0.002*	0.336	0.000*	0.044*	0.084	0.006*	0.802	0.374

*Key: FIH = Food Intake Households. The Duncan Multiple Range (homogeneity of variances) test was performed at one per cent level of significance. a and c indicate the lowest and highest percentage proportion of household energy / nutrients delivered from food types. * indicates significant difference.*

There was a significant positive relationship between food adequacy and the contribution to diets of starch and legume foods. During the second round, starchy foods contributed significantly higher proportions of protein, vitamin A and vitamin E. During the first round, legumes contributed significantly higher proportions of vitamin E to households with inadequate food intakes. During the second round, legumes contributed significantly higher proportion of Vitamin A to the intakes of households with adequate food intakes. Legumes also contributed significantly higher proportions of energy to households with adequate intakes during the first survey round.

Fats had the third highest influence on variation. There was a negative relationship between food adequacy and the nutritional contribution of fats to the diets of the sample households. During the first round, fats contributed a significantly higher proportion of vitamin A to households with inadequate food intakes. In the second round, fats contributed significantly higher proportions of Vitamin A and E to households with inadequate food intakes. Fats are therefore important to households with inadequate food intakes as they are energy-dense and contain relatively high concentrations of fat-soluble vitamins. Animal foods also provided significantly higher proportions of vitamins E and A to the diets of households with inadequate food intakes in rounds one and two respectively.

Generally, based on both the homogeneity of variances and ANOVA tests, vegetables and fruits made significant positive contributions (quantity) to diets. While the consumption of starches, vegetables and fruits were significantly associated with adequate food intakes, fats and animal foods were associated with improvements to the diets of households with inadequate intakes. Legumes contributed significantly to the nutritional quality of households classified as having both inadequate and adequate food intakes.

The nutritional contribution within the food groups was assessed using a score of one to five (1 = least important; 5 = most important). Scaling accounted for the proportion of energy, protein and micronutrients obtained from each food group (see Table 6.5) and was obtained by adding the household food intake scores (see Table 6.6). Therefore, the food group that obtained a sub total score of 15 was found to be the most important provider of a specific nutrient element. The food group which obtained a total score of three, was the least important provider of the specific nutrition items.

During November 2004, starchy foods provided 77.99, 78.83 and 80.16 per cent of dietary energy for households with inadequate, moderate and adequate intakes (see Table 6.5), contributing five points for each category of food intake households (see Table 6.6). In this month, starchy foods provided the highest proportion of energy in diets. Vegetables and fruits provided 1.44, 1.52 and 1.63 per cent of energy for households with inadequate, moderate and adequate intakes during November 2004 (see Table 6.5). Vegetables and fruits scored two points for inadequate food intake households and one point for each of the remaining households (see Table 6.6). Vegetables and fruits scored four points, and provided the lowest proportion of energy for households, possibly due to overall low consumption levels.

Table 6.6: Scores for importance of food varieties to households, Nov. 2004/ March 2005

Nutrients	November 2004					March 2005				
	Starches	Legume	Veg/fruit	Fats	Animal	Starches	Legume	Veg/fruit	Fats	Animal
Energy										
Inadequate FIH	5	3	2	4	1	5	4	1	3	2
Moderate FIH	5	3	1	4	2	4	5	1	3	2
Adequate FIH	5	3	1	4	2	5	4	1	3	2
Sub Total	**15**	**9**	**4**	**12**	**5**	**14**	**13**	**3**	**9**	**6**
Protein										
Inadequate FIH	5	3	2	1	4	4	5	2	1	3
Moderate FIH	5	3	2	1	4	4	5	2	1	3
Adequate FIH	5	3	2	1	4	4	5	2	1	3
Sub Total	**15**	**9**	**6**	**3**	**12**	**12**	**15**	**6**	**3**	**9**
Iron										
Inadequate FIH	5	4	3	1	2	4	5	3	1	2
Moderate FIH	5	4	3	1	2	4	5	3	1	2
Adequate FIH	5	4	3	1	2	4	5	3	1	2
Sub Total	**15**	**12**	**9**	**3**	**6**	**12**	**15**	**9**	**3**	**6**
Vitamin A										
Inadequate FIH	4	2	5	3	1	5	3	4	1	2
Moderate FIH	4	1	5	3	2	4	3	5	2	1
Adequate FIH	5	1	4	3	2	5	3	4	2	1
Sub Total	**13**	**4**	**14**	**9**	**5**	**14**	**9**	**13**	**5**	**4**

Nutrients	November 2004					March 2005				
	Starches	Legume	Veg/fruit	Fats	Animal	Starches	Legume	Veg/fruit	Fats	Animal
Vitamin E										
Inadequate FIH	4	1	2	5	3	4	1	2	5	3
Moderate FIH	4	1	2	5	3	4	1	2	5	3
Adequate FIH	4	1	2	5	3	4	1	2	5	3
Sub Total	**12**	**3**	**6**	**15**	**9**	**12**	**3**	**6**	**15**	**9**
Grand Total	**70**	**37**	**39**	**32**	**37**	**64**	**55**	**37**	**35**	**34**
Overall importance	5	3.5	4	2	3.5	5	4	3	2	1

Key: FIH = Food Intake Households; The scoring values in this Table reflect those of Table 6.5

The most important sources of energy were starches and fats in the first round, and starches and legumes in the second survey round. Starches and animal foods were the most important sources of protein during the first survey round, while legumes and starches were most important during the second round. Starches and legumes provided the important iron during both survey rounds. Starches and vegetables and fruits were the most important sources of vitamin A during both survey rounds. Legumes and animal foods were the least important sources of vitamin A in both survey rounds. For both rounds, fats and starches were the most important sources of vitamin E, while legumes were the least important. These findings are consistent with those reported in chapter 5. The food group scores in Table 6.6 show the overall importance of the food groups to food intakes.

With reference to the South African Food Based Dietary Guidelines (SAJN, 2001), the quality of meals was analysed across the two seasons. The first guideline, 'Making starchy foods the basis of most meals' was achieved during both rounds. The guideline 'eating plenty of vegetables and fruits' and 'eat dry beans, peas, lentils and soya often') were met by the households. Households did not eat animal products every day.

6.4 Summary

The current study showed that it is possible to relate food intake to both dietary diversity and quality. Food intakes were positively associated with dietary diversity. Dietary quality was relatively similar across seasons and households, irrespective of their food intake classification. Household dietary quality was better in the second than in the first survey round. A possible reason for this is the availability of food during the harvest season in the second round. This study revealed that household dietary quality was better maintained during the season of plenty (second round).

CHAPTER 7: USING THE COPING STRATEGY INDEX TO UNDERSTAND FOOD CONSUMPTION

7.1 Introduction

The Coping Strategies Index was developed as a relatively simple and quick food security measure for food emergencies (Mzibule 2004 *a,b,c*). This chapter compares the Coping Strategies Index scores for the sampled households with their food adequacy and dietary diversity scores. As discussed in chapters 5 and 6, household food adequacy was measured using a Household Food Adequacy Index and Nutrient Adequacy Ratios. The Coping Strategies Index explores consumption behaviour and the severity of the strategies employed by households (CARE and WFP, 2003).

Households deploy several coping strategies in response to shocks and anticipated changes in their consumption and/or income patterns. The SADC FANR VAC (2002) categorised the coping strategies into four broad categories, namely: consumption strategies; expenditure strategies; income strategies; and migration strategies. According to SADC FANR VAC (2002), the grouping of coping strategies is as follows:

- Consumption strategies (buying food on credit, relying on less preferred food, reducing number of meals per day, skipping meals for entire days, regularly eating meals of vegetables only, eating unusual types of wild food normally uneaten, restricting adult consumption at expense of children and feeding working members at expense of non-working members of the household)
- Expenditure strategies (avoiding spending on education and health for food)
- Income strategies (selling household assets, selling livestock)
- Migration strategies (sending children to relatives to eat, migrating to look for work) and complete migration from the area to other areas.

As listed by Shoham (2005) and CARE and WFP (2003), the categories of coping strategies are as follows:

- Dietary changes (relying on less preferred and less expensive foods)
- Short-term measures to increase household food availability (borrowing food/relying on help; purchasing food on credit; gathering wild food; hunting or harvesting immature crops; consuming seed stock)
- Short-term measures to decrease the number of people to feed (sending children to eat with neighbours and sending household members out to beg)
- Rationing or managing the shortfall (limiting portion size at mealtimes, restricting consumption by adults in order for small children to eat,

feeding working members of household at the expense of non-working members, rationing money and buying prepared food, reducing the number of meals eaten in a day and skipping entire days without eating)

Several authors have reported additional coping strategies. Collins (2004) in the CSI Baseline Survey for the World Food Programme to assist refugees in western Tanzania, reported engaging in prostitution or theft for food as additional strategies. Food insecurity is defined as the inability to acquire or consume an adequate diet - in quality and quantity - in socially acceptable ways, or the uncertainty that one will not be able to do so (McIntyre, 2003). Young *et. al*. (2001) have suggested that food security is not achieved in situations where people use strategies that damage livelihoods in the long term, or incur other unacceptable costs, such as acting illegally or immorally (Young *et. al.,* 2001). Collins (2004) also reported 'selling higher value foods to purchase a large quantity of less expensive food', as a coping strategy that principally relates to the strategy of 'relying on less preferred and less expensive foods'. Reporting of 'prostitution or theft for food' and 'selling higher values of food to purchase large quantities of less expensive food' could be expected where communities are refugees obtaining food through foreign aid.

As detailed in the Field Methods Manual developed by CARE and WFP (2003), there are several steps to be followed in measuring coping strategies, as listed below. First, coping strategies practised by people in the study area are documented. From the literature reviewed in chapter 2, it is clear that, although the list provided by CARE and WFP is comprehensive, it may not be exhaustive. Second, the individual strategies are classified by severity as perceived by the community – usually through a focus group discussion. The numerical value *one* indicates that the coping strategy employed is least severe, while *four* indicates that the coping strategy is most severe and more damaging in terms of future resilience. Third, respondents are asked how frequently the household used each strategy over the previous week or month. CARE and WFP (2003) have categorised the frequencies of application as follows:

- all the time/everyday
- pretty often/three to six times per week
- once in a while/one or two per week
- hardly at all/less than once a week
- never or not at all

For the purpose of calculating the Coping Strategies Index, the responses (frequencies*) all the time, pretty often, once in a while, hardly at all* and *never* are valued as 7, 4.5, 1.5, 0.5 and 0, respectively following the CARE and WFP (2003) protocol. Lastly, the weekly frequency of practising the coping strategy is multiplied by its severity ranking as defined by the focus group. The Coping Strategies Index is obtained by adding the scores for each coping strategy. The higher the Coping Strategies Index score, the more food insecure a household is.

7.2 Methodology

The Coping Strategies Index used in this study followed the CARE and WFP (2003) protocol as outlined above. A focus group discussion was held during the period of less abundant food (November 2004). With the help of the LIMA Rural Development Foundation and EFO's members' register, nine people were randomly selected from the Embo wards and invited to participate in a focus group discussion. The Focus Group consisted of five women and four men. CARE and WFP (2003) suggested that the focus groups should include women, who usually know more about household consumption patterns than men do. Table 7.1 shows the coping strategies identified by this group as practised by the community and the ranking assigned to the severity of each practice.

Table 7.1: Coping strategies identified and ranked by severity by focus group members, Embo, November 2004

Strategy	Members									Average	Consensus Ranking
	1	2	3	4	5	6	7	8	9		
Less preferred /less expensive food	4	1	2	2	1	2	1	1	1	1.67	2
Borrow food/money for food	3	2	2	3	2	2	1	2	2	2.11	2
Purchase food on credit	2	4	3	1	1	1	1	1	2	1.78	2
Help from relative/friends outside	1	3	3	3	3	3	1	4	2	2.56	3
Limit food portions	2	3	3	2	1	2	2	3	4	2.44	2
Ration money to buy street food	1	2	2	1	2	1	2	2	1	1.56	2
Limit own intake for sake of children	1	3	2	2	2	1	1	3	4	2.11	2
Reduce number of meals	2	2	2	2	1	1	3	2	3	2.00	2
Skip whole day without eating	4	4	4	3	4	4	2	4	4	3.67	4

The CSI was calculated as per the methodology outlined previously and as outlined in Table 7.2.

In order to understand the relationship between food intake adequacy and the CSI, the mean CSI scores were found for each household intake category delivered from both the Household Food Intake Index and Nutrient Adequacy Ratios. Analysis of Variances (ANOVA) was used to regress the CSI against intake categories derived in chapters 5 and 6. The likelihood (chance) of households adopting a certain coping strategy, rather than not adopting a respective coping strategy, was estimated as the ratio of *never used* (proportion of households who did not employ the coping strategy in percentage) to *often used* (proportion of households who often employed the coping strategy in percentage) adopting the particular strategy. When the chance of adopting a strategy was higher than one, the household was unlikely to engage in that strategy. A chance of adoption of one indicated equal chances of adopting and not adopting (equal chances).

Table 7.2: Calculating the household Coping Strategies Index, Embo, 2004

In the past 30 days, if there have been times when you did not have enough food or money to buy food. How often has your household had to:	All the time? Everyday?	Pretty often? 3–6*/week	Once in a while? 1 -2*/week	Hardly at all? < 1*/week	Never? 0*week	Raw score (Table 3)	Severity weight (Table 2)	Score = Raw score * weight
Relative frequency score (Table 1)	7	4.5	1.5	0.5	0			
Use less preferred/less expensive food			X			1.5	2	3
Borrow food/money for food				X		0.5	2	1
Purchase food on credit				X		0.5	2	1
Get help from relative/friends outside					X	0	3	0
Limit food portions					X	0	2	0
Ration money to buy street food			X			1.5	2	3
Limit adult intake for children to eat				X		0.5	2	1
Reduce number of meals				X		0.5	2	1
Skip whole day without eating					X	0	4	0
Total Household Score	SUMMING THE TOTALS FOR EACH INDIVIDUAL STRATEGY							**10**

7.3 Results and discussion

Relying on less preferred and inexpensive foods was the most frequently practised coping strategy among sample households. As illustrated in Table 7.3, relying on less preferred and inexpensive foods was practised by 61.40 per cent of households. This was followed by relying on help from friends and relatives, borrowing money for food, purchasing food on credit, limiting meal portions, reducing the number of meals, adults leaving food for children and skipping meals for a whole day, respectively.

The results suggested that efforts to mitigate shortages started with ensuring that there was food for household members, including relying on less preferred or less expensive foods (practised by 61.40 % of the households); relying on help from relatives and friends (53.50 %); borrowing food or money (52.80 %) and purchasing food on credit (33.50 %). Following efforts to make sure that there was food for household members was the management of available food, including: limiting portions (33.00 %); reducing the number of meals (20.30 %); limiting adult intakes so children could eat (14.20 %) and skipping meals (3.60 %).

Table 7.3: Frequency of coping strategies undertaken by households in Embo, November 2004

Frequency	Numeric values	Proportion (%) of household practicing the coping strategy							
		Rely on less preferred /expensive food	Borrow food or money	Purchase food on credit	Help from relative/friend	Limit portions sizes	Limit adult intake for children to eat	Reduce meal number	Skip meals
Everyday	7	24.90	19.30	12.20	19.00	21.30	10.20	8.60	2.60
3 - 6 days/week	4.5	19.80	25.40	14.20	25.00	8.10	3.60	9.60	1.00
1 - 2 days/week	1.5	10.70	7.60	4.10	7.50	3.00	0.50	2.00	0.00
Not more than once / week	0.5	6.10	0.50	3.00	0.50	0.50	0.00	0.00	0.00
Never happened	0	38.60	47.20	66.50	46.50	67.00	85.80	79.7	96.40
Proportion used a strategy		61.40	52.80	33.50	53.50	33.00	14.20	20.30	3.60
Popularity rank		1	3	4	2	5	7	6	8

The other notable trend was that households used coping strategies frequently, indicating that the strategies have become a common practice. Almost 40 per cent of sampled households did not practise any of the listed coping strategies. Only 1.5 per cent of surveyed households pursued all eight coping strategies. As shown earlier in Table 7.1, consensus ranking indicated that only one coping strategy - skipping whole days without eating - was classified by the community members as a severe strategy.

The strong and negative correlation between dietary diversity and the number of coping strategies employed showed that households with higher dietary diversity applied fewer coping strategies and vice versa (Table 7.4). The relationship between food adequacy and the number of coping strategies taken was also found to be negative, though not statistically significant across the three categories of household food intake. Households with inadequate food intakes were found to employ relatively more coping strategies, compared with households with adequate food intakes. The current finding shows that households with inadequate food intakes and low diversified diets were driven to practise more coping strategies. As food adequacy was found to be positively related to dietary diversity (chapter 6), the current findings suggest that households applying many coping strategies were food insecure.

Similarly, negative correlations were found between the CSI and food adequacy (Table 7.5). Food adequate households were food secure. However, the Nutrient Adequacy Ratio was more sensitive (showing more significant relations) to the CSI compared with the Household Food Intake Index.

Table 7.4: Number of coping strategies undertaken related to dietary parameters, Embo, November 2004 and March 2005

Household Food Adequacy Index		Nutrient Adequacy Ratios	
	Average number of coping strategies undertaken		Average number of coping strategies undertaken
November 2004		November 2004	
Inadequate Intake households	3.42[b]	Inadequate Intake households	2.92 [a]
Moderate Intake households	2.75 [ab]	Moderate Intake households	2.98 [a]
Adequate Intake households	2.34 [a]	Adequate Intake households	2.49 [a]
March 2005		March 2005	
Inadequate Intake households	2.98 [a]	Inadequate Intake households	3.18 [a]
Moderate Intake households	2.72 [a]	Moderate Intake households	2.82 [a]
Adequate Intake households	2.70 [a]	Adequate Intake households	2.40 [a]
Correlation with overall food diversity in round 1	-0.289**	Correlation with overall food diversity in round 2	-0.516**

*Key: ** = correlation is significant at 0.01 % level of confidence*

Table 7.5: Relationship between Coping Strategies Index scores and Food Adequacy, Embo, November 2004 and March 2005

Household Classification with regards to Household Food Adequacy Index	Household food adequacy categories	Mean household Coping Strategy Index score	Correlation (r) between Food intake indices and Coping Strategy Index
November 2004	Inadequate Food Intake	35.56	
	Moderate Food Intake	28.29	
	Adequate Food Intake	26.98	-0.082
March 2005	Inadequate Food Intake	37.20	
	Moderate Food Intake	29.10	
	Adequate Food Intake	30.32	-0.086
Household Classification with regards to Nutrient Adequacy Ratios			
November 2004	Inadequate Food Intake	34.23	
	Moderate Food Intake	29.96	
	Adequate Food Intake	26.66	-0.146*
March 2005	Inadequate Food Intake	33.02	
	Moderate Food Intake	31.77	
	Adequate Food Intake	26.28	-0.199**

*Key: * = correlation is significant at 0.05 % level of confidence, ** = correlation is significant at 0.01 per cent level of confidence*

A negative and significant relationship was found between the CSI and dietary diversity - based on five food groups (starch, legumes, fruits/vegetables, fats and animal). The negative relationship between dietary diversity and the CSI showed that households with low dietary diversity were food insecure (Table 7.6).

Table 7.6: Relationship between the Coping Strategy Index score and dietary diversity, Embo, November 2004 and March 2005

Coping Strategy Index	Statistics for household food diversity with regards to food groups					
	Overall	Starch	Legume	Fruits/ vegetable	Fats	Animal
Nov. 2004	- 0.209**	- 0.201**	- 0.135	- 0.156*	- 0.188**	- 0.160*
March 2005	- 0.280**	- 0.052	- 0.171*	- 0.177*	- 0.276**	- 0.372**

The probability of applying coping strategies indicated the chance of households practising certain coping strategies. As was reported in the preceding chapter, the ratio (X) was interpreted as follows:

- $X < 1$, where a higher chance existed for household to practise the particular coping strategy
- $X > 1$, where a lower chance existed for households to practise the particular coping strategy
- $X = 1$, where equal chances exist for households to either practise or reject the particular coping strategy

Households with inadequate food intakes made up 25 per cent of households that did not rely on less expensive and less preferred foods (Appendix B). Households with inadequate food intakes also made up 42.9 per cent of households that often relied on less expensive and less preferred foods (Appendix B). As shown in Table 7.7, the chances of households with inadequate intakes relying on less expensive or less preferred foods was 0.58 (obtained by dividing 25.0 into 42.9 %). As long as the value 0.58 is less than one, households were more likely to rely on less expensive and less preferred foods. This showed that households with inadequate food intakes were more likely to rely on less expensive and less preferred foods.

Respectively, households with moderate food intakes made up 34.2 per cent of households that did not rely on less expensive and less preferred foods (Appendix B). Also, households with moderate food intakes made up 22.4 per cent of households that often relied on less expensive and less preferred foods. The chances of households with moderate food intakes relying on less expensive and less preferred foods was 1.53.

Table 7.7: Probability of households practising Coping Strategies, Embo, November 2004 and March 2005

Survey round		Chances / Never: very often ratios with respect to household food adequacy categories							
		Coping Strategy							
	Household food intake categories	Less preferred /expensive food	Borrowing money/food	Use credit	Help from friends/relative	Limiting portion sizes	Limiting adult intake for children to eat	Reduce number of meals	Skip meals
Households Classification with regards to Household Food Intake Index									
Nov. 2004	inadequate	0.58	0.51	0.81	0.51	0.89	1.14	2.10	1.70
	moderate	1.53	1.87	1.58	1.87	0.98	0.60	1.02	0.55
	adequate	1.18	1.30	0.90	1.34	1.15	1.78	0.63	1.67
March 2005	inadequate	***0.86***	0.49	0.68	0.49	1.43	1.07	2.86	NTE
	moderate	1.01	1.23	1.46	1.23	0.67	0.75	0.69	0.57
	adequate	1.11	1.99	1.05	1.99	1.19	1.39	0.82	0.85
Households Classification with regards to Nutrient Adequacy Ratios									
Nov. 2004	inadequate	0.58	0.49	0.73	0.49	0.88	1.14	2.10	0.83
	moderate	1.56	1.78	2.81	1.78	1.05	0.64	1.35	0.57
	adequate	1.13	1.39	0.75	1.39	1.10	1.69	0.53	NTE
March 2005	inadequate	***0.76***	0.41	0.79	0.41	0.64	0.79	0.85	0.81
	moderate	0.99	1.76	1.65	1.76	0.96	0.72	2.10	0.83
	adequate	1.29	1.72	0.87	1.72	1.80	2.41	0.70	1.72

Key: NTE = not taken every day.

Forty-eight per cent of households with adequate food intakes did not rely on less expensive or less preferred foods (Appendix B), with 38.7 per cent of households often relying on less expensive and less preferred foods (chance = 1.18). This showed that households with adequate food intakes were less likely to rely on less expensive or less preferred foods (as the ratio is more than 1).

As shown in Table 7.7, the chances of practising coping strategies were similar for both the Household Food Adequacy Index and the Household Nutrient Adequacy Ratios. In order to understand the coping strategies most likely to be practised by households during the two seasons, an average for the chances of adopting a particular coping strategy was calculated as a mean Food Adequacy Index and the Nutrients Adequacy Ratios (Table 7.8).

Table 7.8: Probability of households practising coping strategies, Embo, November 2004 and March 2005

Round	Household Food Intake categories	Probability ratio for coping strategies practised (%)							
		Less preferred/expensive food	Borrowing money/food	Using credits	Help from friends/relatives	Limiting portion sizes	Limit adult intake for children to eat	Reduce number of meals	Skip meals
Nov.2004	Inadequate	0.58	***0.50***	0.77	0.50	0.89	1.14	2.10	1.27
	Average	1.55	1.83	2.20	1.83	1.02	0.62	1.19	0.56
	Adequate	1.16	1.35	0.83	1.37	1.13	1.74	0.58	#
Mar.2005	Inadequate	0.81	***0.45***	0.74	0.45	1.04	0.93	1.86	#
	Average	1.00	1.50	1.56	1.50	0.82	0.74	1.40	0.70

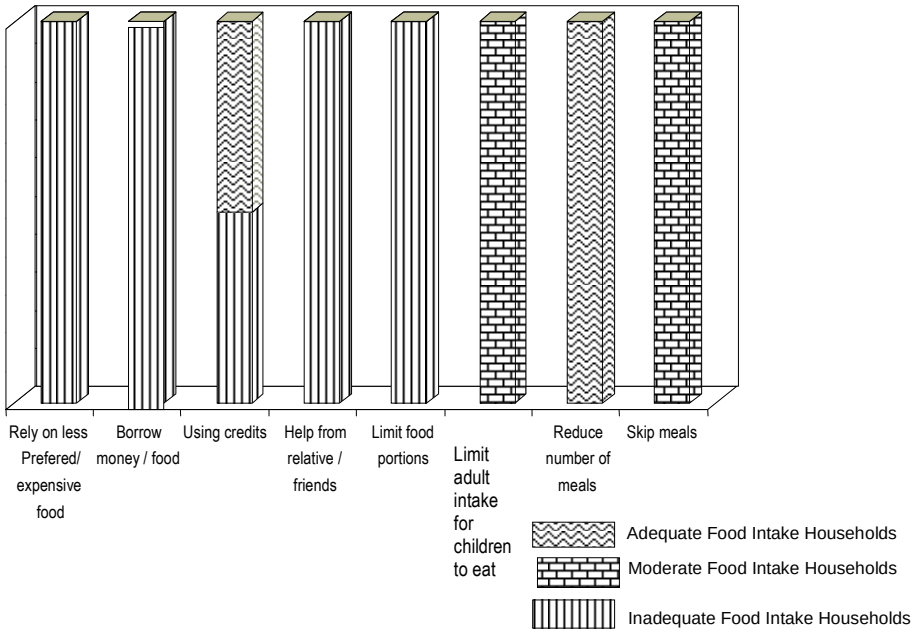
The highlighted figure (i.e. (0.86 + 0.76)/2 = 0.81) was the chance of households with inadequate intakes to consume less preferred or less expensive foods in March 2005. This figure is calculated from the average of probabilities of strategies obtained through Household Food Adequacy Index and Nutrient Adequacy Ratios in March 2005 (see bold and italicised figures in Table 7.7 and 7.8).

During the period of less abundant food (November 2004), households with inadequate food intakes were more likely to practise all the listed coping strategies, except for limiting adult intakes so children were assured of food, reducing the number of meals and skipping meals (Figure 7.1). During the period of more abundant food (March 2005), households with inadequate food intakes were more likely to practise all the coping strategies except limiting food portions and reducing the number of meals per day (Figure 7.2). Five of the seven coping strategies were employed by households with inadequate food intakes in November 2004 and March 2005, respectively, indicating relatively more efforts to curb food shortage in such households.

During the period of lower food availability (November 2004), households with moderate food intakes were more likely to limit adult intakes so children could eat and were more likely to skip meals. During the period of more abundant food (March 2005), households with moderate food intakes were more likely to leave food for children, skip meals and limit food portions. These households showed moderate food insecurity.

During both survey periods, households with adequate food intakes were most likely to reduce the number of meals consumed per day and use credit to attain food. Limiting adult intakes to ensure that children eat and skipping meals were coping strategies employed by households with moderate food intakes during November 2004 and March 2005. Practising similar strategies during both seasons indicates that

these households continually engaged in these strategies to fulfil household food requirements.



7.1: Coping strategies more likely to be practised with regards to household food adequacy, Embo, November 2004.

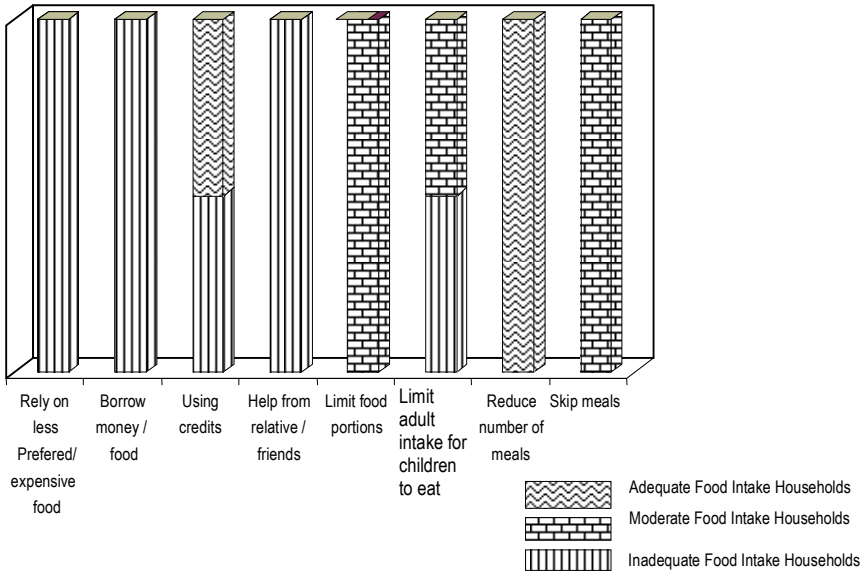


Figure 7.2: Coping Strategies mostly likely to be practised with regards to household food adequacy, Embo, March 2005.

Table 7.9: Probability of households practising coping strategies, Embo, 2004 / 2005

Household Food Intake categories	Coping Strategies Undertaken							
	Less preferred /expensive food	Borrowing money/food	Using credit	Help from friends /relatives	Limiting portion sizes	Limit adult intake for children to eat	Reduce number of meals	Skip meals
Inadequate	0.70	0.48	0.75	0.48	0.96	1.04	1.98	#
Average	1.27	1.66	1.88	1.66	0.92	0.68	1.29	0.63
Adequate	1.18	1.60	0.89	1.61	1.31	1.82	0.67	#

The highlighted figure in Table 7.9 (0.48) is the overall (annual) chance of households with inadequate intakes borrowing money or food. The figure is the result of the average of probabilities of households with inadequate food intakes practising a respective strategy (see bold and italicised figures in Table 7.8). The overall (annual) probability of households with inadequate food intakes borrowing money or food was obtained as (0.50 + 0.45)/2 = 0.48. The value, 0.48 being less than 1, indicates that the chances are high that households with inadequate food intakes borrow money or food to curb food emergencies.

As shown in Table 7.9, households are more likely to practise the coping strategies when the change is less than one. Households are less likely to practise the coping strategies when the chance is greater than one. The results showed that households with inadequate food intakes are likely to apply all the listed coping strategies, except limiting adult intakes for children to eat and reducing the number of meals eaten (Figure 7.3)

The same analysis also showed that households with moderate food intakes practise limiting food portions, leaving food for children and skipping meals. Households that have adequate food intakes use credit to obtain food and reduce the number of meals when faced with food shortages.

7.4 Summary

Applying more coping strategies and higher CSI scores were associated with inadequate food intakes and low dietary diversity, indicating household food insecurity. Both the Household Food Adequacy Index and Nutrient Adequacy Ratios provided fairly similar relationships to the CSI, supporting the use of the Household Food Adequacy Index as a valid measure of household food security.

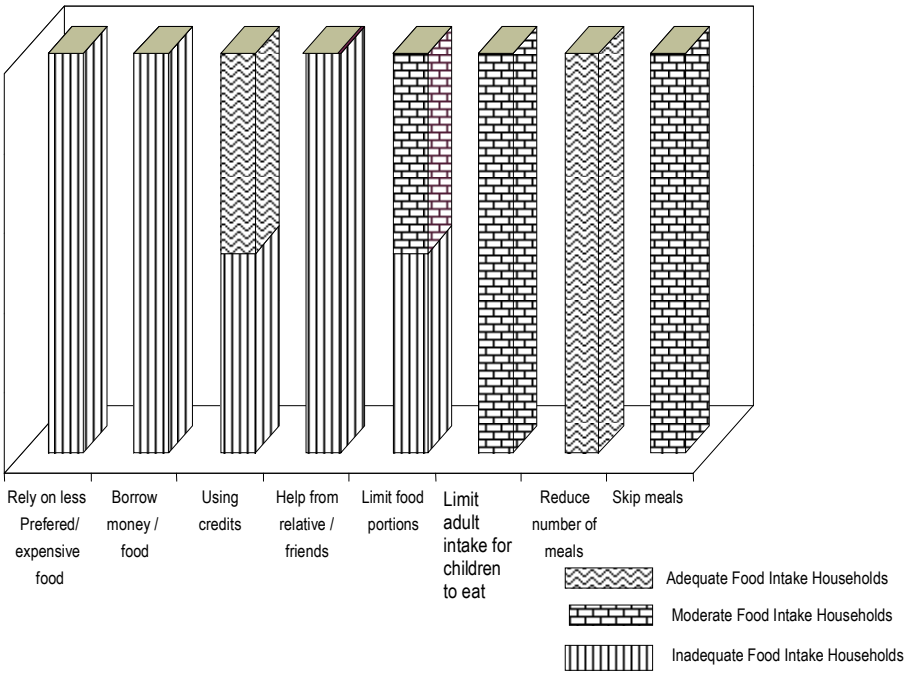


Figure 7.3: Coping strategies likely to be practised throughout the year with relation to household food adequacy, Embo, 2004/05

Common behaviour patterns were evident among households in the same intake adequacy categories. Overall, households employed coping strategies to protect food supply or levels of consumption, before applying consumption rationing strategies. There was a high possibility that households with inadequate food intakes would apply most of the listed coping strategies, while households with moderate and adequate food intakes typically applied less severe strategies only, commonly reducing the number of meals consumed, skipping meals, using credit to obtain food and reducing the number of meals eaten.

Coping strategies are a simple way to determine household food consumption responses and offer a benchmark for monitoring food insecurity and the impact of interventions. However, due to the involvement of communities in the identification and ranking of the strategies, the CSI has limited comparability power between communities.

Given the clear link between household food intake, food diversity and coping strategies, a concise understanding of household food security can be achieved by linking and using the three components (household food adequacy, food diversity and coping strategies) to prepare a more convenient tool to measure household food security. The following chapter compares the findings of Chapters 5 to 7 with demographic and socio-demographic measures used in typical food security analyses.

CHAPTER 8: MEASURING HOUSEHOLD FOOD INSECURITY USING THE HOUSEHOLD FOOD INSECURITY SCALE AND INDEX

8.1 Introduction

Wolfe and Frongilo (2001) suggest that improved measures of household food security should complement conventional measures, assuring in-depth understanding of food insecurity. As mentioned in chapters one and two, a convenient tool to measure household food insecurity is required to enable effectiveness in relation to time, personnel and logistics. The usefulness of household food security estimators relate to the cost-effectiveness of measures in relation to time, personnel and logistics involved, while ensuring that they support the universal definition of the matter in both theory and practice (Riely *et. al.*, 1999). Dietary adequacy, dietary diversity and dietary quality are used to measure food consumption at household level (Ruel, 2003; Rose and Tschirley, 2000). Given the difficulties in acquiring valid and reliable figures for income, expenditure, production and dietary diversity, and the cost of data collection, the CSI was developed to capture short-term food sufficiency elements of food insecurity at household level (Maxwell, 1995). The CSI is a relatively simple and quick to use indicator of household food security (Mzibule 2004 *a,b,c*; CARE and WFP 2003), but is limited by being location-specific, requiring an in-depth understanding of the availability of food potential and culture of the locality to identify and interpret any given indicator (Dixon *et. al.*, 2004; Chung *et. al.*, 1997). Another significant shortcoming of the CSI approach is that the assessment cannot be repeated for the same community, as respondents may alter their responses to the coping strategy behaviour questions in subsequent rounds of investigation (Hendriks and Maunder, 2006).

This chapter prepares a more convenient tool to measure household food security based on accessible household socio-economic data, typically collected for poverty and demographic information systems or through census surveys, to estimate household food security. The results of the previous chapters provide the benchmarks for validating the new measure.

8.2 Methodology

Potential household demographic and socio-economic indicators were identified through literature. Thirteen commonly collected demographic and socio-economic variables were used to develop a Household Food Security Index and Scale and descriptive analyses were conducted. Food expenditure per capita was calculated using two methods: first, by dividing total expenditure to obtain adult equivalence units (where children were regarded as half an adult), and second, by dividing total food expenditure by household size. Correlations were used to identify the relationships between household variables and the food consumption indicators estimated in previous chapters, and to develop the Household Food Insecurity Scale and Index.

Each of the selected socio economic and demographic indicators were classified using the 50th percentile. The two categories (made of 50th percentiles) for each of thirteen socio-economic and demographic indicators were named as zero and one, where *zero* showed percentile related to household food insecurity and *one* indicated percentile related to household food security. The summation of values for each of the thirteen variables was used to obtain the Household Food Insecurity Scale. Principal Component Analysis was used to break down household variables into categorical or interval variables and obtain weights and principal components (Filmer and Pritchett, 1998). The results obtained from the first Principal Component Analysis (explaining variability) were used to develop the Household Food Vulnerability Index based on Equation 8.1, following (Filmer and Pritchett, 1998).

$Aj = f_1 \text{ x } (aji\text{-}a_1)/ (S_1) + \ldots\ldots f_N \text{ x } (faj_N\text{-}a_N) /(s_N)$ (Equation 8.1)

Where: Aj represents the Household Food Insecurity Index, f_1 represents scoring factors or coefficients for each set of vulnerability variables (e.g. household size, number of assets etc.), *a* represents household score, in the particular food security indicator, where a_1 and s_1 are the mean and standard deviation of the vulnerability indicator respectively.

The relationship between the Household Food Security Scale and Index was tested using correlation. Both indices were related to household food consumption indicators (food intake, diversity and CSI) determined in the previous chapters. Cut-offs based on the 33.3 and 66.6 percentiles were used to identify households that were food insecure, moderately food secure and food secure.

8.3 Results and discussion

This chapter consists of several sections. Section 8.3.1 describes the demographic variables of the surveyed population to identify the most useful parameters for use in the development of the simple tool. Section 8.3.2 describes the socio-economic variables of the surveyed population to identify the most useful parameters for use in the development of the simple tool. The Household Food Insecurity Scale and Index are then developed and tested for validity in Section 8.4.

8.3.1 Demographic characteristics related to household food consumption

Food intake was significantly ($P \leq 0.05$) higher in households headed by females than in households headed by males (Table 8.1). The relatively high number of coping strategies employed, high Coping Strategies Index scores, low dietary diversity, low Household Food Intake Index and Nutrient Adequacy Ratios in households headed by males, indicated relatively lower consumption compared with households headed by females.

The current study showed that households with more educated household heads tended to consume relatively less food (Table 8.2). There was a positive and significant relationship between the education level of the household head and the

Coping Strategies Index ($P \leq 0.05$). There was a negative and significant relationship between the education level of the household head and household food intake ($P \leq 0.01$). There was no significant relationship between education of the household head and food diversity in both survey rounds.

Table 8.1: Gender of household head as related to food consumption indicators, Embo, November 2004 and March 2005 (n = 200)

Indicator	Household head gender		P-value
	Male	Female	
Average number of Coping strategies	2.87	2.66	0.488
Average Coping Strategy Index score	31.52	28.88	0.464
Average Nutrient Adequacy Ratio (Nov. 2004)	3.13	3.42	0.139
Average Nutrient Adequacy Ratio (March 2005)	4.28	4.48	0.050**
Average Household Food Intake Index (Nov. 2004)	-0.21	0.26	0.001*
Average Household Food Intake Index (March 2005)	-0.70	-0.53	0.005*
Average Food Diversity score (Nov. 2004)	19.81	20.70	0.332
Average Food Diversity score (March 2005)	24.02	24.11	0.917

*Relatively higher scores in Nutrient Adequacy Ratio and Principal Component Analysis indicated more food intake. Relatively higher Coping Strategy Index scores indicate food insecurity. household size, per capita income and land used in production are direct determinants of household food security. * and ** = significant difference at the one and five per cent level of statistical significance.*

Table 8.2: Household food consumption indicators related to household demographics, Embo, November 2004 and March 2005 (n = 200)

Food security indicators	Household head's years in school	Age of household head	Household size	Household gender ratio	Age dependency
Average number of Coping strategies	0.115	0.003	0.100	0.016	0.108
Avereage Coping Strategy Index score	0.184*	0.089	0.195**	0.013	0.133
Average Nutrient Adequacy Ratio (Nov. 2004)	-0.281**	-0.060	-0.506**	-0.028	0.021
Average Nutrient Adequacy Ratio (March 2005)	-0.358**	-0.012	- 0.476**	-0.046	0.070*
Average Household Food Intake Index (Nov. 2004)	-0.192**	0.041	-0.466**	-0.142*	-0.007
Average Household Food Intake Index (March 2005)	-0.262**	-0.006	-0.536**	-0.286**	-0.001
Food Diversity (Nov. 2004)	0.127	-0.002	0.181*	0.006	0.078
Food Diversity (March 2005)	0.030	-0.061	0.116	0.004	-0.011

** = significant relationship at 5 % level of confidence, ** = significant relationship at 1 % level of confidence*

Age of the household head did not have a significant influence on household food consumption. There was a negative relationship between the household gender ratio and food adequacy (Table 8.2). A relatively larger household gender ratio indicates more males than females in a particular household. Having more males in the

households was associated with household food inadequacy. Both the Nutrient Adequacy Ratios and Household Food Intake Index showed the same trend, although the Household Food Intake Index was more sensitive to the household gender ratio than the Nutrient Adequacy Ratios.

As reported in chapter 3, while 8.2 per cent of households did not have age dependants (ratio of children who are less than 15 and adults over 65 years of age), 65.6 per cent of households had at least one age dependant. Only one method employed to estimate food intake (Nutrient Adequacy Ratio) indicated a significant and positive relationship with age dependency during the first round, suggesting this may be a less useful indicator of household food consumption.

Household size was strongly and positively correlated to the Coping Strategies Index scores, indicating that households with larger household sizes adopted more strategies to cope with household food shocks and did so more often. The strong negative relationship between household size and intakes estimated, using both the Nutrient Adequacy Ratios and the Household Food Adequacy Index during both survey rounds, showed household size as a useful household food security indicator. The relationship indicates that larger households had lower food intakes. The same pattern was not evident through comparison of household size with dietary diversity, showing that dietary diversity was not sensitive to household size and would not pick up the concerning element of reduced food (or intra-household) allocation that would affect individual intakes. The current findings concur with Hendriks' (2003) findings regarding food consumption in two KwaZulu-Natal communities, showing that households purchased relatively the same quantities of food each month regardless of household size. The current finding showed clearly that while dietary diversity is important for micro-nutrient adequacy, it may not be adequate to pick up intake inadequacy.

The number of household members in each occupational category was related to household food consumption indicators (Table 8.3). The number of infants per household was positively and significantly related to the number of coping strategies practised by the household and the Coping Strategies Index, showing that households had been struggling to assure that food is available for infants. The significant and positive relationship between the number of infants and dietary diversity during the leaner period (November 2004) showed that increased food purchases were associated with higher dietary diversity. The negative and strong relationship between the number of infants in the household and food inadequacy suggested that households struggle to ensure enough food provision. The number of infants in the household seemed a useful variable to measure household food insecurity.

Table 8.3: Household member occupation as related to household food consumption indicators, Embo, November 2004 and March 2005 (n = 1584)

Occupation	Food Security Indicators							
	Total coping strategies	Coping Strategy Index	Diversity Nov. 2004	Diversity March. 2005	NRA Nov. 2004	NRA March. 2005	HFAI Nov. 2004	HFAI March. 2005
Wage-employed	-0.054	-0.060	0.053	0.134	-0.234**	-0.278**	-0.212**	-0.251**
Farming	-0.133	-0.163*	0.123	0.122	-0.183**	0.103	-0.197**	-0.109
Self-employed	0.017	0.043	0.087	0.138	0.062	-0.012	-0.030	-0.079
Housekeeping	0.089	0.066	0.067	-0.048	-0.051	-0.058	-0.115	-0.047
Pensioners	-0.039	0.038	-0.016	0.064	-0.027	-0.006	-0.030	-0.003
Disabled	0.033	0.064	0.123	0.037	-0.066	-0.164*	-0.051	-0.103
Unemployed	0.145*	0.222**	-0.138	-0.023	-0.346**	-0.268**	-0.282**	-0.402**
Students	0.039	0.101	0.238**	0.096	-0.346**	-0.386**	-0.359**	-0.396**
Infants	0.168*	0.224**	0.143*	-0.011	-0.310**	-0.305**	-0.177*	-0.222**
Vagrants	0.017	0.079	0.202**	0.098	-0.064	-0.141*	0.094	-0.094

** = significant relationship at 5 % level of confidence, ** = significant relationship at 1 % level of confidence.*

The number of unemployed people looking for jobs was strongly related to household food consumption. The study showed that more coping strategies were applied in households where there were proportionally high numbers of unemployed members and similarly, the CSI scores were also high. The Nutrient Adequacy Ratio and Household Food Intake Index showed that households with relatively high numbers of unemployed members had inadequate food intakes. Therefore all six indicators showed a relationship with a proportionally high number of potentially productive yet unemployed members.

The number of students in a household was also related to household food security. For all six indicators, except for dietary diversity in the first round, the number of students in a household was negatively related to household food security. As it was in the case of the number of infants in the household, food diversity was high in households with more students during November 2004. Diversity here might be due to the fact that food during this period is outsourced (purchased).

Having more wage workers in the household was strongly and negatively related to household food security. Both the Nutrient Adequacy Ratio and the Household Food Intake Index revealed that households with more wage employees had inadequate food intakes. This may be due to low wages as this was not considered in the survey question but was purported by a local resident (Makhanya, 2005).

During the first round, the number of farmers per household was found to be significantly and negatively related to household food intake adequacy. During the

second round there was no significant relationship between the number of farmers in the household and food adequacy. As the contribution of farmers to household food consumption was realised during the harvest season, their presence in the household was more appreciated during the period of harvest than in the period prior to the harvest.

The number of household vagrants (household members who did not seek to be productive or seek employment) and disabled members were the weakest parameters related to food security consumption. While households with more vagrants were found to have significantly more diversified diets in November 2004, the same households were found to have significantly inadequate food intakes (with regard to Nutrition Adequacy Ratios) in March 2005. Having more disabled persons was related to food inadequacy (with regard to Nutrition Adequacy Ratios) during March 2005.

The effect of the number of persons in the household engaged in self employment, housekeeping and pensions was found to be almost neutral with regard to the household food security indicators. The variable "vagrant" was left out of the analysis since 93.4 per cent of the households did not have vagrants. For further analysis, the potential household demographic variables - household size, number of wage earners, number of farmers, number of unemployed, number of scholars and the number of infants - were categorised with respect to the 50^{th} percentile (Table 8.4). The gender of the household head did not need reclassification. As mentioned before, households headed by males and females of the sample were 54.8 and 45.2 per cent, respectively.

Table 8.4: Potential household demographic categorised by 50^{th} percentile, Embo, November 2004 and March 2005

Characteristics	Minimum	Maximum	Mean	Characteristics of under 50th percentile	Relationship to Household Food Security
Household head education	0	9	1.84	50 % of household heads had up to 1 year of schooling	- ve
Household size	1	25	7.94	54.5 % of households had up to 7 people	- ve
Household wage workers	0	4	0.68	50.3 % of households did not have wage workers	- ve
Household unemployed	0	7	1.60	54.7 % of households had 1 unemployed person	- ve
Household farmers	0	4	0.68	54.3 % of households had no farmers	+ ve
Household scholars	0	10	2.72	53.8 % of households had up to 2 scholars	- ve
Household infants	0	7	0.91	48.7 % of households had 0 infants	- ve

For household head education, n = 200, for the rest of variables n = 1584.

8.3.2 Household socio-economic aspects as related to household food consumption

Quantitative (household non-farming and farming income, household food expenditure from own production, land size, ownership of assets and number of houses/rooms) and qualitative variables, such as the strength of household's strategies to cope with income shock in determination of household food security, were analysed (Table 8.5). Other factors, such as sources of water and energy, materials for building and household amenities such as toilets, were not included in further analysis due to homogeneity among the sample households (see chapter 4). The proportion of household food expenditure to total expenditure was also compared to household food security indicators.

Household income per capita, income obtained from non-farming activities and income obtained through farming activities were correlated against household food security indicators. While the relationship between household non-farming income and all food consumption indicators was not significant, household income per capita and income from non-farm income was positively related to food intake and food diversity in November 2004 and March 2005, respectively. However, significant relationships between household income per capita and income from non farm income to food intakes and food diversity occurred only once, and so were not considered. Likewise, the size of cultivated land was not related to food intakes. Although households headed by males cultivated relatively larger areas and had more income compared to female headed households, the two were not directly related to higher food consumption.

Table 8.5: Household socio-economical aspects with relation to food security, Embo, November 2004 and March 2005 (n = 200)

Food security indicators (average)	Income per capita	Household non-farm income	Household farming income	Food expenditure from own production	Land size	Number of household assets	Number of rooms / houses	Number of coping to income shocks strategies
Number of Coping strategies	-0.058	- 0.053	- 0.027	- 0.008	-0.057	-0.297**	0.002	0.178*
Coping Strategy Index	-0.109	- 0.01	- 0.008	- 0.058	-0.133	-0.284**	0.118	0.237**
Nutrient Adequacy Ratio (Nov. 2004)	0.067	0.000	- 0.049	0.314**	0.044	-0.011	- 0.314**	0.124
Nutrient Adequacy Ratio (March 2005)	-0.016	0.079	- 0.002	0.108	0.035	-0.058	- 0.263**	0.019
Household Food Intake Index (Nov. 2004)	0.155*	- 0.021	- 0.067	0.277**	0.056	-0.088	- 0.292**	0.003
Household Food Intake Index (March 2005)	0.106	- 0.058	- 0.103	- 0.180*	0.095	-0.097	- 0.348**	- 0.082
Food Diversity (Nov. 2004)	0.034	0.059	- 0.024	-0.071	-0.053	0.455**	0.089	-0.157*
Food Diversity (March 2005)	-0.052	0.156*	0.037	0.153*	-0.087	0.276**	0.120	- 0.071
Relationships with selected variables								
Household size	- 0.040	- 0.111	0.105		- 0.139	0.120	0.568**	0.002
Number of assets	-0.049	0.257**	0.030		0.059		0.120	0.199**

** = significant relationship at 5 % level of confidence, ** = significant relationship at 1 % level of confidence*

The correlation analysis showed that a positive relationship between the number of assets and household food adequacy and the number of assets owned, was a good indicator of household food diversity (quality) and the number of coping strategies undertaken to cope with hunger. Households with relatively more household assets had high food diversity, employed fewer consumption coping strategies and had low Coping Strategies Index scores during both rounds (see also Appendix C). The number of rooms per household was strongly associated with household size. As there was no significant relationship between household size and number of assets, the current findings suggest that more rooms per households were the result of household size and not wealth.

The neutral relationship between the size of cultivated land and the food consumption indicators suggested the size of cultivated land was not a good indicator for household food security. There was, however, a strong and positive relationship between the number of assets owned and household non farm income (Appendix C). Households that owned relatively more assets practised more income coping strategies.

As described earlier in chapter 4, while only one per cent of the surveyed households practised none of the income coping strategies, 10 per cent practised all the income shock strategies listed in the survey (having savings, reducing spending, receiving help from friends or relatives, performing additional work, reducing or stopping debt payments, borrowing money from relatives, lowering food consumption, selling livestock, selling other domestic assets and borrowing money from money lenders (stockvels)). When correlated with household food consumption indicators, the number of household income coping strategies was not related to household food intake indicators and indices, but was positively related to the number of consumption coping strategies, namely the Coping Strategy Index and household food diversity. The findings showed that households that practised more and frequent consumption coping strategies also practised more income coping strategies. The negative and strong relationship between household food diversity and the number of income shocks during November, 2004 indicated that households that practised more income coping strategies had lower food diversity during the period of lower food availability (November 2004). The relationship between household savings and dietary diversity is presented in Appendix D. Households with savings consumed a more diverse range of animal products. Findings showed that households that allocated more expenditure to food had fewer assets (Table 8.6).

The strong and negative association between proportions spent on food during November 2004 (the period of less food availability) indicated that households that allocated a higher proportion of their budgets to food had higher food intake and had less diverse diets. During March 2005, there was a neutral relationship between the proportion of the budget allocated to food and household food diversity.

Table 8.6: Budget indicators as related to other household indicators, Embo, November 2004 and March 2005. (n = 200)

Household expenditure Proportion Food / total	Household Food Diversity	Household Food Intake Index	Nutrient Adequacy Ratio	Household number of coping strategies	Coping Strategies Index	Household number of income shocks	Total number of assets	Household size	Income per capita
Nov. 04	-0.492**	0.387*	0.405**	0.154*	0.100	0.183*	-0.538**	0.217 **	0.088
Mar.05	-0.002	0.196**	0.224**	-0.02	0.021	0.081	-0.529**	0.220**	0.009

** = significant relationship at 5 % level of confidence, ** = significant relationship at 1 % level of confidence*

During November 2004, practising more consumption and income-coping strategies was positively related to higher budgetary allocations to food, but the same was not found for March 2005. In March 2005 (harvest time), households relied on food obtained from own production, reducing the need for consumption and income-coping strategies. During both rounds, the Coping Strategies Index did not relate to the proportion of expenditure allocated to food. As shown in Table 8.6, larger households allocated a larger portion of the budget to food, indicating income constraints in such expenditure on food rather than low expenditure.

Food secure households had more assets, fewer rooms (related earlier directly to household size), applied fewer income coping strategies (indicating the impossibly of more stable income), had savings, and spent a lower proportion of their budget on food. The potential socio-economic indicators are categorized by the 50th percentile as shown in Table 8.7.

8.4 Measuring household food insecurity through demographic and socio-economic variables

Thirteen demographic and socio-economic variables that were strongly related to household food consumption were selected to be used as a proxy for food security. These variables were: gender of the household head; education level of the household head; household size; number of wage workers; number of unemployed members in the household actively seeking work; number of farmers; number of students; number of infants; number of assets; number of rooms per homestead; number of income coping strategies applied; having savings; and the proportion of expenditure on food.

8.4.1 Household Food Insecurity Scale

With reference to Tables 8.4 and 8.7, bivariate values were assigned to the percentiles (Table 8.8) whereby a variable was assigned a value of one if the value for that household fell above the 50th percentile. Households headed by males and females were marked as zero and one respectively.

The household values for all variables were summed to provide the Household Food Insecurity Scale. Arithmetically, the minimum and maximum values of the scale were expected to be zero and 13 respectively. A household that scored 13 was expected to be the least food insecure while a household that scored zero was expected to be food insecure. The Household Insecurity Scale scores were normally distributed for the sample households. No households scored zero or 13. Figure 8.1 display the households' distribution to Household Food Security Scale in surveyed households of Embo community.

Table 8.7: Potential household socio-economic indicators categorised by 50th percentile, Embo, November 2004 and March 2005

Characteristics (average)	Minimum	Maximum	Mean	Characteristics of under 50th percentile	Relationship to household food security
Number of assets	0	10	2.76	56.8 % of households had up to 2 assets	+ ve
Number of houses/rooms	1	8	3.27	65.3 % of households had below 4 rooms	- ve
Number of income shocks coping strategy	0	10	6.65	60 % had up to 7 income shocks coping strategies	- ve
Having savings	0	1	0.32	Up to 68 % of households had no savings	+ ve
Proportion of budget to food	6.7	100	61.46	Up to 67.6 % of expenditure for food.	- ve

HFS = Household Food Consumption

Table 8.8: Summary statistics for measuring household food insecurity, Embo, November 2004 and March 2005

Selected household selected variables	Cut off for 50th percentile	Variables values for computation with respective quintile	
		Up to 50th percentile	Above 50th percentile
Gender of Household head	45 % of household were female headed	Male headed household = 0, female headed household = 1	
Education of Household head	50 % of households heads had up to 1 year of schooling	1	0
Household size	54.5 % of households had up to 7 people	1	0
Household wage workers	50.3 % of households did not have wage workers	1	0
Household unemployed	54.7 % of households had 1 unemployed person	1	0
Household farmers	54.3 of households had no farmers	0	1
Household scholars	53.8 % of households had up to 2 scholars	1	0
Household infants	48.7 % of households had 0 infants (No infants?)	1	0
Number of assets	56.8 % of households had up to 2 assets	0	1

Selected household selected variables	Cut off for 50th percentile	Variables values for computation with respective quintile	
Number of houses/rooms	65.3 % of households had below 4 rooms	1	0
Number of income shocks coping strategies	60 % had up to 7 income shocks coping strategies	1	0
Having savings	Up to 68 % of households had no savings	0	1
Proportion of budget to food	Up to 67.6 % of expenditures for food.	0	1

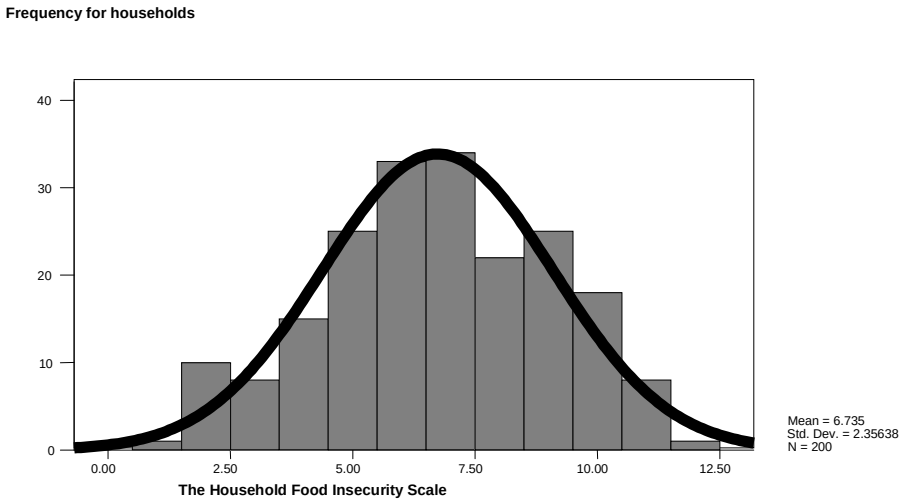


Figure 8.1: Distribution of households along the Household Food Insecurity Scale.

8.4.2 Household Food Insecurity index

The 13 selected household variables were categorised and analysed using the Principal Component Analysis. The summary statistics are presented in Table 8.9. Higher Household Food Insecurity Index scores indicated lower food insecurity. The household demographic characteristics (household size, number of wage workers, number of unemployed looking for work, number of farmers, number of students and the number of infants) were the most important variables explaining 59.79 per cent of the variation across households (Table 8.9). Figure 8.2 shows the distribution of households along the Household Food Security Index.

Table 8.9: Summary statistics for Principal Component Analysis Embo, November 2004 and March 2005 (n = 200)

Household vulnerability variable	Minimum	Maximum	Factor	% variance	Mean	Standard Deviation
Household head gender	0	1	0.085	4.427	0.450	0.499
Household head education	0	1	0.200	9.116	0.518	0.501
Household size	0	1	0.314	18.131	0.548	0.499
Household wage workers	0	1	0.153	4.995	0.508	0.501
Household unemployed	0	1	0.214	9.981	0.578	0.495
Household farmers	0	1	0.047	4.012	0.452	0.499
Household students	0	1	0.229	13.939	0.543	0.499
Household infants	0	1	0.198	8.732	0.493	0.501
Number of assets	0	1	-0.163	2.358	0.432	0.497
Number of houses/rooms	0	1	0.194	8.126	0.658	0.475
Number of income shocks coping strategy	0	1	0.000	3.295	0.598	0.492
Having savings	0	1	0.163	6.876	0.472	0.500
Proportion of budget to food	0	1	0.156	6.012	0.478	0.501

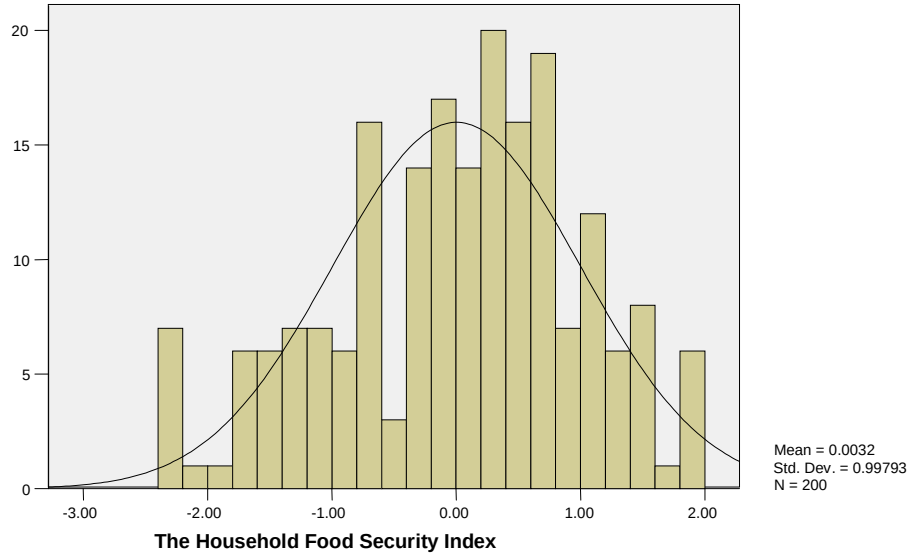


Figure 8.2: Distribution of households along the Household Food Insecurity Index.

Correlations were run between the household food insecurity measuring tools and household food consumption indicators to investigate relationships (Table 8.10).

Table 8.10: Correlations between household food insecurity measuring tools and household food consumption indicators, Embo, November 2004 and March 2005

Food Security indicator	Food Security Measurements	
	Household Food Insecurity Scale	Household Food Insecurity Index
Nutrient Adequacy Ratios (November 2004)	0.327**	0.447**
Nutrient Adequacy Ratios (March 2005)	0.327**	0.371**
Household Food Intake Index (November 2004)	0.379**	0.421**
Household Food Intake Index (March 2005)	0.468**	0.520**
Number of Coping Strategies to food	- 0.184**	- 0.046
Coping Strategies Index	- 0.253**	-0.112
Dietary Diversity (November 2004)	-0.112	- 0.315**
Dietary Diversity (March 2005)	- 0.094	- 0.216**

*** = significant at 1 % level of confidence*

The scores for the Household Food Insecurity Scale and Index were highly correlated. During both rounds the Household Food Insecurity Index was sensitive to household dietary diversity, but not sensitive to the number of household coping strategies to food shortages or the Coping Strategies Index. On the other hand, the Household Food Insecurity Scale was not sensitive to household dietary diversity, but sensitive to both the number of household coping strategies to food shocks and the Coping Strategies Index.

To validate the new tool, the 33.3 and 66.6 percentiles cut-offs for the Household Food Insecurity Scale and Index were used to prepare three categories of household with regard to food insecurity (insecure, moderate and food secure). As shown in Table 8.11, cross tabulation was carried out between the above categories and the Nutrient Adequacy Ratios and the Household Food Adequacy Index developed in chapter 6 (Table 8.11).

The highly significant relationship between the Household Food Insecurity Scale and Index and food intake adequacy scores showed that household food security is strongly related to household food intake adequacy.

Probability ratios were used to predict the chances of a household with a particular food security status having inadequate food intake. Using the data displayed in Table 8.11, the proportion of households with inadequate food intakes was divided by the proportion of households with adequate food intakes in the same food security status / category. Table 8.12 shows the results.

Table 8.11: Household food security as related to household food adequacy, Embo, November 2004 and March 2005 (n = 200)

Parameter	Proportion (%) contributed to intake group											
	Methodology used (Survey round)											
	Household Food Intake Index (Nov. 2004)			Household Food Intake Index (March 2005)			Nutrient Adequacy Ratios (Nov. 2004)			Nutrient Adequacy Ratios (Mar 2005)		
	Inadequate	Moderate	Adequate	Inadequate	Moderate	Adequate	Inadequate	Moderate	Adequate	Inadequate	Moderate	Adequate
Household Food Insecurity Scale												
Insecure	45.5	30.9	12.1	53.0	28.4	7.5	43.9	31.3	13.4	37.9	34.3	16.4
Moderate	40.9	34.2	27.3	31.8	40.3	28.4	37.9	34.3	28.4	36.4	28.4	35.8
Secure	13.6	36.8	60.6	15.2	31.3	64.2	18.2	34.3	58.2	25.8	37.3	47.8
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
X^2			0.000*			0.000*			0.000*			0.025*
Household Food Insecurity Index												
Insecure	50.0	36.8	12.1	63.6	28.4	7.5	48.5	37.3	13.4	45.5	29.9	23.9
Moderate	33.3	36.8	30.3	24.2	47.8	28.4	33.3	34.3	32.8	28.8	40.3	31.3
Secure	16.7	26.5	57.6	12.1	23.9	64.2	18.2	28.4	57.3	25.8	29.9	44.8
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
X^2			0.000*			0.000*			0.000*			0.034*

** = statistically significant relationship at the 5% level*

Table 8.12: Relationship between household food security status and food intake, Embo, November 2004 and March 2005 (n = 200)

Household Food Security Status	Household Food Intake Status INADEQUACY : ADEQUACY RATIOS (Probability of having adequate / inadequate intake)			
	Household Food Intake Index		Nutrient Adequacy Ratios	
	November 2004	March 2005	November 2004	March 2005
Household Food Insecurity Scale				
Insecure	3.76	7.07	3.28	2.31
Moderate	1.50	1.12	1.33	1.02
Secure	0.22	0.24	0.31	0.54
Household Food Insecurity Index				
Insecure	4.13	8.48	3.62	1.90
Moderate	1.10	0.85	1.02	0.92
Secure	0.29	0.19	0.32	0.58

During November 2004, households that were food insecure made up 45.5 per cent of all households with inadequate food intakes (Table 8.11). Households that were food insecure made up 12.1 per cent of households with adequate food intakes (Table 8.11). The probability of food insecure households having inadequate food intake was obtained by dividing 45.5 by 12.1, the answer being 3.76 (Table 8.12). This showed that the likelihood for food insecure households to have inadequate food intake was 3.76 (approximately 4) times higher than having adequate food intake.

With regard to household food intakes estimated using the Nutrient Adequacy Ratios and Household Food Intake Index, both the Household Food Security Scale and Household Food Security Index showed that there were more chances for food insecure households to have inadequate food intakes ($X > 1$). It was also noted that there were equal chances for moderate food secured households to have either adequate or inadequate food intake ($X \approx 1$). It was also shown that there were fewer chances of food secure households having inadequate food intakes ($X < 1$). The situation was similar during both rounds.

The analysis of variance test was done to determine the variability (mean food diversity within food groups) for each household category of food insecurity. Findings showed that household food security is inversely proportional to household dietary diversity based on food groups. Dietary diversity was shown to be more sensitive when correlated with the Household Food Security Index (Table 8.13). The current findings, using food groups as a measure of dietary diversity, conform well to findings that are measured through food count, involving food diversity (see Table 8.10). Relatively high dietary diversity, related to food insecurity, does add weight to the suggestion that dietary diversity is not a substantial measure of food security.

Table 8.13: Household food security status as related to household food diversity, Embo, November 2004 and March 2005 (n = 200)

Household Food Security Status	Household mean dietary diversity from 5 food groups									
	November 2004					March 2005				
Household Food Insecurity Scale	Starch	Legume	Fruits/ vegetable	Fats	Animal	Starch	Legume	Fruits /vegetable	Fats	Animal products
Insecure	6.58[a]	0.92[a]	6.53[a]	1.68[a]	5.10[a]	7.37[b]	1.24[b]	9.32[b]	2.20[a]	5.28[a]
Moderate	6.18[a]	0.93[a]	5.79[a]	1.54[a]	5.24[a]	6.79[a]	0.96[a]	7.72[a]	2.10[a]	5.19[a]
Secure	6.16[a]	1.01[a]	5.82[a]	1.69[a]	4.72[a]	7.22[ab]	1.00[a]	7.92[a]	2.20[a]	5.49[a]
P-va;ue	0.329	0.438	0.237	0.452	0.394	0.074	0.019*	0.006*	0.629	0.728
Household Food Insecurity Index	Starch	Legume	Fruits /vegetable	Fats	Animal	Starch	Legume	Fruits /vegetable	Fats	Animal
Insecure	6.86[b]	1.00[a]	6.76[b]	1.77[a]	5.58[b]	7.24[a]	1.24[b]	9.44[c]	2.27[a]	5.76[a]
Moderate	6.36[b]	0.94[a]	6.31[b]	1.61[a]	5.28[b]	7.13[a]	1.07[b]	8.33[b]	2.07[a]	5.19[a]
Secure	5.66[a]	0.93[a]	5.00[a]	1.52[a]	4.16[a]	6.99[a]	0.85[a]	7.27[a]	2.16[a]	5.04[a]
P-value	0.000*	0.657	0.000*	0.171	0.001*	0.613	0.001*	0.000*	0.245	0.150

** = significant difference*

Analysis of food diversity, using the Household Food Security Index, showed that cereals, fruits/vegetables and animal foods varied significantly across households during November 2004, while legume and fruits/vegetables varied significantly across households during March 2005. Analysis using the Household Food Insecurity Scale signified that differences existed between household food diversity in legume and fruits/vegetables categories of foods.

As noted before, higher household food diversity was experienced in relatively larger households with higher numbers of students and infants and in households that spent a lower proportion of income on food (Table 8.4, 8.5 and 8.9).

8.5 Remarks

Using the 13 variables (set of household socio-economic and demographic variables), the Household Food Insecurity Scale and Household Food Insecurity Index were developed and employed to measure household food security. Both the Household Food Insecurity Scale and the Household Food Insecurity Index were useful tools to measure household food security and were strongly related to household food intakes. While the Household Food Insecurity Scale was strongly related to the number of coping strategies employed by households to cope with food shortages, the Household Food Insecurity Index was strongly related to dietary diversity. The consistent correlations across seasons and the household food security variables validate the tools.

The current findings have shown clearly that while dietary diversity is important for micro-nutrient adequacy, it may not be adequate to pick up household intake adequacy and food insecurity. Both the Household Food Insecurity Scale and the Household Food Insecurity Index have been useful in measuring household food insecurity in Embo Community. While the Household Food Insecurity Index has been important in explaining the influence of household demographic and socio-economic variables towards household food security, the Household Food Insecurity Scale is simpler to use (easy data collection and use during computation process) and is strongly related to the Coping Strategies Index.

CHAPTER 9: CONCLUSIONS AND RECOMMENDATIONS

9.1 Summary

Measurement of food insecurity at household level is necessary to meaningfully assess the impact of development interventions. While early warning and national surveillance systems have made great strides in monitoring national food security, little agreement exists internationally regarding the most appropriate indicators of household food security. Finding an appropriate measure for household food security has been a challenge to both international and national agencies. This study set out to prepare a quick and convenient tool to measure household food security. In order to prepare a tool to measure household food security, the study was divided into four sub-problems.

Sub-problem 1: To determine household food adequacy among the sample households using the Household Food Adequacy Index.

Sub-problem 2: To find the relationship between household food adequacy and dietary quality among sampled households.

Sub-problem 3: To relate household food adequacy and dietary quality to the Coping Strategy Index for the sampled households.

Sub problem 4: To develop and validate the Household Food Insecurity Scale and Index using commonly available household, socio-economic and demographic variables.

While food security is a cross-cutting, complex and multifaceted phenomenon, indicators have traditionally focused on specific, narrowly measured aspects, such as current food supply, individual caloric intake, and so on, often without capturing the complexity of the concept. Having no single indicator that captures all aspects of food insecurity, and at the same time provides relevant and timely information in a cost-effective manner have led to efforts to find easy-to-implement and reliable alternative indicators.

Food purchases were the main source of food among the sample in Embo. Seasonal availability explained the variation in consumption patterns over the two survey rounds, with more food obtained through own production in March 2005 (period of plenty around harvest time) than in November 2004. While energy, iron and protein intakes varied among households, dietary diversity was low. Improved food intake and diversity was observed in March 2005 compared with November 2004. Only one third of the sampled households showed adequate food intakes during November 2004. During November 2004, energy intake seemed a good indicator for protein and micronutrient intakes. Cereals were key sources of energy and iron, legumes were key sources of protein and vegetables were key sources of iron and vitamin A. Fats were the major source of vitamins E. Seasonality strongly affected nutrition intakes and adequacies.

The Coping Strategy Index scores were related to both household food intakes and dietary diversity. The influence of seasonality on food intake and diversity were related to the Coping Strategies Index. Relatively higher household Coping Strategies Index scores (more food insecure) were related to low food intakes. Seasonality influenced the relationship between household food diversity and Coping Strategies Index, particularly in March 2005, when greater diversity of produce was available.

Using 13 demographic and socio-economic variables, the Household Food Insecurity Scale and Household Food Insecurity Index were developed. Both the Household Food Insecurity Scale and the Household Food Insecurity Index are useful tools to measure household food security in Embo Community. The Household Food Insecurity Index explains the influence of demographic and socio-economic variables in the community, while the Household Food Insecurity Scale was simpler to use (easier data management and computation process) and is strongly related to the Coping Strategies Index.

9.2 Conclusions

The Household Food Insecurity Scale and Index provide simple, convenient and quick to use tools that can be estimated from commonly available data, and are strongly correlated to conventional food security measures. The tool employs household demographic and socio-economic data and provides a new measure of household food security status. The data required are readily available through various sample surveys and censuses. Household demographic and socio-economic variables are widely used to measure various livelihood parameters, such as poverty and welfare. The ability to measure household food insecurity through household demographic and socio-economic data offers an avenue to connect household food insecurity with other social and livelihood parameters.

9.3 Recommendations

The current tool has potential for use by many stakeholders. Once baselines are established, the tool can be used by relief agencies during food emergencies and for monitoring and evaluation of development programmes aimed at improving food security.

The Integrated Food Security Strategy for South Africa (IFSS) is among potential users of the proposed tool. The IFSS approach, which is developmental, has five strategies linking its intervention to target groups, such as food insecure populations. In order for the intervention to take place, the target population needs to be identified along with productive resources, income and job opportunities, capacity to access nutritious and safe foods, accessibility due to disability and extreme conditions such as destitution. The IFSS has been stressing that intervention should be grounded on accurate information and that the impact should be able to be constantly monitored and evaluated. The proposed tool is therefore key to implementation of IFSS.

More trials should be done involving the current developed measurement for household food security in various settings. Additions and omissions of variables to

and from the set of indicators will depend on the central agreement on how they work in specific agro-ecological/economic/cultural zones. Development of the set of indicators should be targeted to cover the possible coverage. The future research is recommended to employ the current technique and marry such analysis in the mapping of food insecurity and vulnerability. The current study has provided a useful tool to measure household food insecurity.

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APPENDICES

APPENDIX A : EMBO HOUSEHOLD AND CONSUMPTION QUESTIONNAIRE NOVEMBER 2004, MARCH 2005

Interviewer: _____

Date: _____

The information captured in this questionnaire is strictly confidential and will be used for research purposes by staff and students at the University of KwaZulu-Natal to inform EFO farmers and stakeholders how they might improve their organic farming venture. Respondents do not have to answer questions – answers are voluntary. The respondent should be the *de facto* household head.

For information call: Dr Sheryl Hendriks, Food Security Programme, University if KwaZulu-Natal. Tel: 033 2605726

Respondent’s name:		Household number:		GPS coordinate:	

	Person (respondent) number									
Please make sure that you write down the Head or the Acting head of the household in ***column 1. Write name of each person.***	**1…… HEAD**	**2…..**	**3…..**	**4…..**	**5…..**	**6…..**	**7…..**	**8…..**	**9…..**	**10…..**
1. Is …… Male or Female	☐ **M** ☐ **F**	☐ **M** ☐ **F**	☐ **M** ☐ **F**	☐ **M** ☐ **F**	☐ **M** ☐ **F**	☐ **M** ☐ **F**	☐ **M** ☐ **F**	☐ **M** ☐ **F**	☐ **M** ☐ **F**	☐ **M** ☐ **F**
2. If the household head is a female is she widowed?	☐ **y** ☐ **N**									
3. Occupation 1 = wage employed 2 = farmer 3 = self-employed (e.g. taxi operator, shop keeper) 4 = housekeeper 5 = Pensioner 6 = disabled	☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5** ☐ **6**	☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5** ☐ **6**	☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5** ☐ **6**	☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5** ☐ **6**	☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5** ☐ **6**	☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5** ☐ **6**	☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5** ☐ **6**	☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5** ☐ **6**	☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5** ☐ **6**	☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5** ☐ **6**

7 = unemployed but seeking work 8 = scholar 9 = Infant or child (0 – 6 years) 10 = Vagrant	☐ **7** ☐ **8** ☐ **9** ☐**10**	☐ **7** ☐ **8** ☐ **9** ☐**10**	☐ **7** ☐ **8** ☐ **9** ☐**10**	☐ **7** ☐ **8** ☐ **9** ☐**10**	☐ **7** ☐ **8** ☐ **9** ☐**10**	☐ **7** ☐ **8** ☐ **9** ☐**10**	☐ **7** ☐ **8** ☐ **9** ☐**10**	☐ **7** ☐ **8** ☐ **9** ☐**10**	☐ **7** ☐ **8** ☐ **9** ☐**10**	☐ **7** ☐ **8** ☐ **9** ☐**10**
Wage or salary income (Rands per month)	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
5. Remitted income (Rands per month)	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
6. If the household head is a migrant or weekly commuter, who is the *de facto* household head?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Age in years	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
8. Highest level of completed schooling or educational training (years)	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____

	Person (respondent) number									
*Please make sure that you write down the Head or the Acting head of the household in **column 1. Write name of each person.***	**1……** **HEAD**	**2…..**	**3…..**	**4…..**	**5…..**	**6…..**	**7…..**	**8…..**	**9…..**	**10…..**
9. During the past year did any household member earn income through any of the non-farm enterprises listed below? If yes, report the income from each activity.	☐ **Y**	☐ **Y**	☐ **Y**	☐ **Y**	☐ **Y**	☐ **Y**	☐ **Y**	☐ **Y**	☐ **Y**	☐ **Y**

	☐ N	☐ N	☐ N	☐ N	☐ N	☐ N	☐ N	☐ N	☐ N	☐ N
9.1 Hiring out accommodation [you constantly change between fonts – stick to one:Arial or Times New Roman]	____	____	____	____	____	____	____	____	____	____
9.2 Hiring out contractor services or equipment [a no. of statements below are Times New Roman – change to Arial to be consistent]	____	____	____	____	____	____	____	____	____	____
9.3 Milling grain	____	____	____	____	____	____	____	____	____	____
9.4 Baking, brewing or selling meals	____	____	____	____	____	____	____	____	____	____
9.5 Building or repairing houses	____	____	____	____	____	____	____	____	____	____
9.6 Block making, stone- or metalwork	____	____	____	____	____	____	____	____	____	____
9.7 Hawking	____	____	____	____	____	____	____	____	____	____
9.8 Shop-keeping	____	____	____	____	____	____	____	____	____	____
9.9 Repairs and maintenance of cars or houses	____	____	____	____	____	____	____	____	____	____
9.10 Making furniture or handicrafts	____	____	____	____	____	____	____	____	____	____
9.11 Other: Please specify:	____	____	____	____	____	____	____	____	____	____

	Person (respondent) number

Please make sure that you write down the Head or the Acting head of the household in ***column 1. Write name of each person.***	**1…… HEAD**	**2…..**	**3…..**	**4…..**	**5…..**	**6…..**	**7…..**	**8…..**	**9…..**	**10…..**
10. Does …. have a savings account (i.e. bank, post office, stockvel etc)? If yes, please provide the following information:	☐ **Y** ☐ **N**	☐ **Y** ☐ **N**	☐ **Y** ☐ **N**	☐ **Y** ☐ **N**	☐ **Y** ☐ **N**	☐ **Y** ☐ **N**	☐ **Y** ☐ **N**	☐ **Y** ☐ **N**	☐ **Y** ☐ **N**	☐ **Y** ☐ **N**
10.2 Current level of savings (Rands) 1 = less than R500 2 = R501 – R1000 3 = R1001 – R5000 4 = more than R5001 DK = do not know	☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **DK**	☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **DK**	☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **DK**	☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **DK**	☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **DK**	☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **DK**	☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **DK**	☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **DK**	☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **DK**	☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **DK**

Housing attributes

Number of rooms to sleep in	
Does the household have electrical power?	☐ **no electricity** ☐ **solar power** ☐ **generator** ☐ **Eskom power**
Main source of drinking water:	☐ **stream** ☐ **protected spring** ☐ **borehole** ☐ **rain tank** ☐ **stand pipe**

9.16	**Yes**	**No**	**Does this household have a:**
A	☐ 1	☐ 2	**land line telephone in the dwelling**
B	☐ 1	☐ 2	**cell phone**
C	☐ 1	☐ 2	**radio**
D	☐ 1	☐ 2	**Hi-fi / music centre**
E	☐ 1	☐ 2	**television?**
F	☐ 1	☐ 2	**personal computer**

G	☐ 1 ☐ 2	**DVD / VCR (video player)**
H	☐ 1 ☐ 2	**Maize mill**
I	☐ 1 ☐ 2	**fridge/freezer**
J	☐ 1 ☐ 2	**bicycle**
K	☐ 1 ☐ 2	**Motorbike**
L	☐ 1 ☐ 2	Trailer/cart
M	☐ 1 ☐ 2	**sewing machine**
N	☐ 1 ☐ 2	**motor vehicle in running order**
O	☐ 1 ☐ 2	**plough**
P	☐ 1 ☐ 2	Generator
Q	☐ 1 ☐ 2	Planter, harrower or cultivator
R	☐ 1 ☐ 2	**tractor**

12 ON-FARM IMPROVEMENTS

Improvement	**Financed privately (Y or N)**	**Year**	**Financed by Government (Y or N)**	**Year**
Irrigation				
Lime				
Fencing for crops				
Crop storage silo Crop storage silo				
Water tanks				
Chicken coops				

Livestock fencing for manure collection llection)				
Other: specify				

14. LAND TENURE SECURITY

14.1 What rights can the household exercise on its own cropland? (tick where appropriate):

Right	Build structures	Plant trees	Erect fences to exclude others:		Bequeath	Lease out	Sell
Response			Summer	All year			
No							
Yes, with consent from local authority							
Yes, without approval from local authority							

14.2. Crop damage

14.2.1	Did livestock stray into your cropland after you planted it last season? If no go to question 14.2.4	☐ **Y** ☐ **N**
14.2.2	If yes, were your crops damaged by the livestock?	☐ **Y** ☐ **N**
14.2.3	If yes, did you seek redress from the traditional authority?	☐ **Y** ☐ **N**
14.2.4	If yes, were you awarded compensation for the damage?	☐ **Y** ☐ **N**
14.2.5	If your crops were damaged and you did not seek legal redress, did the owner of the livestock pay you any compensation for the damage?	☐ **Y** ☐ **N**
14.2.6	Are there rules limiting the number of livestock that people may graze on communal land?	☐ **Y** ☐ **N**
14.2.7	If yes, are penalties applied to people who exceed the limit?	☐ **Y** ☐ **N**

15 LIVESTOCK

Livestock and livestock products	Cattle	Goats	Sheep	Pigs	Chickens	Donkeys	Other: specify
Number currently owned by all household members							
Approximate value of livestock (Rands)							
Number sold during past year							
Gross income from sales during past year (Rands)							
Animals slaughtered for food in past year							
Animals slaughtered for festivities in past year							
Product sales? E.g. eggs, skin, manure, milk							

16 CREDIT AND CASH LOANS

What was the largest loan or credit transactions (*i.e.*Agoods/services received before full payment is made) that you made during the past year?

Question	Transaction
Amount of cash borrowed or credit used	
Main purpose of loan or credit (*e.g.* to pay for food, social functions, medicine, education, appliances, furniture, fixed improvements, farm inputs, non-farm inputs, etc.)	
Source of loan or credit (*e.g.* Bank, seller, local money lender, friends, relatives, employer, stockvel, burial club, etc.)	
Security provided (*e.g.* land, assets purchased, guarantor, etc.)	

17 INCOME SHOCKS

Which of the following strategies does the household use to cope with income shocks (e.g. drought, lower than expected income, etc.) (Please tick where appropriate)

Strategy	Strategy used?
Sell livestock	☐ **Y** ☐ **N**
Sell other assets	☐ **Y** ☐ **N**
Use own cash savings	☐ **Y** ☐ **N**
Borrow money from relatives	☐ **Y** ☐ **N**
Borrow money from stokvel	☐ **Y** ☐ **N**
Receive help from friends or relatives	☐ **Y** ☐ **N**
Took on additional work	☐ **Y** ☐ **N**
Reduce spending	☐ **Y**

	☐ **N**
Reduce food consumption	☐ **Y** ☐ **N**
Reduce or stop debt repayments	☐ **Y** ☐ **N**
Other: Please specify	☐ **Y** ☐ **N**

18. In this section, we look at the patterns of **food consumption** for all resident household members. This should include all the food they have eaten. It should not include food that has been bought for resale or exchanged for commercial purposes. Below is a list of different kinds of food that people may have eaten in the past **MONTH**.

Food Item	**1.** **Was [..] eaten by this household in the past *month*?** **Yes No**	**3.** **What was the value of [..] eaten from *purchases* in the past month?** **Rand**	**N1.** **What was the value of [..] eaten received as *gifts* in the past month?** **Rand**	**N2.** **What was the value of [..] eaten received as *payment* in the past month?** **Rand**	**5b.** **What was the value of [..] eaten from *own production* in the past month?** **Rand**
Maize grain / samp	**1 2**				
Mealie Meal / Maize Flour	**1 2**				
Rice	**1 2**				
White / Brown Bread	**1 2**				
Wheat Flour	**1 2**				
Breakfast Cereal	**1 2**				
Dried Peas / Lentils / Beans	**1 2**				
Potatoes	**1 2**				
Tomatoes	**1 2**				
Sweet Potatoes	**1 2**				
Madumbes / Other roots / Tubers	**1 2**				
Vegetable Oil	**1 2**				
Peanuts/ Other nuts	**1 2**				
Peanut butter	**1 2**				

Food Item	1. Was [..] eaten by this household in the past *month*? Yes No	3. What was the value of [..] eaten from *purchases* in the past month? Rand	N1. What was the value of [..] eaten received as *gifts* in the past month? Rand	N2. What was the value of [..] eaten received as *payment* in the past month? Rand	5b. What was the value of [..] eaten from *own production* in the past month? Rand
Margarine/Butter / Ghee / Other Fats	1 2				
Cheese	1 2				
Jam	1 2				
Fresh Milk/ Steri Milk / UHT	1 2				
Sour Milk/ Maas/ Yoghurt	1 2				

Food Spending and Consumption (Continued)

Food Item	1. Was [..] eaten by this household in the past *month*? Yes No	3. What was the value of [..] eaten from *purchases* in the past month? Rand	N1. What was the value of [..] eaten received as *gifts* in the past month? Rand	N2. What was the value of [..] eaten received as *payment* in the past month? Rand	5b. What was the value of [..] eaten from *own production* in the past month? Rand
Baby Formula	1 2				
Milk Powder	1 2				
Sugar	1 2				
Mutton / Beef / Pork / Goat meat	1 2				

Tinned meat / Processed meat / Polony	**1**	**2**				
Offal	**1**	**2**				
Chicken	**1**	**2**				
Eggs	**1**	**2**				
Fresh Fish	**1**	**2**				
Tinned Fish	**1**	**2**				
Pumpkin / squash	**1**	**2**				
Green mealies	**1**	**2**				
Green vegetables / Tinned vegetables	**1**	**2**				
Other vegetables / Wild vegetables / Imifino	**1**	**2**				
Bananas	**1**	**2**				
Apples, peaches, etc.	**1**	**2**				
Citrus fruit	**1**	**2**				
Soft drinks	**1**	**2**				
Tinned fruit	**1**	**2**				
Meals prepared outside home	**1**	**2**				
Other food expenditure / consumption	**1**	**2**				

		Were any [..] ? Yes No	What was the total value in the past month? Rand
Meals Given to Guests	**1 2**		
Meals Received as Guests	**1 2**		

19 Regular Non-Food Spending

FOR EACH ITEM, ASK: In the past **MONTH**, about how much did the household spend on [..] ?

PERSONAL ITEMS:	**Rands per month**
Cigarettes, tobacco	
Beer, wine, spirits	
Entertainment (cinema, sports, music, lottery, etc)	
Personalised care items: cosmetics, soap, shampoo, haircuts, and so on	
Newspapers/stationery, envelopes, stamps	
Telephone (service + calls + prepaid) including cell phone	
REGULAR TRANSPORT COSTS:	
Petrol, oil and car service	
Buses, taxis, trains and air tickets	
MISCELLANEOUS:	
Washing powder etc.	
Crèche/Childcare	
Religious and membership dues of organisations	
Informal taxation and donations	
Domestics, gardeners and other household labour	
ENERGY, WATER AND MUNICIPAL RATES:	

Water, Electricity, and Municipal Rates (IF PAID TOGETHER)	
Water (e.g., rates if paid separately from municipal rates, tanker)	
Electricity (if paid separately from municipal rates)	
Municipal Rates (if paid separately from water and electricity)	
Other energy sources (wood, paraffin, charcoal/coal, candles, gas, purchasing/charging batteries, diesel oil for generators, other)	

20 Occasional Non-Food Spending

FOR EACH ITEM, ASK: How much the household spent on [..] ?

HOUSEHOLD ITEMS:	**Rands per year**
Kitchen equipment, like pots and pans, lamps, torches etc.	
Home maintenance and repairs to the dwelling	
Bedding, sheets, blankets and towels	
Furniture and other household appliances	
CLOTHING AND SHOES:	
Shoes and clothes for children (excluding school uniforms)	
Shoes and clothes for adults	
Material to make clothing, curtains and other items	
HEALTH AND CARE:	
Medical Aid Scheme/Medical Insurance Fees	
Dentists, doctors or nurses (not covered by Medical Aid/Insurance)	
Hospital/Clinic fees (not covered by Medical Aid/Insurance)	
Medical supplies, for example, medicines, bandages and so on (not covered by Medical Aid/Insurance)	
Traditional healer's fees	
PERSONAL AND OTHER ITEMS:	
Jewellery, watches, other luxury goods	

Ceremonies (weddings, funerals, etc.)	
EDUCATION:	
School fees and tuition	
University/College fees	
Books and Uniforms (including stationery)	
Other School Expenses (transport, meals at school, boarding fees, contributions to school buildings, extra costs for teachers, extramural activities, other)	
LIFE AND PROPERTY INSURANCE:	
Life insurance, funeral policies, burial societies	
Short-term insurance (e.g., car, property & fire, crop)	

21: Which months of the year did you eat food you grew yourselves instead of buying all food / have to rely on food you did not grow yourselves instead of growing it all yourselves. ***Tick the appropriate boxes.***

A		**Aug 03**	**Sept 03**	**Oct 03**	**Nov 03**	**Dec 03**	**Jan 04**	**Feb 04**	**Mrch 04**	**April 04**	**May 04**	**June 04**	**July 04**
B	Had to buy staples e.g. maize instead of growing all	☐ 1	☐ 1	☐ 1	☐ 1	☐ 1	☐ 1	☐ 1	☐ 1	☐ 1	☐ 1	☐ 1	☐ 1
C	Ate food we grew ourselves, instead of buying all	☐ 2	☐ 2	☐ 2	☐ 2	☐ 2	☐ 2	☐ 2	☐ 2	☐ 2	☐ 2	☐ 2	☐ 2
D	Borrowed food / received food from others	☐ 3	☐ 3	☐ 3	☐ 3	☐ 3	☐ 3	☐ 3	☐ 3	☐ 3	☐ 3	☐ 3	☐ 3
E	Had to eat wild food through hunting / gathering	☐ 4	☐ 4	☐ 4	☐ 4	☐ 4	☐ 4	☐ 4	☐ 4	☐ 4	☐ 4	☐ 4	☐ 4
F	Begged for food	☐ 5	☐ 5	☐ 5	☐ 5	☐ 5	☐ 5	☐ 5	☐ 5	☐ 5	☐ 5	☐ 5	☐ 5
G	Had to work for food in kind	☐ 6	☐ 6	☐ 6	☐ 6	☐ 6	☐ 6	☐ 6	☐ 6	☐ 6	☐ 6	☐ 6	☐ 6
H	Received food as a gift	☐ 7	☐ 7	☐ 7	☐ 7	☐ 7	☐ 7	☐ 7	☐ 7	☐ 7	☐ 7	☐ 7	☐ 7

22 Which months over the past year did you experience a period of lack of food or money such that one or more members of the household had to go hungry? (Y/N)

A. Aug	B. Sept	C. Oct	D. Nov	E. Dec	F. Jan	G. Feb	H. March	I. April	J. May	K. June	L. July
☐ Yes	☐ Yes	☐ Yes	☐ Yes	☐ Yes	☐ Yes	☐ Yes	☐ Yes	☐ Yes	☐ Yes	☐ Yes	☐ Yes
☐ No	☐ No	☐ No	☐ No	☐ No	☐ No	☐ No	☐ No	☐ No	☐ No	☐ No	☐ No

23 Which months of the year did your household: (*Tick the appropriate boxes)*

	Aug 03	**Sept 03**	**Oct 03**	**Nov 03**	**Dec 03**	**Jan 04**	**Feb 04**	**March 04**	**April 04**	**May 04**	**June 04**	**July 04**
Buy all maize consumed by the household?												
Supplement home produced maize with bought maize meal?												
Borrow food / receive food from others?												
Have to eat wild food through hunting / gathering?												
Beg for food?												
Have to work for food in kind?												
Receive food as a gift?												
Experience hunger?												

24 In the past 30 days, if there have been times when you did not have enough food or money to buy food, how often has your household had to do the following;

STRATEGIES UNDERTAKEN	**FREQUENCIES *tick the appropriate boxes***				
	All the time? Everyday?	Pretty often? 3–6*/week	Once in a while? 1 -2*/week	Hardly at all? < 1*/week	Never? 0*week
Consume Less preffered/less expensive food					
Borrow food/money for food					
Purchase food on credit					
Get help from relative/friends outside					
Limit food portions					
Ration money to buy street food					
Limit adult intake for children to eat					
Reduce number of meals					
Skip whole day without eating					

Thank you for participating in this survey!

APPENDIX B:

PERCENTAGE PROPORTIONS OF HOUSEHOLDS WHO ADOPTED THE RESPECTIVE COPING STRATEGIES ACROSS HOUSEHOLD'S FOOD ADEQUACY CATEGORIES, EMBO, NOVEMBER 2004, MARCH 2005

		Frequencies of Coping Strategies employed by households															
Classification with regards to Household Food Intake Index	**Household Food Intake classes**	**Consume less prefered / expensive food**		**Borrow**		**Use credit**		**Rely on help**		**Limit portions**		**Leave to children**		**Reducing number of meals**		**Skip whole day without meals**	
		Never	V.often	Never	V.often	Never	V.often	Never	V.often	Never	V.often	Never	V.often	Never	V.often	Never	V.often
November 2004	Inadequate	25.0	42.9	26.9	52.6	33.6	41.7	26.9	52.6	31.8	35.7	34.3	30.0	36.9	17.6	33.9	20.0
	Average	34.2	22.4	34.4	18.4	32.8	20.8	34.4	18.4	32.6	33.3	30.2	50.0	29.9	29.4	32.8	60.0
	adequate	40.8	34.7	38.7	29.8	33.6	37.5	38.7	28.9	35.6	31.0	35.5	20.0	33.1	52.9	33.3	20.0
Total		**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
March 2005	inadequate	26.3	30.6	25.8	52.6	28.2	41.7	25.8	52.6	34.1	23.8	32.0	30.0	33.8	11.8	32.3	0.0
	Average	32.9	32.7	32.3	26.3	36.6	25.0	32.3	26.3	31.8	47.6	33.7	45.0	32.5	47.1	33.9	60.0
	adequate	40.8	36.7	41.9	21.1	35.1	33.3	41.9	21.1	34.1	28.6	34.7	25.0	33.8	41.2	33.9	40.0
Total		**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Classification with regards to Nutrient Adequacy Ratios																	

		Frequencies of Coping Strategies employed by households															
Classification with regards to Household Food Intake Index	**Household Food Intake classes**	**Consume less prefered / expensive food**		**Borrow**		**Use credit**		**Rely on help**		**Limit portions**		**Leave to children**		**Reducing number of meals**		**Skip whole day without meals**	
		Never	V.often	Never	V.often	Never	V.often	Never	V.often	Never	V.often	Never	V.often	Never	V.often	Never	V.often
November 2004	Inadequate	25.0	42.9	25.8	52.6	33.6	45.8	25.8	52.6	31.3	35.7	34.3	30.0	36.9	17.6	33.3	40.0
	Average	38.2	24.5	37.6	21.1	35.1	12.5	37.6	21.1	34.8	33.3	32.0	50.0	31.8	23.5	33.9	60.0
	Adequate	36.8	32.7	36.6	26.3	31.3	41.7	36.6	26.3	34.1	31.0	33.7	20.0	31.2	58.8	32.8	0.0
Total		**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
March 2005	Inadequate	26.3	34.7	22.6	55.3	32.8	41.7	22.6	55.3	27.3	42.9	31.4	40.0	29.9	35.3	32.3	40.0
	Average	34.2	34.7	32.3	18.4	34.4	20.8	32.3	18.4	34.1	35.7	32.5	45.0	36.9	17.6	33.3	40.0
	Adequate	39.5	30.6	45.2	26.3	32.8	37.5	45.2	26.3	38.6	21.4	36.1	15.0	33.1	47.1	34.4	20.0
Total		**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

APPENDIX C: RELATIONSHIP BETWEEN ASSET OWNED AND HOUSEHOLD FOOD DIVERSITY, EMBO, NOVEMBER 2004 AND MARCH 2005

Households with regards to asset ownership	Food Groups					
	November 2004					
	Total	Starch	Legume	Fruits/vegetable	Fats	Animal
Up to 2 assets	17.51	5.76	0.81	5.30	1.38	4.08
3 and above assets	23.76	7.04	1.16	7.03	1.98	6.27
ANOVA	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
	March 2005					
	Total	Starch	Legume	Fruits/vegetable	Fats	Animal
Up to 2 assets	22.55	7.12	0.96	7.55	2.08	4.83
3 and above assets	26.05	7.20	1.19	9.30	2.31	6.05
ANOVA	0.000*	0.717	0.010*	0.000	0.013*	0.000*

APPENDIX D: HOUSEHOLDS SAVINGS AS RELATED TO HOUSEHOLD FOOD DIVERSITY, EMBO, NOVEMBER 2004 AND MARCH 2005

Household saving status	Number of food items consumed					
	November 2004					
	Total	Starch	Legume	Fruits/vegetables	Fats	Animal
No savings	19.63	6.23	0.94	5.99	1.63	4.73
Have savings	21.13	6.42	0.98	6.09	1.64	5.59
ANOVA	0.135	0.467	0.565	0.794	0.944	0.015*
	March 2005					
	Total	Starch	Legume	Fruits/vegetables	Fats	Animal
No savings	23.54	7.07	1.09	8.25	2.13	5.00
Have savings	24.80	7.23	0.97	8.29	2.27	6.03
ANOVA	0.196	0.462	0.166	0.920	0.174	0.002*