FOOD SECURITY AND COPING STRATEGIES OF A RURAL COMMUNITY WITHIN THE VALLEY OF A THOUSAND HILLS

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DEDICATION

This research is dedicated to the community members that reside in The Valley of a Thousand Hills, for the willingness to participate and the active involvement in conducting the study.

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The Valley of a Thousand Hills Ward Councillor, for allowing this research to be conducted in the community of a Valley of a Thousand Hills, and for hosting the first community meeting in the local community hall.

My parents, grandparents, siblings and husband for the love, patience, motivation, support and encouragement demonstrated especially towards the end of the research.

DECLARATION

This work has not previously been accepted in substance for any degree and is not concurrently submitted in candidature of any degree.

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This dissertation is being submitted in fulfilment of the requirements for the degree of Magister Technologiae.

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ABSTRACT

Food security is a global concern and the insecurity thereof is prevalent in South Africa even though the country is deemed to be secure in terms of food availability.

The study was conducted to determine the socio-economic, health and nutrition and food security status of the community living in the Valley of a Thousand Hills in KwaZulu Natal, in addition to analysing their coping strategies.

Two hundred and fifty seven respondents were required to participate in this study. Data were collected by interviewing the respondents using pre-designed and pre-tested questionnaires; socio demographic questionnaires, dietary intake questionnaires- namely 24 hour recall and Food Frequency Questionnaire (FFQ) and the coping strategy questionnaires were used. Lastly anthropometric measurements were taken to determine BMI.

A prevalence of extreme poverty exists as a magnitude of the high unemployment rate, out of which 75.8% had been unemployed for more than 3 years. The household monthly income was less than R500 per month for 37.3% of the respondents. The mean Food Variety Scores (FVS) (±SD) for all foods consumed from the food groups during seven days was 22.45 (±10.32), indicating a low food variety score. In this study the food group diversity is summarized as the majority of the respondents (91.1%, n=226) being classified with a good dietary diversity score using 6-9 food groups. The mean of the three 24-Hour recall nutrient analysis indicated a deficient intake by both men and women in all of the nutrients (100% of the men and women could not meet the DRI's for energy and calcium) except for the mean (±SD) carbohydrate intake by men aged 19-50 (214.71 ± 80.22). The main source of food intake was from the carbohydrate food group with an insufficient intake of animal products, dairy products and fruits and vegetables respectively; contributing to the macro and micro nutrient inadequacies.

Ninety six percent of this community experienced some level of food insecurity with the worst Coping Strategy Index food insecurity score being 117 out of a possible 175. Four percent of this community was classified as being food secure.

Overweight and obesity were the most exceptional anthropometric features by the women respondents with 26.5% (n=66) being overweight and 57% (n=142) obese. The men's anthropometric features were predominantly normal weight.

This study has established poverty and unemployment as being the principal contributors for the food insecurity experienced by the populace and poor dietary intakes. The low food variety diet consumed by the respondents resulted in the DRI's not achieved for most nutrients. The

majority of the respondents only consumed two meals a day, as a coping strategy to reduce/prevent temporary food insecurity. Intervention strategies are needed to improve the food security status and dietary intake of the community members to overcome the crisis of malnutrition.

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LIST OF ABREVIATIONS

AI- Adequate Intake

ARV- Antiretroviral

AVDRC- Asian vegetable Research and Development Centre

BEE- Black Economic Empowerment

BMI- Body Mass Index

CDC- Centre for Disease Control

CSI- Coping Strategy Index

DRI- Daily Recommended Intake

EAR- Estimated Average Requirement

EER- Estimated Energy Requirements

FAO- Food and Agriculture Organisation

FFQ- Food Frequency Questionnaire

FGDS- Food Group Diversity Score

FVS- Food Variety Score

GAIN- Global Alliance for Improved Nutrition

GFRP- Global Food Response Programme

GHS- General household Survey

GPS- Global Positioning Systems

HPI- Human Poverty Index

HSRC- Human Sciences Research Council

IES- Income and Expenditure Survey

IFSNP- Integrated Food Security and Nutrition Programme

IFSS- Integrated Food Security Strategy

LAPC- Land and Agriculture Policy Centre

LSM- Living Standards Measure

MDG- Millennium Development Goal

MPI- Multidimensional Poverty Index

MUAC- Mid Upper Arm Circumference

MVP- Millennium Villages Project

NAMC- National Agricultural Marketing Council

NAR- Nutrient Adequacy Ratio

NDA- National Department of Agriculture

NFCS- National Food Consumption Survey

NGO- Non Governmental Organisation

NICUS- Nutrition Information Centre of the University of Stellenbosch

NSNP- National School Nutrition programme

NTD- Neglected Tropical Diseases

PEM- Protein Energy Malnutrition

PPS- Portable Physician Scale

RDA- Recommended Daily Allowance

RDP- Rural Development Programme

SADC- South African development Community

SASSA- South African Social Security Agency

SD- Standard Deviation

SFT- Skin Fold Thickness

UL- Upper Intake Level

UN- United Nations

UNDP- United Nations Development programme

UNEP- United Nations Environment programme

UNFCCC- United Nations Framework Convention on Climate Change

UNICEF- United Nations Children's Fund

UNSSCN- United Nations System Standing Committee on Nutrition

WFP- World Food Programme

WHO- World Health Organisation

SYMBOLS

***** - Women 19-50 yrs

- Women >50 yrs

~ - Men 19-50 yrs

+ - Men > 50 yrs

µg- Microgram

~ - Frequency scoring

º - Severity weight

***** - Correlation is significant at the 0.05 level (2-tailed)

******- Correlation is significant at the 0.01 level (2-tailed

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CHAPTER 1: THE PROBLEM AND ITS SETTING

1.1 INTRODUCTION

Progress has been made ever since the 1950s in combating problems of poverty, hunger and malnutrition in the majority of the world with food production increasing globally; and a significant reduction in the prevalence of preschool malnutrition and infant and child mortality (World Health Organisation (WHO), 1997). In spite of these remarkable improvements, poverty, hunger and malnutrition continue to be a massive challenge (WHO, 1997).

Malnutrition is used to describe inadequate nutrition , either in surplus or insufficiency and can be displayed in different ways depending on location, meanwhile food insecurity prevails ubiquitously (Spool & Torino, 2008). Food insecurity may be described as inadequate access to plentiful, safe, nutritious food that meets the nutritional needs as well as food predilection of individuals and communities and plays a significant role in the advances of malnutrition in resource-poor and resource-adequate settings (Spool & Torino, 2008).

Seven hundred and ninety million people in developing countries and 34 million people in developed countries are experiencing malnourishment and do not have sufficient amounts of food (Oldewage-Theron, Dicks & Napier, 2006). Although Oldewage-Theron *et al.* (2006) suggests that globally there is an enhanced nutritional state of affairs; the reality is that the nutritional status has degenerated in numerous countries, particularly in Africa.

1.2 BACKGROUND TO THE PROBLEM: A GLOBAL PERSPECTIVE

The World Food Program (2009) reveals that over the past decade there have been a series of events that have impacted on the global food crises: In 2000 an escalated demand for grains resulted in a depreciated global stockpile, the US dollar started to depreciate in 2002 until 2008, and the oil prices escalated in 2004 resulting in elevated transportation and fertilizers cost. In 2005 crops were crucified by a draught in Russia, Ukraine and Australia, and in 2006 the cost of cereals increased by 21%. In 2007 the cost of cereals increased by an additional 31% whilst crops were destroyed by floods in Northern Europe, and by draught in southern Europe, and western Africa which catalyzed export restrictions and a 49% food price hike in 2008 which resulted in an additional 40 million people experiencing hunger.

1.2.1 Global Issues- Malnourishment

During the past few years there have been restricted definitions to the term malnutrition and it has been associated with undernutrition. In order to address diseases prevention and predisposition adequately, malnutrition needs to be redefined and find relevance within various contexts of society (United Nations Systems, 2004).

The WHO (2000) defines malnutrition as the cellular inconsistency between the supply of nutrients and energy and the body's demand to ensure growth, maintenance and specific functions.

Malnutrition is experienced around the globe, as depicted by the following facts:

- Roughly 1 billion individuals worldwide lack sufficient dietary intake to meet their bodily nutrient demands and are suffering from malnutrition (Havas & Salmon, 2011).
- An excess of 840 million people in the developing world are undernourished out of which 204 million people live in Sub-Saharan Africa (Labadarois, Mchiza, Steyn, Gericke, Maunder, Davids & Parker, 2011).
- Twenty countries from Asia, Africa, Western Pacific and the Middle East attribute to 80% of the world's macro and micro nutrient malnutrition status (Havas & Salmon, 2011).
- Three and a half million child, under the age of 5, fatalities occur per annum owing to illnesses associated with malnutrition (Horton, 2008; Black, Allen, Bhutta, Caulfield, De Onis, Ezzati & Rivera, 2008; Havas & Salmon, 2011)
- Africa, South Asia and the South pacific Islands are all countries where 40% of the child population suffer from nutrient related growth stunting (WHO, 2010).
- Adult and child malnutrition rates have depreciated in South Africa (Faber, Witten & Drimie, 2011).
- Globally an excess of 3.5 million mothers and children die annually as a result of malnutrition and an estimate of 178 million children suffer from stunted growth (Saunders, Smith & Stroud, 2010).
- Forty three percent of children globally are stunted and 16% of children in the United States either go hungry or is at risk of insufficient food intake (Ngozi & Tola, 2010)
- One hundred million children globally are deemed to be underweight (WHOa, 2011)

1.2.2 Global Issues- Food Security

Food security is a global concern as an excess of 1 billion people are projected to consume insufficient dietary energy , and twice as many people suffer from micronutrient deficiencies (Barrett, 2010). A study conducted by Havas and Salmon (2011) suggests that there is an

adequate amount of food to feed the world's population; however it is not satisfactorily distributed nor is it all culturally fitting.

- The Food and Agriculture Organisation (FAO) (2009) estimated that approximately 833 million people worldwide were food insecure. It is also interesting to note that the estimates for Asia were 66.6% greater than the United States Department of Agriculture (USDA's) and 33% lower for Sub-Saharan Africa (Barrett, 2011).
- South Africa is deemed to be a food secure country based on food availability, yet the WHO has listed it as one of the 36 greatest burden countries and is home to a large percentage of stunted children (Faber *et al*., 2011).
- Eight hundred and seventy million people globally do not have sufficient food to eat. This number has reduced by 130 million since 1990; however the downward spiral has lagged since 2008 (FAO, 2012).
- Ninety eight percent of hungry people reside in developing countries with 15% of these individuals being undernourished (FAO, 2012).
- The greatest proportion of hungry people (563 million) lives in Asia and the Pacific (FAO, 2012).
- In the developing world 66 million (out of which 23 million live in Africa) preschool going children attend school hungry (World Food Programme (WFP), 2011)
- "Hunger is the world's No.1 health risk. It kills more people every year than AIDS, malaria and tuberculosis combined" (WFP, 2011).
- One point one billion people were surviving on less than $1 a day and 923 million were undernourished, prior to the food, fuel and financial crises (Food Crises, 2012).
- Food prices remain volatile (Food Crises, 2012).
- As at 2012, the World Bank Board-approved Global Food Response Programme (GFRP) projects to the value of $1,238.9 million, of which $202.4 million is from the Food Price Crisis Response Trust Fund for 27 countries, of which 17 are in Africa (Food Crises, 2012).

1.3 BACKGROUND TO THE PROBLEM: AN AFRICAN PERSPECTIVE

Notwithstanding the universal diminution in food insecurity (Sanches, 2005), Africa's food security and nutrition position is worsening. Africa has been exposed to several waves of chronic food insecurity resulting in a vast reduction in livelihoods and life during the past decade (Folaranmi, 2012; United Nations Development Programme (UNDP), 2012). Collectively African countries have not made much progress towards attaining the Millennium Development Goal (MDG) of reducing hunger by half by 2015 (Clemens, Kenny & Moss, 2007) and presently 33% of Africans live in persistent hunger (Lobell, 2008). West and East Africa

are in the midst of one of the most severe food crises in modern times- 23 million people are exposed to chronic food insecurity and are vulnerable to malnutrition (UNICEF, 2013). The contributing factors include remarkably elevated population growth rates, political altercations, climate changes and widespread poverty.

Hunger could be a daily certainty for about 42 million children in Africa and Vitamin A deficiency is currently prevalent in 78 developing countries worldwide (Ngozi & Tola, 2010). The food insecurity situation in Africa is attributed to drought, famine, poor governance and uneven access to food which is compounded by chronic malnourishment and seasonal hunger whereby generations of Africans suffer the consequences. Creating a sustainable food secure future for Africans requires innovation and accomplishment in essential areas including increasing the productivity of smallholder farmers, improving nutrition amongst children, creating durable communities and sustainable food systems, and sanctioning women and the rural poor (United Nations Development Programme (UNDP), 2012). Accomplishment in these sectors is only possible if food security is viewed as a challenge that extends beyond sectoral mandates and reaches national development programmes, in addition to amalgamating humanitarian and development work to reinforce the buoyancy of individuals and the communities including the most relentless predicament (UNDP, 2012).

1.4 BACKGROUND TO THE PROBLEM: THE SOUTH AFRICAN PERSPECTIVE

The South African food and agricultural policy planning was initiated in the early 20th century, after the implementation of the Land Act 1913. All the policies at the time were not so successful and were not established enough to protect South Africans from the great depression of the 1930's. After this the food marketing policy was introduced, the primary purpose of this policy was to guarantee dependable and available food nationally (Makhura, 1998).

Subsequently South Africa's food policy has been aimed at warranting food self sufficiency, at a national level, in basic foodstuffs (Land and Agricultural Policy Centre (LAPC), 1993; National Department of Agriculture (NDA), 1996). The food policy process was initialised as a reaction to ruthless political and economic conditions that were crippling the country, rather than being logical and well thought out. As the emphasis of the food policy changed to food security policy, the focus had to be redirected to people, markets and resource development. The food security policy foundation is based on improving accessibility to adequate food as well as illustrates what is required at macro and micro level to provide sustainable food security nationally.

Makhura (1998) explains that for a number of years South Africa has experienced food security issues whereby the following reoccurring food security challenges presented themselves:

- Ensuring enough food is available at macro level has been and is currently still a huge challenge. Variable factors such as that of macro-economic constraints, increased demand, climate change, change in technology and insufficient farm production, inefficient farmer support system, ineffective previous policies and trade restrictions have all played a role in contributing to the challenges at a macro level.
- Owing to severe poverty, inconsistent and decreasing incomes, food price hikes, restricted employment opportunities and unproductive food distribution systems; pairing incomes and prices to guarantee accessibility of food to all South Africans has been a challenge.
- Not all South Africans have had access to nutritional education thus lack knowledge of food safety issues, and are unable to make informed choices for their health and wellness (Makhura, 1998).

Makhura (1998) suggests there have been numerous challenges for developing a sustainable and feasible food security policy. Strategic issues that need to be addressed are as follows:

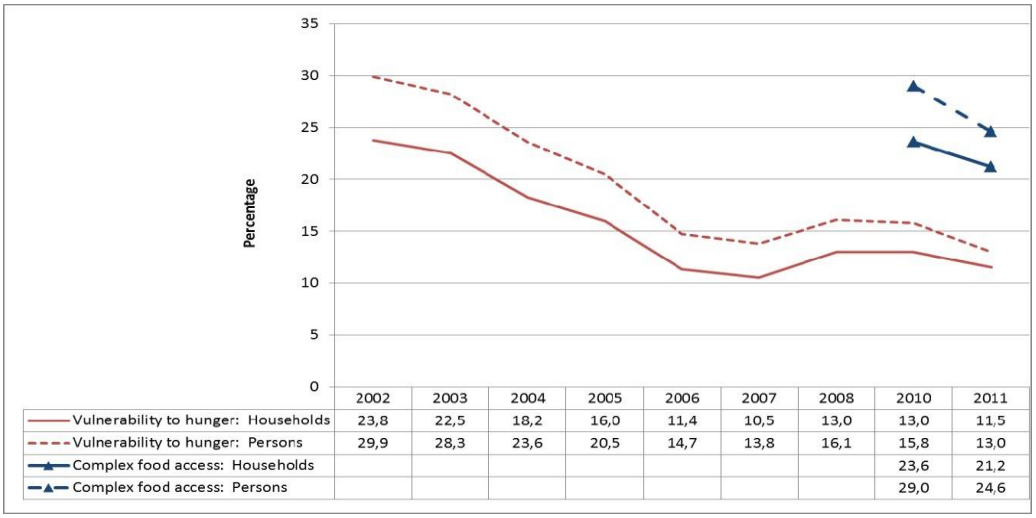
- Agricultural development and land reform. Maximising the involvement of the agricultural sector to economic empowerment of groups at risk, and triumphant agricultural settlement as part of the land reform and redistribution programme.
- Food trade. Encouraging food trade as a means of maintaining regional and national food security in spite of rising demand for food in an aggressive global market.
- Income enhancement and diversification. Improving the incomes and income generating capability of groups at risk in urban and rural areas.
- Social security and welfare services. Warranting valuable and specific access by qualifying individuals to social security, welfare services and specified benefits.
- Disaster mitigation. Preserve and provide income throughout times of stress caused by national disasters.
- Food consumption and nutrition. To encourage South Africans to consume safe and nourishing food daily (Makhura, 1998).

Altman, Hart and Jacobs (2009) reveal that in South Africa there is no regularised accepted means for measuring food insecurity, owing to the fact that food insecurity/security is multi-dimensional in nature and vicissitudes over time, which resultantly makes it challenging for

policy makers to address it adequately as there is no amalgamated measure that allows for the setting or monitoring of food security goals. Labadarios *et al*. (2011) reveal that between 1999 and 2008 the pervasiveness of food insecurity has decreased from 52.3% to 25.9%.

Altman *et al*. (2009) reveal that there is limited confidence about the food security status of South Africans, as research has not yet been able to determine conclusively the base line estimate, which is a major delinquent as access to sufficient amounts of nutritious food is a basic human necessity especially for human development.

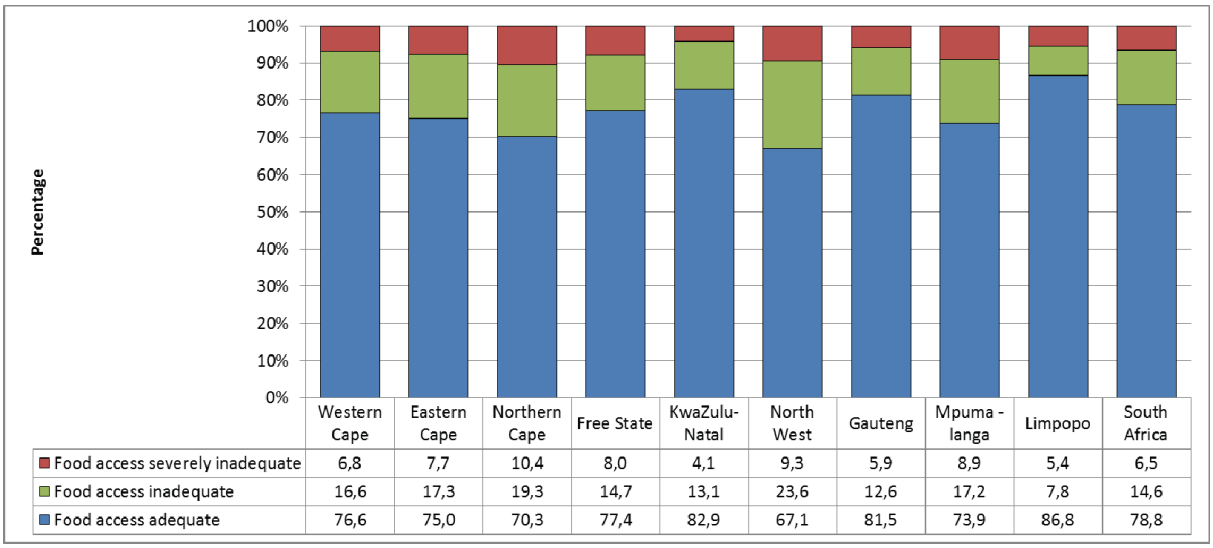
Figure 1.1 illustrates that the results of the General Household Survey (GHS) (Statistics South Africa, 2011) revealed that 11.5% of South African households were vulnerable to hunger and that 21.2% of households had complex food access (limited access to food) in 2011 which has declined from 2010.



	2002	2003	2004	2005	2006	2007	2008	2010	2011
Vulnerability to hunger: Households	23,8	22,5	18,2	16,0	11,4	10,5	13,0	13,0	11,5
Vulnerability to hunger: Persons	29,9	28,3	23,6	20,5	14,7	13,8	16,1	15,8	13,0
Complex food access: Households								23,6	21,2
Complex food access: Persons								29,0	24,6

Figure 1.1 Vulnerability to hunger and access to food (Statistics South Africa, 2011).

A study conducted by Labadarios *et al*. (2011) reveals that South Africa is inundated by poverty and unemployment as a consequence to the global economic crisis, sharp food and fuel prices, heightened electricity tariffs and cumulative interest rates which has attributed to 14.6% of South Africans having inadequate food access and 6.5% of South Africans having severely inadequate access to food which is illustrated in Figure 1.2.



	Western Cape	Eastern Cape	Northern Cape	Free State	KwaZulu-Natal	North West	Gauteng	Mpuma - langa	Limpopo	South Africa
Food access severely inadequate	6,8	7,7	10,4	8,0	4,1	9,3	5,9	8,9	5,4	6,5
Food access inadequate	16,6	17,3	19,3	14,7	13,1	23,6	12,6	17,2	7,8	14,6
Food access adequate	76,6	75,0	70,3	77,4	82,9	67,1	81,5	73,9	86,8	78,8

Figure 1.2 Percentage of households with food adequacy/inadequacy by province (GHS, 2011).

Figure 1.2 establishes that 82.9% of people living in KwaZulu-Natal have sufficient access to food, 13.1% having inadequate access to food and 4.1% of people living in KwaZulu- Natal have severely inadequate access to food. This is of particular interest seeing that the community that is being researched resides in The Valley of a Thousand Hills, which is in KwaZulu-Natal. Figure 1.3 illustrates where in KZN the Valley of a Thousand Hills lies.

Figure 1.3: Map illustrating Valley of a Thousand Hills (African Invitation, 2010).

"The Valley of a thousand Hills is named after the many hills, cliffs and valleys which rise up from the banks of the Umgeni River as it flows from the distant Drakensberg mountains to the Indian Ocean. The valley has been home to the Zulu people for centuries, with many continuing to practice and live their unique traditional lifestyle. Many local Zulu people have maintained a traditional lifestyle in the Umgeni and Shongweni Valleys, giving the area a powerful sense of history and identity" (Durban Tourism, 2012). A clear picture of the traditional livelihoods of the locals is depicted in Figure 1.4.

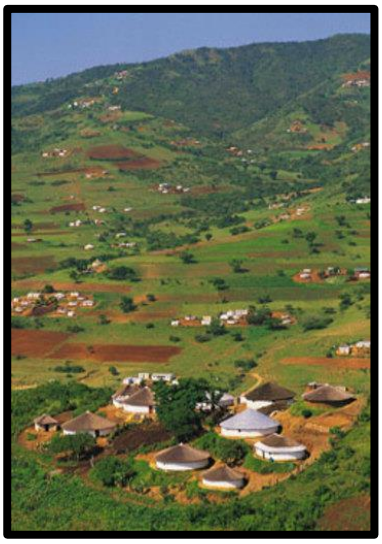


Figure 1.4: Image of houses in a valley of a thousand hills (SA Venues).

Numerous food security studies have been conducted in South Africa over the last decade, some of which are listed in Table 1.1.

Table 1.1 Food security research conducted in South Africa between 2003 and 2013.

Author and reference	Study population	Measuring instruments	Summarized results
Rose, D. and Charlton, K.E. 2002.Quantitative indicators from food expenditure survey can be used to target the food insecure in South Africa. The Journal of Nutrition 132: 3235-3242.	30 000 households, Nationally	Income and Expenditure survey, Food poverty measure and low energy availability measure.	The various analyses demonstrated that households that were food insecure with all measures predisposed to reside in rural areas, have reduced incomes or large household sizes, and be headed by Africans. These results suggest that food poverty and low energy availability are valid and reliable precursors for analyzing food insecurity in South Africa

Clover, J. 2003. Food security in sub-Saharan Africa. *African Security Studies*, *12*(1), 5-15.	N/A	Analysis of existing data from other researchers	840 million people globally are malnourished, with the majority being in Africa. Food security continues to prevail as a consequence to inadequate analysis and actions. Africa struggles to address food security owing to its complexity

			and interrelatedness with economic, social and political factors which is compounded by issues with accessibility, affordability and access.
Oldewage-Theron, W. H., Dicks, E. G., & Napier, C. E. 2006. Poverty, household food insecurity and nutrition: coping strategies in an informal settlement in the Vaal Triangle, South Africa. Public Health, 120(9), 795-804.	357 randomly selected caregivers and 149 children aged 9–13 years old	Socio demographic questionnaire, 24 hour recall, quantified food frequency questionnaire (QFFQ) and Cornell hunger scale	Majority of caregivers had an income of <R500 per month, majority indicated a frequent shortage of money- of which 58.3% spent less than R100 per week on food. The coping strategies used included: restricting the variety of foods served, restricting portion sizes, skipping of meals and maternal buffering.
Coates, J., Frongillo, E.A., Roger, B.L., Webb, P., Wilde, P.E. and Houser, R. 2006. Commonalities in the experiences of household food insecurity across cultures: what are measures missing? The Journal of Nutrition136 (5): 1438S-1448S.	HFSSM-11 cross country cultures, ethnography-11 cross country cultures	Household food security survey measures (HFSSM), ethnography grounded scale	Inadequate food quantity, inferior food quality, and anxiety about food were a significant part of the food insecurity experienced by the various cultures; worries about social unacceptability prevailed in all ethnographic accounts.
Webb, P., Coates, J., Frongillo, E.A, Rogers, B.L., Swindale,A.and Bilinsky, P. 2006. Measuring household food insecurity: why it's so important and yet sodifficult to do. The Journal of Nutrition 136(5): 1404S-1408S	N/A	Analysis of existing data by other researchers.	Food insecurity is a daily reality for many around the globe. Three indicators can be used to measure food insecurity. *1*) Measuring "inadequate access"; *2*) a shift from a focus on objective to subjective measures; and *3*) a growing importance on fundamental measurement as opposed to dependence on distal, alternative measures.
Gentilini, U. and Webb, P. 2008. How are we doing on poverty and hunger reduction? A new measure of country performance. Food Policy 33: 521-532.		Human development index, Poverty and hunger index (PHI)	Poverty and hunger are interrelated yet need to be individually monitored. The PHI allows for countries to monitor their progress towards achieving the millennium development goals.
Altman, M., Hart, T. and Jacobs, P. 2009. Food security in South Africa. *Pretoria: HSRC*.	National data was used.	South Africa income and expenditure survey. South Africa labour Force Survey. National surveys of food consumption, incomes and poverty. South Africa general household survey.	There is uncertainty about the food security status of households in South Africa. Food insecurity can be chronic or transitory, and at varying intensities. Rural households spend more on food than urban dwellers. Household production does not necessarily equate to enhanced food security. There is a lack of knowledge about the gendered dimensions of food security. Food security policy strategies are often generic. HIV

			and AIDS impact negatively with food security.
Labadarios, D., Davids, Y. and Mchiza, Z. 2009. The assessment of food insecurity in South Africa. Unpublished paper, Centre for Poverty, Employment and Growth, Pretoria: Human Sciences Research Council	NFCS-2 894 children (1-9); SASAS- 3 500 adults; FIVIMS-499 households; GHS-29 311 households; IES- 22 617 households; LFS-3080 households; community and HIV-10 584 households.	The National Food Consumption Surveys (NFCS), Food Insecurity and Vulnerability Information Management System (FIVIMS; regional study), General Household Survey (GHS), Income and Expenditure Survey (IES), Labour Force Survey (LFS), Community Surveys and the national HIV/AIDS Surveys.	High unemployment rate as a result of inadequate job opportunities available. Income and expenditure affects one's ability to procure food. There is a large percentile of individuals who experience hunger. There have been enhancements in quality of live as a result of improved basic services. There is a need for national representative survey that measures food insecurity, income and health.
Aliber, M. 2009. Exploring Statistics South Africa's national household surveys as sources of information about food security and subsistence agriculture .Pretoria: Human Sciences Research Council	IES- 22 617 households; GHS-29 311 households, LFS-3080 households.	Food expenditure share, Hunger scale proxy, General household Survey (GHS), Labour Force Survey.	These surveys do not reveal sufficient data regarding household food security. There has been a reduction in the prevalence of hunger during the period 2002–2007, and substantially lower food expenditure per annum in rural areas, signifying a greater extent of 'self-provisioning than is frequently believed.
Labadarios, D., Mchiza, Z., Steyn, N.P., Gericke, G., Maunder, E.M.W., Davids, Y.D., & Parker, W. 2011. Food security in South Africa: a review of national surveys. Bulletin World Health Organization 89:891–899	2894 households NFCS 1999; 2469 households NFCS 2005; 3500 households SASAS 2008; 1500 children aged 1-9.	1999 National Food Consumption Survey (NFCS), the 2005 National Food Consumption Survey Fortification Baseline – I (NFCS: FB-I), and the 2008 South African Social Attitudes Survey (SASAS) were included.	These surveys revealed a large decline in food insecurity between 1999 and 2008. In poorer households women coped with food insecurity by either feeding their children a poor diet or skipping meals so that their children could have adequate consumption. The 1999 NFCS illustrated that food secure households consumed an average of 16 different food items in 24 hours, however poorer households consumed less than 8 different food items. The NFCS showed that stunting in children declined from 1999 to 2005. The South African government needs to initiate systems to improve the disappointingly high level of food insecurity in poorer households.

1.5 RATIONALE & JUSTIFICATION

Evans (2009) reveals that human doings are altering civilization at a faster pace than ever before. An increasing population results in an increasing demand for energy which is catalyzing a change in both the local and global climate at a rate that is virtually unbelievable

to mankind. As quoted by Evans (2009) “a ‘perfect storm’ of factors have now combined to make food security one of the preeminent challenges facing humankind.”

The United Nations (UN) Population Division has projected that the global population will peak at 9.3 billion by the year 2050 and that Africa’s population will grow from 856 million in 2010 to 3.3 billion (Null, 2011) which directly catalyzes an increased demand for food (Bremner, 2013).

Population growth affects the future food security, sustainable food security and pliability to climate change (Mogelgaard, 2012). Climate change is associated with an elevated percentage of people at risk of developing hunger and is projected to increase the percentage of undernourished people by 5-26% by 2080 (Schimdhuber & Tubiello, 2007; Fischer, Shah & Van Velthuizen, 2002).

Presently 25% of all people in Sub-Saharan Africa do not have sufficient amounts of food to live a healthy active life, as a consequence of high food prices and drought (Bremner, 2013). South Africa presents an exceptional situation whereby food is in abundance yet widespread food insecurity prevails, which is likely to continue over the next decade owing to the lifestyle standards inequalities that exist in addition to the poverty and unemployment experienced in the country (Vella, 2012).

South Africa is experiencing high rates of urbanisation which poses a food insecurity threat to the urban areas, owing to strain on resources and infrastructure in addition to which South Africa also has to be the powerhouse and centre for Economic growth in Africa which will require South Africa to feed refugees/ immigrants and be a principal source for outgoing food aid that exacerbates the situation further (Vella, 2012).

The food security predicament has recently been aggravated further by numerous factors that coerce the cost of food including the increased cost of domestic electricity supply as well as the rising oil prices. Altman *et al.* (2009) also suggest that these increased prices will in turn affect fertilizer supply owing to the fact that petroleum is an input for chemical fertilizers and agro-food transport costs.

The FAO (2009) as well as Heady and Fan (2008) and Evans (2009) agree that food prices will continue to increase over the next decade, these rising food prices, especially of those products which are considered to be the staple foods for poor South Africans present severe problems to the poor. Raised food prices will result in poor people spending a greater

percentage of the income on food. This situation will present huge implications for their diets and wellness as the diets will become less varied, the quality will most likely be inferior, and the average calories consumed will reduce. According to the FAO (2009), those that are most vulnerable are the poor, both urban and rural, the landless and female run households.

The Human Sciences Research Council (HSRC) (2007) suggests that South Africa encounters household food insecurity in selected households with the primary causes being chronic poverty and unemployment. Other dilemmas that South Africa faces are that there are no specific measures of food security and currently there are no measures put into place to regularise the monitoring of food security.

The only solution to the food insecurity predicament is sustainable and feasible growth and structural changes. It is important to realize that many South Africans are starving and need to eat today, and cannot wait for tomorrow. Altman *et al*. (2009) imply that the countries future for growth and development needs to be based on human development whose foundations rest on accessibility to nutritious food and clean water.

The findings from this study will assist in formulating practical recommendations for a sustainable consistent intervention strategy to improve the food security and nutritional status of this group

1.6 RESEARCH AIM

The research aim of this cross sectional, descriptive study was to conduct an analysis of the food security and corresponding nutritional status, in addition to analysing the coping strategies used, of the community members from The Valley of a Thousand Hills in KZN..

1.6.1 Specific Research Objectives

The purpose of this study was to evaluate the food security and nutritional status, and to analyze the coping strategies used by The Valley of a Thousand Hills community members, for the compilation of recommendations in order to improve the food security and nutritional status. The specific objectives of the study were to:

- Determine and describe the socio-demographic profile of the community members by means of a socio-demographic questionnaire.
- Determine and describe the dietary intake patterns of the community members by means of three 24-Hour Food Recall conducted on one weekend day and two week

days Establish the food diversity score of the community members by administrating the Food Frequency questionnaire.

- Determine and describe the coping strategies used by the community members by conducting a Focus Group discussion and thereafter administrating the coping strategies questionnaire.
- Establish the nutritional status of the community members by the use of the anthropometric measurements.
- Determine and describe the level of food security/insecurity and suggest recommendations to implement sustainable solutions to improve the food security and nutritional status of the community members.

1.6.2 Research plan

The framework of the research study is illustrated in Figure 1.5 and was developed by the researcher under the supervision of Prof. C. Napier.

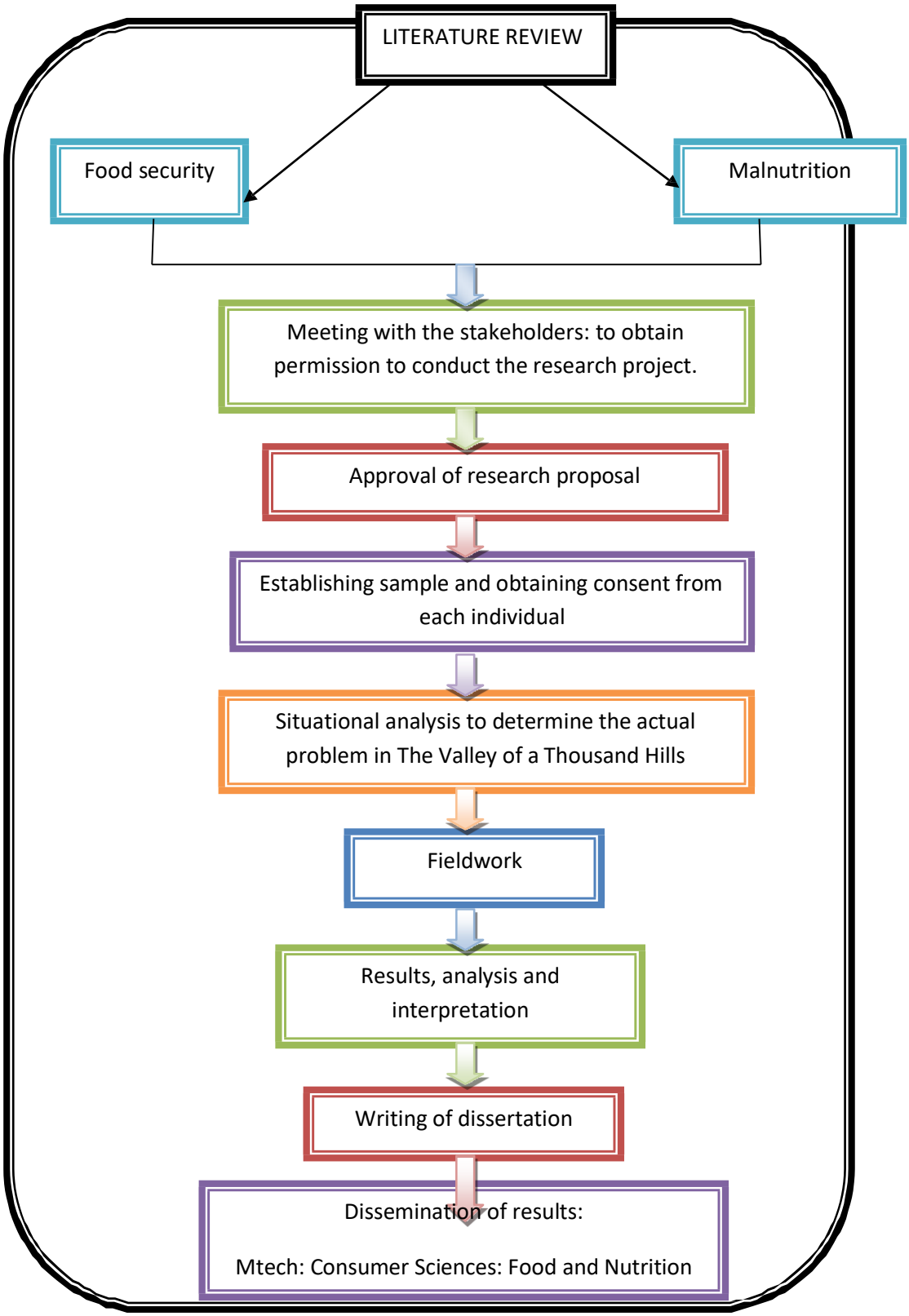


Figure 1.5: Framework of the research.

1.7 STRUCTURE OF THE DISSERTATION

An overview of the dissertation is illustrated in Figure 1.6, which represents a summary for each chapter conducted by the researcher under the supervision of Prof. C. Napier.

Figure 1.6: Dissertation overview.

1.8 CONCLUSION

The research consists of a theoretical structure and a descriptive study. The dissertation consists of five chapters that are illustrated in Figure 1.6. The structure of the dissertation outlines the contents of each chapter, namely: Chapter 1- The problem and it's setting, Chapter 2- Literature review, Chapter 3- Methodology, Chapter 4- Results and discussion and Chapter 5- Conclusion and recommendations.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

Although South Africa is deemed to be food secure in terms of food availability, many households nationally are exposed to short term or medium to long term food insecurity (Barrett, 2010).

A study conducted by Faber, Witten and Drimie (2011) indicates that recent studies have found that both adult and child malnutrition rates have depreciated in South Africa. The exacerbating factors for the depreciated malnutrition rates include, but are not limited to: poor dietary intake, food insecurity, illness/disease including HIV/AIDS and poor quality of basic services which is saddling an already strained health system. Misselhorn (2005) affirms this and proclaims that food crises together with persistent food shortages result in compromised well-being, hunger and malnutrition which challenges governmental and non-governmental institutions and policy makers to develop strategies to reduce poverty, reduce the prevalence of malnutrition and attempt to enhance food security.

South Africa is devoted to the Millennium Development Goals (MDG) of eradicating hunger and poverty and has set a goal of reducing poverty by 50% from 2004- 2014 (Jacobs, 2009). Food insecurity founds a global crisis hence the reason for promulgating eradicating poverty and hunger as being the first MDG (Labadarios *et al*., 2011). Accomplishing food security is a perilous component for eradicating hunger and poverty (Altman, Hart & Jacobs, 2009). In order to achieve this, Government has established an Integrated Food Security Strategy (IFSS) with the primary focus on exterminating hunger and nutrition discrepancies among low income households, which was subsequently integrated into the Integrated Food Security and Nutrition programme (IFSNP) (De Schutter, 2012). The IFSS endorses improved household food production, trade and distribution, however, their policies have not considered social identities and the impact of gender inequalities in food production, dissemination and admittance (Altman *et al*., 2009). Labadarios *et al*. (2011) expounds that the IFSNP policies have directed food fortification, food supplementation, school feeding schemes and day care centre schemes.

According to De Schutter (2012), strategies that the Government has implemented include the IFSS 2002 (which aims to ensure sustainable access to nutritious foods at all times, and focuses on escalating household production and informal trading, job creation, superior nutrition and safe foods and ever-increasing food emergency managements systems), the Zero Hunger programme 2009 (which aims to enhance food production and trade through

small scale framing and aquaculture), Together Doing More and Better (2009-2014) whose aim is to halve unemployment and poverty by 2014 (by means of economic growth, sustainable income, improved infrastructure, food security, land access, rural development, improved education and health care, fight against crime and corruption, feasible research management), the food security policy (which addresses food availability, accessibility, utilization and affordability).

The National School Nutrition Programme (NSNP) is geared to enhancing an improved quality education by augmenting children's learning capability; relieving short term hunger, motivating children to attend school and to be punctual, in addition to addressing certain micro nutrient deficiencies (Labadarios *et al*., 2011).

The right to food is defined as the right to a suitable diet that can provide sound nutrition to enable individuals to live a healthy, active life and encompasses the means to food access (De Schutter, 2011). The National Food Security (Right to Food Guidelines) urges the state to guarantee that changes to availability and accessibility to the food supply does not compromise dietary composition, intake, diversity and healthy eating. The right to food will tackle with the association between health and malnutrition and clarifies that malnutrition encompasses undernutrition, micronutrient deficiency and overnutrition. De Schutter (2011) also suggests that all existing food systems have not adequately alleviated the prevalence of hunger, and in some instance have promoted diets that promulgated obesity.

Figure 2.1 is a framework that was developed (Misselhorn, 2005) to illustrate the strategic theoretical elements and outcomes of food security whereby six categories of catalysts (drivers) of food insecurity were identified including: economic, socio-political; cultural and religious; scientific and technological; physical, biological and chemical and demographic. Catalysts either react over short term or long term or may directly or indirectly initiate other catalysts for food insecurity. Food insecurity is as a result of insufficient access to food or owing to not being able to produce enough own food resources for personal consumption (Misselhorn, 2005). This theoretical framework will be used to guide the literature review.

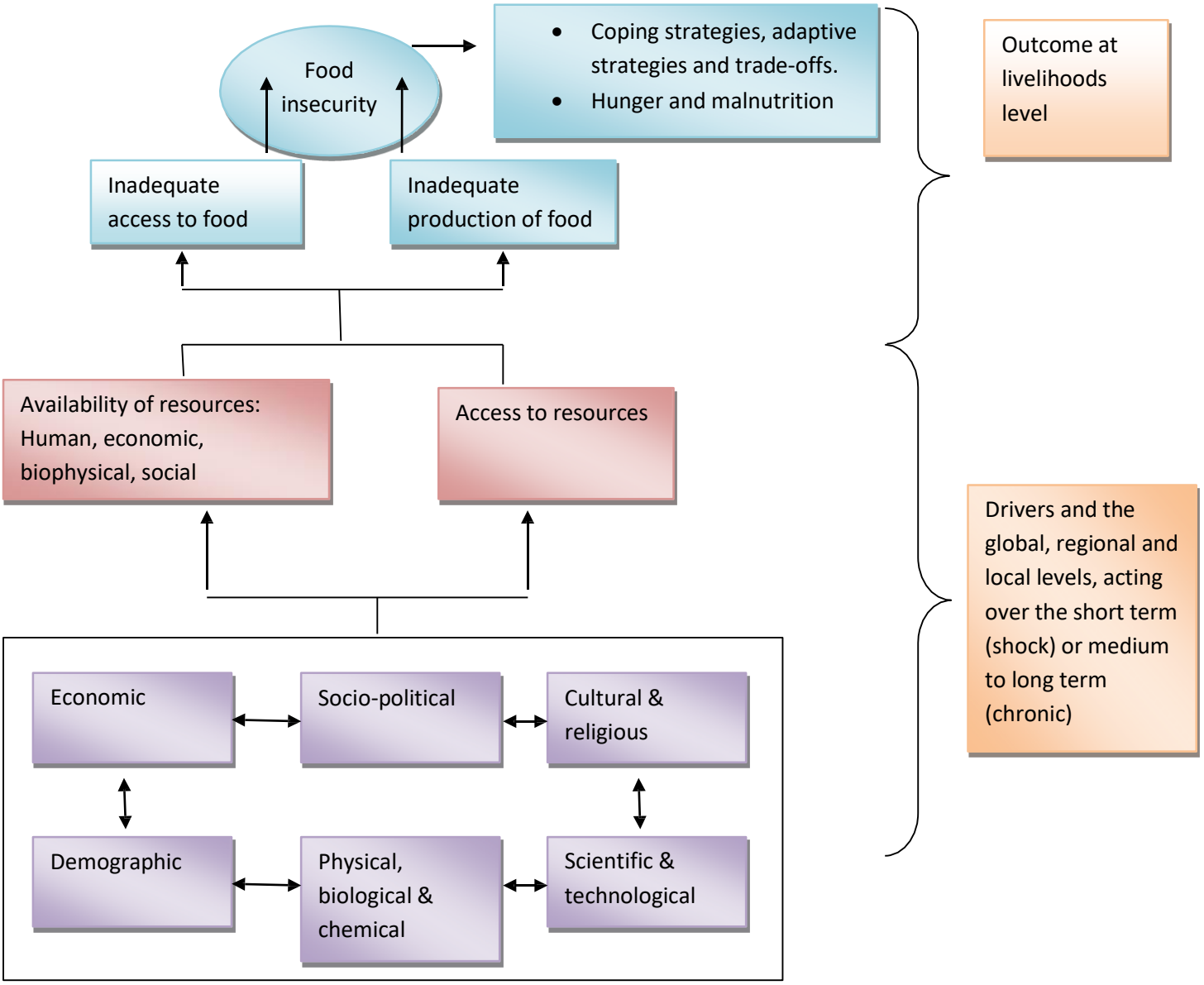


Figure 2.1 Theoretical frameworks of the processes motivating food insecurity and the resultant outcomes for people at the living level. (Misselhorn, 2005)

2.2 FOOD INSECURITY

2.2.1 Definition of food security

Food security is "a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious foods that meets their dietary needs and food preferences for a healthy life" (World Summit on Food Security, 2009; Faber *et al.* 2011.; Barrett, 2010 and the South African Department of Agriculture, 2002). Maxwell, Ahiadeke, Levin, Armar-Klemesu, Zakaiah and Lamptey (1999) suggest that to understand food security, the following elements need to be investigated including physiological needs, trade-offs between foods and basic supplies, deviations over time and should mirror uncertainty and risk. Food security encompasses economics, sociology, policy and politics which researches the

catalysts for food availability and affordability. It also encompasses agricultural aspects including restricted food production, poor soil, reduced rainfall, be deficient in quality seeds, prevalence of pests and diseases (Laing, 2011). Food security addresses social protection, income sources, rural and urban development, household structure, wellness, land access, water and inputs, retail markets, education, nutritional knowledge, livelihood patterns, structural dynamics and asset accumulation (Altman *et al.,* 2009).

Food security is related to access of foodstuffs; with the attributing peril factors including urbanisation, income inequality, overcrowding, ecosystem deterioration, animal health and food wholesomeness. For a food security system to be all encompassing it needs to address both elements of food defence and food wholesomeness (Havas & Salmon, 2011). It also needs to consider the nutritional adequacy of the diet and needs to focus on the dietary diversity and quality of nutrients consumed (Faber *et al*., 2011). Food security is as a result of availability, access and utilization (Barrett, 2011; Kruger, Schonfeldt & Owen, 2008) and that persists when one permanently has secure access to ample amounts of food for a healthy life (Maxwell, 1996; Maxwell *et al.*, 1999; Labadarios *et al.* 2011).

A food security crisis has erupted in South Africa with numerous individuals not being able to absorb the shocks and stresses that have been exacerbated by the HIV pandemic, including loss of jobs, environmental factors, death of a bread winner, land degradation and weakened health care system (Drimie & Casale, 2009). The food security status of households is vibrant and may change radically depending on the vulnerability to the exposed risks and their ability to cope i.e.: food price hikes, global economic recession, illness and/or death of a wage earning household member, crop failures owing to environmental factors and scarcity of water (Faber *et al*., 2011)

2.2.2 Definition of food insecurity

Food insecurity may be defined as having restricted availability of nutritionally sound and safe food or the incapability of purchasing foods in communally tolerable ways (Miller, Bangsberg, Tuller, Senkungu, Kawuma, Frongillo & Wesier, 2010). Household food insecurity is as a result of chronic poverty and unemployment (Altman *et al*., 2009) in addition to households not being able to cope when livelihood systems alter or are unable to accommodate environmental shocks (Kruger *et al*., 2008). Food insecurity is a pervasive and avoidable ‘invisible epidemic’ (Hoelscher & Evans, 2012). Natural disasters such as drought, earthquakes, floods and war are linked to unadorned food insecurity, whereas severe poverty is linked to food insecurity (Barrett, 2011).

In South Africa most people procure the food they consume, nevertheless livestock and crop production still occurs in rural areas as subsistence farming (Maunder & Meaker, 2007). Approximately 800 million South Africans are food insecure and food insecurity is a foundation for malnutrition and death (Kruger *et al*., 2008). Labadarios *et al.* (2008) reveal that only 20% of all South Africans could be considered food secure. Food insecurity has been exacerbated by increase in food prices as a consequence to climate change, accelerated requirement for food items in emerging economies, agricultural production used for bio-fuels, hasty population growth and urbanisation (FAO, 2008).

Sharkey, Dean and Johnson (2011) categorize levels of food insecurity or security as "food secure" or "low food security"- which is food insecurity without hunger, and "very low food security", which is food insecurity with hunger. The United Nations (1975) suggests that food insecurity may be chronic, seasonal or transitory. Chronic food insecurity occurs on a perpetual basis and that transitory food insecurity occurs on an impermanent basis (Maxwell, 1996).

2.2.3 Food Sovereignty

Food sovereignty focuses on the right to food, self-determination, indigenous rights to terrain, and on the rights of rural individuals to produce food for local and national markets. Food sovereignty protects agriculture with farmers, fisheries with artisanal fishing communities, forestry with forest communities and steppes with nomadic pastoralists (FAO, 1998). Food sovereignty focuses on the people on the ground, needs to value food providers and food systems, is required to be localised, should bring knowledge and skill to the people and needs to work simultaneously with environmental preservation (FAO, 2008).

2.2.4 Predicting food insecurity

Food insecurity could be predicted by means of the Proportional Odds Model whereby the set of autonomous predictors is measured against the relationship between Food Consumption Scores (Lokosang *et al*., 2011). The study was conducted in the post conflict setting of Sudan and found twelve variables that could statistically define the outcome of food consumption and provide a line of reference for envisaging food insecurity, the twelve variables included state, ownership of land, use of land, planting of land, livestock ownership, ownership of vegetable gardens, main source of livelihood, main sources of cereals, wealth index quintiles, size of household head, months harvest food lasted and number of daily meals (Lokosang *et al*., 2011). The findings from this study responsible for a 5% significant interval that positively

relates to food consumption were household size, the number of months that harvest food lasted and the number of meals eaten by the household per day.

2.2.5 Consequences of food insecurity

There are several negative consequences to food insecurity and include exacerbated parenting practices, decelerated child progression, reduced educational achievement, slackened school performance, degenerated diet and nutritional status (Nanama & Frongillo, 2012). The same study also indicated that food insecurity negatively impacts on physical and emotional wellbeing owing to the lack of food, poor diet and resultant hunger which is associated with social and psychological significances (Nanama & Frongillo, 2012). There is a strong relationship in adults between food insecurity and poor mental and physical wellbeing; furthermore food insecurity cause difficulties with obesity, diabetes and cardio vascular disease (Sharkey *et al*., 2011).

Similarly Sorsdahl, Slopen, Siefert, Seedat, Stein and Williams (2011) established that food insecurity affected social and mental wellbeing by stimulating aggravation, anxiety, depression, distress, reduced serum concentration levels, poor self reported health status, poor functional health, limited activity, numerous chronic conditions, heart disease, diabetes and high blood pressure. Food insecurity was allied with anxiety, distress, malnourishment and reduced IQ in children, behavioural and emotion problems in school aged children as a result of the shame and discomforts of skipping a meal in addition to a heightened adult mortality rate as a product of substance abuse, poor mental health and restricted social support (Belsky, Moffitt, Arseneault, Melchior & Caspi, 2010).

In food insecure households, those that are most affected are women and children and the consequence of such are related to slow educational growth and stunting (Altman *et al*., 2009). Thirty eight percent of South African households experience food inadequacies and also denoted that women had a heightened chance of experiencing anxiety and mood disorders in addition to the nutritional inadequacies when experiencing food insecurity, it was also found that food insecurity is a precursor for depression and *vice versa* (Sorsdahl *et al*., 2011). The Southern African Development Community (SADC) (2006) has encountered severe food shortages since the 1990s, owing to poor climatic conditions, poor access to basic services, economic problems and inadequate governance.

In children food insecurity is linked to compromised nutritional status, reduced academic performance, diminished health related quality of life, developmental problems and higher prevalence of overweight and obesity (Sharkey *et al*., 2011). Food insecurity affects children's development, psychosocial adjustment, school performance, academic accomplishments,

cerebral functioning, cognitive capabilities, in addition to physical and psychological well being (Roustit, Hamelin, Grillo, Martin & Chauvin, 2010). Learning disabilities and other behavioural problems may exist in children resultant/influenced by depressive, anxious mothers owing to being exposed to food insecurity (Gooze, Hughes, Finkelstein & Whitaker, 2012).

Hoelscher and Evans (2012) pronounce that inadequate amounts of foods during crucial progressive phases in child development can result in shortfalls that may preserve. Children exposed to food insecurity are most at risk of psychosocial issues, stomach aches, headache, jeopardy of being hospitalized, behavioural issues, worsened developmental outcomes, chronic illness, impaired functioning, slackened mental aptitude, iron deficiency anaemia, and increased risk of obesity which may reduce life expectancy (Gunderson & Kreider, 2009).

Food security can be the solution to scholastic performance and poverty (as poverty is associated with food insecurity) and that improvements in neurodevelopment and academic performance are likely to have sustainable positive effects in the long term as this helps break the poverty cycle and decreases social health inequalities (Roustit *et al*., 2010).

2.3. NUTRITION SECURITY

Nutrition security encompasses the access to a variety of good quality and safe foods that are required for child growth and development and ensures an active and healthy life (FAO, 1997). Nutrition security in Africa can be achieved through sound governance, secure leadership and ensuring that the judicial system is an independent entity (Heidhues, Atsain, Nyangito, Padilla & Le Vallee, 2004).

2.4 HUNGER AND MALNUTRITION

Hunger and malnutrition are a consequence to food insecurity.

2.4.1 Definition of malnutrition

There is a national and international consensus with regards to the definition of malnutrition. The consensus is that the malnutrition definition and its operationalism are inadequate and insufficient. For the malnutrition definition to be all encompassing it needs to include the following elements: deficiency of energy; deficiency of protein; decrease in fat-free mass; function and inflammation; involuntary weight loss; BMI and nutritional intake (Meijers, Van Bokhurst-de Van der Schureen, Schols, Soeters & Halfens, 2010). Malnutrition is a broad term for a variety of different sub groups, namely undernutrition, overnutrition, micronutrient malnutrition, undernourishment and hunger. All of the above mentioned sub groups are attributed to and influenced by food and nutrition security/ insecurity. People are malnourished when the diet does not supply sufficient energy, protein, vitamin and minerals, preservation and health or if they are

not able to expend the food that they consume due to ill health or undernutrition in addition to ingesting too many calories or if their diet is not balanced (Kuzwayo, 2008). Stein's (2010) definition of malnutrition puts it simply, by recognising the fact that most humans understand malnutrition as being chronic hunger. FAO (2009) indicates that 1 in every 6 persons is undernourished.

Malnutrition is a state whereby adequate nutrients are not transported to bodily cells, to deliver the substrate for ideal functioning; the body requires the consumption of 45 nutrients on a daily basis in the correct quantities (Ngozi & Tola, 2010). Malnutrition consists of a joint persuasion of over and under malnutrition and inflammatory action on body composition and biological gathering. Over nutrition, more commonly termed obesity, indicates an optimistic nutrient balance and undernutrition an inadequate nutrient balance (Meijers *et al.*, 2010). Bender and Bender (ND) define malnutrition as "disturbance of form and function arising from deficiency or excess of one or more nutrients."(Bender & Bender, ND: 227).

There are three causes of malnutrition, the first being the immediate causes and include insufficient dietary intake, lack of care and disease. The second being the underlying causes that are owing to insufficient access to food, care for mothers, children and health services and an unhealthy environment. The third cause is basic causes and includes inadequate education, formal and non-formal institutions, political and ideological superstructures, economic structures and lack of potential resources (Vorster, 2010).

A study conducted by Saunders, Smith and Stroud (2010) indicates that malnutrition can be attributed to altered nutrient processing (heightened metabolic demand or liver dysfunction); inadequate intake (poor diet, reduced appetite, pain/ nausea with food, dysphagia, depression or unconsciousness); malabsorption of nutrients; and surplus depletion of nutrients as a result of vomiting, tube drainage, diarhhoea, surgical drains, fistulas or stomas. De Schutter (2012) found that 13.3% of children that resided in Kwa-Zulu Natal suffered from severe malnutrition.

2.4.2 Malnutrition throughout the life cycle

South Africa is riddled with nutritional problems, over and above the intergenerational, ferocious cycle of poverty and malnutrition, and is in desperate need for a nutrition intervention component in poverty-alleviation programmes. This malnutrition cycle can be broken by enhancing the nutritional status of women in the productive years, further to which foetal malnutrition, detained cognitive development and physical stunting in children, adolescents and adults can be prohibited (Vorster, 2010). Figure 2.2 illustrates the cyclical approach to malnutrition throughout the lifecycle.

Poverty influences nutrition during the entire life-span and in a wide-range of manifestations, including an increased tendency to many diseases, both infectious and non communicable, a diminished physical work capability, a lesser learning and intellectual aptitude, an amplified exposure and susceptibility to lifestyle-related and environmental risks, a condensed participation in social decisions, and a insignificant capacity of resolution when faced with ecological challenges (Pena & Bacallao, 2002).

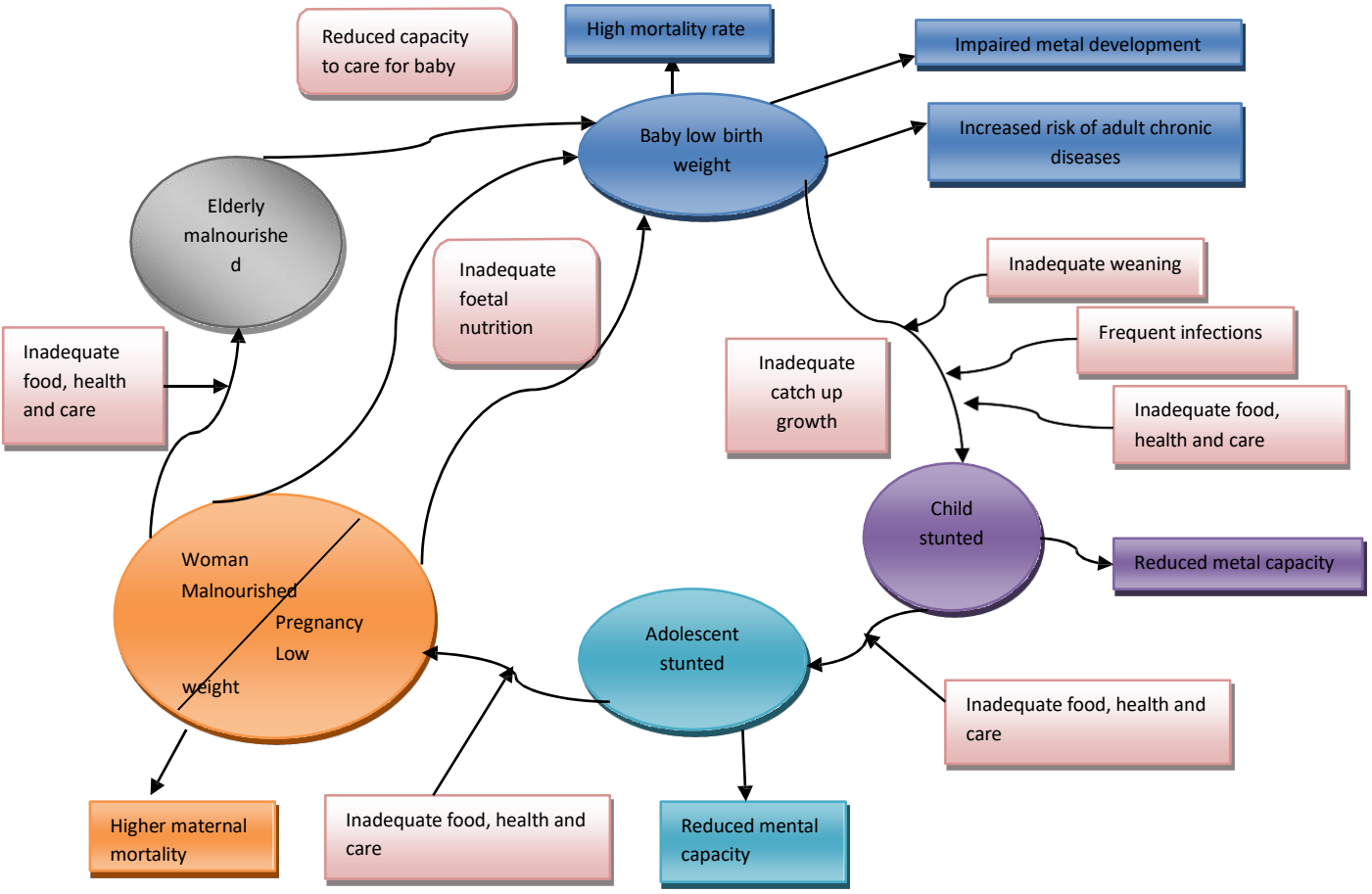


Figure 2.2: Malnutrition throughout the life cycle (IFPRI-UNSSCN, 2000)

Poor nutrition begins whilst in the womb and its unfavourable consequences become evident in early postnatal life and continue through youth into maturity in terms of heightened risk, reduced survival from disease, and reduced labour capacity (Community Nutrition Challenges of the 21st century, 2000., Paneth & Susser, 1995., Scholl, Hediger & Ances, 1990).

The consequence of inadequate nutrition in the first year normally compromises the intellectual capacity and is not evident until 2 or 3 years later at school age. Infections and

insufficient nutrients in preschool children aggravate the unfavourable effects of intrauterine growth retardation (Pena & Bacallao, 2002).

Malnourished children endure more frequent severe illnesses and have greater risks of mortality. Fifty-four percent of death of children under the age of 5 globally is ascribed to low weight for age. Most of these deaths are owing to the additional effects of mild to moderate malnutrition. Infections in the period of preschool ages are inclined to subsist or re-emerge at school ages and affect school attendance and performance (United nations (UN), 2000., Chandra, 1991., Pelletier, 1994., Pelletier, Frongillo & Habicht, 1993). Figure 2.3 illustrates the causes of malnutrition as identified by UNICEF.

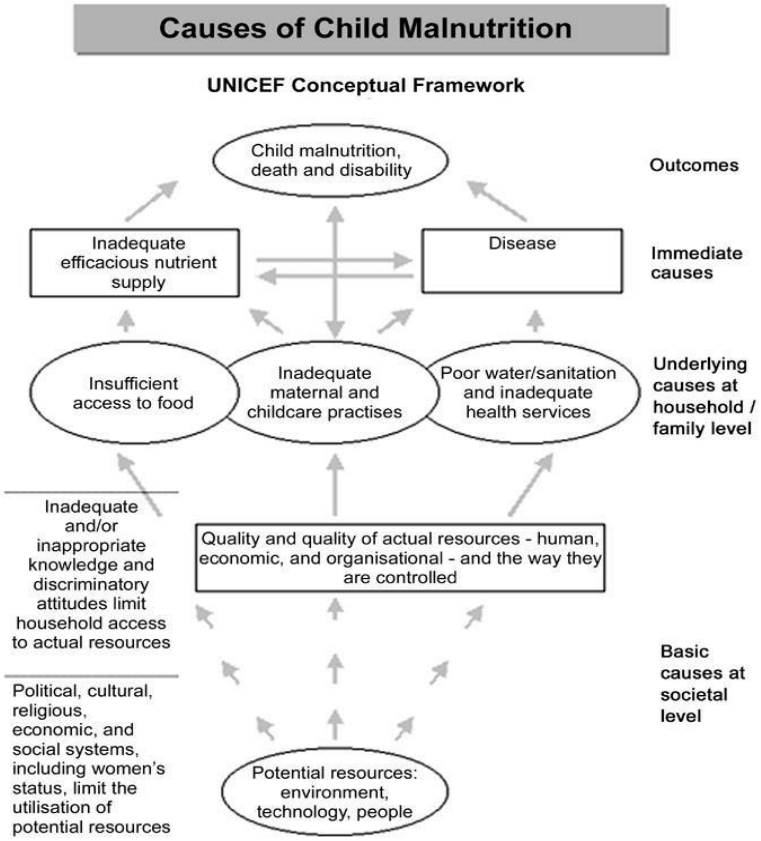


Figure 2.3: UNICEF (2006) conceptual framework; causes of childhood malnutrition

According to the World Food programme (2011), 200 million children under the age of 5 are undernourished in the developing world and severe malnutrition affects school performance, economic productivity, susceptibility to illness, and potential earning power. This has lead to an initiative to ensure the infants and mothers receive “the right food, at the right time” and are maximizing the use of fortified ready to use foods. Ivers, Cullen, Freedberg, Block, Coates and Webb (2009) identify that a common fortified ready to use therapeutic food source is a spread

of milk powder, sugar, vegetable oil, peanuts, vitamins and minerals that is not susceptible to bacterial growth and the added bonus is that it doesn't require cooking.
Adolescence is a time of rapid growth during which several physical, intellectual, and psychological changes are encountered. There is a vast increase in the nutritional demand infrequently fulfilled in the poor, whom carry the collective burden of previous deprivation and lack of access to adequate nutrition and sanitation (Pena & Bacallao, 2002).

Household wellbeing is dependable on the health, nutritional status, and the physical and intellectual capabilities of the adults. The ever-increasing observable fact of family disturbance that riddles poor countries undermines the capacity of families to survive and to guarantee basic nutritional and health requirements (UN, 1997).

Pregnancy in teenage years and protein energy malnutrition (PEM) are extra common in poorer countries and predominant in low income, low-education groups. Throughout pregnancy, poor nutrition is a widespread cause of intrauterine retarded growth and reduced birth weight (Garn, 1991). Newborns with reduced birth weight have greater risk of mortality, are more regularly affected and less defiant to communicable diseases during early postnatal life, and are candidates for potential diabetes mellitus, hypertension, and other chronic disease (Barker, 1992., Barker,1998., Godfrey & Barker, 2001).

2.4.3 The link between malnutrition and poverty

Twenty five percent of the world's poor people as defined by the new multidimensional poverty index (MPI) live in Africa and the 64.5% of the population in Sub-Saharan Africa are defined as being MPI poor (Alkire & Santos, 2010). MPI is a measure of poverty severity and mirrors scarcity in health, education, sanitation, child mortality and asset ownership which gives a more rounded approach to understanding the nature of the poverty. Annually 100 million people are forced into poverty from the inability to afford health services (De Schutter, 2011). Therefore, there is a need for improving the standard of living for South African citizens. Sixty percent of South Africans live in poverty; that the most poverty stricken houses have the largest number of children- approximately 7 million children live in 20% of the poorest households in contrast to 1.7 million children living in 20% of the richest households (De Schutter, 2011).

Poverty is associated with being the catalyst for food insecurity and hunger, captivatingly though not all poor people are food insecure or hungry (Hoelscher & Evans, 2012). According to Ziol-Guest, Duncan, Kalil and Boyce (2012), children born into low income households, would

likely remain as low income earners as adults and were associated with hypertension and arthritis.

Poverty is the utmost peril factor for obtaining and succumbing to disease, besides the fact that poverty increases ones vulnerability to communicable disease and the deficiency in medical care and treatment once infected (Alsan, Westerhaus, Herce, Nakashima & Farmer, 2011). Poverty and infectious disease are interrelated (Alsan *et al*., 2011; Faber *et al*., 2011). King and Bertino (2008) suggest that location and environment are influential factors that contribute to disease formation and the prevalence of disease.

2.4.4 The link between malnutrition and diseases

Sub-Saharan Africa has the greatest burden of diseases worldwide and the immune suppression as a product of malnutrition is comparable to immune suppression owing to HIV and AIDS (Singer, 2011). Food insecurity increases vulnerability to HIV exposure and infection, and the equally HIV and AIDS intensifies the inclination to food and nutrition insecurity (Faber *et al*., 2011). HIV/AIDS attributes to food insecurity and conversely food insecurity causes an increase in mortality for HIV/AIDS infected persons (De Schutter, 2012). Ivers *et al.* (2009) indicate that an excess of 800 million people globally are affected by undernutrition and that HIV is prevalent amongst the undernourished, it affects roughly 33 million people, which is the consequence to the heightened vulnerability to other infections which is accelerated by the inadequate nutrient and kilojoule intake which hastens malnutrition. Ivers *et al*. (2009) elicit that HIV/AIDS and malnourishment have negative reaction loops.

There is a cycle between poverty and vulnerability to infectious disease in that poor nutrition encumbers infectious disease and stifles immune response (Sawers & Stillwaggon, 2008). Poor people are more exposed to ecological risks (improper sanitation, unwholesome food, violent behaviour, and natural disasters) and less equipped to cope with them, are less educated about the benefits of healthy lifestyles, and have less access to excellent health care. These people are consequently more at risk of ill health and disability (WHO, 2000). Furthermore, there is a cyclical relationship involving poor nutrition, increased vulnerability to infectious diseases, resulting in immunological dysfunction and metabolic responses that further modify nutritional status and, wherever possible, are associated with physiological mechanisms (Keusch, 2003).

Singer (2011) explains that an asymbiotic relationship exists between disease and malnutrition, in that an inadequate diet reduces the development of antibodies, reduction in immunoglobulin levels, reduction in T cells (helper cells), reduction in lymphocytes and

interferon production levels which results in a weakened immune response to infection. Conversely when one is already infected with a disease one experiences increased macronutrient requirements in order to maintain weight and activity levels in addition to increased energy requirements by the immune system to replace immune cells to adequately tackle pathogenic invasion (Singer, 2011).

There are 3 predominant correlations between malnutrition and disease, the first being a compromised immune system capacity as a product of insufficient quality and quantity of foods, the second is particular nutrients i.e.: Vitamin C, E and selenium help alleviate the effects of oxidative stress which catalyzes a rapid destruction in the body's cells (promoting viral duplication, deteriorating cell repair, reducing immune cell propagation and contributing to loss of immune function), and thirdly, it causes damage to the immune system response (Singer, 2011). Ivers *et al*. (2009) suggests that HIV reduces metabolic functions including that of absorption, malabsorption of carbohydrates and fats, alterations in insulin and glycogen levels, storage and nutrient utilization which results in compromised immunity, nutrient deficiencies, heightened susceptibility to infectious diseases, and severe wasting which further intensifies HIV infection.

Neglected tropical diseases (NTD) are also associated with poverty; globally 1 billion out of the 2, 7 billion impecunious individuals suffer from NTDs (Alsan *et al*., 2011), which poverty stricken individuals can not afford to treat comprehensively (King & Bertino, 2008). NTDs are defined as neglected chronic infections that are transmitted through poverty, that persist for long periods of time and encompass helminthiases, protozoa, bacterial and fungal infections, which are common in disadvantaged communities in the developing world and conversely are rare amongst affluent communities in the developed world (King & Bertino, 2008).

The side effects of NTDs include undernutrition, fatigue, diarrhoea, abdominal pain and intolerance to exercise which is associated with diminished physical function, reduced productivity, reduced wage earning capability, reduced stamina and lastly, they exacerbate birth outcomes which results in individuals being entrapped in poverty (King & Bertino, 2008).

2.4.5 Consequences of malnutrition

Consequences of macronutrient malnutrition include (but are not limited to) inferior immune response, stunting, lagging mental development and emaciation (Havas & Salmon, 2011) and can be detrimental in that it can affect the utility and retrieval of every organ system (Saunders, *et al.* 2010). The organ systems that are commonly affected by malnutrition include muscle and bone; cardiovascular and respiratory systems; gastrointestinal function; immunity and tissue

repair systems; endocrine functions; psychological and reductive adaptation (Saunders *et al*., 2010).

Malnutrition is usually the most evident in weight loss, and this is owing to a diminution of fat, muscle and organ mass. It is also important to note that muscle function usually degrades prior to changes in mass occurring. People most at risk of suffering bone and muscle issues, are those whose diets are low in calcium, magnesium and vitamin D (Saunders *et al*., 2010).

Micronutrient deficiencies in iron, zinc and iodine are renowned for having a negative impact on public health (Stein, 2010; Horton, Alderman & Rivera, 2008). Deficiencies in calcium and selenium also cause health problems, but not as severe as those by iron, zinc and iodine deficiencies (Stein, 2010; Black *et al.,* 2008). Deficiencies in magnesium and copper prevail in common health problems (Stein, 2010; White & Broadley, 2009).

Cardiac and respiratory function is also impacted as a result of malnutrition; this is owing to a depletion of cardiac muscle mass as a result of PEM (Webb, Kiess & Chan-Yan, 1986). Saunders *et al.* (2010) suggests that a diminished cardiac output has parallel influence on renal function in that it decreases renal perfusion and glomerular filtration rate. It is important to realize that micronutrient deficiencies (especially B vitamins) and a diet deficient in electrolytes may also influence cardiac function.

A nutritious diet and proper nourishment is vital for maintaining gastrointestinal function. Severe malnutrition can result in changes and impacts on public health in pancreatic function, intestinal blood flow and intestinal absorbency; with the consequences being diarrhoea and loss of digestive enzymes. It is also imperative to remember that diarrhoea can result in fatalities in severely malnourished individuals (Saunders *et al*., 2010; Pimparkar, Donde, Ambegaontar & Bharucha, 1977).

Individuals who are malnourished also suffer from stifled immune function and hindered healing of wounds in addition to affecting the antibody response and impaired cell mediated immunity (Britannica Encyclopaedia, ND). The endocrine system is also affected by malnourishment including the reduction in hormones levels; insulin secretion decreases yet insulin sensitivity increases; T4 and T3 are diminished; and lastly if iodine deficiencies prevail, thyroid stimulating hormones may also be affected (Saunders *et al*., 2010).

The detrimental consequences of malnutrition can also influence the psyche of individuals in that they may catalyse lethargy, melancholy, apprehension and mistreatment of oneself (Saunders *et al.*, 2010).

Another detrimental consequence of malnutrition is the body's ability to draw on its functional tissue reserves stored in one's muscles, as well as that of adipose tissue and bone at times of severe starvation, all of which contribute to severe wasting (Saunders *et al*., 2010).

2.4.6 Prevalence of malnutrition in SA

"Hunger, malnutrition, diseases and rural poverty are some of the current challenges facing previously disadvantaged populations in South Africa" (Pauw, 2005). In South Asia and parts of Southern and East Africa the rate of undernutrition has decreased whilst the number of undernourished has increased and this is as a result of population growth (Barrett, 2011).

One of the primary factors that contribute to malnutrition in South Africa is due to vitamin and micronutrient deficiencies, more commonly termed as "hidden hunger" (Lewu & Mavengahama, 2010; Stein, 2010; Stein & Qaim, 2007). Rural areas are the worst affected by hidden hunger although the land is fruitful with highly nutritious wild vegetables which should provide both micro and macro nutrients alike (Lewu and Mavengahama , 2010); the use of wild vegetables in rural dwellings has decreased which could account for the increase in frequencies of nutritional deficiencies.

South Africa is a multicultural, multinational country in which a large percentage of its occupants are in transit from traditional rural lifestyles to urban, modern, westernised lifestyles. The transitions between lifestyles also requires a nutrient transit as diets are diversified, eating patterns alter, physical activity levels change, alcoholic beverage intakes vary, and socio-economic and educational status diverge (Vorster, 2010). Nutrition transition refers to the change in dietary habits and consumption of nutrients by individuals, families, communities and entire populations when their food environments and other circumstances diversify. A nutrition transition is usually convoyed with demographic transition and epidemiological transition which usually result in chronic diseases of lifestyle (Vorster & Bourne, 2008). The stimulants for a nutrition transition include urbanisation, modernisation and acculturation and as a result of the globalisation and supermarketization of the South African food systems/food chain which has switched from foods high in carbohydrates and fibre to those high in fats and sugars and has resulted in a disease pattern transition from nutrient deficiency diseases to coronary heart disease, diabetes, cancer and obesity (De Schutter, 2011; Vorster, 2010). Faber *et al.* (2011) suggest that as a result of this nutrition transition people are consuming energy dense processed

foods, which are cheap and accessible and have lead to the high levels of undernourishment, chronic disease and obesity. Diets rich in sugars, oils and fats are cheaper than a healthy diet rich in fruits and vegetables which results in poor people consuming foods in a manner that is not beneficial to their health (De Schutter, 2011).

People that have sedentary lifestyles and that consume diets rich in salt and alcohol may suffer from high blood pressure which heightens the risk of strokes, heart diseases and kidney failure and those that consume diets high in saturated fats increase cholesterol levels which can catalyse cardiovascular diseases and are accountable for 2.6 million deaths annually (De Schutter, 2011).

Vorster (2010) also emphasises that all these lifestyle and nutrient transitions are inter-connected and can account for the differences and changes in nutritional and health status of both the rural and urban occupants alike. According to De Schutter (2011), a solution to the nutrition transition could be the introduction of food taxes as a penalty for high fat, high sugar foods in order to subsidize access to fruits and vegetables. Such an example would be to introduce a 10% tax on soft drinks which would result in 10% reduction in purchases, which further exacerbates the poor as unhealthy foods are cheaper than healthier alternatives.

Presently the economic crisis has worsened the malnutrition situation as the price of food has increased without income increasing proportionately, and the poor people begin to starve (Vorster, 2010).

A study conducted by Lewu and Mavengahama. (2010) emphasizes the importance of utilizing wild vegetables to help alleviate the micronutrient malnutrition prevalence amongst low or marginal income brackets of the population. The benefits of using wild vegetables includes that they are locally available, inexpensive, rich in nutrients, can be used to prepare sauces, assist in providing food security and aid in the management of nutrition related illnesses. De Schutter (2011) indicates that unhealthy diets increase the risk for cancers (breast, colon, prostate and others) and diets lacking in fruit and vegetables heighten the risk for cardiovascular disease and gastrointestinal cancers.

The report written by Chopra, Whitten and Drimmie (2009) which is based on the working paper that is published by the Global Alliance for Improved Nutrition (GAIN) summarizes the steps that have been taken by South Africa to reduce the prevalence of malnutrition. The report also reveals why the progress has been slow and offers some solutions to combat the identified issues.

The results from the report written by Chopra *et al.* (2009) show that malnutrition is still rife despite the efforts and progress made by the national nutrition and primary health care programmes. The GAIN report (2009) reveals that 18% of children nationally are stunted, 9% are underweight, 10% are overweight and 4% are classified as obese. Sixty percent were deficient in Vitamin A of which 25% were women. Thirty percent of the women and children that were analysed were anaemic and nearly 50% of the children nationally were deficient in zinc. Chopra *et al*. (2009) emphasize that there is a reduction in the percentage of lactating mothers who exclusively breastfeed their babies which consequently negatively impacts their nutritional status.

People living with diseases especially HIV and AIDS, are more in danger of being exposed to hunger. Chopra *et al.* (2009) reveal that the current national malnutrition status is interconnected with poverty and food insecurity which resultantly presents numerous challenges to the economic development of South Africa. Malnutrition encourages public, private and civil societies to engage and allocate investments to help alleviate or reduce the incidence of malnutrition.

Chopra *et al.* (2009) indicate that to combat the national malnutrition problem in South Africa a multidisciplinary approach needs to be adopted whereby the following focus areas need to be targeted: improvement of breastfeeding practices and/or feeding practices; reinforce micronutrient deficiency management programmes; incorporation or implementation of government malnutrition relief efforts; enhanced nutrition observation and to strengthen appropriate conglomerates.

The most vital area that needs to be reviewed and revised is the National Integrated Nutrition policy, so that it can place greater emphasis on infant feeding and to encourage healthier lifestyles for adults (Chopra *et al*., 2009). Once the policy has been revised the government needs to provide sufficient resources i.e.: funding, training and support. In order for it to be sustainable it needs to encourage greater involvement by the public and private sectors. The policy needs to encourage manufacturers to contribute to alleviating malnutrition by fortifying foods, and improving quality as well as quality monitoring processes for items produced (Chopra *et al*., 2009).

The double burden of malnutrition is as a result of high incidence of under and over nutrition in countries (Moore, Hall, Harper & Lynch, 2010).

2.4.7 Definition of undernutrition

"No single-case definition of undernutrition is appropriate for all purposes" (Peterson & Chen, 1990). Undernutrition can be defined as the consequence to insufficient dietary intake and/or recurring infectious diseases (Kuzwayo, 2008). There are various contributing factors to undernutrition including food, health and caring practices (Kruger, Hendricks & Puoane, 2008) with the basic cause of undernutrition being poverty (Ramakrishan & Huffman, 2001). Ngozi and Tola (2010) state that undernutrition is due to starvation, bodily dispossession or lack of nutrients which could be concealed by insufficiency, food shortage and warfare. The result of undernutrition can be seen visibly in the form of stunting or wasting.

Two major indicators of severe macronutrient disorders are conditions known as kwashiorkor and marasmus which are both as a result of protein energy malnutrition or protein calorie malnutrition (Kuswayo *et al*., 2008; Ngozi & Tola, 2010). Children with primary PEM typically are found in developing countries as a consequence of insufficient food supply caused by socio-economic, political, and sporadically environmental factors such as natural disasters (Grover, 2009). According to the United Nations Children's Fund (UNICEF), PEM is an indistinguishable emergency much like the tip of an iceberg, where its fatal consequences are unseen.

The word kwashiorkor, was initially introduced by Cicely D. Williams in 1935, and is taken from the Ga language of Ghana and represents the sickness of the weaning. Kwashiorkor occurs mainly in older infants and young children, and stems from a diet with insufficient protein however reasonably typical caloric intake, frequently exacerbated by superimposed disease (Grover, 2009).

Marasmus, the more widespread syndrome, is regarded clinically as depletion of subcutaneous fat reserves, muscle wasting, and nonexistence of edema. It stems from the body's physiologic adjustment to starvation in return to relentless deprivation of calories and nutrients (Grover, 2009).

A child with marasmic kwashiorkor presents with a combination of both marasmus and Kwashiorkor. Typically, these children have simultaneous gross wasting and edema and habitually are stunted. They generally have mild hair and skin changes and an enlarged blatant fatty liver (Grover, 2009).

Kruger *et al*. (2008) illustrate that the types of macronutrient undernutrition can be classified as follows:

- Wasted infant: weight- for- height Z- score <-2 SD
- Stunted child: height - for - age Z- score <-2 SD

- Marasmus: weight - for – age < 60% of the international standard
- Kwashiorkor: weight - for – age < 80% of the international standard and oedema
- Marasmickwashiokor: weight - for – age < 60% of the international standard and oedema.

Kruger *et al.* (2008) suggest that macronutrient undernutrition pre-empts general undernutrition with the consequence being below average body size.

Kruger *et al.* (2008) explain that often children deaths are owing to a combination of undernutrition and the presence of an infectious disease.

2.4.8 Symptoms and consequences of undernutrition

The world nutrition report (UNSSCN, 2010) illustrates that the present nutrition transition situation contributes many challenges to undernutrition as the shift in one's diet has lead to an increased consumption of processed foods, animal products, sugars, fats and alcohol. Moore *et al*. (2010) suggest that undernutrition is pandemic in the developing world and is associated with high rates of infectious disease.

In China and South East Asian tens of millions less people experience under nutrition when compared to the previous generation; this is believed to be as a result of prompt economic development. In South Asia and East and Southern Africa, the rate of undernutrition has decreased in spite of the number of undernourished people increase owing to population expansion (Barrett, 2011). Undernourishment refers to the number of undernourished people, within a country, as a measure of food deprivation. There are more undernourished children in rural areas than in urban areas, this is due to the fact that the majority of rural areas have limited infrastructure, with inferior water and sanitation facilities, little or no electricity and inadequate education facilities (Kruger *et al*., 2008).

Altman *et al.* (2009) reveal that under nutrition denotes to insufficient intake of micro nutrients which may result in growth problems and being underweight. The outcome from the NFCS of 2005 showed that 20% of all children aged 1-9 years of age were stunted (Labadarios, Swart, Maunder, Kruger, Gericke & Kuzwayo, 2008).

Undernourishment is a consequence of inadequate energy intake (Barrett, 2011).

Premature undernutrition impacts on behavioural development (Smart, 1993). Children that experience undernutrition in the first year of life were found to be stunted, wasted, and had a reduced head circumference paralleled with an impairment of physical and mental development (Chase & Martin, 1970).

Adult undernutrition is a consequence of insufficient intake and/or increased requirements, impaired absorption, malformed transport, and distorted nutrient utilization. Individuals may experience weight loss, inflammatory/hypermetabolic/hypercatabolic circumstances. Inflammation is more frequently identified as an key basic factor that increases risk for malnutrition, and that may attribute to suboptimal response to nutrition intervention and heightened risk of mortality (White, Guenter, Jenson, Malone, Schofield, The Academy Malnutrition Work Group, the Aspen Malnutrition Task Force & Aspen Board of Directors, 2012).

2.4.9 Overnutrition

Overnutrition is attributed to overindulging, eating too much of the incorrect types of foods, including diets high in fat, salt and sugar, and not expending enough calories in the form of exercise (Kuzwayo, 2008). One can visibly see the result of overnutrition in the form of obesity.

Overweight and obesity are as a result of a global movement towards a diet high in caloric sweetners, foods of animal origin, fats and a decrease in physical activity owing to a more sedentary lifestyle (Moore *et al.*, 2010). Melhorn, Krause, Scott, Mooney, Johnson, Woods and Sakai (2010) reiterate that the consumption pattern attributes to body compositional and weight vicissitudes and advocate that the consumption of a high fat diet can adjust dietary patterns and facilitate adiposity. Senekal, Machiza and Booley (2008) and Melhorne *et al.* (2010) propose that obesity is as a result of a positive energy balance i.e. you consume more calories than you can expend. Obesity is a diverse disorder with numerous causes; with one of the rare causes of obesity being as a result of genetic disorders that results in leptin receptor deformities (Senekal *et al*., 2008). The majority of obesity cases are as a result of genes being influenced by environmental influences and diseases. Melhorne *et al.* (2010) expounds that dietary pattern is influenced by biological and ecological factors including food deprivation or restraint; eating disorders, stress, pharmacological treatments, physical activity, social circumstances, time of day, macronutrients and hormones.

Obese individuals with a larger weight circumference are linked to an increased risk of morbidity (Senekal *et al*., 2008). As the obesity levels increase i.e. BMI score increases, the number of associated health risk increase too and advocate that the health risks linked to obesity include hormone related cancers, reproductive hormone abnormalities, polycystic ovary syndrome, impaired fertility, lower back pain, heightened anaesthetic risk, foetal defects associated with maternal obesity, coronary heart disease, hypertension, osteoarthritis especially in the knees, hyperuricaemia and gout, diabetes, gall bladder disease, dyslipidaemia, insulin resistance, breathlessness and sleep apnea. Overweight and obesity

are associated with an increased risk of heart disease, diabetes, musculoskeletal disorders and certain types of cancer (Moore *et al*., 2010; Melhorne *et al.,* 2010). Melhorne *et al.* (2010) also add that obesity is also associated with fatty liver and kidney disease. Body fat distribution contributes significantly to the health status of obese individuals; individuals whose body fat is distributed in the central/abdominal region or commonly termed "apple shape" have a heightened risk of obtaining diseases such that of diabetes, heart disease, stroke etc. Whereas those whose body fat is distributed in the lower body or more commonly termed "pear shape" are less at risk of developing diseases i.e. lower body fat distribution is healthier than central body fat distribution (Senekal *et al*., 2008).

High fat diets are highly appetizing and palatable, and they have postingestive properties that allows for overindulging which consequently results in gaining of weight and adiposity (Melhourne *et al*., 2010). The same study also affirms that consuming many small meals throughout the day decreases body weight when comparing consuming the same number of calories via a few larger meals, and that by reducing meal regularity by one meal per day has been publicized to increase body adiposity. Melhorne *et al*. (2010) explains the double burden of a high fat diet, in that a high fat diet incites the consumption of larger meals, and consuming larger meals accelerates the gain of adipose tissue i.e. weight gain and body compositional changes. Therefore, one can conclude that meal size has a greater influence on adiposity changes than inclusive food consumption.

Overweight and obesity are rife in South Africa, especially amongst urbanised women, black African women and White men (Senekal *et al.*, 2008). One billion people globally are overweight and 300 million people are obese, which cause 2.8 million deaths annually, and in Africa 41% of deaths caused by high BMI occurs in people under the age of 60 (De Schutter, 2011). Obesity accounts for 100 000 deaths per annum and is considered the second leading cause of preventable death. This also augments the pervasiveness of cancer, diabetes, disability and heart disease (Chubinski & Carrozza, 2012).

According to the World Health Organisation (WHO) (2011), nationally 42.8% of women and 23.2% of men are obese and that nationally 79% of deaths are owing to communicable diseases and 15% as a result of non communicable disease. Labadarios *et al.* (2008) and De Schutter (2012) reveal that 51.5% of women were obese or overweight which has to lead to a government initiative to address obesity, physical activity and health.

The main contributing factor for black African women becoming obese is attributed to the dietary changes of a more urbanised/westernised diet in exchange for low fat traditional diets, that are

higher in fibre than westernised diets that are rich in oils, sugar, fried foods, soft drinks and refined foods (Senekal *et al*., 2008). The more urbanised lifestyle is also associated with reduced activity levels. De Schutter (2012) elaborates that the traditional diet of fortified maize and traditional root and wild vegetables is nutritionally superior to the modern western diet.

The principle means of managing obesity is by preventing gaining of weight for individuals with a healthy weight as well as preventing further weight gain in already obese individuals. It is vital that weight loss is through sustainable dietary and lifestyle changes. Senekal *et al.* (2008) indicates that 10% loss of body weight by an overweight or obese person can show a substantial improvement in both glycaemic control and associated lipid profile.

Senekal *et al.* (2008) suggest that for one to have a sustainable weight loss programme the following components need to be included: reasonable weight goals, healthy eating component - this should be based on the South African food based dietary guidelines, increased physical activity, and lastly the behavioural and psychological component - this refers to body image, stress management and self concept.

Hoelscher and Evans (2012) apprise that even though the impression of food insecurity and obesity may seem incongruous, it has been supported by many studies. According to a study conducted by Velasquez-Melendez, Schlussel, Brito, Silva, Lopes-Fiho and Kac (2011) there is an overall relationship between food insecurity and obesity, and its prevalence was highest amongst rural black women with less than 4 years of primary education. This is supported by Chubinski and Carrozza (2012) who state that it is the poor, less educated, women living in rural areas, who experience food scarcity that are at highest risk of becoming obese.

Obesity is allied with insufficient dietary intake, reduced socio-economic status and living in the unstable areas and often excludes health related issues, alcohol consumption and level of physical activity (Velasquez-Melendez *et al*., 2011). The same study revealed that food insecure women were more likely to gain 4.5kg per annum than those that were food secure, and this is attributed to the high consumption of cheap, energy dense foods; or overconsumption of foods when money is available to recompense for the under consumption; or the consumption of a monotonous diet rich in cereals, oil, sugar and beans; or owing to the psychological effects and the stress of food insecurity on one's consumption behaviour.

Chubinski and Carrozza (2012) insinuate that the food insecurity/obesity relationship is attributed to binge eating, poor nutritional habits, inadequate access to purchase foods, proximity to supermarket, and restricted variety of food in grocery stores. Those that live in the

immediate vicinity of a supermarket are associated with lower obesity rates and those living in the immediate vicinity of small convenience stores to higher obesity rates, correspondingly those that live near fast food outlets are also at risk of obesity (Chubinski & Carrozza, 2012). A possible explanation of the obesity incidence is that when people are faced with the uncertainty of the availability of food, they may over eat as they have an unhealthy perspective on dietary consumption (Gooze, Hughes, Finkelstain & Whitakers, 2012). Kruger *et al.* (2008) suggest that the obesity prevalence is as a result of a combination of lack of exercise and large servings of staple foods i.e. maize.

2.4.10 Micronutrient malnutrition

The consequence of micronutrient deficiencies is vast and includes chronic and infectious diseases, it acts as a stimulant for disease, and in extreme instances may result in the irreversible loss of intellectual and physical function. It is important to note that infants from 9 months to 2 years of age are particularly vulnerable and are reliant on the care giver's knowledge to apply food adequately (Barrett, 2011).

Micronutrient malnutrition, also known as "hidden hunger", is when an individual ingests enough energy yet they do not consume sufficient amounts of essential micronutrients (including vitamins, minerals and trace elements), and once neglected leads to malnutrition crises (Kuzwayo, 2008; Ngozi & Tola, 2010; Stein, 2010; Singer, 2011). Hidden hunger is a contravention of children's right to live a life of physical and mental development and achievable standard of health (De Schutter, 2011).

The prevalence of micro nutrient deficiencies is unknown, however it has been suggested that iodine, iron, vitamin A and zinc deficits touch about 2 billion people, primarily woman and children alike and impact on their intelligence, strength and vivacity (Ngozi & Tola, 2010; Barrett, 2011). Deficiencies in iodine, iron, vitamin A and zinc are considered some of the most severe health risk influences globally (Ngozi & Tola, 2010, FFI, 2008, Stein, 2010; Horton *et al*., 2008). Globally 100 million children are Vitamin A deficient, 4-5 billion people experience iron deficiency, and 2 billion people are anaemic (De Schutter, 2011).

Singer (2011) indicates that trace elements including iron, zinc, copper and selenium as well as Vitamins A, C and E are required to help strengthen the skin (bodies first defence mechanism for fighting pathogens) and mucosa, thus when deficiencies prevail it reduces the bodies ability to fight pathogenic invasion. Selenium adequacy is important, as deficiencies in this nutrient result in inadequate functioning of the immune response (T cells, macrophages

and neutrophils), as well as stimulate the progression of AIDS. Iron deficiency directly negatively impacts on antibody production (Singer, 2011).

Micronutrient malnutrition can result in anaemia, reduced immune response, cretinism, blindness, and cerebral impairment (Havas & Salmon, 2011). Ngozi and Tola (2010), Stein (2010) and De Schutter (2011) indicate that micronutrient undernutrition results in deficiencies such as night blindness, lowered immunity, increased risk of developing respiratory and diarrheal infections, retarded rate of growth and bone development (all owing to vitamin A deficiency), nutritional anaemia (iron deficiency), goitre (iodine deficiency), zinc deficiency, infantile paralysis (owing to folic acid deficiency), altered brain development in children (owing to iron deficiency), increase in heart disease and stroke (owing to folate deficiency), and reduced labour productivity (owing to iron and iodine deficiency).

Kruger *et al.* (2008), Stein (2010) and Horton *et al*. (2008) illustrates that insufficient amounts of iron, iodine, zinc and vitamin A can have a serious impact on ones' health. Insufficient intakes of iron can lead to anaemia. WHO (2009) estimates that 2 billion people globally are anaemic. Kruger *et al*. (2008) explain that most anaemia is due to lack of iron intake, however, it may be attributed to a diet insufficient in folate and vitamin B12. Aneamia symptoms include fatigue, impaired cognitive function, behavioural changes, pallor, nails may become spoon shaped and the spleen may enlarge. Iron deficient persons are subject to an increased risk of lead poisoning, owing to an increased absorption of lead (Kruger *et al*., 2008). Death may result in patients with severe anaemia, when their bodies are stressed under extreme physiological demand.

Kruger *et al*. (2008) stresses that iodine deficiency results in goitre but this is not a fatal condition yet in severe cases may impact on swallowing or breathing. Stein (2010) and De Bonoist, (2008) indicate that iodine deficiency can cause mental retardation and cretinism. Goitre, however, is a serious condition during pregnancy as it may result in foetal retardation as well as impaired growth, psychomotor and cognitive development; which can result in mental and/or growth retardation or mental retardation and deaf mutism. Kruger *et al.* (2008) explain that the most unfortunate time to develop iodine deficiency is throughout foetal growth and early childhood as this is when the developing brain is subject to the worst consequences of permanent neurological defects, reduced intelligence and learning disabilities.

WHO (2000) suggests that 2 billion people do not consume the dietary recommended intake for zinc. Zinc deficiency can be seen by alopecia (loss of hair), diarrhoea, infections, skin lesions and anorexia; in extreme conditions zinc deficient patients may die as a result from infections and/or diarrhoea. Consequences of zinc deficiency present themselves as stunting,

hypogonadism and slowed sexual maturation in children. Severe zinc deficiency may result in neuropsychological function and less severe cases may result in impaired cognitive performance in children (Kruger *et al*., 2008). It is believed that diets lacking in zinc may result in a compromised immune system, weakening of the thymus, abnormally low white blood cells in the blood, impaired cell-mediated responses, and increased vulnerability to infection and disease. Kruger *et al*. (2008) state that mildly zinc deficient diets may result in diminished tasting, and meagre wound healing. Kruger *et al.* (2008) also claim that diets that have a reduced zinc to energy ratio are normally connected to a reduced growth rate of lean body mass even though adipose tissue may still be placed.

The study conducted by Saunders *et al.* (2010) reveals that micronutrient deficiencies influence vast numbers of the world population and it is believed that iodine deficiency single-handedly disturbs about 2 million people.

Hillcocks (2011) indicates that globally 2 billion people are subjected to micronutrient deficiencies out of which the most common micronutrient inadequacies are vitamin A, iron, zinc and iodine. Deficiencies in vitamin A, iron and iodine contribute to numerous maternal and childhood deaths and/or are associated with the fighters being blinded or mentally underdeveloped (Ngozi & Tola, 2010). Vitamin A deficiencies distress a projected 127 million children annually (Hillcocks, 2011). The same study also indicates that deficiencies of iron, zinc and vitamin A feature amongst the top 10 foremost reason for death through disease in developing countries, including cholera, typhoid and malaria.

A lack of vitamin A is associated with diminished eye sight and a high measles mortality and malaria mortality rate (Hillcocks, 2011). UNICEF predicts that the suppression of Vitamin A deficiencies would reduce child deaths from malaria by half. The report written by Hillcocks (2011) indicates that 5.8 billion people globally present an increased risk of diarrhoea, pneumonia and malaria in young children owing to zinc deficiencies and that iron deficiency anaemia accounts for a 20% neonatal and 10% maternity mortality, contributing to 2.4% of annual global deaths from disease.

Ngozi and Tola (2010) indicate that malnutrition can be eliminated through the use of micronutrient supplementation, bio fortification and food fortification, diversifying ones diet, nutrition education, implementation of agricultural programmes, complimentary feeding, food supplementation, introduction of school feeding programmes and improved food processing and storage methods.

2.4.11 Hunger

Hunger is another concept that relates to food and nutrition insecurity. Kuzwayo (2008) reveals that there is currently no globally accepted definition for hunger. Kuzwayo (2008) describes hunger as serious food deprivation in combination with diverse forms of undernutrition. UNICEF (2006) defines hunger as the bodies' way of indicating that the body is running short of food and that one needs to consume more. Prolonged hunger can result in malnutrition and is as a result of food insecurity (Kuzwayo, 2008; UNICEF, 2006).

FAO (2011) reveals that the depth of hunger in South Africa is food deficit of undernourished population kcal/per person/per day. Barrett (2011) clearly states that starvation is the consequence to people not having enough food to consume, and is not to be confused with there not being sufficient amounts of food to consume. Barrett (2011) further explains that hunger is a physical distress due to lack of food. Altman *et al.* (2009) clarify that hunger is linked to not consuming sufficient amounts of food.

The National Food Consumption Survey of 2005 discovered that 52% of households experienced hunger and that 33% were at risk of hunger (Labadarios *et al*., 2008 & 2009). De Schutter (2011) reveals that 14% of people globally are hungry. Seasonal hunger is as a result of annual cycles of diminishing food stocks, increased prices and reduced income.

The study conducted by Ngozi and Tola (2010) elicits that starvation and poverty are induced by unemployment; weakened social arrangements; degrading health care system; poor road access; limited agricultural schemes and industrial investment; and heightened food inflation rates resulting in basic foods items being expensive and barely affordable.

A study conducted by Griffioen-Roose, Mars, Siebelink, Finlayson, Tome and De Graaf (2012) indicates that individuals that experience hunger prefers high-protein foods. This is due to the fact that after a protein deficit the human body illustrates adaptive mechanisms to restore protein status therefore stimulates the selection of high protein savoury foods i.e. after protein deficit, individuals protein consumption increased by 13%.
Griffioen-Roose *et al.* (2012) also discovered that individuals that consume low protein diets tend to experience hunger more frequently and severely, experience decreased satiety, increased desire to eat, increased appetite for savoury foods and occasionally craved sweet foods.

2.5 METHODS TO DETERMINE FOOD SECURITY, DIETARY INTAKE AND NUTRITIONAL STATUS

2.5.1: How to measure food insecurity

Food security is excessively multifaceted to be suitably captured via a solitary indicator and is usually reliant on a combination of indicators (Maxwell *et al.*, 1999). A food security research team needs to design measurements based on longitudinal data, whereby it captures the food security risk of an individual and voices the risk in a perception based manner. Food security means based on individual or household data give a more representative result than data based on national level (Barrett, 2011).

Food security can be measured by household income, enhanced quality and quantities of the diet and cumulative food expenditure, therefore, rendering it viable to state that measuring dietary diversity as a useful measure in determining food security status (Thorne-Lyman, Valpiani, Sun, Semba, Klotz & Bloem, 2010).

Research activities to determine the food insecurity status as well as behaviours, make use of survey based studies that utilize anthropometric and perception measurements (Barrett, 2011). Food insecurity depends on measuring food consumption either through calculating gross production and procurement activities over a specified time frame or measuring the growth or depletion of food stocks or via 24 hour recalls (Maxwell, 1996). Maxwell (1996) also suggests making use of food balance sheets, rainfall and marketing data, hunger index, food insecurity scales and anthropometric measurements to assist in monitoring food security.

2.5.2: Food Intake data

2.5.2.1 Food Frequency Questionnaire (FFQ)

The FFQ is used to calculate approximately the nutrient intake of a trial populace (Brown, 2008). The food frequency arranges food into nine categories namely: cereal, roots and tubers; other vegetables; vitamin A rich fruit and vegetables; flesh foods (meat, poultry, fish); fats and oils; dairy; other fruits; legumes and nuts as well as eggs (Oldewage-Theron & Kruger, 2008). The FFQ is used to compile information on the frequency of a specific food or category of food that is consumed per day, per week or per month. It is imperative that FFQ are administered by trained dietary interviewers in order to achieve quality assurance, accuracy and consistency (Anderson, Harris, Tylavsky, Perry, Houston, Hue, Strotmeyer & Sahyoun, 2011).

A study conducted by Labadarios, Steyn and Nel (2011) indicates that measuring food diversity should be included as an additional food security measuring tool, owing to the fact that food security cannot be measured on its own. Dietary diversity reflects dietary quality which directly relates to nutritional status (Brinkman, De Pee, Sanogo, Subran & Bloem, 2010). Poor dietary diversity could reveal food insecurity or poor food security (Labadarois *et al*., 2011).

Dietary diversity is typically analysed by establishing the quantity of individual foods, termed the food variety score (FVS) and the quantity of food groups utilized as the food group diversity score (FGDS) from the food frequency data (Oldewage-Theron & Kruger, 2008; Ruel, 2003). Food variety is inferior in poorer and rural households, and higher in richer and urban households (Labadarios *et al*., 2011).

Studies that monitor the dietary intake of individuals as well as the complexity of the diet are a good means for demonstrating correlations between food and nutrient intakes as well as their bioavailability (Anderson *et al*., 2011).

2.5.2.224 Hour recall

The principal rationale of administering the 24-hour recall is to evaluate the sample populace overall diet quality and to identify nutritional deficiencies and, therefore, make suggestions to enhance health status (Brown, 2008). Twenty four hour recalls provide more accurate consumption data than analysing gross production and procurement activities over a period of time or measuring the expansion or exhaustion of food stocks, however, they are subjected to minor weaknesses including memory lapses, observer prejudice, respondent lethargy, and a short unreliable recall timeframe (Maxwell, 1996).

Rankin, Hanekom, Wright and MacIntyre (2010) reported that an advantage to the 24 hour recall is that it is applicable to populations of varying ethnicities. The questionnaire is used at an individual interview with the respondent, with assistance of food models, food pictures, real food items and household utensil measures to authenticate the type and amount of food consumed (Katzenellenbogen, Joubert & Abdool Karim, 1997). Two 24 hour recalls are recommended to analyze the average food consumption patterns and nutrient intake estimates compared to the sample populace DRIs (Rankin, Hanekom, Wright & MacIntyre, 2010; Gibson, 1990).

The use of 24 hour recall alone cannot provide a full assessment of food security, as it does not survey vulnerability or sustainability and does not reveal household food access (Maxwell, 1996).

2.5.2.3 aily food record or food diary

According to Joubert and Ehrlich (2007), a daily food record or food diary records the types and quantities of food and beverages consumed, in addition to the time of consumption for a period varying from one day to one week. In order for the food record to be accurate it needs to be completed as foods and beverages are consumed. A variety of recorded data is used to determine usual intakes including non consecutive, random days from different seasons, including weekends. This is usually used in smaller studies containing <50 people.

2.5.2.4 Diet history

According to Joubert and Ehrlich (2007), a diet history is used to analyse an individual's food consumption and selection variables that may manipulate intake over an extended time frame, for example a month or a year. Dietary histories are a comprehensive means for establishing dietary information that is used when conducting research of small groups or individuals. This type of food intake record requires a trained interviewer to obtain information regarding the number of meals consumed per day, appetite, food likes/dislikes, prevalence of nausea and vomiting, nutritional supplement usage, smoking, sleeping and resting habits and work as part of an interview.

2.5.2.5 Other methods for determining food intake

According to Joubert and Ehrlich (2007), additional methods for obtaining dietary intake include duplicate food collections, visual records including photographs, and lastly direct visual observation by trained personnel.

2.5.3: Socio-demographic data

The overall economic and social situation of respondents is usually measured by means of income, education and occupation. A validated socio-demographic questionnaire is henceforth used as a measurement tool (Napier, 2006). This is a method used to obtain data relating to the social status of an individual and/or groups of people. It essentially measures the social well being of an individual. When studying the level of poverty in a given community, a variety of demographical factors including age, gender, occupation, education level and income status need to be obtained in order to measure the consequence of these variables.

The socio-economic position (reflects an individual's position within society) of individuals is used to measure aspects of poverty, in addition to alternative social and economic conditions that are important influences on health. Individuals of low socio-economic status have less social and economic resources available to draw on to maximize health whereas those of high socio-economic status have greater access to resources (Joubert and Ehrlich, 2007). The socio-demographic data is paralleled with the Human Poverty Index (HPI) which measures poverty and concentrates on deprivations in basic proportions of life and various anthropometric indicators (Chakravarty & Majumder, 2005).

2.5.4.: Food coping strategies

Food insecurity is seasonal or frequent but irregular occurring; therefore, people predict the possibility and engage in coping strategies to prevent severe food insecurity (Barrett, 2011). Coping strategies are discussed in focus groups and respondents are required to rate each strategy according to its seeming severity (Barrett, 2011; Maxwell *et al*., 1999; Kruger *et al*., 2008). The incidence and relentlessness of coping strategies used is a progressive indicator of food security and has been used for over twenty years (Maxwell *et al.*, 1999).

Coping strategies measure the type of strategies used by individuals in order to cope with short term food insecurity. The types of strategies were determined by the community as part of an in depth Focus Group discussion. The Focus Group discussion uses a qualitative research technique to gather information on opinions, perceptions and ideas. The result of the Focus Group discussion was the top 10 activities that the community members partake in when they do not have sufficient funds to purchase foods (Maxwell *et al*., 1999).

The coping strategies index is used as an indicator of household food security. Successions of questions regarding how households deal with insufficient food for consumption, are administered and result in a simple numerical score. Provided that the respondents are from the same community, one can conclude that the lower the score the lesser the severity of food insecurity, the greater the score the greater the severity of food insecurity (Maxwell *et al*.,1999).

2.5.5: Anthropometric measurements

Anthropometric measurements are currently considered as a significant indicator of an individual's health and nutrition status and are widely used due to them being inexpensive and non invasive measures of an individual or general population. The four primary pillars of measure anthropometric assessment are: age, gender, height and weight (Perissinotto,

Pisent, Sergi, Grigolletto & Enzi, 2002; Dey, Rothernberg, Sundh, Bosaeus & Steen, 1999; Schwarts, 1998).

Anthropometric measurements encapsulate how underweight an individual is i.e. weight for height; height for age; or mid upper arm circumference (Barrett, 2011). Height and weight are useful in establishing nutrition status in adults. Both height and weight need to be measured as individuals have the tenacity to overestimate height and underestimate weight, resulting in an inaccurate Body Mass Index (BMI). BMI is calculated by dividing the weight by the height squared, both weight and height are measured twice and the average of the two is used (Anderson *et al*., 2011). The importance of BMI is that it represents differences in body composition by identifying the level of adiposity and referencing it to height, thus eradicating dependency on the frame size index (Lee & Nieman, 2003, 2010). Table 2.1 reflects the different classifications of BMI.

BMI values are age reliant and pertinent for both men and women (Moore et al., 2010). Women have a higher occurrence of obesity and it is more common for men to have a higher prevalence of being underweight (Moore *et al*., 2010). The same study also revealed that 9.3% of the highest income and 7.6% of the lowest income were obese, 27.4% of the highest income and 22.7% of the lowest income were overweight, 5.8% of the highest income and 8% of the lowest income were deemed to be underweight. In Africa 9.8% of urban dwellers were considered obese and 6.6% rural dwellers were considered obese, and 7.3% urban dwellers compared to 9.3% rural dwellers were underweight.

The study conducted by Garcia (2012) indicates that when measuring food insecurity in children, stunted growth or malfunction to gain weight is due to social, economic and health conditions rather than being hereditary.

Table 2.1 BMI classifications, WHO (1995).

Classification	BMI (kg/m) Principal cut-off points	Additional cut-off points
Underweight	<18.50	<18.50
Severe thinness	<16.00	<16.00
Moderate thinness	16.00- 16.99	16.00 - 16.99

Mild thinness	17.00- 18.49	17.00 - 18.49
Normal range	18.50-24.99	18.50 - 22.99 23.00 - 24.99
Overweight	≥25.00	≥25.00
Pre-obese	25.00- 29.99	25.00 - 27.49 27.50 - 29.99
Obese	≥30.00	≥30.00
Obese class 1	30.00- 34.99	30.00 - 32.49 32.50 - 34.99
Obese class 11	35.00- 39.99	35.00 – 37.49 37.50 – 39.99
Obese class 111	≥40.00	≥40.00

a) Height and weight

Height and weight are measured according to the WHO (1995) guidelines as explained in chapter 3

b) Subcutaneous fat (skin fold thickness)

Triceps skin fold thickness (SFT) supplies a measure of subcutaneous fat; triceps SFT is calculated using calibrated callipers on the outer surface of the arm, halfway between the acromion process and the elbow with the arm hanging loosely by the side, whilst the respondent is in an upright standing position. A value of <4mm (men) or <9mm (Women) indicates under nutrition (Woodward, 2002).

c) Waist circumference

A non stretchable tape measure is typically used to calculate the space around the smallest area below the rib cage and above the umbilicus where the waist circumference is situated. This measurement assesses abdominal fat content. A measure greater than 88cm for women and 102cm for men is an autonomous risk factor for disease (Centre for Disease Control, 2002). These calculations are less likely to be as successful for those greater than 60 inches tall or with a BMI of 35 and above (CDC, 2002).

d) Mid- upper arm circumference (MUAC)

MUAC is derived from calculations of both the MUAC and triceps SFT and is used to evaluate protein-energy malnutrition; the dimension of the muscle mass is an indicator for protein reserves. MUAC calculations are most effective for individuals who cannot be weighed and for the elderly with chronic oedema in who BMI or percentage weight loss may be deceptively normal (Kuczmarski, Kuczmarski & Najjar, 2000; Mahan & Escott-Stump, 2008).

2.6 STRATEGIES TO ADDRESS FOOD SECURITY AND MALNUTRITION

Poverty, hunger and malnutrition remain persistently high in developing countries, and the sustainable solution to combat this is to improve availability, access and utilization.

2.6.1Food based dietary guidelines and daily recommended intakes

Food based dietary guidelines integrate the nutrient compilation of foods, together with the non-nutrient components of food and supplies guidance on utilization of the types of food components for which there are community related health concerns (Labadarios & Steyn, 2001). The food based dietary guidelines consist of locally available foods, sustainable food fabrication; food patterns (i.e. traditional diets) and the authority on morbidity and transience levels in the populace (WHO, 1999).

The food based dietary guidelines for South Africa were adapted to suite consumer groups of varying ethnic backgrounds over the age of 5 years for both rural and urban counterparts, (Vorster, Love & Browne, 2001; National Nutrition Week, 2012) and include the following guidelines:

- Enjoy a variety of Foods
- Be Active
- Make Starchy foods part of most meals
- Have mass, milk or yoghurt every day
- Eat plenty of fruit and vegetables every day
- Eat dry beans, split- peas, lentils and soya often
- Lean meat, fish, chicken, milk and eggs can be eaten every day
- Eat fats sparingly, choose vegetable oils rather than hard fats
- Use salt and foods high in salt sparingly
- Drink lots of clean, safe water
- Use sugar and foods and beverages high in sugar sparingly.

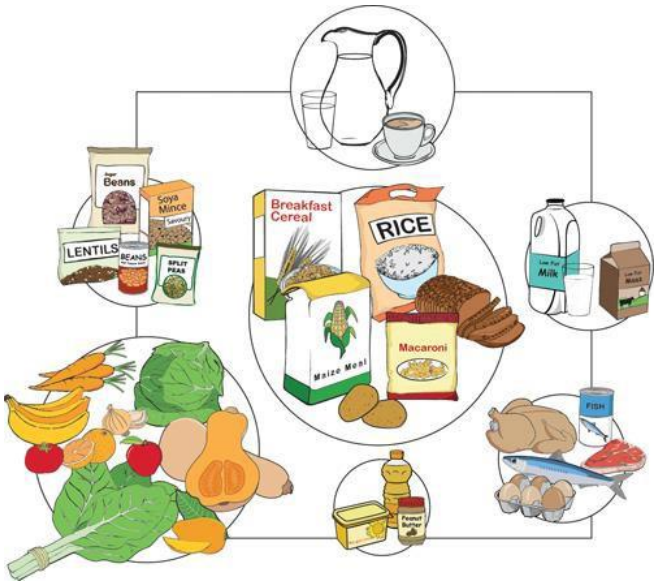


Figure 2.4: South African food guide 2012 (Meyer, 2012).

Figure 2.4 Illustrates the South African food based dietary guidelines that were revealed at the South Africa Nutrition Week 2012. The basis for the food guide revolves around the fact that dietary variety is linked with longevity (Voster *et al*., 2001). Faber *et al*. (2011) indicate that a variety of food is required to ensure sufficient intake of essential nutrients, which is supported by the Food Based Dietary guidelines that promote one to "enjoy a variety of foods", conversely the poor may not have the resource to ensure that they consume a variety of foods. A diet unswerving from the dietary guidelines of consuming sufficient amounts of vegetables, fruit, whole grains, poultry, fish and reduced fat dairy products is linked to enhanced nutritional status and quality of life in addition to a lower mortality rate in the elderly (Anderson *et al*., 2011). Not only is the risk of chronic diseases, cognitive function, dementia, Altzheimer's disease, coronary heart disease and stroke being reduced in the elderly (owing to higher levels of folate, Vit B12, Vit C, tocopherol, beta carotene, holotranscobalamin and reduce levels of homocysteine), but the diet is also feasible and sustainable (Anderson *et al*., 2011). Labadarios *et al*. (2011) state that the average South African adult requires a minimum of R9.55 daily or R286.5 monthly to procure a healthy balanced diet.

The food based dietary guidelines can be used to address malnutrition and food security by being used as a guide to develop nutrition education material; promotes the use of micronutrient rich foods; can be tailored to the requirements of vulnerable groups; focuses on enhancing the ratio of absorption enhancers and food preparation methods that increase bioavailability should be promoted (Tontisirini, Nantel & Bhattacharjee, 2002).

The Nutrition Information Centre of the University of Stellenbosch (NICUS) (2003) reports that the DRI's represent a paradigm shift from preventing a deficiency condition to take complete advantage of one's health and enhance the quality of life. NICUS (2003) indicates that the DRI framework encompasses the following into its objectives:

- To create recommendations to meet a variety of uses
- The involvement by nutrients in the risk reduction for chronic diseases
- The incorporation and review of other food components
- The use and the underlying principle for functional end points
- The assessment of estimates of upper safe levels of nutrient intake.

The figures utilized to validate the DRIs have resulted from case control studies (scientific, dose-response, balance, depletion-repletion, observational) and publications from peer reviewed journals, NICUS (2003).

The DRIs are characterized into four nutrient based reference values including the average mean intake over time that is the nutritionally important reference value (NICUS, 2003):

- Estimated Average Requirement (EAR) is the average daily dietary intake level estimated to meet the nutrient requirements of half of all healthy individuals in a given life stage and gender.
- Recommended Dietary Allowance (RDA) is the average daily dietary intake level adequate to meet the nutritional requirements of nearly all healthy individuals in a given life stage and gender.
- Adequate Intake (AI) is used in a case where there is not sufficient scientific evidence to set an EAR. An AI is viewed as an indication that substantially more research is required in order to have an EAR established and an RDA calculated.
- Tolerable upper intake level (UL) is the maximum daily level for a nutrient intake that is likely to pose no perilous health effect for almost all individuals in the general population.

2.6.2 Food availability

Food availability is dependent on production and supply, food stability and access and can be characterized into physical (what is actually available from arable land/production outputs or resources available to procure foods) and cultural aspects (foods are deemed edible/ harmful/ acceptable /unacceptable as a social or cultural bias based on knowledge and beliefs) (Kruger *et al*., 2008). Food has to be wholesome to eat, as it is not beneficial for one to consume food that is available and accessible if it is not wholesome, as it may lead to illness (Havas & Salmon, 2011). Food borne illness may be attributed to microbiological

organisms, parasites or chemical contaminants which may be introduced from consuming animals or by products of animals that have been suffering with all kinds of zoonotic diseases. Based on the aforementioned statement, one can conclude that food safety is also a key food security issue (Havas & Salmon, 2011).

According to Barrett (2011), the most substantial means for improving food availability is due to improved agricultural production developments. Food availability can be measured via household food inventory and food obtaining data and that income and food access are the most significant elements of food availability (Labadarios *et al*., 2011).

Food Availability, Access, Consumption, and Nutrition are interrelated in that: (1) having enough food available at national and local levels is essential, however, not adequate for making certain that households have sufficient access to food; (2) having ample household access to food is required but not enough for ensuring that all household members consume a tolerable diet; and (3) consuming a satisfactory diet is indispensable nonetheless not sufficient for preserving a healthy nutritional status. Figure 2.5 illustrates how increased food availability results in increased access to foods, which leads to improved consumption and in turn leads to improved nutritional well-being and security (Diskin, 1995).

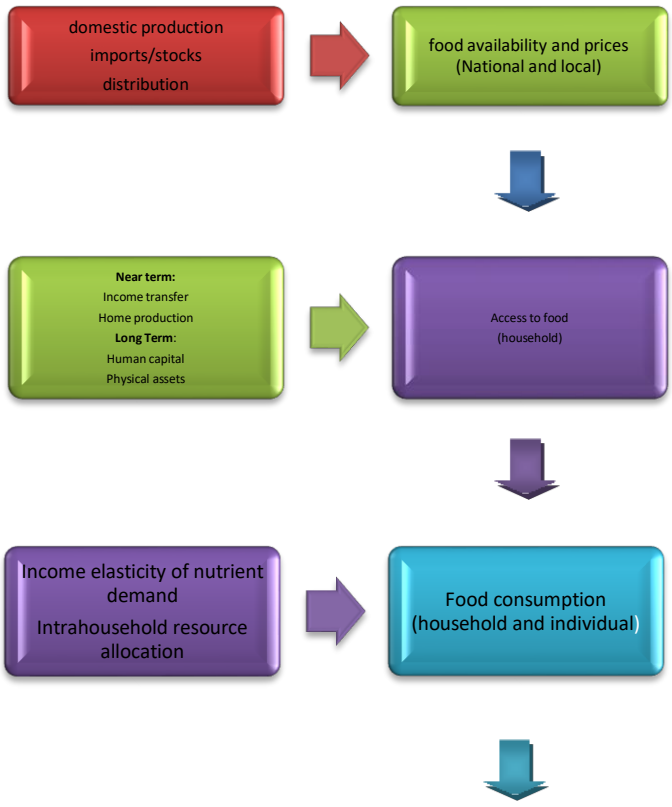


Figure 2.5: Linkages from food availability to nutritional analysis (Diskin, 1995)

2.6.3 Food access

Food access is defined as the household's ability to procure plenty of food of adequate quality to allow for all individuals to meet their nutritional requirements and lead fruitful lives and can be measured by the hunger experienced by the individuals or their dietary diversity and is articulated as means and their corresponding standard deviations (Labadarios *et al*., 2011).

Food access does not only consider accessibility to food in terms of location. It encompasses the ability to spend money to purchase food, which resultantly is reliant on disposable income, food prices and the location of food outlets. In some instances food items may be affordable but difficult to get to (i.e. spatially inaccessible) or *vice versa* (Crush & Frayne, 2011). The concept of food access is characteristically multidimensional and becomes more complex to measure (Barrett, 2011). Food access is characterised by income and the price of foods (Brinkman *et al*., 2010). Witt (2011) found that food access was restricted by limited income, unemployment, social segregation, fall of rural economies, inadequate governance, badly chosen policies, inability to cope with changing conditions, insufficient access to land to produce foods, and the destruction of bartering systems.

Access to wholesome food and potable water strengthens human development (Altman *et al.*, 2009). Insufficient access to affordable and wholesome foods can contribute to inconsistency in diet-related chronic disease (Story, Kaphingst, Robinson- O'Brian & Glanz, 2008).

2.6.4 Utilization

Utilization refers to the apt usage of foods in terms of processing, storage, application of nutritional knowledge, and adequate hygiene and sanitation practices whilst handling foods (Kruger *et al*., 2008). Barrett (2011) explains that utilization look at whether people procure essential foods with a high nutrient intake versus purchasing foods of low nutritional value; as well as how foods are prepared i.e. are foods prepared in a safe, hygienic manner that allow food items to retain their nutritional value. Utilization also reflects whether the individual's health status will allow them to absorb and utilize the essential micronutrients that they are consuming .Utilization can be measured by means of anthropometric measurements, dietary intake or blood nutrient levels (Labadarios *et al*., 2011).

2.6.5 Vegetable gardens

The WHO recommends that individuals consume 400g daily of fruit and vegetables in order to protect against cardiovascular disease and certain types of cancers (Faber *et al*., 2011). The book written by the World Vegetable Centre reports that vegetables are a necessity in fighting malnutrition in the developing world as they are rich in the essential micronutrients including vitamins, minerals, carotenes, folates and dietary fibre (Chadha, Engle, Hughes, Ledesma & Weinberger, 2011). The information contained within the chapter written by Chadha *et al*. (2011) was tabulated for ease of reading. Table 2.2 presents the micronutrients available in various vegetables. Faber *et al.* (2011) indicate that community based agricultural interventions focus on planting the following vitamin A rich crops: carrots, orange fleshed sweet potato, butternut, pumpkin, mangoes, papayas and dark green leafy veggies including spinach and wild growing leaves, all of which have been proven to increase the vitamin A status, eradicating vitamin A deficiencies, improving all round dietary intake including that of calcium, iron, magnesium, vitamin B2 and vitamin C in addition to decreasing the risk of degenerative diseases, cancer and cardiovascular disease.

Table 2.2: Vegetables and their nutrient availability (Chadha *et.al.*, 2011).

Vegetable/ plant	Nutrient rich in…	Availability
African spider plant **Bitter lettuce** **Amaranth**	Iron	49.95mg/ 100g edible portion
Pumpkin leaves **Puncture vine** **Cassava leaves** **Amaranth** **Cape myrtle**	Zinc	1.63mg/ 100g edible portion
African Spider flower **Puncture vine** **Cassava leaves**	β-Carotene	16.13mg/100g edible portion
Tomato **Pepper**	Antioxidants: including carotenoids Vitamin C Phenolics	

The benefits of vegetable gardens are not only limited to nutritional improvement but also improved food security, cost effectiveness, sustainability, human productivity and reduce the incidence of hunger (Blasbalg, Wispelwey & Deckelbaum, 2011; Faber *et al*., 2011). An average sized home garden in Sub-Saharan African can generate between 170-250kg of vegetables annually, which allows for opportunities of income generation and nutrition and food security (Chadha *et al*., 2011). Another benefit of home grown vegetable gardens is that

they allow for individuals to harvest numerous seasonal plants (warm and cool weather crops) throughout the year which can assist in securing an annual food supply and could potentially improve dietary diversity and nutritional adequacy of the diet (Blasbalg *et al*., 2011; Faber *et al*., 2011). Vegetable gardens are most effective when paired with nutrition education intervention; this multidisciplinary approach ensures that households have sufficient supply of foods that are rich in micronutrients as well as the knowledge of how to use them applicably. Diverse farming systems are the only sustainable solution to improve dietary diversity, however, assistance programmes are required to assist the livelihoods of poor farmers and to enable them to be economically viable (De Schutter, 2011).

Bio fortification has not been well accepted owing to the poor market perception of genetic modification and would require government initiatives to address biosafety regulations. The trial of enhancing staple crops such as sweet potatoes, wheat, rice, maize, beans and cassava with vitamin A, iron and zinc have proven to have positive results on the micronutrient status (Hillcocks, 2011). See Table 2.3 below for source of micronutrients and vitamins.

Wild vegetables are highly nutritious and are capable of reducing malnutrition in low income brackets of communities as well as have the ability to improve nutrition status of higher income brackets within the same community (Lewu *et al*., 2010). A primary focus by the AVDRC (Asian Vegetable Research and Development Centre) is the promotion of indigenous vegetables that are rich in nutrients and bioactive composites.

Table 2.3: Food Sources of micronutrients and vitamins Hillcocks, 2011)

Nutrient	Source
Vitamin A	Orange fleshes fruits and vegetables
Vitamin B6*	Banana, fish, meat, poultry, sweet potato, seeds and nuts
Vitamin B12	Eggs, fish, meat, dairy products
Vitamin E*	Groundnut, nuts, vegetable oil
Vitamin K	Green vegetables, soya bean
Folate	Leafy greens, pulses, groundnut, nuts
Iodine	Salt water fish, iodized salt
Magnesium*	Leafy greens, pulses, groundnut, nuts
Phosphorus*	Pulses, nuts, animal products
Iron	Animal products, pulses, leafy greens
Zinc*	Pulses, animal products
***cereals are a good source but only if fortified or wholegrain**	

The statistics presented by the 2011 South African General Household Survey (GHS) indicated that 23.0% of South African households are involved in agricultural activities of which 4.2% partake in these activities to provide a main source of food and 84.1% embark on these activities to provide an additional source of food, whereas De Schutter (2012) indicates that 2.5 million households in South Africa partake in small scale subsistence farming to create income. Those households that partake in farming activities to provide a main source of food indicate extreme poverty (Faber *et al*., 2011).

Figure 2.6 indicates that 2.5% of the South Africans that are involved with agricultural activities do so as a core source of income, whereas 5.1% do so to provide an additional source of income.

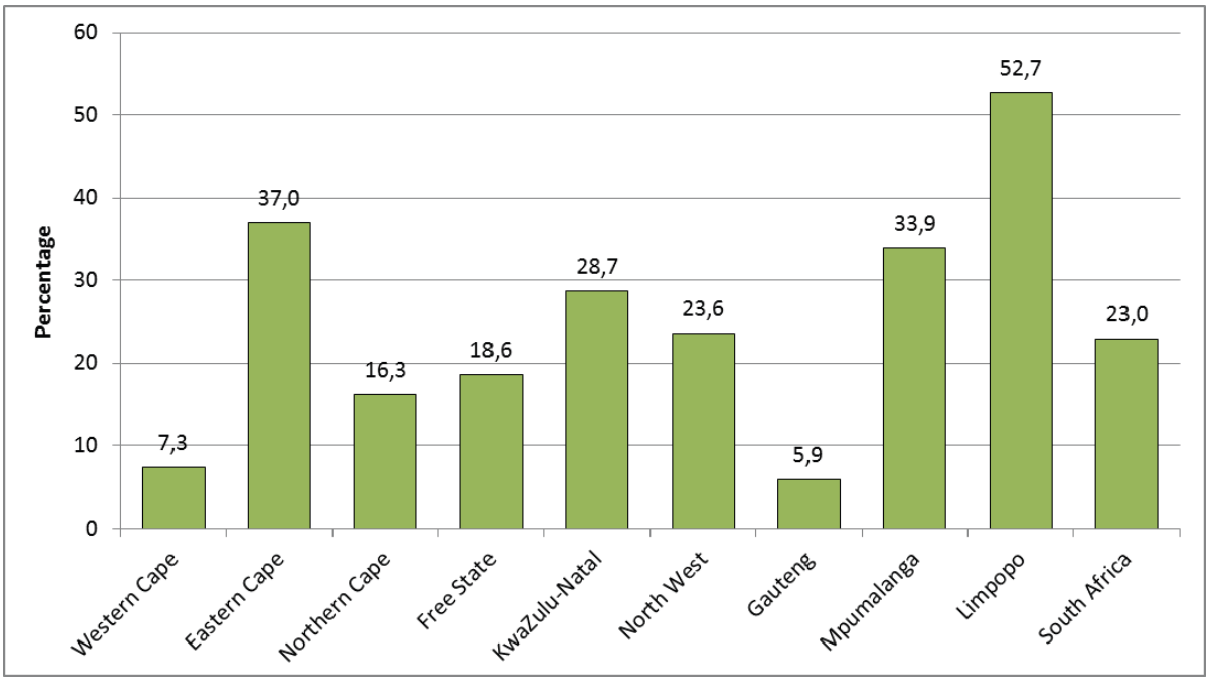
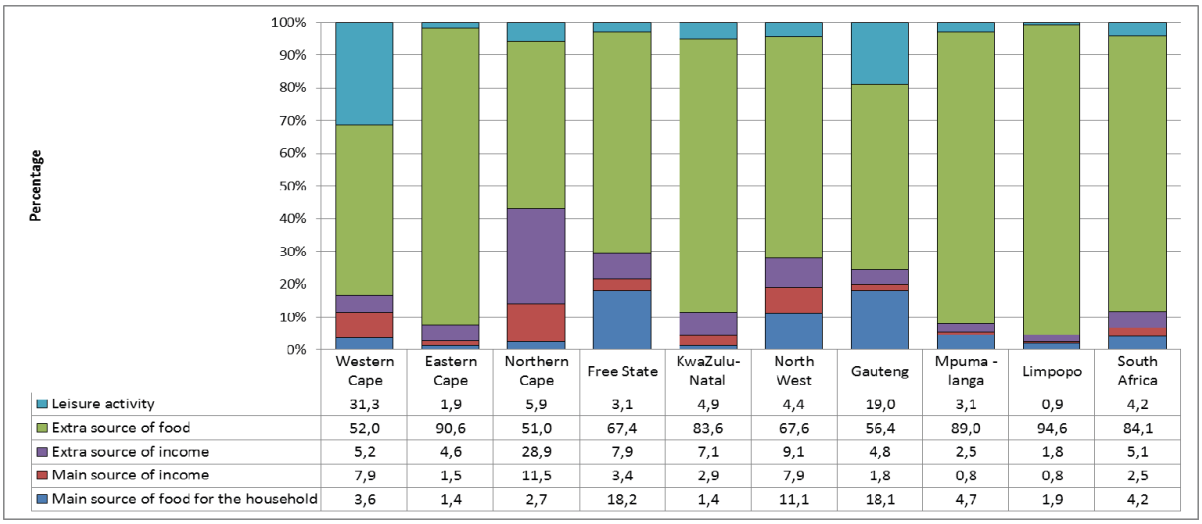


Figure 2.6: Household involvement in agricultural activities, by province (GHS, 2011)



	Western Cape	Eastern Cape	Northern Cape	Free State	KwaZulu-Natal	North West	Gauteng	Mpuma-langa	Limpopo	South Africa
Leisure activity	31,3	1,9	5,9	3,1	4,9	4,4	19,0	3,1	0,9	4,2
Extra source of food	52,0	90,6	51,0	67,4	83,6	67,6	56,4	89,0	94,6	84,1
Extra source of income	5,2	4,6	28,9	7,9	7,1	9,1	4,8	2,5	1,8	5,1
Main source of income	7,9	1,5	11,5	3,4	2,9	7,9	1,8	0,8	0,8	2,5
Main source of food for the household	3,6	1,4	2,7	18,2	1,4	11,1	18,1	4,7	1,9	4,2

Figure 2.7: Main reason for agricultural involvement, by province (GHS, 2011)

The cause for partaking in agricultural activities or not (see Figure 2.7), is associated with changes in household size and the presence of an capable member; this parallels with the fact that the majority of rural households expend the majority on their income on procuring grain produce, fruit and vegetable versus meat alternatives. Small scale subsistence farming can contribute to financial savings as well as allows for a more diverse diet (Altman *et al*., 2009). Government interventions need to address educating small scale farmers on how to produce low cost, high input vegetables that are rich in nutrients (Altman *et al*., 2009).

2.6.6 Climate change (this is not a strategy to address malnutrition- this is a factor that can contribute to malnutrition)

Climate change has never been a key focus point when researching food insecurity, however, recent studies have indicated that climate change is increasing the severity of the food insecurity crises and is predicted to accelerate food insecurity during the next 30-50 years (Laing, 2011). As a result of climate change people may be more prone to suffering from water scarcity in South Africa as a direct result of uncertain and variable rainfall which unswervingly impacts disease, reduces institutional capacity, reduces livelihood opportunities and restricts adaptive capacity.

Rainfall will become more intensified and drought will occur more frequently in the future which will be very influential for small scale subsistence farmers; they also found that climate change increases the risk of water borne diseases during intense rainfall, such as cholera and diarrhoea, dehydration during drought, and skin cancers and strokes associated with higher temperatures (Quinn *et al*., 2011).Water insecurity was considered a greater stressor than climate change as reduced rainfall catalyzes increase in food prices as well as

stimulates more health problems which together cripple one's ability to cope and adapt (Quinn, Ziervogel, Taylor, Takama & Thomalla, 2011). Schulze (2011) voiced concern on South Africa's water quality as it is being compromised by metals from mining, agro-chemicals, acidic atmospheric deposits, urban and commercial effluent and disproportionate sediments.

Ziervogel and Taylor (2008) suggest that a combination of climate change and other problems such as an ascend in diseases and heightened demand for water may expose people to new and unknown conditions which may result in people selling their assets to meet direct needs which consequently alters vulnerability. Adaptive decisions are not undertaken solely as a response to climate change, however, involve trade-offs to diminish the risks from a variety of interacting and forceful stresses for instance unemployment, inadequate basic services, food insecurity and disease (Parry, Hammil & Drexhage, 2005).

Schulze (2011) projects that the Western Cape will be the hardest hit by climate change in South Africa and will have less rain and higher temperatures which will administer pressure and threat for all the fruit farmers in the region, KZN is projected to have more rain coupled with higher temperatures. Quinn *et al.* (2011) suggest that individuals may hinder the planting of crops as a result of rainfall shortages which makes them more reliant on obtaining food from local markets, however, due to the lack of planted crops and disposable income from the selling thereof, they are more likely to become food insecure owing to lack of financial resources to procure food items.

2.6.7 Rising costs: fuel, electricity, food price hikes (factor contributing to malnutrition)

The study by Crush and Frayne (2011) reveals that 90 percent of urban poverty is as a result of increased food prices. Christian (2009) suggests that economic crises and food price hikes have a direct impact on the food security status, nutritional status and health status of individuals. When the cost of the basic food increases, households are subjected to decreasing the quality and quantity of food consumed, resulting in an increase in the pervasiveness of hunger which results in development and growth complications (Brinkman *et al.*, 2010). There is a significant correlation between high food prices and the risk to food and nutrition insecurity i.e. a 100% increase in food prices would result in a 5-23% decrease in food consumption (Brinkman *et al*., 2010). Crush and Frayne (2012) reiterate that households that already spend a large percentage of their income on food, are immediately affected by food price inflations and price shock which directly relates to their food security status i.e. food insecurity increases as the cost of staples escalates.

Christian (2009) suggests that those most affected by food prices hikes are individuals that experience severe food insecurity, hunger and poverty whereas Brinkman *et al.* (2010) suggest those that are most affected are young children, pregnant and lactating women and the chronically ill as they have the highest dietary requirements. Christian (2009) agrees with Brinkman *et al.* (2010) in that maternal nutritional status is affected by food price hikes that have the potential to increase maternal mortality rates, reduces birth weight, maternal wasting, affect birth outcomes, negatively impact on child care and feeding, prevent exposure to health care, all of which can result in degradation of health. Economic crises and food price inflation can stimulate child mortality owing to poorer dietary quality and micronutrient intake and to date globally 3.5 million deaths per annum are as a result of malnutrition. Economic crisis and/or severe food price hikes are expected to decrease the intake of vitamin A rich foods and increase the prevalence of zinc deficiencies which are associated with diarrhoea, pneumonia and stunting which could potentially increase by 7% owing to economic crisis (Christian, 2009).

Food price will continue to escalate throughout the decade which is exacerbated by the increase in domestic electricity supply, rising fuel, demand for biofuels and oil costs, with the outcomes being that the poor will spend a smaller portion of their income on food which is a catalytic agent for a less varied diet, of inferior quality, and reduced energy consumption (Altman *et al*., 2009; Brinkman *et al*., 2010).

The Income and Expenditure Survey (IES) (Statistics South Africa, 2005/2006) data reveal that the cost of food for a household of 5 was R1100 or R225 per person per month. The National Agricultural Marketing Council (NAMC) 2012 Food price Monitor report reveals that from July 2011 to July 2012 the cost of the basic food basket increased from R396 to R428 (8.1%), the equivalent of R32.27 and that the rural consumers paid R18.24 more than urban consumers for the same food basket. Labadarios *et al.* (2011) confirms this by stating that prices of food are highest in areas where the poor live.

Even though the rural counterparts have to spend more than the urban counterparts to procure the same food basket, they spend substantially less, as much as 15% less, on each household member (Altman *et al*., 2009; Faber *et al*., 2011). The IES report of 2005/2006 revealed that in July 2011 the basic food basket costs the poorest of the population 35.0% of their monthly income, which increased to 37.8% of their expenditure in July 2012. See Table 2.4 for the comparison of urban and rural prices. Poor families in developing countries spend 50%-80% of their income on food (Brinkman *et al*., 2010).

Table 2.4: Comparison between urban and rural food prices for selected food items (Statistics South Africa, 2012)

Product	Rural food price (R)			Urban food price (R)			Price difference (July-11)	Price difference (Apr-12)	Price difference (July-12)
	July-11	Apr - 12	July-12	July-11	Apr-12	July-12	R/unit	R/unit	R/unit
Full cream long life milk 1l	10.99	10.99	11.34	9.54	9.73	10.57	1.48	1.61	1.11
Loaf of brown bread 700g	7.39	7.97	7.71	7.99	8.24	8.25	0.05	-0.53	-0.28
Loaf of white bread 700g	8.19	9.06	8.75	8.90	9.17	9.34	0.14	-0.42	-0.38
Maize meal 5kg	25.17	29.70	34.23	17.72	26.41	25.93	8.06	7.82	7.33
Margarine 500g	16.30	17.07	16.66	16.24	15.94	16.3	1.32	0.72	2.93
Rice 2kg	25.54	26.01	26.71	20.35	22.64	21.12	4.52	4.07	5.56
Sunflower oil 750ml	13.74	14.59	14.91	15.76	16.90	16.67	-1.88	-1.99	-1.70
Ceylon/black tea 62.5g	8.14	7.25	7.38	7.32	7.38	7.67	1.63	0.00	-0.09
White sugar 2.5kg	23.15	24.54	25.85	20.79	22.54	23.22	3.25	3.31	3.76
Total							18.57	14.59	18.24

The quarterly food price monitor report (Stats SA, 2012) specifies that the price inflation from July 2011 to July 2012 (±10%) for staples including maize meal, peanut butter, tuna, cabbage and milk could have a deleterious influence on both dietary diversity and household food security. The National Food Consumption Surveys conducted by Labadarios, Steyn, Maunder,

Macintyre, Gericke, Swart, Huskisson, Dannhauser, Vorster, Nesamvuni, and Nel (2005) indicate that the 5 most extensively consumed food items by South Africans include maize porridge, brown bread, sugar, tea and full cream milk and selected items are costing R3.75 more per portion in 2012, when comparing 2011 results. Whole grains and oil seed prices have increased by more than 50% from May 2012 to June 2012, which act as a catalyst in prices of meats and other food items. NAMC predicts that there will be a price inflation of more than 20% in the first quarter of 2013, which will further exacerbate the percentage of income spent on food items and promulgates the food security status of the already food insecure and those that are subject to food insecurity. Rosen and Shapouri (2008) indicate that it is difficult to predict the price trends for agricultural raw materials as they are influenced by price unpredictability owing to climate correlated shocks. Countries that are worst affected by economic shocks are those where political instability is rife which in turn hinders domestic production (Rosen & Shapouri, 2008). The availability of Food Aid also reduces as a result of price hikes, which enhances food insecurity among the poverty stricken (Rosen & Shapouri, 2008).

2. 7 ECONOMIC IMPACT OF MALNUTRITION AND FOOD SECURITY

Food insecurity negatively disturbs the economy by increasing the health cost of those that are food insecure as well as by distressing instructive and lifetime education potential (Hoelscher & Evan, 2012). The same study also emboldens policy makers as well as business leaders to support food assistance programmes.

Food insecurity is often as a consequence of the inability to purchase good quality food as a result of deflation in currency, diminished purchasing power, salary diminution, job retrenchment, eradication of housing/transportation/health care subsidies, and irregular access to retail outlets (Crush & Frayne, 2011). Velasquez-Melendez *et al.* (2011) reveals that households that experience food insecurity spend approximately 66 percent of the household income on food.

Crush and Frayne (2011) have revealed that a supermarket revolution has exploded in that supermarkets are now assertively targeting all urban consumers and not only the middle to upper LSM groups. With the introduction of Wallmart to the retail market, the supermarkets are now having an enormous impact on, and totalling pressure on the informal food retailers and resultantly on food security of the urban poor. Crush and Frayne (2011) explain that the informal markets (i.e.: food vendors, street traders, etc.) attribute to job creation which accounts for a valuable income source for many urban homes. With the heightened competition amongst the prices of the formal and informal markets, the informal markets are

the most likely to be defeated, which is resulting in consumers spending their money on poor quality, energy dense but cheap and affordable foods from the formal sector which is as a result of supermarket expansion with greater purchasing power, and better pricing due to bulk buying. The dynamic supermarket expansion is having catastrophic effects on the informal market as it is threatening their existence by their encroachment in local vicinities which have been a source of job creation for many in the informal sector for many years (Crush & Frayne, 2011).The same study revealed that although the supermarkets may be cheaper, they may not be the preferred place to shop for the urban poor, owing to inconvenient geographical location. It is also important to realize that the poor do not usually have refrigerators or access to electricity; therefore, are required to shop daily for fresh food items. Crush and Frayne's study (2011) revealed that in the Ethekwini metropolitan area, there were a reported 20 000 traders, of which Durban street vendors sold 28 tonnes of cooked mealies daily.

The informal sector accounts for 93 percent of all new jobs created which attributes to a basic livelihood strategy, most of the households rely on multiple income sources including grants, pension, remittances, loans, gifts, causal labour and informal activities, out of which the majority is spent on food and not on health or education (Crush & Frayne, 2011).

Many corporate food companies are getting involved and sharing their social responsibility by donating food, or supporting school based community farming projects; they may even donate books or scholarships (Crush & Frayne, 2011).

2.8 COPING STRATEGIES, ADAPTIVE STRATEGIES AND TRADE- OFFS

Coping strategies are the contingency mechanism to cope with temporary food inadequacy- as they are not sustainable and indicate that the food security status is degrading and that adaptive strategies are the long term sustainable changes that are characterized as risk minimization, in which individuals and/or households acquire adequate food or income (Maxwell, 1996). Devine, Jastran, Jabs, Wethington, Farrell and Bisogni (2006) define coping strategies as "the things people do to avoid being harmed by life strains", and may include altering conditions that may be causing strain, or to manage the emotive stress caused by the strain. Drimie and Casale (2009) define coping strategies as temporary adjustments that are required for survival and that erosive strategies are not sustainable.

Coping strategies represent coping behaviours in times of inadequate amounts of food or money to procure food items and that female headed household primarily use strategies that increase food availability (Maxwell, 1996). Kruger *et al.* (2008) indicate that coping strategies assuage food stress and/or poor availability. The rising cost of essential services' exhausts

household income and accelerates food insecurity. This reduction in disposable income results in skipping of meals, reducing portion size and simplifying diets (Crush & Frayne, 2011).

People that experience food insecurity also partake in the following activities: temporary dietary changes i.e. consuming less expensive or less preferred food; decreasing or restricting consumption i.e. limiting portion size, skipping meals or skipping food for an entire day; changing household composition; changing intra-household food dispersal; exhaustion of food stores, heightened use of credit facilities for consumption tenacities; heightened dependence on wild foods; temporary labour relocation; temporary changes to crop and livestock fabrication; selling of assets, borrowing food or money to purchase foods; maternal buffering i.e. mothers deliberately reduce their intake to ensure that children get enough food; stealing food; abandoning children and distress migration or migration back to rural areas (Maxwell, 1996).

The study conducted by Devine *et al.* (2006) provides incongruous results, in that coping strategies are also used by low income working families that work multiple low paying service sector jobs, nonstandard hours that consume meals away from home that are high in fats, sugar, calories and salt and that are low in fruits and vegetables, which directly impacts on household nutrition and food expenditure. The food choice coping strategies used by hard working low income individuals include controlling the feelings of stress and exhaustion from parallel eating; reduction in meals owing to lack of time to eat; staggering lunch breaks to ensure not everyone eats together; and by prioritizing eating.

2.8.1Dietary change

Households will reduce dietary diversity as well as kilojoule intake; eliminate the use of expensive foods; reliant on cheaper foods, reduce the size and frequency of the meals, eat less preferred foods as well as prioritize children's consumption over their own all as a strategy to cope with food price spikes and/or reduced income, which resultantly catalyses degradation of macro and micronutrient intakes and deteriorates one's health and nutritional status (Brinkman *et al*., 2010; Maxwell *et al*., 1999; Kruger *et al*., 2008). Brinkman *et al*. (2010) reveal that the consequences to this may include wasting, stunting, heightened vulnerability to infections, reduce cognitive development and diminished productivity. Drimie and Casale (2009) suggest that households will reduce dietary diversity to deal with the lack of food.

2.8.2 Increase short term household food availability

Individuals or households may partake in food seeking strategies to increase quantity of available foods i.e. begging or doing jobs for food, borrowing food or borrowing money to buy foods from friends and/or relatives (Maxwell *et al*., 1999). Kruger *et al.* (2008) suggest that borrowing money for food was a commonly used strategy, interestingly enough the same study revealed that households would not loan food to individuals that were reliant on food parcels, as they would not be able to meet the repayment.

2.8.3 Decrease the number of people that eat at home

Maxwell *et al.* (1999) suggest one strategy would be to reduce the number of people to be fed at any given time. Drimie and Casale (200) found that individuals would marry off their daughters at young ages or that they would insist on child labour (which is illegal) to provide income to provide food.

2.8.4 Rationing strategies

People will partake in rationing strategies by means of controlling inefficiency in terms of rationing portion size or rationing money available to purchase street foods (Maxwell *et al*., 1999). Women may limit their own intake to ensure that their children get adequate amounts of foods (Crush & Fayne, 2011; Maxwell *et al*., 1999). Households with working individuals would often prioritize feeding the working individuals at the disbursement of rationing food for nonworking members. Mothers would ration their own portions to ensure that the males and children had sufficient amounts to consume (Kruger *et al*., 2008).

2.8.5 Reduce meals and Skipping meals

Individuals may reduce portion size at mealtimes or reduce the number of meals consumed daily and in extreme situations may skip food for an entire day or number of days (Maxwell *et al*., 1999., Maxwell, 1996., Crush & Fayne, 2011; Brinkman *et al*., 2010).

2.8.6 Buy on credit

Food insecure individuals may borrow money to purchase foods or they may buy on credit (Maxwell *et al*., 1999). Buying foods on credit was a severe strategy as their low income restricts their ability to make repayments and oftentimes exacerbated the poverty cycle even further (Kruger *et al*., 2008).

2.8.7 Gather food from crops

Kruger *et al.* (2008) also suggest that gathering wild foods is socially acceptable in South Africa and significantly contributes to daily food intake and provide dietary diversity. Many South Africans are reliant on rain-fed farming, however, this makes them very vulnerable to

the elements including weather, economy and government policy (Drimie & Casale, 2009). Faber *et al.* (2011) and Altman *et al.* (2009) indicate that reliance on natural resources including nutrient rich indigenous plants is a sustainable strategy used to diminish food and nutrition insecurity, provided that there is sufficient access to consistent water supply for irrigation purposes, fences to ensure that crops are protected from wild animals, and input from agriculturist to provide professional assistance with gardening projects and advice. Conversely Drimie and Casale (2009) found that households were required to sell or slaughter livestock to provide ample food for the family or they had to reduce their investments in their own land owing to the expense of it, which cascades down in the long run to reduced productivity, which is paralleled to the findings of the Kruger *et al.* (2008) study, in that Kruger *et al.* (2008) found that individuals would partake in seeking strategies including the gathering of wild foods in addition to consuming seed stock.

2.8.8 Bartering and trading

Trade-off's may be taken for food i.e. they do not spend money on health care, education, prolific assets and shelter, in order to purchase foods (Maxwell *et al*., 1999). Food insecurity is associated with a high incidence in sexual behaviour as women are forced to engage in sexual transactions in order to provide food for their children, i.e. food insecurity provokes them to partake in sex work, almost as a trade off of sex for food and other subsistence goods (Miller *et al*., 2011; Altman *et al*., 2009; Ivers *et al*., 2009; Drimie & Casale, 2009).

Miller *et al.* (2011) also suggest that women will remain in abusive relationships owing to their dependence of their partners provision of income and/or food and that widows are at greater risk of being approached to partake in sexual transactions, as a result of other men foreseeing the desperation for provision due to food insecurity, conversely women that are widowed and whose husbands had left them with land and farm animals are less likely to partake in sexual transaction.

Ivers *et al.* (2009) also suggest that individuals also partake in selling of assets for money to buy food or to pay for medical expenses.

2.8.9 Send children to schools where there are feeding schemes

The unique rationale of feeding children at school was to guard them against the most unpleasant consequences of household food insecurity (Devereux, Sabates-Wheeler & Martinez, 2010). The school feeding scheme is implemented to decrease food insecurity and decrease scholastic challenges yet the results from their study revealed that the food insecure individual that did not attend a school with a feeding scheme were at greater risk of school

difficulties, as such the school feeding programme could reverse the effects of food insecurity (Roustit *et al*., 2010).

2.9 FACTORS AFFECTING FOOD INTAKE

Income, urbanization, demographic changes, enhanced transportation, and consumer sensitivity towards quality and safety are altering consumption patterns worldwide. Varying diets, food expenses and food budget responses to income and price modifications vary between the Third and First World. Diet diversification and a heightened demand for improved quality and convenient products have amplified imports of high-value and processed food products in developed countries (Regmi, 2001). The headings in this section relate to the drivers of access as depicted in figure 2.11.

2.9.1 Economic

The wealthy live longer than the poor owing to improved nutrition, availability and access to medical resources, safer environment and less perilous occupations which contribute to a reduced death rate (Haan, 2000).

Low Living Standards Measures (LSM) countries expend a substantial proportion of their budget on food and are more vulnerable to income and food price alterations than middle- and high LSM countries. Superior value food items experience greater budget regulations to price and income shocks, while budgets for staple food items change the least (Regmi, Deepak, Seale & Bernstein, 2001).

Household income per annum is a considerable influential factor on the consumption of vitamin A, vitamin C, and calcium (Nayga, 1994)). Initially nutrient consumption increases, peaks, and then declines with consecutive percentage increase of income (Nayga, 1994). According to Adrian and Daniel (1976), using consumption per household per week as reliant variables, also indicated that income is a considerable factor affecting household consumption of protein, fat, iron and thiamine.

2.9.1.1 Inflation

Inflation: the NAMC August food price monitoring report (2012) stresses that the price inflation of 10% or more has a destructive impact on household food security, in that the affordability of vital staple increases to a point where you get substantially less value for their money. The staple foods affected by the price inflation include maize meal, peanut butter, tuna, cabbage and milk. The Monthly Food Security Bulletin of South Africa: July 2012 revealed that

Consumer Price Index (CPI) inflation rate for the annum in KZN was 5.8% and is expected to remain in the region of 5.1% until the end of 2014.

2.9.1.2 Lack of access to financial capital and credit

The South Africa Social Security Agency manages the grant system which provides cash transfers to low-income families; as of October 2010, nearly fourteen million beneficiaries were accepting grant payments (South African Social Security Agency (SASSA), 2010). The goal is to direct resources to the households most in need, the social grant candidates are subjected to a qualifying individual or household income means test, the conditions of which differ by grant. Extensive evidence suggests that the grants have appreciably reduced poverty among receiver families in South Africa (Samson, Lee, Ndlebe, MacQueen, Van Niekerk, Ghandi, Harlgays & Abrahams, 2004). Moreover, grant receipt has been allied with superior school enrolment (Samson, 2004; Case, Hosegood & Lund, 2005), amplified food consumption (Booysen, 2004; Case, 2001) and enhanced dietary status among beneficiaries (Case, 2001; Duflo, 2000; Taylor, Kidman & Thurman, 2011).

According to Labadarios *et al.* (2011), social grants (pension funds, disability grants, child support grants, foster care grants and care dependency grants) are a government initiative to alleviate food insecurity by increasing women's procuring power in addition to the access to food, conversely not all South Africans that qualify for these grants are managing to access them. Currently the reliance on social welfare grants is vast and has improved household food insecurity, remarkably 51% of seriously hungry households are entitled to social grants that they do not obtain, therefore, it is imperative to progress accessibility of these grants to diminish the prevalence of hunger (Altman *et al*., 2009). South African Social Agency (SASSA) (2010) indicates that the amount of the pension is generous, currently R1010.00 per pensioner per month. Laing (2011) suggests that financial resources are vital for food security even when producing your own food as seeds, fertilizer, tools, harvest bags etc. all require financial capital and are long term investments that only pay off over 20-30 years.

2.9.1.3 Unavailability of employment

According to Altman *et al*. (2009), food insecurity would be eradicated through expanding employment opportunities; income security is essential for combating food insecurity. In 2004 the South African National Government was commanded to reduce and halve poverty and unemployment by 2014. Since the economic recession unemployment rates have rocketed globally and are of great concern in South Africa. At the 2012 State of the Nation Address, President Jacob Zuma declared that the solution to eradicating poverty and inequality was via higher growth and job creation (Environmental affairs, 2012). In 2011 Financial Minister Pravin

Gordhan had propelled a “Jobs Fund” to the value of R9 billion to address the high rates of unemployment. Unfortunately the Quarterly labour Force survey report released by Statistics South Africa 2012, which reports on the South African labour market accomplishments of individuals aged 15 to 64, illustrates that employment opportunities have diminished by 400 thousand from 2008 to 2012 and have waned by 75 000 jobs from the fourth quarter in 2011 to the first quarter in 2012, which emphasizes the unemployment crises in the country. According to the quarter 1 labour survey (Statistics South Africa, 2012), 4 526 000 people were unemployed in South Africa, 14 838 000 people were not economically active out of which 2 335 000 individuals were discouraged work seekers. The same report revealed that the employed reduce by 107 000 jobs in the formal sector and by 28 000 jobs in the informal sector, employment in private households increase by 33 000 and by 26 000 jobs in the agricultural sector.

According to the quarter 1 labour survey (Statistics South Africa, 2012), in KZN there were 6 776 000 people of working age out of which 2 562 000 people were employed, see Figure 2.8. The number of unemployed persons in South Africa rose to 4 500 000 and that women were 1.2 times more likely to be unemployed than their male counterparts.

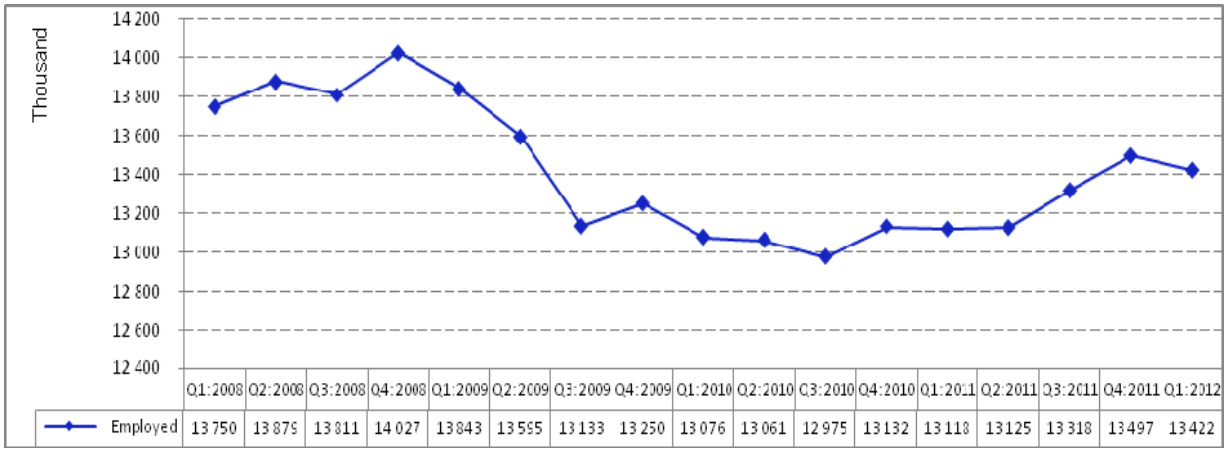


Figure 2.8: Total employment, quarter 1:2008 to quarter 1:2012 (Statistics South Africa, 2012)

Figure 2.9 below from the unemployment labour survey of 2012 shows that the number of unemployed persons in South African increased from 3.9 million persons in 2008 to 4.5 million people in quarter 1 of 2012.

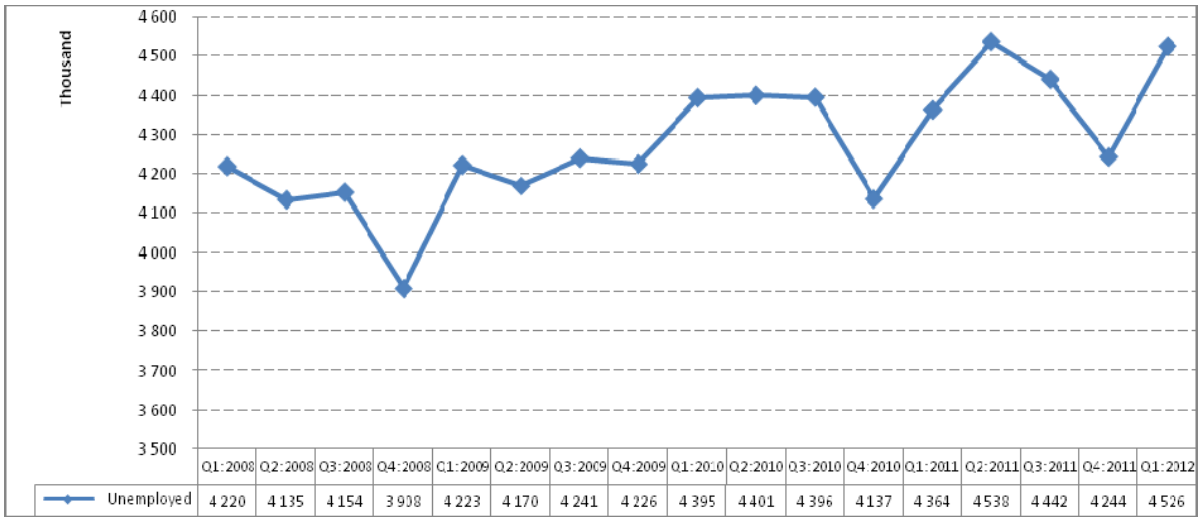


Figure 2.9: Total unemployment, quarter 1:2008 to quarter 1:2012 (Statistics South Africa, 2012)

The unemployment labour survey of 2012 indicated that in KZN there was an increase in unemployment by 1.2% (to a total unemployment rate of 20.5%) when comparing the fourth quarter of 2011 to the first quarter in 2012. A disheartening fact is that both the educated and uneducated persons have been affected by the high unemployment rate. Nine point five percent of tertiary educated individuals are unemployed and 27.1% of people with matric are unemployed. Interestingly enough only 29.3% of people with an education level lower than matric, are unemployed.

2.9.1.4 overty

Chambers (1988) identifies five proportions of poverty:

- 'Poverty proper' being deficiency in adequate income or assets to engender income;
- Physical weakness owing to under-nutrition, illness or disability;
- Physical or social segregation owing to peripheral locality, lack of access to supplies and services, ignorance or illiteracy;
- Susceptibility to crisis and in danger of becoming even poorer; and
- Powerlessness within active social, economic, political and cultural structures.

Money metric poverty measures possibly offer the paramount solitary 'objective' proxy for poverty status (Woolard & Leibbrandt, 1999). Poverty is a topic of not only having hardly any assets, but also of constraints which frontier the effectiveness with which those assets are utilized (Carter & May, 1999). Restricted or no access to health services, restricted or no access to safe potable water, illiteracy or reduced education level and a warped insight of rights and requirements are also among the indispensable components of poverty (WHO,

2000). The longer persons remain in poverty, the more susceptible they become to natural disasters and civil unrest, and the more probable that overseas aid for them will appear only as humanitarian relief efforts (Barrett & Carter, 2002). Poverty is undeniably a great risk factor for obtaining and succumbing to disease globally (Alsan *et al.*, 2011).

Poverty, hunger, malnutrition, nutrition transition, obesity and non communicable diseases have cohabited in Africa and parts of the Middle East, creating disparities that need to be tackled politically. Countries in these regions require nutrition resolution that is modified to their circumstance and that coalesce supplement use as well as agricultural and educational activities to achieve improved and sustainable nutrition for superior public health (Atinmo, Mirmiran, Oyewole, Belahsen & Serra-Majem, 2009).

2.9.1.5 oor market access

The rural poor must have access to markets and technologies that permit them to convert their assets into sustainable earnings ample for a healthy life (Barrett & Carter, 2002). According to Laing (2011), small scale subsistence farmers do not have the necessary transportation means to dispatch their produce to the local markets and often rely on traders purchasing their produce for resale, thereby not fully benefiting from the financial sales as the farmers only obtain approximately 5-10% of the retail price for their produce. Chitja (2011) incites that having access to markets and sound infrastructure could enable small scale farmers to take a stand in providing a solution to food insecurity. She also indicated that South Africa was food secure and was a primary exporter of food, however, lost that entitlement in about 2007 when food prices spiked.

2.9.1.6 Sale of assets

"Distress asset sales" (Gilligan, Hoddinott, Kumar & Taffesse, 2009) occur when households gradually sell off the few assets that they possess in response to repeated shocks in order to fulfil their food needs, with the result that they will become permanently dependent on peripheral transfers (Gilligan *et al*., 2009; Holmes, Jones & Marsden, 2009).

2.9.2 Demographic

2.9.2.1Population pressure

Food production for the human populace can be seen as inelastic; this rigidity presides over the rate of population growth or conversely population growth can be seen as a stimulant for agricultural developments, therefore, indicating that changes in agricultural patterns are catalyzed by the pressure of population growth. Population pressure may result in agricultural land maximization whereby land is continuously used by means of continuous cropping of the

entire area several times per annum, which may require investment activities and/or new tools (Boserup, 2002). This land is continually despoiled, and its soils depleted, owing to concentrated or untenable agricultural production methods. It is projected that the consequences of climate change will weaken productivity further – plummeting yields by to 33% in some areas (United Nations Framework Convention on Climate Change (UNFCCC), 2012).

2.9.2.2 In- and out-migration

The end of the South African Apartheid regime catalyzed remarkable demographic, socio-political and economic transitions and amalgamated with these changes and stimulated rapid urbanisation of the black South African population (Lester, Nel & Bins, 2000). Urbanization is associated with numerous variables like accessibility to various types of supplies providing a wide variety of foods; divergences in the social, cultural and economic environments such as professional opportunities and education and the amount of information presented to the person (Scearce & Jensen, 1979).

Urbanisation is driven by grinding poverty and food insecurity, therefore, employment opportunities for the rural poor needs to be promoted (Laing, 2011). Witt (2011) suggests that rural-urban migration may be as a corollary of drought, indebtedness, political instability, inadequate political support, land requisition, subsidized trade competition, and lastly as a result of unwillingness to work the land. Research conducted by Caballero (2001) revealed that urbanisation heightens the risk of nutrition related non communicable diseases including obesity, diabetes and cardiovascular diseases which are paralleled with the results of the Popkin, Horton and Soowon (2001) study which found that there is an epidemiological transition from endemic deficiency diseases (owing to inadequate diet) and infectious diseases (elevated by poor nutrition) to primarily epidemic chronic diseases.

Popkin, Keyou, Zhai, Guo, Ma and Zohoori (1993) indicated that over a century ago, a nutrition transition was already underway in South Africa. Viljoen, Botha and Boonzaaier (2005) elicit that the nutrition transition is to a more Westernized diet from one that has an intake of indigenous foods. Charlton (2000) affirms that urbanisation has influenced a change in dietary habits.

2.9.2.3 Gender distribution

Even though Black Economic Empowerment (BEE) is well entrenched, the majority of black African women are unemployed; and those that do work are inclined to earn less than male equivalents. Another problem associated with women is that approximately 33% of women

have HIV and, therefore, have great nutritional requirements. This could possibly explain why Altman *et al.* (2009) found that there is a high incidence of women in subsistence farming as a coping strategy to help alleviate the constraints that they face. Interestingly the study also reveal that majority of small scale farmers were between the ages of 15 and 29 years of age.

Altman *et al.* (2009) and Faber *et al.* (2011) also confirmed that other roles and responsibilities associated with women were food selection and preparation; care and feeding of children, elderly and the sick; collection of water, fire wood and other chores. Altman *et al.* (2009) and Faber *et al*. (2011) also found that women were controlled by access to land, finances, markets and time.

2.9.2.4. Household size

As household size amplifies, it is theorized that an individual would reduce the intake of majority of nutrients owing to possible income constraint. Weight, height, age, and income are theorized to have non linear associations with nutrient ingestion (Nayga, 1994).

2.9.3 Socio political

2.9.3.1Social and political unrest or war

Significant correlations exist between unrest, socio-economic variables and food insecurity. Conflict and oppression affect several innocent individuals by reducing the ability to purchase food, diminishing the availability of foodstuffs, as well as unrest may affect accessibility to markets and shops and subsequently food intake and nutritional status may be compromised. Devastation persists into the post-war period and becomes a primary catalyst for food insecurity: owing to demolition of houses, land, livestock and agricultural products in addition to loss of family members (Ogden, 2000).

2.9.3.2 ormal and informal government policies

Governments, with the aid of intergovernmental organisations and NGOs, must work together to develop and coordinate sustainable initiatives that bring the public and private sectors together on food utilization and fabrication issues (United Nations Environment Programme (UNEP), 2012).

As stated by Laing (2011), government needs to address the following areas: pro-agriculture laws, regulations and policies; pro-trade policies; safeguarding of farmers from unfair trade; financially supporting agricultural research and resource provision; construction of infrastructure; land reform activities that promote individual ownerships; land transfer management- ensuring that productive farms remain intact; promotion of environmental

protection; control water resources more patently; being proactive against climate change and changes to agricultural activities; and establishing and managing urbanisation programmes. Schulze (2011) suggests that government needs to invest in South Africa's scientific aptitude, improve communications between policy makers and scientists, assist with lowering bureaucratic overheads, promotion of a multidimensional approach and accommodate policy negotiations and partnerships.

2.9.3.3 Rights and/or land access

Laing (2011) indicates that land ownership plays a pivotal role in investments individuals are prepared to partake in, in order to partake in farming activities, if the land is tribal land the likelihood of investing in capital developments is reduced and if politicians take over land ownerships, farmers will finish to invest in those farms. Laing (2011) also suggests that all attempts that have been made by the government for land reform/distribution have failed dismally with the majority of the projects resulting in productive farms being taken out of food production. De Schutter (2012) indicates that the land reform programmes that are currently in place are inadequate to provide for sustainable livelihoods and that many improvements need to be made to support and assist with knowledge, skills and the necessary infrastructure. Labadarios *et al.* (2011) elicit that majority of South Africans do not have land for farming activities, therefore, have to procure food items commercially.

2.9.3.4 Illegal residency status

Meeting the nutritional requirements of refugees can best be achieved through enhancing refugees' active livelihood and food obtaining strategies, acknowledging their abilities to become economic agents that can satisfy their own needs. An objective would be to diminish the constraints on refugees from active policies and systems of management which oftentimes weakens refugees' access to resources and markets, principally through altering population distribution (via camps) and by enforcing a variety of petty restrictions on activities. Accessibility to food aid expenditure indicates that the provision of cash, paralleled with programmes to preserve food in local markets, would be a superior means of ensuring refugee entitlement (Wilson, 1992).

2.9.3.5 Poor social networks

According to McCornack (1997), socialisation of food would influence nutritional status, for that reason, the deterioration impinges on social networks that can be ascribed by the death of a spouse, siblings or friends, or even a disability or illness. The study conduct by Devine *et al.* (2006) suggests dietary behaviours differ between genders and cultures and that woman that are educated consume better diets. The same study also suggested that work and family

roles impact on health and health behaviours owing to the fact that it either promotes or restricts access to health sources.

Devine *et al.* (2006) also suggest that stressful family situations directly impact on food choice such as being a single parent, looking after infants, no help with food preparation, having to look after a family member with serious health conditions, caretaking responsibilities for family members, insufficient income, extensive distance from work and/or childcare with restricted transport, activities with children i.e. projects, homework etc. that may compete with time for meal preparation, matrimonial strain and insufficient support from families.

2.9.3.6 Lack of education

Roustit *et al.* (2010) suggest that parents without education contribute to social inequalities regarding economic resources that is paralleled with poor health outcomes. This is owing to the reduced household income and heightened food insecurity prevalence. Gundersen and Kreider (2009) suggest that a sustainable solution to food insecurity would be to implement educational programmes that aid families with food budgeting.

2.9.3.7 Livelihood opportunities

The study conducted by Havas and Salmon (2011) emphasizes that the educating of women is a key factor in improving nutritional status, as educated women appear to have smaller families and an improved economic standing, therefore, resulting in a favourable impact on the nutritional status of her family. Chitja (2011) promotes farming as a livelihood strategy and reiterates the importance of support from government and commercial farmers to assist with skills development, technical knowledge, market access and the provision of mentorship programmes.

The Ethekweni municipality has an initiative called the peri-urban agro ecology strategy which targets poverty and unemployment and provides agricultural support centres to assist in agro ecology techniques, agro ecology research and development centre, training venues, marketing avenues and a future seed bank (De Schutter, 2012). In addition to which is the One home, One garden programme which has proven to decrease food insecurity and provide nutritious foods and that to date 15 765 food production packages and that 6 390 vegetable gardens have been implemented (De Schutter, 2012).

2.9.4 Physical, biological and chemical

Food intake is influenced by the fundamental number of physiological and non physiological factors and that non-physiological and environmental factors have a predominant role in intake regulation (De Castro, 2010). The compensated factors that affect meal patterns are stomach content, hunger and genes (the latter effects the choice of environment that one occupies) and that the uncompensated factors include changes to the built environment including the number of people that are eating together at a meal (meal consumption is 44% larger when eating with others versus eating on your own), density of the diet i.e. kj/g of food, active restraint of intake, time of day (dinner is 69% larger than breakfast, and 15% larger than lunch), activity levels, palatability, variety and availability of attractive foods, eating out and home delivery of attractive pre-prepared foods (De Castro, 2010).

According to Drimie and Casale (2009), vulnerability refers to the coverage of contingencies and stress and the means for coping with them, of which the external side encompasses the exposure to physical changes, economic/social/political changes, economic globalisation, urbanisation, infectious diseases, infrastructural changes and environmental changes whereas the internal fragment looks at the ability to cope with the economic and/or ecological amendments.

De Castro (2010) explains that consumption is subjective to a multitude of physiological and non physiological elements and total ingestion results from the congruency of their influences. De Castro (2010) also suggests that there is no statistically significant correlation among meal size and the subsequent interval of the next meal and that non physiological factors have a superior influence on intake regulation. Both compensated (represents physiological factors) and uncompensated (represents environmental factors) affects one's dietary intake; compensated factors include meal pattern data, stomach content and hunger whereas uncompensated factors include the number of people present for the consumption of a meal, the solidity of the diet, the sum of energy/gram of food, one's ability to actively restrain intake, the time of day that the meal is consumed and the influence on intake and activity levels. An individual's genetic makeup affects the choice of environment that one occupies and the influence on their behaviour i.e. genes may affect the time of day that people chose to eat and their favoured lusciousness (De Castro, 2010).

Brinkman *et al.* (2010) indicate that high food prices have reduced one's access to food. The consequence of inadequate access to food can result in several health issues (Havas & Salmon, 2011).

2.9.5 Prevalence of HIV and AIDS

South Africa has been inundated with a synergism between food insecurity and HIV and AIDS which compromises the health, nutrition and food security status as well as socio economic development of the affected populace (Singer, 2011). Miller *et al.* (2011) suggest that it is difficult to establish whether food insecurity preceded or followed HIV infection. South Africa is conveyed as having the greatest number of HIV infected persons globally, with an approximate of 5.5 million people affected by HIV; which oftentimes is exacerbated by food insecurity (Altman *et al*., 2009). The annual global economic loss owing to HIV and AIDS is approximately $25 billion (Ivers *et al*., 2009).

The study conducted by Hillcocks (2011) acknowledges that HIV and AIDS is an established threat to community food and nutrition security this is attributed by reduced food consumption patterns owing to illness and dwindling labour productivity, which results in reduced land use, reduce crop yields, a lesser amount of crop variety with a negative impact on diet, income and soil fertility.

Altman *et al.* (2009), Miller *et al.* (2011), Ivers *et al.* (2009) and Drimie and Casale (2009) explore the asymbiotic relationship between HIV and food insecurity and have implied that HIV infected persons have an increased susceptibility to food insecurity owing to the economic impact of the disease i.e. powerlessness to seek or retain employment, the forfeiture of income, failure of support from social networks, capabilities to partake in subsistence farming declines, productivity reduces, labour and capital loses increase, all of which may grind down the ability to supply nutritious foods.

HIV infected persons are subjected to critical oxidative stress (which results in viral duplication, loss of immune function, reduced immune cell creation, severe weight loss and amplified sensitivities to the side effects of HIV drugs), therefore, have heightened energy requirements (Singer, 2011). This is degenerated by the fact that ARV's increase hungriness and other household members having to forfeit food, thereby aggravating an already perilous situation (Altman *et al*., 2009). Food assists with the absorption of ARVs, and that an increased appetite is pleasing as this helps reverse the effects of the severe wasting and improve health status (Ivers *et al*., 2009).

Singer (2011) and Ivers *et al.* (200) suggest that the consequences of HIV and AIDS result in children being exposed to extreme psychosocial stress, as a result of dropping out of school to partake in agricultural activities or taking on the roles and responsibility of care giver or household head and heightened susceptibility to malnutrition, diminished health, abuse and exploitation. Thirty eight percent of households that have adopted/care for more than 1 child

that was orphaned to HIV and AIDS might be categorized as “food insecure with child hunger”, versus 7% of households that had only adopted/cared for 1 orphan child (Singer, 2011).

To the contrary Altman *et al*. (2009) and Sawers and Stillwaggon (2008) suggest that food security may also have the potential to heighten one’s exposure to HIV, and may also reduce one’s ability to manage the disease; in that females are more exposed to infection as they may partake in sexual activities in order to generate an income to procure foods which are usually of poor quality; therefore rendering their diets poor in macro and micro nutrients which further compromises the immune system. Interestingly, Miller *et al.* (2011) found that men who knew that women were widowed, owing to husbands dying from HIV and AIDS, and that they had the potential to be HIV positive, were not discouraged from offering these widows food in exchange for sex, conversely some women would not disclose their HIV status with men offering sexual transactions for food, owing to their desperation to feed their children.

AIDS affected dwellings were at greater risk of experiencing severe poverty than non-affected dwellings (Singer, 2011). Conversely, that same study also incited that poverty forced men to seek employment, which often results in labour migration/commuting from rural to urban dwelling, which also boosts the demand for commercial sex dealings which consequently spreads disease. Sex work would catalyse the spread of HIV and labour migration has significantly contributed to the HIV epidemic (Sawers & Stillwaggon, 2008).

A weakened immune system results in fatigue and decreased physical activity, which promulgates the progression from HIV to AIDS, as a result food and nutrition security are essential in bettering the effects of HIV and allows HIV positive people to live healthier lives that enable them to continue to be frugally active (Altman *et al*., 2009). Drimie and Casale (2009) established that numerous HIV and AIDS infected parents did not make provisions for the children’s/dependents future and majority relied on the government’s social grants to provide for their well being.

2.9.6 Climate & environmental factors

Climate change, declining water resources (which is vital for food security), dwindling arable land, increase in fertilizer and fuel prices all impact food production and availability (Laing, 2011). As stated by Schulze (2011), an increase in temperatures will heighten evaporation from dams, rivers and wetlands whilst reducing water levels will lead to a downward spiral in agricultural yields and alter growing seasons for sorghum, soybeans and sugarcane.

Environmental factors including risk factors stemming from poverty are pivotal determinants linked to household food security and is reliant on food access, food security, understanding and skills to advance dietary intake and access to health services (Labadarios *et al*., 2011). When one's environment improves i.e. housing, water, sanitation, so does one's nutrition security improve (Labadarios *et al*., 2011).

De Castro (2010) suggests that the following environmental factors have contributed to the high prevalence of obesity in our current society: variations in the built environment, dietary energy densities, portion amount, delectableness, diversity, accessibility of striking foods, eatery eating, mealtime skipping and changing of intake to the evening, watching of television and advertisements for food, home deliverance and well presented prepared foods.

2.9.6.1 Poor agricultural potential of land

Only 13% of South Africa land can be used for arable farming activities, out of which 22% had high potential with the primary restricting factor being the availability of water (Schulze, 2011). Population density, soil condition, climate, availability of land and crop management directly impact on agricultural output and directly affect food security status (Palm, Smulker, Sullivan, Mutuo, Nyadzi & Walsh, 2010). If the soil is not of sound condition acid and minerals may be leached out of the soil including phosphate, zinc and boron which exacerbates the nutritional value of relevant crops (Laing, 2011).

Land deprivation, deteriorating soil fertility, indefensible water usage, overfishing and marine surroundings dilapidation are all decreasing the capability of the natural resource base to supply food. It is projected that this predicament will be accelerated by the consequences of climate change (UNEP, 2012).

A primary objective of the Millenium Villages Project (MVP) is to escalate crop yields and enhance food security throughout interventions recommended by the United Nations Millennium Project Hunger Task Force (Palm *et al*., 2010).

2.9.6.2 Insufficient agricultural inputs

Availability of agricultural technologies and infrastructure needs to be enhanced to decrease food losses in developing countries. Food losses result in reduced availability, higher prices, lost income for farmers and governments, and exhausted agroecological assets regarding land, soil nutrients, water and other inputs (UNEP, 2012).

The global population is predicted to increase by 30% to 9 billion in 2050, and to maintain a state of food security will require a worldwide increase in agriculture production to ensure access to food, which is restricted by competition for water and harassed agricultural land, and that requires huge investment in improved technologies (Kerr, 2011).

Intercontinental trade in food commodities is the only feasible solution to counteracting the consequences of local food system failures i.e. agricultural output cannot meet the demands of the increased population, resulting in higher food prices and reduce food security status (Kerr, 2011). High food prices result in reduced quality of life and famine and in severe cases even death, the same study also reveal that even when famine is rife, the wealthier individuals always have access to food (Kerr, 2011).

Access to international supplies will reduce the effects of price spike and reduce their extent. It is also interesting to note that export restrictions increase food prices in the local market (Kerr, 2011). As income increases, so does the desire for animal based protein, which results in an increased demand for grain (as animals are fed grain) which results in a grain prices increase, and the poor people are the ones who suffer the most. It is important to note that biofuel also leads to an increase in the price of grains and oilseeds, and that in order to produce biofuels about 30-40% of cropland is being used for its generation (Kerr, 2011).

2.9.6.3 Pests and diseases of crops and livestock

Local production is not always simple as it is effected by drought, frost, pests, diseases, floods, input shortages and innumerable of other tribulations that effect agricultural production (Kerr, 2011). Post-harvest loses can contribute to half of the crop yields which destabilize food availability, nutritional status and dietary diversity (Palm *et al*., 2010). Twenty to 50% of post harvest losses in South Africa is attributed to rodents, moulds and weevils and errs caution of using pesticides and agrochemicals as they may be hazardous to the environment and/or consumer (Laing, 2011). Planting a variety of crops will enhance soil fertility and will prevent plant pests and diseases which in turn decrease the risk of crop failure (Faber *et al*., 2011).

2.9.6.4 Other livestock losses

Natural disaster can have huge ramifications on food production especially droughts and floods, as both can render crop failure and loss (Laing, 2011). Gbetibuou, Ringler and Hassan (2010) elicit that small scales subsistence farmers are less able to adapt and cope from interruptions such as drought whereas Drimie, Germishuyse, Rademeyer and Scwabe (2009) found that farmers reliant on rainfed systems were more vulnerable to drought especially if they relied on rainfed systems for maize crops.

Quinn *et al.* (2011) established that efficiency in the ecological systems has deteriorated with a diminution in edible grasses, uncultivated foods and traditional medicines.

2.9.7 Cultural

2.9.7.1Gender biases

Women are primarily accountable for overseeing, producing and dispensing food inside the household, sharing significant value for intra-household food security. Women's edification and nutritional awareness within the household supplies more than 50% to the diminution of child malnutrition (Quisumbing, Brown, Feldstein, Haddad & Peria, 2000). Undeniably poorer households headed by women endow with more nutritious food for their children as opposed to those headed by men, stressing the significance of gender-based familiarity and roles with consideration to food security (Holmes *et al*., 2009).

Women are disproportionately represented in unofficial, susceptible and informal employment and, all over most regions, women are paid not as much money as men for the equivalent jobs (Holmes *et al*., 2009). Female headed houses are poorer than those headed by male counterparts, and that 32% of children in South Africa are hungry or at risk of hunger, whilst 20% of households have insufficient access to food, and 10.55% of south African adults are affected by HIV/AIDS (De Schutter, 2012). Female-headed households have a tendency to spend significantly more on food than male-headed households and for that reason are knocked further by higher food prices (FAO, 2008).

Microcredit programmes need to be implemented to help alleviate socio-economic and gender inequalities, this too will help illuminate women's dependence on male partners for provision of food (Miller *et al*., 2011). Sawers and Stillwaggon (2008) suggest that the elimination of gender inequality would negate unsafe sexual behaviour and transaction sex.

2.9.7.2 Traditions and cultural preferences

The ethnicity of an individual can have an effect on the procurement habits and, therefore, the quantity of nutrients obtainable to an individual; nonetheless, race is convoluted by its affiliation with former socio-economic and demographic qualities (Nayga, 1994). District and race manipulates individual utilization of majority of food nutrients, therefore, more proficient, nutrition education should be specific and uniformly directed at the entire populace.

2.9.8Scientific and technological

In numerous developing countries, reduced skilled production technology is in use in primary agriculture and dispensation. In higher income countries, meat production and meat processing industries have had to accommodate labour saving technology. It has become essential to make use of more capital-intensive technology to stay profitable. Productivity growth as a result of technological advancement has significantly contributed to agricultural growth (Gelhar & Coyle, 2001). Advances in transportation technology have significantly facilitated trade of unpreserved food products by diminishing delivery times, sustaining product quality and a decrease transportation costs. Packaging creations, fruit and vegetable coatings, bioengineering and other techniques have been developed to diminish the decomposition of food products. This has assisted distributors to extend the distribution of perishable products. Additionally, new technologies in transport are progressively increasing trade of a variety of perishable products. Satellite technologies, including the global positioning systems (GPS), which have become more common and more affordable; allowing shippers to follow their consignment around the globe (Coyle, Hall & Bellenger, 2001).

Plant breeding technologies have resulted in new varieties of traditional fruit, with increasing demand for these products by favouring consumers which is facilitated by improved storage facilities, including that of controlled atmosphere storage which has resulted in ensuring the fruit crisp pending the next crop being harvested (Pollack, 2001).

Innovative food technologies such as irradiation need to gain acceptance by the consumers which is based on their alleged benefits and risks of the new technology and its substitutes (Henson, 1995). Acceptance of and willingness to spend money on new technology that diminishes food safety risks varies amongst a given populace (Buzby, 2001).
Consumers may be reluctant to procure food formed using biotechnology such as genetic engineering (Vogt & Parish, 2001; Buzby, 2001).

2.10 AVAILABILITY OF RESOURCES: BIOPHYSICAL, ECONOMIC, SOCIAL AND HUMAN

The study conducted by Sharkey, Dean and Johnson (2011) suggests that the pervasiveness of food insecurity increased with an increase in household composition and a decrease in employment and income, conversely the partaking in food assistance programmes substantially reduced the ruthlessness of food insecurity. The location of the food store, and the distance thereof, together with the alleged quality of the surrounding food environment increased the probability of food insecurity as well.

Sharkey *et al.* (2011) suggest that in order to combat food insecurity sustainable actions at community level need to be undertaken, including the implementation of educational programmes that address food and management skills, multi-sectional partnerships, development of food aid programmes and improved research efforts.

The study conducted by Sharkey *et al.* (2011) indicated that people who acquired prepared foods from neighbours or friends were more liable to be food secure. The same study analyzes the relationship between demographic descriptions, healthiness, access and mobility, food price, governmental and NGO food and nutrition aid programmes, alleged quality of the food surroundings, food security, consumption behaviours and different food sources.

Crush and Frayne (2011) indicate that the loss in formal sector employment and the rise in unemployment have a negative impact on household food security.

According to Crush and Frayne (2011), characteristics of those vulnerable to food insecurity are those that have restricted cash income. They try to diversify their income sources, they have a reduced social structure with increased household pressure and lastly they alter their food consumption patterns when availability or accessibility to food declines.

De Schutter (2012) indicates that 10 million people benefited from child grants, 3 million people from pension grants, 1 million from disability grants and 500 000 from the foster care grants which account for 30% of the National population. These grants instantly reduce poverty and enhance health, nutrition and education status. De Schutter (2012) indicates that the National Food Relief programme provides food parcels that contain fortified foods to the most vulnerable individuals, their budget for 2011 was R160 million. Laing (2011) signifies that in South Africa investments in agricultural research and the provision of resources has been underpinned for political reasons and has been inadequately managed for the last century.

2.11 CONCLUSION

After examining and synthesizing existing reports on food security and malnutrition, the information portrayed in this chapter conveys to the reader the current state of knowledge as well as the strengths and limitations of the underlying research. The key findings of this chapter include the following:

Food security has several inter related components to consider including availability, access, cultural appropriateness and wholesomeness. Food defence and food safety are directly associated with wholesomeness of food; as in their absence the wholesomeness of food is reduced. It is also important to realize that both unsafe food as well as not having sufficient

access to food both result in compromised nutrition, reduced energy, and poor immune system owing to insufficient intakes of required nutrients.

Unfortunately the poor do not have access to nutritionally sound food, occupy unsanitary environments without access to adequate amounts of clean potable water and basic services in combination with lack of appropriate education and information. Social protection programmes such as provision of social welfare grants to those that are eligible, strategies to stabilize food prices, and education interventions will enable members to purchase more diverse and nutritionally sound foods. It should be the objective for policy makers to ensure that all South Africans have access to food, water, sanitation and health care which can only prevail if there is sound economic growth and improved employment opportunities.

CHAPTER 3: METHODOLOGY

3.1 INTRODUCTION

The aim of this chapter is to explain the procedure for data collection, with the aid of specialized resources, and to determine the socio-economic, nutrition, and food security status of the community living in the Valley of a Thousand Hills in KwaZulu Natal, in addition

to analysing their coping strategies. This study has been designed to yield a representative sample of the people that acquire and prepare the food within each household.

In order to obtain reliable data, research design, and appropriate planning were carefully considered and deemed to be crucial to the success of the field study. Calibrated scales were influential in providing accurate and valid results.

This localised study will assist in root cause analysis of food insecurity at a household level, which will contribute to an improved understanding of the national data. The study conducted by Altman *et al.* (2009) expressed the requisite for reliable localised studies to be conducted to express the food security or insecurity situation in different contexts and at different levels.

Barrett (2010) confirms that to measure food security as an exclusive concept remains a challenge as food security is an indefinable concept. Seeing that food security is a multidimensional topic, the research methods were prudently chosen in order to satisfy the research objectives.

3.2 PERMISSIONS AND INFORMED CONSENT

The research proposal was submitted and approved in 2010 by the Faculty of Applied Sciences Research Committee (FRC) at the Durban University of Technology (DUT) prior to the commencement of the study. Ethical clearance was obtained from the FRC as part of the proposal approval and was not approved by the Institutional Research Ethics Committee (IREC) as this committee was only constituted during 2011. All Faculty ethics applications were dealt with at FRC level prior to this date. Therefore, from 2011 all DUT research had to adhere to the ethical guidelines as per the DUT website.

Permission was granted to conduct the field work in The Valley of a Thousand Hills community by the chief counsellor of the area (Annexure A). At 10am on the 23 June 2011 a meeting was held with the community by the chief counsellor at Michael Gwala Hall (Inchanga Fredville) and the researcher explained the study to everyone that attended the meeting. The community had the opportunity to ask questions for clarification and an information letter was issued to everyone interested in participating in the study (Annexure B). Approximately 100 people attended the meeting. All participants were required to sign a letter of voluntary consent (Annexure C). Prior to the commencement of the study each participant was allocated a number to ensure confidentiality and anonymity. All confidential information is stored in a locked cupboard in the Department of Food and Nutrition at the Durban University of

Technology. After 15 years the information will be shredded. Only the researcher and supervisor have access to the confidential information.

3.3 EMPIRICAL STUDY DESIGN

Steps followed in research process:

Stage 1: Literature review: This stage was composed from researching and analysing scientific literature pertinent to the study.

Stage 2: Planning the study design:

2.1 Obtaining approval to conduct the research study from the Durban University of Technology Faculty Research Committee.

2.2 Communicating with the chief counsellor from the community in the Valley of a Thousand Hills and obtaining permission to conduct the study.

2.3 Community visit: Meeting with the chief counsellor and scheduling a date to hold a community meeting.

2.4 Meeting with the community members to discuss the research and survey protocol, and appointing field workers from the community.

2.5 Conducted the coping strategies and FFQ Focus Group discussion with the field workers from the community.

2.6 Conducted field worker training.

Stage 3: Conducting the field work.

Food security has several interrelated components to consider including availability, access, cultural appropriateness and wholesomeness. Food defence and food safety are directly associated with wholesomeness of food, as in the absence of these the wholesomeness of food is reduced. There was a significant improvement in community member's participation due to close proximity and convenient walking distance. For each day that the research took place a different field worker's house was used as the location for the study. This was to ensure that the accessibility to the community was greatly enhanced, as each fieldworker lived in various segments within the community where the study took place. The study was conducted on the 11th, 12th, 13th and 14th July 2011, in four different areas within the Valley of a Thousand Hills community. On average it took one hour to complete the assessment of one person.

Stage 4: Reporting on results: The results will be discussed in detail in Chapter 4

3.4 SAMPLING DESIGN AND SAMPLING METHODS

The sampling frame was based on stratified random sampling. The study was cross- sectional descriptive in nature, however, composed of elements of quantitative data and qualitative data. Quantitative data was obtained via questionnaires (including socio-demographic, 24 hour recall, FFQ, coping strategies questionnaire) during the individual interviews at the various research stations. Qualitative data were obtained via the coping strategies and FFQ Focus Group discussion. Anthropometric measurements were recorded at the predetermined stage at the research location.

3.5 SAMPLING STRATEGY

The sample was calculated using a power calculation and 257 subjects out of a population base of 7000 community household dwellings in The Valley of a Thousand Hills were required to obtain statistically significant data.

Sample size was calculated as follows:

$$Ss = \frac{Z^2 * (p) * (1-p)}{C^2}$$

Where:

Z= Z value (e.g.: 1.96 for 95% confidence level).

P=percentage picking a choice, expressed as decimal (0.5 used for sample size needed).

C= confidence interval, expressed as decimal = 0.06 (three units on both sides of the normal).

The final sample consisted of 249 with 230 women and 19 men. The remaining 8 participants data were not used, as 6 were under the age of 18, and 2 participants did not complete all stages at the survey location, therefore, missing data presented itself. A total of 257 people participated in the study.

Inclusion criteria:

The sample was defined as people that acquire and prepare the food within each household. The respondents had to be permanent residents in the community of a Valley of a Thousand Hills.

The following were used as the exclusion criteria for the study:

- Community members who did not acquire and prepare the food for their household.
- Physically disabled people (for the collection of anthropometric data)
- Mentally unstable individuals

- Individuals not residing in the community within the Valley of a Thousand Hills.
- Individuals who were residing in the area on a temporary basis.

Data collection took place between 8:00am and 3:30pm daily during the field work study period. Refreshments and a fruit were served to each respondent on survey and anthropometric measurement completion.

3.6 RECRUITMENT AND TRAINING OFFIELD WORKERS

All field workers had to be able to read, write and speak both English and Zulu. Communication with the participants was in the participant's language of choice, which primarily was Zulu, with the data being captured in English.

Three previously trained field workers were recruited from amongst the Durban University of Technology 3rd year Consumer Science: Food and Nutrition students, to conduct the 24 hour recall questionnaire. These three field workers were retrained on how to complete the 24 hour recalls using food samples to assist in estimating portion size and triggering one's memory.

Twelve field workers were recruited from the community itself and were responsible for completing the socio-demographic questionnaires, FFQ, coping strategy questionnaire and anthropometric measurements respectively. All the field workers were trained in a role play situation on how to obtain the anthropometric measurements, and were trained via a training session on how to complete the surveys in a purposeful, courteous, respectful, friendly and patient manner. An area of focus was to ensure that participants felt comfortable, at ease and did not feel threatened by the field workers asking too many questions. All the field workers were trained as per the field worker manual (Annexure D) and were expected to be punctual and to record the data accurately and efficiently as each participant was giving up their valuable time to participate in the study.

3.7 ADMINISTRATION OF QUESTIONNAIRES AND MEASURING INSTRUMENTS

Various data sources were obtained through the use of questionnaires in order to address the variables concerned with the research objectives. The following questionnaires were used, and will be discussed in detail below: socio-demographic questionnaires, dietary intake questionnaire- namely 24 hour recall and FFQ and the coping strategy questionnaire. Lastly anthropometric measurements were taken to determine BMI.

3.7.1 Socio-demographic questionnaire

A pretested and validated socio-demographic questionnaire, written in English, was used (Oldewage-Theron *et al.* 2005). The socio-demographic questionnaire was used to classify people according to their living standards, using criteria such as degree of education, ownership of cars and major appliances, personal data and family profile, demographic data (type of house and services) and socio-economic data. Personal data and family profile included name; address; occupation; names, age and sex of other family members; and the relationships to the head of the family. Education looked at adult literacy and children's school attendance. Socio-economic data included number of people employed in the household; the number of people contributing to household income; household income; food expenditure; other expenses and food security. Demographic data looked at the type of house; the number of rooms; availability of services including electricity, sanitation, running water, waste removal, water and fuel. Two hundred and forty nine questionnaires were completed (Refer Figure 3.1)

Figure 3.1: Field worker completing the socio-demographic questionnaire

3.7.2 Dietary intake

Dietary intake was determined by means of using a 24 hour recall and the developed FFQ. Trained interviewers asked the respondents to recall all food items consumed in the previous 24 hours for 3 occasions, to assist in ensuring that the information obtained is valid as well as to determine individual's eating patterns. The information obtained from the participants had to be one weekend day and two days during the week, and the days had to be three consecutive days. Twenty four hour recalls required individuals to list specific food and beverage items and the quantities that were consumed in the previous 24 hours; the interviewer needs to assist the respondent with estimating portion size with the aid of food models. Challenges related to this type of survey include that the researcher has to rely on

the individual's ability to recall consumption and the individual's honesty with regards to reporting intakes. Resources required to record the data for the 24 hour recall effectively include food models, eating utensils, specialized interviewing skills and special analysis programme. The data obtained from the 24hr recalls included nutritive data, see Figure 3.2 for a photograph of the field workers completing the 24 hour recalls.

Figure 3.2: Trained field workers completing the 24 hour recalls, with the aid of the food models.

The 24 hour recall was used to determine the nutrient intake and was analysed by using the FoodFinder software version 3 program, based on the food composition tables developed by the Medical Research Council (Langenhoven, 1991). The dietary information obtained from the 24 hour recalls needed to be coded, using the specific code in the database and weighed in grams for each food. The portion sizes of the food consumed was estimated by referring to and comparing the portion size to that of the food sample models. Adequacy of nutrient intake is determined by comparing the actual nutrient intake to that of estimated average requirements (EAR), recommended daily allowance (RDA), adequate intake (AI) or tolerable upper intake level (UL). Nutrient adequacy ratios were determined: if the actual intake was less that 100% of the DRI's, it is deemed to be inadequate consumption for that nutrient.

The FFQ supplied by the Durban University of Technology was adapted by the researcher to suit the community. The FFQ gives a retrospective view of intake frequency and measures the types of food consumed in a week. Foods are organised into 9 nutritious food groups within the same nutrient content. The FFQ provides an overall picture of intake, however, does not provide meal pattern data. An existing FFQ was adapted to suit the needs of the community and to determine the variety of food intake over a 7 day period. The FFQ will assist in determining the relationship between diet and disease. See Figure 3.3 for a photo of a field

worker completing the FFQ. The FFQ together with the 24 hour recall enabled the researcher to determine the top twenty food items consumed as well as the nutrient adequacy ratio.

Figure 3.3: Field worker completing the FFQ

The FFQ provide information on the Food Group diversity and food variety and is captured on an excel spreadsheet and analysed for descriptive statistics.

The coping strategies were determined by means of a Focus Group interview with 10 community members. The Focus Group discussion took place at the Michael Gwala Hall (Inchange Fredville), on the 23 June 2011 at 12pm. The community members that were part of the Focus Group discussion were those that were elected to be the field workers. A discussion took place whereby the community members discussed which strategies were most commonly used, and the researcher took minutes of the discussion. Once the top coping strategies were established, they were then given a severity score by the community members.

3.7.3 Coping strategies

Maxwell clarifies that the coping strategies are a short term means for addressing food insecurity at a household level and are not to be confused with adaptive strategies which are a long term means of addressing food insecurity (Maxwell, 1996).

Coping strategies measure the type of strategies used by individuals in order to cope with short term food insecurity. The types of strategies were determined by the community as part of an in depth Focus Group discussion. The Focus Group discussion uses a qualitative research technique to gather information on opinions, perceptions and ideas. The result of the

Focus Group discussion was the top 10 activities that the community members partake in when there is not sufficient funds to purchase foods. The coping strategies used ranged from minor changes in eating patterns (i.e. borrowing food from the tuckshop/ friend/ relative) to dramatic changes to eating patterns (i.e.: skipping food for an entire day). The Focus Group participants then ranked each strategy according to severity. Individual coping strategies (mean) and the cumulative food security index were determined.

According to Maxwell, Watkins, Wheeler and Collins (2003) the Coping Strategies Index Score (CSI) can be calculated as follows:

- The first step is to identify the relevant coping strategies used by the community. The coping strategies used by this community included:
  - Clean gardens/ wash clothes/ wash taxis/ make and sell arts and crafts.
  - Eat at friends/ relatives houses
  - Use grant/ pension money to buy food
  - Use tokens/ vouchers/ stock fell for money to buy food
  - Borrow food from the tuckshop
  - Borrow money from a friend or relative
  - Reduce size of meals
  - Only eat 2 meals a day
  - Skip food for a day
  - Get soup from a soup kitchen
- Secondly, establish the relative frequency of use of each strategy. The relative frequency is established by counting the number of days per week that individuals had to engage in a given strategy.

Relative frequency categories				
All the time? Every day	Pretty often? 3-6 */week	Once in a while? 1-2 */week	Hardly at all? <1 */ week	Never 0*/week
are scored according the mid-point value of the range of each category:				
7	4.5	1.5	0.5	0

- Thirdly, categorize each strategy and give weighting to each. The strategies are grouped according to the appropriate levels of severity and assigned a weighting. Each strategy gets grouped according to four strategies i.e.: 1 is the least severe and 4 is the most severe.

  In this community the strategies were categorized as follows:

  Category 1- least severe:

- Clean gardens/ wash clothes/ wash taxis/ make and sell arts and crafts
- Use grant/ pension money to buy food

Category 2- moderate severity

- Use tokens/ vouchers/ stock fell for money to buy food
- Borrow food from the tuckshop
- Borrow money from a friend or relative

Category 3- more severe

- Eat at friends/ relatives houses
- Reduce size of meals
- Only eat 2 meals a day

Category 4- most severe

- Skip food for a day
- Get soup from a soup kitchen

- Fourthly determine the CSI score, frequency and severity are multiplied to get a numerical score. The greater the frequency any coping strategy is used, the higher the score should be for that individual strategy. Secondly, the greater the severity of the strategy, the higher the weight should be for that entire grouping.
- Lastly, correlate the CSI with other information.

A total score was established for each participant, composed of the addition of each cumulative score for individual coping strategies. The result of the total coping strategies score directly linked to the associated food security or insecurity status of the individual i.e. the higher the score the more food insecure the individual was.

3.7.4 Anthropometric measurements

Anthropometric data were collected to be an indicator of BMI. BMI determines the level of fatness according to relationship of weight to height, whilst considering the size of the frame.

Weight and height were the anthropometric measurements that were obtained. In order to record weight accurately, a calibrated scale was used (Scales 2000: PPS Physician Scale); subjects were required to be in light clothing and were asked to remove their shoes. Two measurements were taken and the average was used.

A stadiometer (Scales 2000) was used to measure height and individuals were required to remove shoes and stand up straight, with the back against the wall, with feet together and arms and legs straight at the sides. Two measurements were taken, and the average of the two was used.

3.8 PROCEDURE FOR CONDUCTING ANTHROPOMETRIC MEASUREMENTS

Anthropometric measurements included weight and height and were conducted as follows:

3.8.1 Weight

- Weight was resolute to the nearest kilogram on a calibrated portable physician scale (PPS).
- Each subject was dressed in light clothing and was asked to remove jackets, shoes, thick jerseys etc. and any additional clothing such as scarves, beanies/hats, socks etc.
- Two trained field workers were responsible for taking the anthropometric measurements.
- The requirement for the position of the scale was on a flat, hard surface and was levelled with the spirit level indication in the centre.
- The scale was turned on and had to read zero (0.0) on the digital reading prior to being used.
- The participant had to stand upright on the scale, facing the field worker and looking ahead, with their feet slightly apart.
- The participant had to remain still on the scale, until the measurement was recorded on the required form.
- The participant had to get off the scale, and wait until the scale read zero (0.0) before repeating the process for the second reading.
- The two readings had to be in the nearest 0.1kg of one another recorded on the same form.
- The averages of the two readings were recorded and used to calculate BMI.

3.8.2 Height

- A stadiometer was used to measure height
- The participants were asked to remove their shoes
- The requirement for the position of the stadiometerwas on a flat, hard surface, next to a smooth and straight wall
- The participant was positioned to be facing the field worker when looking straight ahead

- The participant was required to stand upright with their shoulders relaxed; arms relaxed at their sides; legs straight and knees together; buttocks and heels touching the wall; feet flat on the floor and heels touching.
- The head piece was then slid down gently to rest on the crow of the participants head. See figure 3.4 as an illustration of how the stadiometer is to be used correctly
- The reading was then taken in meters and recorded on the required anthropometric measurement form.
- The procedure was then repeated, and the reading taken to the nearest 5mm or 0.5cm and recorded on the required form.
- The averages of the two readings were recorded and used to calculate BMI.

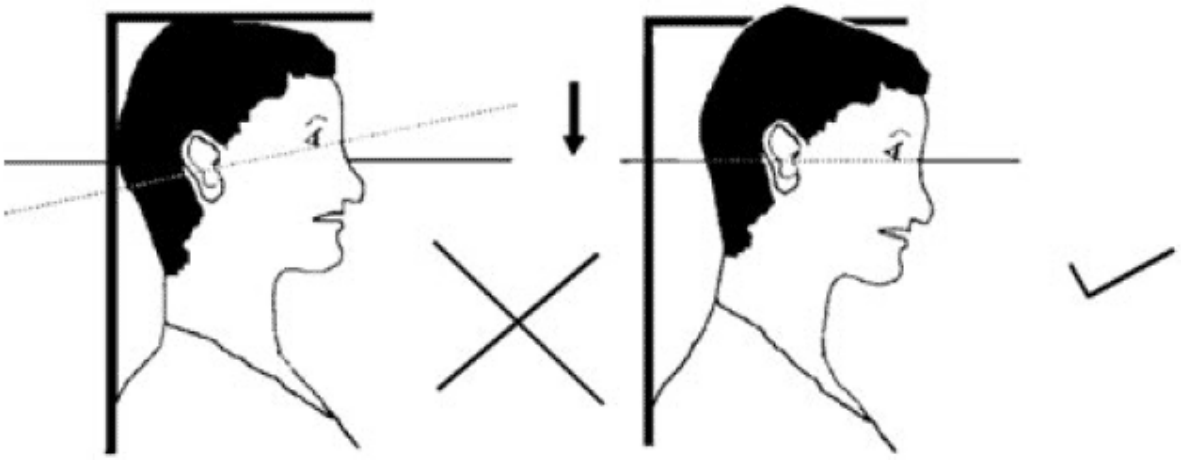


Figure3.6. Stadiometer protocol (Scottish Government, 2009)

3.9 RADIMER/CORNELL HUNGER AND FOOD SECURITY INSTRUMENT

The Radimer/Cornell is a questionnaire used to differentiate between households experiencing progressively severe hunger and food insecurity. It categorizes household food insecurity, individual food insecurity and childhood hunger yet does not include items to assess diet quality (Kendall, Olsen and Frongillo, 1995). This questionnaire was not used as diet quality was assessed and childhood hunger was not included in this study.

3.10ANALYSIS OF DATA

3.10.1 Socio demographic questionnaires

Upon completion of the fieldwork, the questionnaires were arranged in numerical order and reviewed by the researcher for completeness and accuracy. The data from the questionnaires were captured by the researcher onto an Excel spreadsheet. The data were analysed by a statistician using Statistical Package for Social Sciences (SPSS) for Windows Version 20,0

software programs. Statistical data was presented in tables and graphs adhering to standardized methods.

3.10.2 Dietary assessment questionnaires

The dietary assessment questionnaires that were used were the 24hr recall and FFQ.
Upon completion of the fieldwork, the questionnaires were arranged in numerical order and reviewed by the researcher for completeness and accuracy. The data from the 24 hour recall were captured and analysed by a nutrition professional using the MRC food finder version 3.0 software. The food finder software makes use of the South African Food Composition Tables, and is designed to analyse the macro and micro nutrient content of the food items consumed by the community members. Means, standard deviations and nutrient intakes were determined and compared to the DRI's.

The data from the FFQ were captured into an excel spreadsheet and analysed by a biostatistician. The nine nutritious food groups, classified by FAO, were used for the categorization of all-encompassing food intakes i.e. cereals, legumes, flesh products, eggs, dairy, vegetables, fruit, vitamin A rich fruit and vegetables, and fats.. Food diversity, variety scores, means for food groups consumed, nutrient adequacy ratios and requested correlations were determined. A low food variety is indicated when less than 30 foods were consumed in the 7 day period. A medium food variety score is indicated when 30- 60 food were consumed in the 7 day period. A high food variety score was indicated when more than 60 foods were consumed within the 7 day period (Oldewage-Theron & Kruger, 2008).

3.10.3 Coping strategies questionnaire

Upon completion of the fieldwork, the questionnaires were arranged in numerical order and reviewed by the researcher for completeness and accuracy. The data were captured in an Excel spreadsheet and analysed by the researcher. The mean, minimum and maximum were calculated using existing formula on the Excel software package. Individual coping strategies (mean) and the cumulative food security index were determined. The coping strategy score was also calculated per income category and reported in a table.

The calculation used was frequency x severity expressed as: (0-7)~x1-4º

Where:

~ **Frequency scoring**: 0 never (zero times per week); 0.5 hardly at all (once or fewer times per week); 1.5 Once in a while (1 to 2 per week);

4.5 Pretty often (3-6 times per week); 7 (All the time/every day).

º **Severity weight**: Based on ordinal ranking by focus group respondents (1 least severe and 4 most seve

Individual coping strategies (mean) and the cumulative foods security index by household income group was determined.

3.10.4 Correlations

Correlations data was conducted by a Biostatistician using the ANOVA statistical test. This determines whether a justifiable and statistically significant difference existed between data resources. Correlations between BMI, household income, money spent on food per month, number of people per household and cumulative household food security score were conducted. This was to determine if the identified variables had a statistically significant effect on the food security status of individuals (Maxwell, 1996).

Correlations were conducted using the ANOVA statistical test. The ANOVA test tests whether a significant difference exists among various sample revenues (Nordness, 2006). The Spearman's Rho correlation coefficient is used for detecting monotonic trends in time series data (Yue et al., 2002). An r value of 0.000- 1.000 indicates a strong relationship and a p value of <0.05 indicates that it is statistically significant.

3.10.5 Anthropometric measurements

All anthropometric measurements data were captured onto an Excel spreadsheet. BMI was calculated by dividing weight, in kg, by the height squared, in m^2. The results were divided into the following categories as determined by the WHO (1995) underweight (BMI <18.5); normal weight (BMI 18.5- 25); overweight (BMI 25- 30); obese class 1 (BMI 30- 34.99); obese class 2 (BMI 35- 39.99); obese class 3 (BMI >40) and expressed in a table.

3.11 CONCLUSION

This chapter comprehensively describes the methodologies used by the researcher to obtain the data required for establishing the socio-economic status, food security status and nutrient status of individuals that reside in community within the Valley of a Thousand Hills. It covers all aspects from design, to the step by step practicalities regarding the implementation of the field work, to the data capturing and review, through to statistical analysis. The results and the interpretation thereof shall be discussed in the next chapter.

CHAPTER 4- RESULTS AND DISCUSSION

4.1 INTRODUCTION

This chapter will report on the results of the study, including analysis of results. The results for the data are tabulated, interpreted and evaluated. The findings from this study include socio-economic factors, dietary intake and food frequency scores, food security scores and coping strategies and lastly anthropometric results. Two hundred and fifty seven respondents participated in the study; however the sample results consisted of 230 women and 19 men. The data from eight participants were not used, as 6 were under the age of 18, and 2 respondents did not complete all the questionnaires. The results are based on 249 participants.

4.2 SOCIO DEMOGRAPHIC DATA

4.2.1 Introduction

The socio-demographic results present the study populace characterized in percentages according to sample size, accommodation, family composition, work status, income, education, language and assets.

4.2.1.1 ample Size and Age

Figure 4.1 illustrates that a large number of the sample was between the age of 30-39 (34%), 23% was between the age of 20-29 and 18% between the age of 40-49. Twenty four percent was older than 50 years of age.

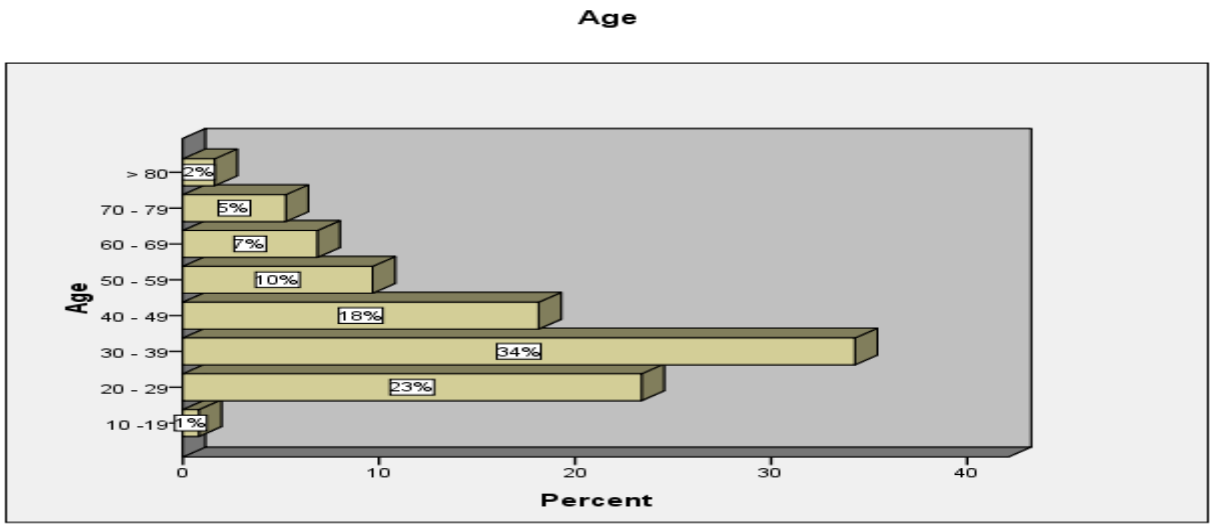


Figure 4.1: Sample distributions according to age (n=249).

4.2.1.2 Accommodation and Family Composition

The results presented in Table 4.1 indicate that 67% of the respondents' role in the family was mothers, followed by 13% being grandmothers and 12% being another relative. It can be seen that the majority of the respondents lived in a rural village (65.5%, n=163).

Table 4.1: Role in the family and living area type

Variables	Number (n=249)	Percentage (%)
Role In the Family		
Mother	**167.0**	**67.0**
Grandmother	33.0	13.0
Father	17.0	7.0
Grandfather	2.0	1.0
Other	30.0	12.0
Total	249	100.0
Living Area Type		
Squatter Camp	41.0	16.5

Rural Village	**163.0**	**65.5**
Hostel	6.0	2.4
Township	39.0	15.6
Total	249	100.0

Most of the respondents shared the house with one to five people (75.5%, n=188) and 61% (n=152) lived in a brick house with less than 2 rooms (82.3%, n=205) as indicated in Table 4.2.

Table 4.2 Household size, type of house and number of rooms per household

Variables	Number (n=249)	Percentage (%)
Household size		
One – Five	**188.0**	**75.5**
Six- Ten	53.0	21.3
Ten and above	8.0	3.2
Total	249	100.0
Type of house.		
Brick	**152.0**	**61.0**
Clay	32.0	12.9
Wood	19.0	7.6
Zinc/ Shack	46.0	18.5
Total	249	100.0
Number of rooms		
<2	**205.0**	**82.3**
3-4	29.0	11.7
>4	15.0	6.0
Total	249	100.0

According to Table 4.3, a large percentage of the respondents lived in the category of other form of living status (32.5%, n=81) which mainly consisted of people living in RDP houses; and own a house/flat (31.7%, n=79).

Table 4.3: Living Status

Variables	Number (n=249)	Percentage (%)
Living status		
Homeless	5.0	2.0
Living with relatives	17.0	6.8
Living with friends	1.0	0.4
Hostel accommodation	29.0	11.7
Squatter home	27.0	10.9
Rented home/ flat	10.0	4.0
Own house/ flat	**79.0**	**31.7**
Other	**81.0**	**32.5**
Total	249	100.0

In addition 58.2% (n=145) had access to flush/sewerage toilets and 58.6% had a tap inside their house (n=146) (see Table 4.4).

Table 4.4: Access to facilities

Variables	Number (n=249)	Percentage (%)
Water Supply		
Tap in House	**146.0**	**58.6**
Tap outside the yard	51.0	20.5
Borehole	6.0	2.4
Fetch water from elsewhere	46.0	18.5
Total	249	100.0
Toilet Facility		
None	13.0	5.2
Pit Latrine	51.0	20.5
Flush/Sewerage	**145.0**	**58.2**
Bucket system	40.0	16.1
Total	249	100.0

Sixty four percent (n=159) of the respondents had access to waste removal facilities. Those that did not have access to the waste removal facilities would throw the waste down the valley, and once sufficient amounts had accumulated, would burn it.

Figure 4.2: Waste removal

In the data in Table 4.5 the respondents could tick more than one option. The results indicate that a large number of problems were experienced with houses included: needing repair (20.5%, n=51); too small to accommodate family members (16.5%, n=41) and being a combination of being too small and needing repair (12.5%, n=31), along with presence of

household pests especially cockroaches (81.1%, n=202), mice/rats (73.9%, n=184) and mosquitoes (46.2%, n=115).

Table 4.5: Problems with housing and pests

Variables	Number (n=249)	Percentage (%)
Problem with housing		
Too small	**41**	**16.5**
Needs repair	**51**	**20.5**
Bad condition	31	12.5
Too small & needs repair	31	12.5
Leaks	30	12.1
Problem with pests		
Flees	66.0	26.5
Mosquitoes	**115.0**	**46.2**
Geckos	8.0	3.2
Frogs	58.0	23.3
Snakes	49.0	19.7
Bed bugs	49.0	19.7
Ant	75.0	30.1
Mice/Rats	**184.0**	**73.9**
Cockroach	**202.0**	**81.1**

4.2.1.3 Work Status and Income

Figure 4.3 illustrates that 97% (n=241) of the populace was unemployed and 3% (n=8) was employed. Figure 4.4 indicates that those that were seeking employment were between the ages of 20 and 69, with the majority being between the ages of 30-39 (40%, n=55). Thirty seven point five percent (n=93) of the respondents between the ages of 20-69 were not seeking employment. Six point nine percent (n=17) older than 70 years of age were not seeking employment.

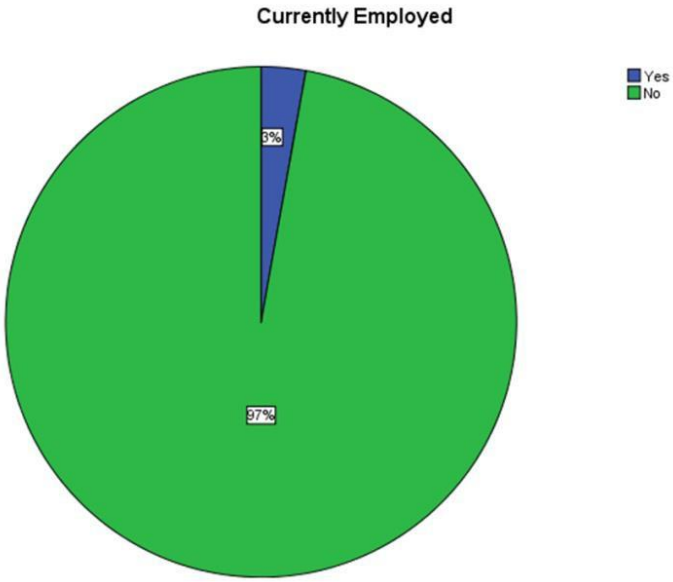


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Figure 4.3: Employment status

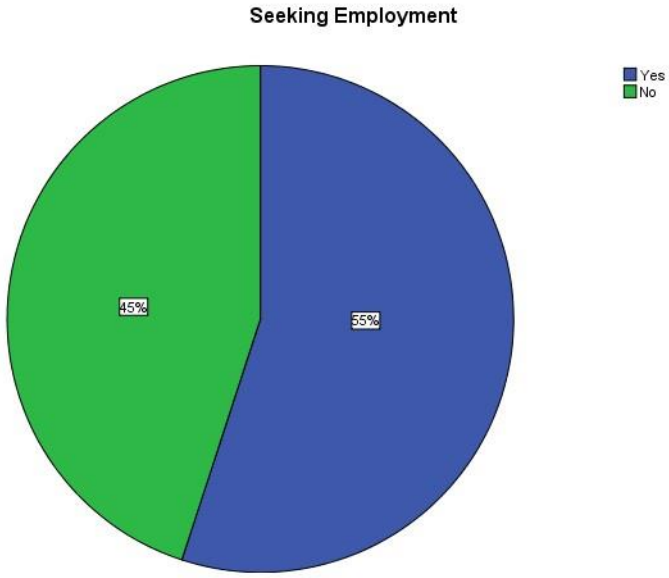

Figure 4.4: Seeking employment

The results in Table 4.6 represent the work status and income with the majority of the respondents being unemployed (87.2%, n=217), therefore, are reliant on government grants including child grants (R250 per child per month) or pension grants (±R1000 per pensioner per month). Moreover the sample total household income ranged between <R500 (37.4%, n=93), between R1001-R2000 (29.7%, n=74); and between R501 to R1001 (29.3%, n=73).

Table 4.6: Work Status and Household Income

Variables	Number (n=249)	Percentage
Current status		
Unemployed	**217.0**	**87.2**
Retired	28.0	11.2
Housewife	3.0	1.2
Other	1.0	0.4
Total	249	100.0
Total Household Income		
<500	**93.0**	**37.4**
R501-R1000	**73.0**	**29.3**
R1001- R2000	**74.0**	**29.7**
R2001-R3000	7.0	2.8
R3001-R4000	2.0	0.8
Total	249	100.0

Table 4.7 indicates the prevalence of temporary food insecurity as 48.6% (n=121) of the sample sometime did not have enough money to purchase foods. The majority of the sample populace (86%, n=214) purchased food once a month and food was purchased from supermarkets (88%, n=219) due to close proximity. Forty three point five percent (n=108) spent more than R500 per month on purchasing food, 10% (n=25) did not know how much is spent on food, the remaining 46.7% (n=116) spent less than R500 per month on food.

Table 4.7: Food Security/ Insecurity Status

Variables	Number (n=249)	Percentage (%)
Frequency of not enough money to purchase food		
Always	69.0	27.7
Often	49.0	19.7
Sometimes	**121.0**	**48.6**
Seldom	1.0	0.4
Never	9.0	3.6
Total	249	100.0
Frequency to purchase food		
Everyday	4.0	1.6
Once a week	13.0	5.2
Once a month	**214.0**	**86.0**
Other	17.0	6.8
Not answered	1.0	0.4
Total	249	100.0
Where food is purchased		
Tuck shop	10.0	4.0
Street vendor	1.0	0.4
Wholesalers	17.0	6.8
Supermarket	**219.0**	**88**
Other	2.0	0.8

Total	249	100.0
Frequency of money spent on food per month		
R0-R50	2.0	0.8
R51-R100	4.0	1.6
R101-R150	5.0	2.0
R151-R200	8.0	3.2
R201-R250	19.0	7.6
R251-R500	78.0	31.3
>R500	**108.0**	**43.5**
Do not know	25.0	10.0
Total	249	100.0

4.2.1.4 ducation and Language

The results presented in Table 4.8 indicate that 37.3% (n=93) of the respondents completed standard 8, and 22.9% (n=57) completed standard 10 as their highest level of education and Zulu is spoken by 95.6% of the populace (n=238).

Table 4.8: Level of Education and Language

Variables	Number (n=249)	Percentage (%)
Level of Education		
None	46.0	18.5
Primary school	49.0	19.7
Standard 8	**93.0**	**37.3**
Standard 10	**57.0**	**22.9**
College/ FET	4.0	1.6
Total	249	100.0
Language		
Zulu	**238.0**	**95.6**
Xhosa	8.0	3.2
English	1.0	0.4
Other	2.0	0.8
Total	249	100.0

4.2.1.5 od Acquisition and Household Assets

Table 4.9 illustrates that the mothers were primarily responsible for the food preparation (77.5%, n=193), decision of type of food purchased (78.3%, n=195) and the amount of money spent on food (77.1%, n=192).

Table 4.9: Food Preparation

Variables	Number (n=249)	Percentage (%)
Responsible for food preparation in the household		
Father	9.0	3.6
Mother	**193.0**	**77.5**
Sibling	15.0	6.0
Grandma	23.0	9.3
Aunt	1.0	0.4
Other	8.0	3.2
Total	249	100.0
Who decides the type of food purchased in the household		
Father	14.0	5.6
Mother	**195.0**	**78.3**
Sibling	8.0	3.2
Grandma	27.0	10.9
Grandpa	1.0	0.4
Aunt	2.0	0.8
Other	2.0	0.8
Total	249	100.0
Who decides the money spent on food		
Father	18.0	7.2
Mother	**192.0**	**77.1**
Sibling	6.0	2.4
Grandma	28.0	11.3
Grandpa	1.0	0.4
Aunt	3.0	1.2
Other	1.0	0.4
Total	249	100.0

According to Table 4.10, the majority of the respondents (53%, n=132) consumed 2 meals per day, with most of their meals consumed at home (88%, n=219).

Table 4.10: Meals Consumed

Variables	Number (n=249)	Percentage (%)
Number of meals consumed		
1	9.0	3.6
2	**132.0**	**53.0**
3	101.0	40.6
>3	7.0	2.8
Total	249	100.0

Where most meals are consumed		
Home	**219.0**	**88.0**
Friends	29.0	11.6
Other	1.0	0.4
Total	249	100.0

Table 4.11 indicates that 48.2% (n=120) of the sample population owned an electric stove, 35.3% (n=88) a paraffin stove, 49.8% (n=124) a refrigerator, 6.4% (n=16) a freezer, 85.5% (n=213) a bed and mattress, 49.8% (n=124) an electric iron, 44.2% (n=110) an electric kettle.

Table 4.11: Household Assets

Variable	Number (n=249)	Percentage (%)
Electrical stove		
Yes	120.0	48.2
Primus or paraffin stove		
Yes	88.0	35.3
Hot plate		
Yes	109.0	43.8
Radio		
Yes	108.0	43.4
Television		
Yes	145.0	58.2
Refrigerator		
Yes	124.0	49.8
Freezer		
Yes	16.0	6.4
Bed base with mattress		
Yes	213.0	85.5
Mattress only		
Yes	143.0	57.4
Lounge suite		
Yes	22.0	8.8
Dining room suite		
Yes	24.0	9.6
Electrical Iron		
Yes	124.0	49.8
Electrical kettle		
Yes	110.0	44.2

Table 4.12 indicates that 71.9% (n=179) uses electricity as fuel for food preparation and that 55.1% (n=137) use aluminium pots to cook food in.

Table 4.12: Fuel and pots used to cook food

Variables	Number (n=249)	Percentage (%)
Type of fuel used for food preparation		

Wood fire	17.0	6.8
Paraffin	52.0	20.9
Electricity	**179.0**	**71.9**
Gas	1.0	0.4
Total	249	100.0
Types of pots used to cook food.		
Cast iron	9.0	3.6
Aluminium	**137.0**	**55.1**
Stainless steel	93.0	37.3
Clay	10.0	4.0
Total	249	100.0

4.2.2 24HR RECALL NUTRIENT ANALYSIS AND TOP 20 FOOD ITEMS

The mean of the three 24-hour recall nutrient analysis indicated a deficient intake by both men and women in all of the nutrients, except for the mean (±SD) carbohydrate intake by men aged 19-50 (214.71g ± 80.22) as indicated in Table 4.13. All of the men and women did not meet the Estimated Energy Requirements (EER) for energy and Adequate Intake (AI) for calcium.

None of the men over the age of 50 (n=5) met the DRI's for the following macro and micro nutrients: with a mean (±SD) energy intake of (4808.06EER ± 2915.40), calcium (85.03mg ±43.57) and vitamins A (33.38µg ± 42.24), B12 (0.37µg ± 0.41) and D (1.23µg ± 1.70). Eighty percent (n=4) of the men over the age of 50 did not meet the DRIs for protein; dietary fibre; zinc; selenium; vitamins B2, B3, B6; folate, panthothenate and biotin or the Estimated Average Requirements (EARs) for carbohydrate intake (refer Table 4.13). Sixty percent (n=3) did not meet the DRI for iron, magnesium, phosphorus, iodine and vitamins B1, E, K.

None of the men aged 19-50 (n=15) met the DRI's for the following macro and micro nutrients: with a mean (±SD) energy intake of (6050.25EER ± 2169.03), dietary fibre (17.25g ± 8.02), calcium (225.18mg ± 129.01) and iodine (34.45µg ± 21.77). Ninety three point three percent (n=14) did not meet the DRI for vitamins: A, B1, B2, C and D. More than 80% of the men did not meet the DRIs for magnesium, zinc and vitamin B6 and vitamin E, selenium, vitamins B12, B6 and vitamin K. The DRI's were not met by 53.3% (n=8) protein, and iron by 40% (n=6). All the men of this age group were able to meet the EARs for carbohydrates.

None of the women over the age of 50 (n=48) met the DRIs for the following macro and micro nutrients: with a mean (±SD) energy intake of (4527.98EER ± 1508.50), calcium (119.17mg± 64.15), selenium (5.16mg ± 5.87), vitamin C (17.90mg ± 9.47) and vitamin D (0.53µg ±1.21). Over 90% of the women did not meet the DRI for vitamins B2, B6, panthothenate, Iodine, biotin, vitamin B3, folate and vitamin A respectively. The DRI's were not met by the women

over the age of 50 for magnesium (89.6%, n=43) with a mean (±SD) intake of 189.48mg (±61.63); zinc (87.5%, n=42), phosphorus (75%, n=36), vitamin K (66.6%, n=32), iron (58.4%, n=28). Over 85% did not meet the DRI for vitamin E, dietary fibre and protein. Ninety one point seven percent (n=44) of the women over the age of 50 were able to meet the DRIs for carbohydrates.

None of the women aged 19-50 (n=179) met the EER for energy with a mean (±SD) energy intake of (4941.25EER ± 1754.95) or AI for calcium (146.82mg ± 97.21). Over 90% of the women did not meet the DRI for vitamin C, Vitamin B2, vitamin D, Iodine, selenium, dietary fibre, panthothenate and vitamin B6. Eighty nine point nine percent (n=160) were unable to meet the DRI for folate. Eighty eight point three percent (n=158) of these women did not meet the DRI's for vitamin B3, vitamin A and Biotin. DRI's were not met by 87.8% (n=157) for iron; 85.5% (n=153) for vitamin E; 83.5% (n=150) for magnesium, zinc and vitamin B1. Seventy three point one percent (n=131) of the women aged 19-50 did not meet the DRI for vitamin B12. The DRI's were not met for 69.3% (n=124) for vitamin K and 64.8% (n=116) for phosphorus. Ninety six point one percent of the women aged 19-50 met the DRI for carbohydrate with a mean (±SD) intake of 182.70g (±59.42). The mean intake of dietary fibre in all the groups were lower than the WHO population nutrient intake goals (>25g).

The aforementioned data reveals that the food insecurity status has resulted in the respondents not being able to consume sufficient amounts of food to meet their nutritional requirements henceforth has results in numerous nutrient deficiencies.

Table 4.13: Dietary Intake Nutrient Analysis, measured using the average of three 24- Hour recall (IOM, 2003).

Nutrients p/day	Women 19-50yrs Mean ± SD	Women >50yrs Mean ± SD	Women 19-50yrs <100% of DRI	Women >50yrs <100% of DRI	Men 19-50yrs Mean ± SD	Men >50yrs Mean ± SD	Men 19-50yrs <100% of DRI	Men >50yrs <100% of DRI	DRI'S
Energy (KJ)	4941.25 ± 1754.95	4527.98 ±1508.50	48.96	44.86	6050.25 ± 2169.03	4808.06 ± 2915.40	46.97	37.33	*#10093kj ~+ 12881kj
Total Fat (g)	22.63 ± 14.96	16.75 ±13.41			30.96 ± 16.97	18.21 ± 14.31			
Carbohydrate (g)	191.62 ± 66.12	182.70 ±59.42	191.62	182.70	214.71 ± 80.22	191.76 ± 114.27	214.71	191.76	*#~+100EAR
Total protein (g)	35.36 ± 17.50	31.99 ±14.43	76.87	69.55	50.14 ± 17.35	34.08 ± 22.24	89.54	60.86	*# 46 RDA ~+ 56 RDA

Total dietary fibre (g/day)	14.39 ± 6.89	15.15 ± 5.48	57.58	72.14	17.25 ± 8.02	14.97 ± 8.82	45.40	49.92	*#21 AI ~+ 38 AI +30AI
Calcium (mg)	146.82 ± 97.21	119.17 ±64.15	14.68	9.93	225.18 ± 129.01	85.03 ± 43.57	22.52	7.09	*~1000 AI #+ 1200 AI
Iron (mg)	5.25 ± 2.38	4.92 ± 2.14	64.77	98.36	6.85 ± 2.93	4.61 ± 2.47	114.23	76.79	* 8.1 EAR # 5 EAR ~+ 6 EAR
Magnesium* (mg)	189.38 ± 68.57	189.48 ±61.63	71.46	71.50	239.59 ± 86.25	209.68 ± 114.55	68.45	59.91	*# 255 EAR ~+ 330 EAR
Phosphorus (mg)	541.23 ± 217.72	490.54 ±180.29	93.32	84.58	749.99 ± 243.68	557.66 ± 329.81	129.31	96.15	
Sodium (mg)	651.54 ± 479.91	563 ± 454.03			946.36 ± 454.40	481.81 ± 716.48			
Zinc (mg)	4.59 ± 2.47	4.24 ± 2.46	67.51	62.32	6.28 ± 2.42	3.87 ± 2.11	66.85	41.13	*# 6.8 EAR ~+ 9.4 EAR
Selenium (µg)	11.63 ± 15.41	5.16 ± 5.87	25.85	11.47	20.98 ± 23.17	13.42 ± 17.97	46.62	29.82	*#~+ 45 EAR
Iodine (µg/day)	27.41 ± 33.88.	26.91 ±28.58	28.86	28.32	34.45 ± 21.77	36.96 ± 47.97	26.27	38.91	*#~+ 95 EAR
Vitamin A RE (µg/day)	172.12 ± 285.32	194.39 ±395.48	34.42	38.88	292.54 ± 573.86	33.38 ± 42.24	46.81	5.34	*# 500 EAR ~+ 625 EAR
Thiamin (mg)	0.65 ± 0.25	0.63 ± 0.21	72.07	69.81	0.75 ± 0.26	0.86 ± 0.61	75.47	86.33	*# 0.9 EAR ~+ 1 EAR
Riboflavin (mg)	0.33 ± 0.27	0.26 ± 0.17	36.96	28.43	0.56 ± 0.48	0.30 ± 0.19	50.85	27.27	*# 0.9 EAR ~+ 1.1 EAR
Niacin (mg)	6.41 ± 4.08	5.03 ± 2.98	58.25	45.72	11.83 ± 6.72	4.77 ± 2.66	98.55	39.78	*#11 EAR ~+12 EAR
Vitamin B6 (mg)	0.59 ± 0.30	0.52 ± 0.24	53.65	40.14	0.74 ± 0.32	0.49 ± 0.30	66.87	34.90	*~ 1.1 EAR # 1.3 EAR + 1.4 EAR
Folate (µg/day)	175.32 ± 109.65	175.98 ±99.14	54.79	54.99	228.47 ± 133.93	174.59 ± 101.21	71.40	54.56	*#~+ 320 EAR
Vitamin B12 (µg/day)	1.80 ± 3.19	0.95 ± 2.07	89.76	47.68	2.98 ± 4.95	0.37 ± 0.41	149.07	18.60	*#~+= 2 EAR
Pantothenate (mg)	2.62 ± 1.87	2.09 ± 1.20	52.34	41.71	4.66 ± 3.24	2.10 ± 1.27	93.25	42.03	*#~+ 5 AI
Biotin (µg/day)	17.48 ± 16.18	15.67 ±19.95	28.26	52.24	27.42 ± 34.44	12.53 ± 10.10	91.39	41.76	*#~+ 30 AI
Vitamin C (mg)	20.51 ± 14.23	17.90 ± 9.47	34.19	29.84	25.38 ± 28.41	9.85 ± 7.88	33.84	13.14	*# 60 EAR ~+ 75 EAR
Vitamin D (µg/day)	1.31 ± 2.16	0.53 ± 1.21	26.23	5.31	2.40 ± 3.67	1.23 ± 1.70	48.02	8.23	*~ 5 AI# 10 AI + 15 AI
Vitamin E (mg)	6.95 ± 5.59	5.02 ± 5.4	57.96	41.82	7.93 ± 6.39	6.46 ± 5.19	66.11	53.81	*#~+ 12 EAR
Vitamin K (mcg)	97.37 ± 135.45	154.20 ±245.14	108.19		57.27 ± 68.26	37.08 ± 55	47.73	30.90	*# 90 AI ~+ 120 AI

*****Women 19-50 yrs; # Women >50 yrs; **~** Men 19-50 yrs; **+** Men > 50 yrs

EER: Estimated Energy Requirements (Institute of Medicine, 2003)
AI: Adequate Intake
EAR: Estimated average requirements

Top 20 food intake

The top 20 most frequently consumed foods are presented on the total intake by the groups (women aged 19-50, women aged >50, men aged 19-50 and men aged >50) on average over the three days as well as the frequency (the number of times the food item was consumed by the group), the mean intake as well as the per capita intake (the average amount each person would have consumed if the whole group had some).

The main source of food intake across the age groups and genders was from the carbohydrate food group, Maize meal appears in number 1 and rice as number 2 in all the groups, except for rice as number 3 in the men >50 years of age. Table 4.14- Table 4.17 reveals the top 20 most popular food items and the average daily intake of the respondents that consumed these items on two week days and one weekend day included in the 24-hour recall.

Table 4.14 indicates that the women between the ages of 19-50 consumed a large amount of carbohydrates as maize (315.62g), rice (209.68g), bread (107.05g) and potatoes (94.87g) appear at number 1, 2, 6 and 7 respectively on the top 20. Chicken appears at number 8 as the first protein but was only consumed 15 times by the group, the portion, however, is 294.00g which is much larger than an average protein portion. Boiled cabbage and sautéed cabbage are present at number 13 and 14 as the first vegetable item with portions sizes of 91.94g and 82.77g respectively. No fruit appears on the top 20 for this group.

Table 4.14: The Top 20 food items consumed over 3 days measured by 24-Hour recalls, for women aged 19-50 years (n=179)

No.	Food item	Total intake (g)	Frequency consumed	Mean intake (g)	Per capita intake (g)
1	Maize meal	59 653.00	189	315.62	333.26
2	Rice	26 628.83	127	209.68	148.76
3	Tea	21 949.33	83	264.45	122.62
4	Sugar beans	8 602.83	57	150.93	48.06
5	Samp and beans	6 333.33	19	333.33	35.38
6	Bread/ rolls	6 101.67	57	107.05	34.09
7	Boiled potato's without skin	4 743.33	50	94.87	26.50
8	Chicken, cooked moist	4 410.00	15	294.00	24.64
9	Cold drink squash, diluted	4 233.33	18	235.19	23.65
10	Rooibos tea	3 250.00	12	293.33	18.16
11	Sugar	2 611.00	147	17.76	14.59

12	Soup powder, reconstituted	2 537.33	77	32.95	14.18
13	Boiled cabbage	2 206.67	24	91.94	12.33
14	Cabbage sautéed in sunflower oil	2 069.33	25	82.77	11.56
15	Onion sautéed in sunflower oil	1 686.67	48	31.14	9.42
16	Pilchards in tomato sauce	1 318.33	15	87.89	7.36
17	Steamed bread	1 274.33	8	159.29	7.12
18	Boiled spinach	1 216.67	11	110.61	6.80
19	Beans, canned in tomato sauce	1 040.00	8	130.00	5.81
20	Instant coffee	1 033.33	4	258.33	5.77

Table 4.15 reveals the top 20 most frequently consumed food items and the average daily intake consumed by women aged >50. The most consumed items were large portions of maize and rice from the carbohydrate groups. Animal based proteins were placed number 9, 10 and 20 on the list in the form of beef (415g) consumed only by 2 people, chicken (117.72g) consumed 6 times and chicken feet (102.68g) consumed 3 times, reflecting a very limited protein intake by the group. Vegetables appear at numbers 7, 11, 14, 16 and included boiled cabbage (94.83g) spinach (137g), sautéed cabbage (73.13g) and sautéed onions (34.90g) consumed only 10, 5, 8 and 13 times respectively by the group. If the portion size is reflected per capita the portion sizes dwindle to 19.76g, 14.27g, 12.19g and 9.45g per person respectively per day.

Table 4.15: The Top 20 food items consumed over 3 days measured by 24-Hour recalls, for women aged >50 years (n=48)

No.	Food item	Total intake (g)	Frequency consumed	Mean intake (g)	Per capita intake (g)
1	Maize meal	18 465.00	55	335.73	384.69
2	Rice	5 606.67	26	215.64	116.81
3	Tea	5 536.67	21	263.65	115.35
4	Samp and beans	3 635.00	10	363.50	75.73
5	Sugar beans	2 167.33	16	135.46	45.15
6	Bread/ rolls	1 080.00	12	90.00	22.50
7	Cabbage, boiled	948.33	10	94.83	19.76
8	Boiled potato's	846.35	9	94.04	17.63
9	Beef stew	830.00	2	415.00	17.29
10	Chicken stew	706.33	6	117.72	14.72
11	Spinach, boiled	685.00	5	137.00	14.27
12	Sugar	644.67	34	18.96	13.43

13	Rooibos tea	595.67	3	198.56	12.41
14	Cabbage sautéed with sunflower oil	585.00	8	73.13	12.19
15	Soup powder, reconstituted	557.67	19	29.35	11.62
16	Onion sautéed with sunflower oil	453.67	13	34.90	9.45
17	Cold drink, squash, diluted	416.67	2	208.34	8.68
18	Steamed bread	381.67	3	127.22	7.95
19	Dumpling	373.00	4	93.25	7.77
20	Chicken feet	308.03	3	102.68	6.42

Table 4.16 reveals the top 20 most frequently consumed food items and the average daily intake consumed by men aged 19-50. The most consumed items were large portions of maize (392.00g) and rice (256.83g) from the carbohydrate groups. Animal based proteins were placed number 7 and 17 on the list with chicken (191.67g) consumed 5 times and pilchards (201.67g) consumed by only one person. Vegetables appear as numbers 11, 15 and 20 and included tomato (333.33g), cabbage (113.34g) and mixed vegetables (90g) with 1, 2 and 2 people consuming one small portion each.

Table 4.16: The Top 20 food items consumed over 3 days measured by 24-Hour recalls, for men aged 19-50 years (n=15)

No.	Food item	Total intake (g)	Frequency consumed	Mean intake (g)	Per capita intake (g)
1	Maize meal	3 920.00	10	392.00	261.33
2	Rice	2 568.33	10	256.83	171.22
3	Tea	1 533.33	6	255.56	102.22
4	Bread/ rolls	1 101.67	9	122.40	73.44
5	Beer, commercial	1 000.00	1	1000.00	66.67
6	Sorghum beer	1 000.00	1	1000.00	66.67
7	Chicken	958.33	5	191.67	63.89
8	Sugar beans	806.67	5	161.33	53.78
9	Samp and beans	553.33	1	553.33	36.89
10	Cold drink, squash diluted	403.33	2	201.67	26.89
11	Tomato	333.33	1	333.33	22.22
12	Coffee	300.00	1	300.00	20.00
13	Mahewu	250.00	1	250.00	16.67

14	Rooibos tea	250.00	1	250.00	16.67
15	Cabbage sautéed in sunflower oil	226.67	2	113.34	15.11
16	Dumpling	208.33	2	104.17	13.89
17	Pilchard in tomato sauce	201.67	1	201.67	13.44
18	Boiled potato	195.00	2	97.5	13.00
19	Crushed wheat	186.67	1	186.67	12.44
20	Mixed vegetables	180.00	2	90.00	12.00

Table 4.17 reveals the top 20 most frequently consumed food items and the average daily intake consumed by men aged >50, on two week days and one weekend day included as per the 24-Hour recall. The most frequently consumed items were large portions of maize (1) and rice (3) from the carbohydrate groups. Sugar beans ranked as number 2 with a portion size of 147.78g consumed 3 times. Animal based proteins were placed number 7, 8, 10 and 17 on the list as pork, eggs, chicken and chicken heads consumed by only 1 person. Vegetables appear as numbers 11, 16 and 18 and included cabbage (41.67g), butternut (28.33g) and onion (21.67g) but only 1 person had some during the 3 day period. Sunflower oil ranked at number 19 , and salt number 20.

Table 4.17: The Top 20 food items consumed over 3 days measured by 24-Hour recalls, for men aged >50 years (n=5)

No.	Food item	Total intake (g)	Frequency consumed	Mean intake (g)	Per capita intake (g)
1	Maize meal	2 093.33	5	418.67	418.67
2	Sugar beans	443.33	3	147.78	88.67
3	White rice	423.33	2	211.67	84.67
4	Sorghum beer	333.33	1	333.33	66.67
5	Tea	250.00	1	250.00	50.00
6	Rooibos tea	250.00	1	250.00	50.00
7	Pork loin chops	91.67	1	91.67	18.33
8	Egg scrambled	80.00	1	80.00	16.00
9	Samp and beans	73.33	1	73.33	14.67
10	Chicken curry	56.67	1	56.67	11.33
11	Boiled cabbage	41.67	1	41.67	8.33
12	Boiled potato’s	41.67	1	41.67	8.33

13	Soup powder, reconstituted	41.67	1	41.67	8.33
14	Brown sugar	39.33	2	19.67	7.87
15	Vetkoek, homemade	33.33	1	33.33	6.67
16	Boiled butternut	28.33	1	28.33	5.67
17	Chicken head	25.00	1	25.00	5.00
18	Onion sautéed in sunflower oil	21.67	1	21.67	4.33
19	Sunflower oil	11.67	1	11.67	2.33
20	Iodised salt	4.83	1	4.83	0.97

In Table 4.18 the results of the energy distribution of the macronutrients from the average of three 24-hour recalls are in accordance with the World Health Organisation's dietary factor goals, except that for fruit and vegetable intake. As a result it proves that the average respondent consumed a balance diet in terms of the macronutrient intake; however it lacked variety and was deficient in several nutrients which will be attributed to insufficient fruit and vegetable intake. Carbohydrates were the main source of food consumption, with very low fruit and vegetable intakes. None of the groups of respondents had any fruit listed on the top 20 food items, except for tomatoes and vegetables.

The total fat intake for all the groups was within the goal recommended by World Health Organisation. Carbohydrates contributed 70%+ of the daily energy needs in the groups which is almost at the top level as recommended by the WHO at 55-75%. The contribution of protein to total daily energy intake for all the groups was within the recommendations of 10-15%, the men aged 19-50 indicated a higher percentage of protein contributing to energy at 14.09%. The intake of fruit and vegetables consumption was significantly lower than >400g goal as recommended by the WHO at between 38-40g per person.

Table 4.18: Dietary factor (food nutrient) intake, to the mean daily intake based on the 24 Hour Recalls (WHO, 2003)**.**

Dietary factor (food nutrient)	Mean ± SD	Mean % Energy contribution	WHO Goal
Women 19- 50 years of age (n= 179)			
Total fat (g)	22.63 ±14.96	16.94	15-30%
Protein (g)	35.36 ±17.50	12.17	10-15%
Carbohydrate (g) & Fibre (g)	206.01 ±73.01	70.88	55-75%
Fruit and vegetable g/day	89.56 ±58.32		>400
Women >50 years of age (n=48)			
Total fat (g)	16.75 ±13.41	13.69	15-30%
Protein (g)	31.99 ±14.43	12.01	10-15%
Carbohydrate (g) & Fibre (g)	197.85 ±64.9	74.28	55-75%
Fruit and vegetable g/day	87.32 ±52.16		>400
Men 19- 50 years of age (n=15)			
Total fat (g)	30.96 ±16.97	18.94	15-30%
Protein (g)	50.14 ±17.35	14.09	10-15%

Carbohydrate (g) & Fibre (g)	231.96 ±88.24	66.97	55-75%
Fruit and vegetable g/day	72.11±55.58		>400
Mean >50 years of age (n=5)			
Total fat (g)	18.21 ±14.31	14.02	15-30%
Protein (g)	34.08 ±22.24	12.05	10-15%
Carbohydrate (g) & Fibre (g)	206.73 ±123.09	73.93	55-75%
Fruit and vegetable g/day	40.00 ±39.10		>400

4.2.3 FOOD VARIETY SCORE, DIETARY DIVERSITY SCORE AND NUTRIENT ADEQUACY

The nine nutritious food groups with a count of the individual foods within the groups were reported in the food variety score which is tabulated in Table 4.19. The total sum of 66 different, individual foods was consumed within the seven day period. The total range of individual food items consumed by the respondents during the seven day period was between 3 -66.

The highest number of individual foods, consumed by the majority of the respondents was between 13- 18 individual foods (25.8%, n=64). The mean Food Variety Scores (FVS) (±SD) for all foods consumed from the food groups during seven days was 22.45 (±10.32), indicating a low food variety score.

The food groups with the most variety were the fruit (15) and vegetable (12) groups respectively. Fifteen different fruits were consumed by 1 respondent only, a large number of the respondents (20.9%, n=52) only consumed 2 different fruits within the seven day period. Twelve different vegetables were consumed by 1 respondent only, 18 % (n=45) of the respondents consumed 3 different vegetables within the same period. It is important to note that 27 people (10.8%) did not consume any fruit and 3 (1.2%) did not consume any vegetables and 77 (31.0%) did not consume any vitamin A rich foods within the seven day period, this is similar to the low fruit and vegetable intake reported in Table 4.18.

Ten different starchy foods were consumed by 1 respondent, whereas 26.6% (n=66) consumed 4 different starchy food, followed closely by 23.4% (n=58) consuming 3 different types of starches.

The least frequently consumed food group was the egg group with 44.4% (n=110) not consuming any eggs within the seven day period. The second least frequently consumed food group was dairy where 40.8% (n=101) of the respondents did not consume any dairy products within the seven day period, and a large number of those that did (29.4%, n=73) only

consumed one type of dairy products, the maximum number of dairy products consumed was 6, by one individual.

The maximum number of legumes consumed was 5, and was consumed by 1.6% (n=4) of the respondents, 31 individuals (12.5%) did not consume any legumes within the seven day period. The greatest number of different flesh foods consumed was 9 and this was consumed by 1 individual, a large number (21.8%, n=54) consumed 3 types of flesh products within the seven day period, and 21 respondents (8.5%) did not consume any flesh products within this period.

Seven different types of fats were consumed by 3 individuals (1.2%), with 27.4% (n=68) consuming two different types of fats, and 5.2% (n=13) not consuming any fat within the seven day period.

Table 4.19: Household Food Access as Measured by the Food Group Variety consumed over a period of seven days (n=248).

Cereal Group (n=9)	Legumes Group (n=5)	Flesh Products (n=9)	Egg Group (n=1)	Dairy Group (n=6)	Vegetable Group (n=12)	Fruit Group (n=15)	Vitamin A Rich Group (n=8)	Fat Group (n=7)	Total Individuals Food Items Eaten From all Groups (n=66)

0=1 1=1 2=19 3=58 4=66 5=51 6=33 7=17 8=1 9=0 10=1	0=31 1=97 2=76 3=29 4=11 5=4	0=21 1=46 2=53 3=54 4=37 5=20 6=7 7=6 8=3 9=1	0=110 1=138	0=101 1=73 2=39 3=19 4=12 5=3 6=1	0=3 1=15 2=43 3=45 4=40 5=31 6=26 7=23 8=10 9=6 10=4 11=1 12=1	0=27 1=28 2=52 3=39 4=30 5=25 6=18 7=11 8=8 9=6 10=2 11=0 12=1 13=0 14=0 15=1	0=77 1=38 2=44 3=43 4=21 5=14 6=6 7=3 8=2	0=13 1=42 2=68 3=44 4=43 5=30 6=5 7=3	0-6=3 7-12=33 13-18=64 19-24=48 25-30=51 31-36=20 37-42=20 43-48=7 49-66=2

Low= 0-3 food groups or <30 individual foods
Medium= 4-5 food groups or 30-60 individual foods
High = 6-9 food groups or >60 individual foods

A summary of the food group variety is presented in Table 4.20. In this community a mean ±SD of 22.45 ±10.32, was consumed indicating a low food variety score (low variety =<30). The vegetable group reported the highest individual mean FVS ±SD of 4.35 ±2.247 followed by, starches, fruits, flesh products, vitamin A rich groups, dairy, legumes and eggs with, 4.32 ±1.434, 3.82 ±2.358, 2.99 ±1.662, 2.82 ±1.571, 1.88 ±1.114, 1.84 ±.964, 1 ±0.000 respectively.

Table 4.20: Summary of Food Variety Score within the Food Groups (n=248)

Food Group	Mean	SD	Range of scores
Cereals, Roots and Tubers	4.32	1.434	0-10
Other vegetables	**4.35**	**2.247**	**0-12**
Vitamin A rich fruit & vegetables	2.82	1.571	0-8
Flesh foods meat, poultry, fish	2.99	1.662	0-9
Fats and oils	2.91	1.447	0-7
Dairy	1.88	1.114	0-6
Other fruit	3.82	2.358	0-15
Legumes and nuts	1.84	.964	0-5
Eggs	1.0	0.000	0-1
Total food items	22.45	10.320	3-66

In Table 4.21 the food group diversity is summarized as the majority of the respondents (91.1%, n=226) could be classified with a good dietary diversity score consuming food from 6-9 different food groups, followed by medium dietary diversity score (6.45%, n=16) consuming 4-5 food groups, and low dietary diversity score (2.4%, n=6) consuming 0-3 food groups respectively. We can thus see a mean low food variety score (22.45) but a high diversity score 6-9 food groups by the majority of the group.

Table 4.21: Summary of Food Group Diversity (n=248)

Number of food groups consumed n=9	Frequency	Percentage
1	0.0	0.0
2	0.0	0.0
3	6.0	2.42
4	4.0	1.61
5	12.0	4.84
6	38.0	15.32
7	46.0	18.60
8	75.0	30.20
9	67.0	27.01
Total	248.0	100.00

Nutrient Adequacy

In Figures 4.5 to 4.12 the Nutrient Adequacy Ratio (NAR) values illustrate the relationship between the food group dietary diversity score (FGDS) and nutrient adequacy ratios for energy, protein and selected minerals and vitamins. These figures reflect an increase in NARs for all nutrients as dietary diversity scores increase, in other words the greater the variety of foods consumed, the better the nutritional status.

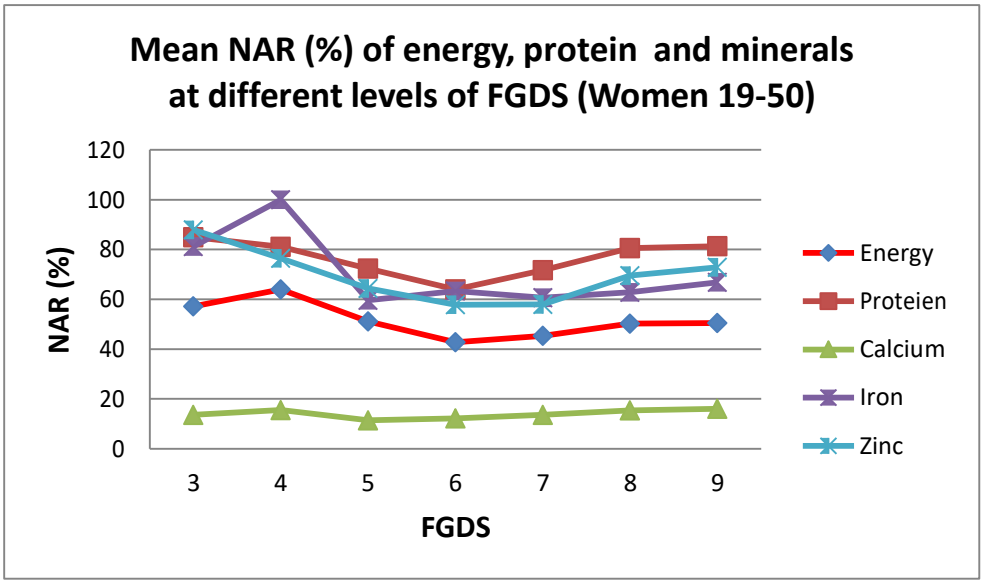

Figure 4.5: NAR% for energy and nutrients; women aged 19-50

Figure 4.5 demonstrates that there is a steady increase in the NARs from food groups 6 upwards for women 19-50 years of age for each of the nutrients i.e.: Energy (±8%); Protein (±20%); Calcium (±8%); Iron (±5%) and Zinc (±15%). Similarly Figure 4.6 also demonstrates a steady increase in NARs from food groups 6 upwards for each of the vitamins i.e. vitamin A (±35%); vitamin B6 (±8%); riboflavin (±15%). There was no visible increase in NARs for vitamin C and folate with an increase in FGDS.

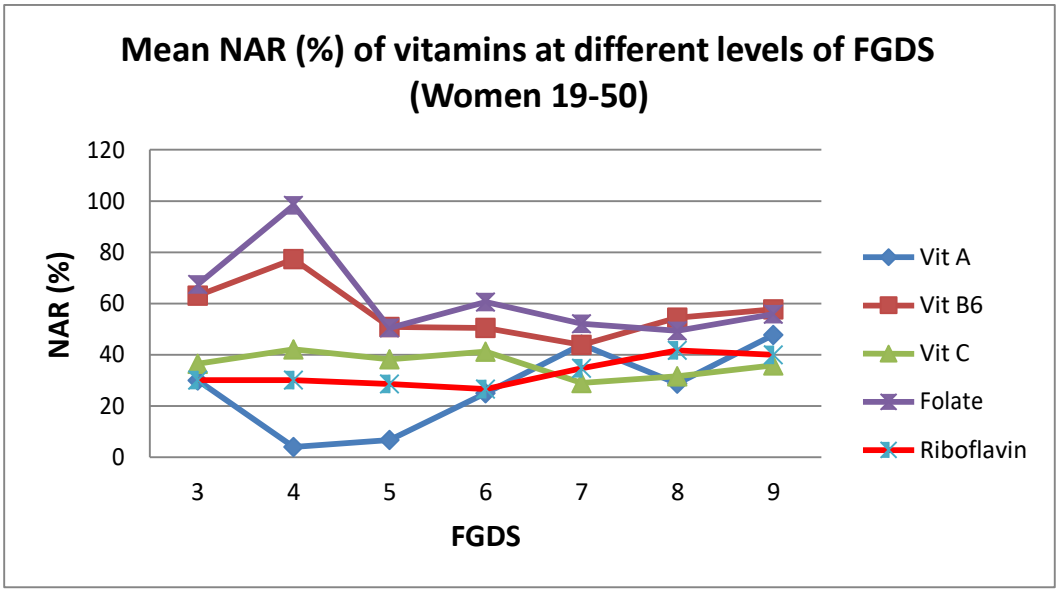

Figure 4.6: NAR% for vitamins; women aged 19-50

Figure 4.7 and 4.8 illustrate the NAR values for women >50 years of age. Figure 4.7 demonstrates that there is a steady increase in the NARs from food groups 7 upwards for each of the nutrients i.e.: Energy (±8%); Protein (10%); Calcium (±5%); Iron (±15%) and Zinc (±2%). Similarly Figure 4.8 also demonstrates a steady increase in NARs from food groups 7 upwards for each of the vitamins i.e. vitamin B6 (±4%); vitamin C (±5%) and folate (±12%).Vitamin A showed an increase (±15%) in NARs from FGDS 9.

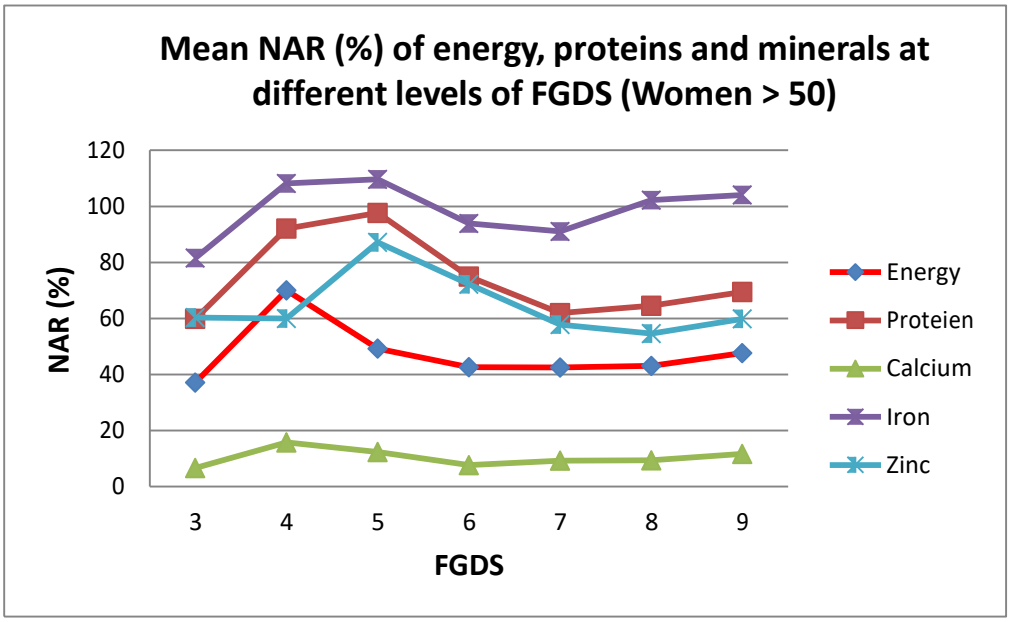

Figure 4.7: NAR% for energy and nutrients; women aged >50

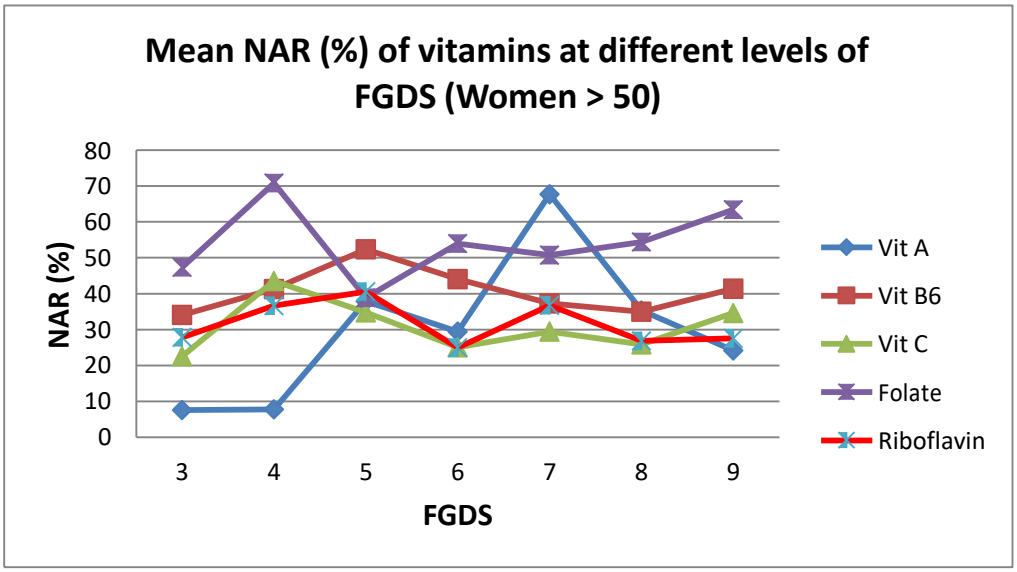

Figure 4.8: NAR% for vitamins; women aged >50

Figures 4.9 and 4.10 illustrate the NAR values for men 19-50 years of age. Figure 4.9 demonstrates that there is a steady increase in the NARs from food groups 7 upwards for each of the nutrients i.e.: Energy (±10%); Protein (±28%); Zinc (±10%). Similarly Figure 4.10 also demonstrates a steady increase in NARs from food groups 3 upwards for each of the vitamins i.e. vitamin B6 (±35%); vitamin A showed a significant increase (±30%) in NARs from FGDS5 and FGDS 9. There was an increase in NARs for riboflavin (±5%) and folate (±8%) from FGDS 8 to FGDS9.

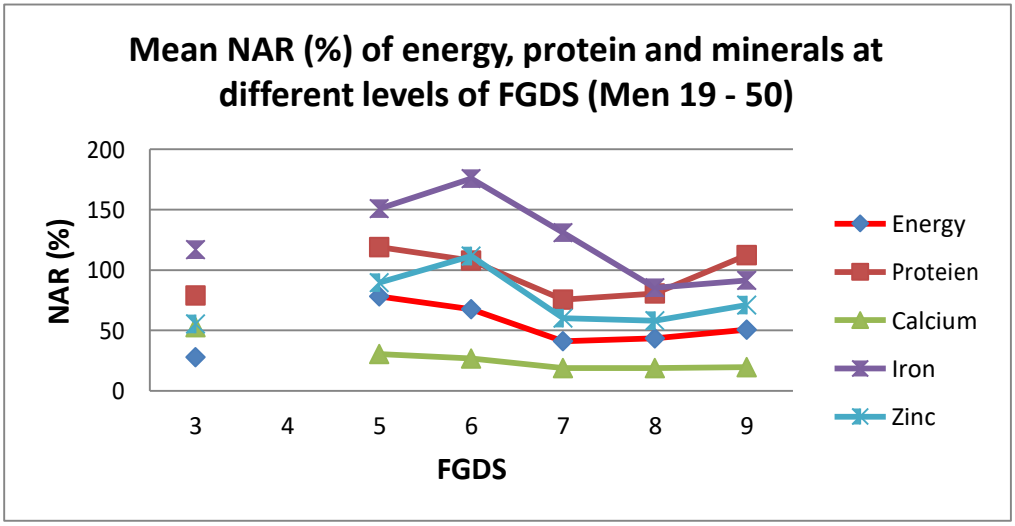

Figure 4.9: NAR% for energy and nutrients; men aged 19-50

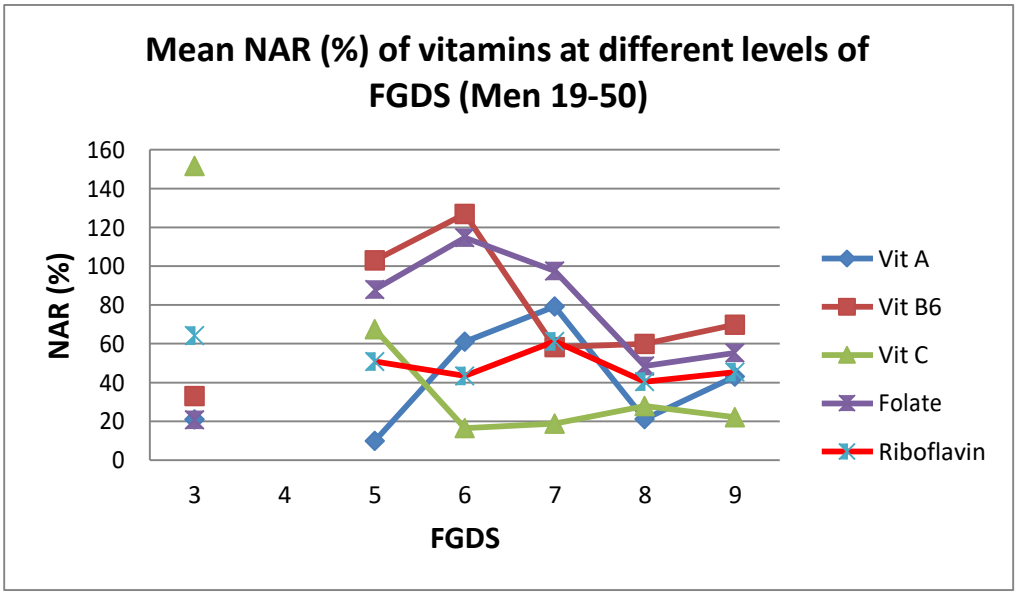

Figure 4.10: NAR% for vitamins; men aged 19-50

Figures 4.11 and 4.12 illustrate the NAR values for men >50 years of age. Figure 4.11 indicates that there is a steady increase in NARs from food groups 6 upward. There is an increase (%) for each of the nutrients: energy (±20%), protein (±40%), calcium (±5%), iron (±60%) and zinc (±20%). Figure 4.12 indicates that there is a steady increase in NARs from food groups 6 upward for each of the vitamins: vitamin A (±8%), vitamin B6 (±30%), vitamin C (±11%), folate (±50%) and riboflavin (±10%).

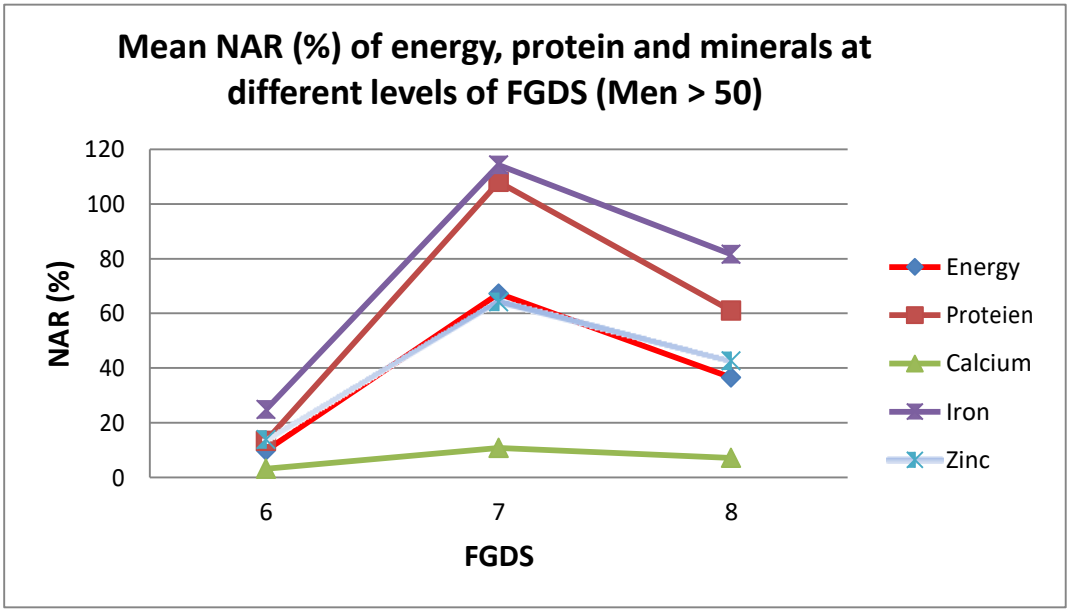

Figure 4.11: NAR% for energy and nutrients; men aged >50

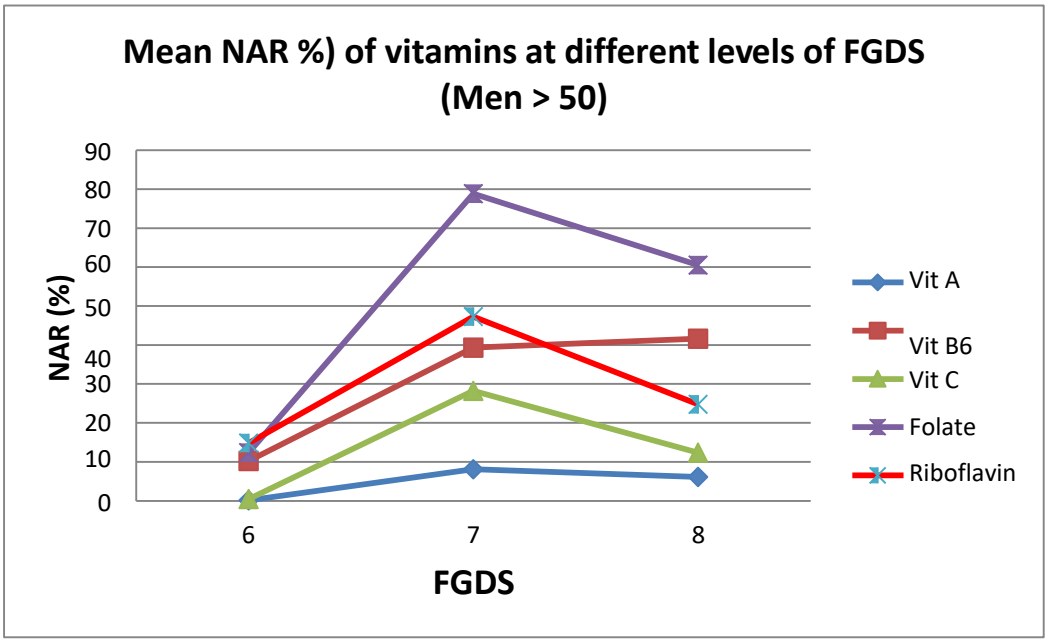

Figure 4.12: NAR% for vitamins; men aged >50

4.2.4 D SECURITY AND COPING STRATEGIES

Individual coping strategies were determined through Focus Group discussion in the community, the ten coping strategies used in this community are reflected in Table 4.22.

Table 4.22: Coping strategies index questionnaire for a Valley of a Thousand Hills Community

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? Every day	Pretty often? 3-6 */week	Once in In a While? 1-2 */week	Hardly At all? <1* /week	Never	Raw score	Severity weight	Score= Relative Frequency X weight
Relative frequency score	**7**	**4.5**	**1.5**	**0.5**	**0**			
1.Clean gardens/ wash clothes/ wash taxis/ make & sell arts &crafts							1	
2.Eat at friends/relatives houses							3	
3.Use grant/pension money to buy food							1	
4.Use tokens/ vouchers/ stock fell for money to buy food							2	
5. Borrow food from the tuckshop							2	
6. Borrow money from a friend or relative							2	
7. Reduce size of meals							3	
8. Only eat 2 meals a day							3	

9. Skip food for a day							4	
10. Get soup from a soup kitchen							4	
TOTAL HOUSEHOLD SCORE								

Severity weight: 1=least severe; 4= most severe

The individual coping strategies and the mean cumulative food security index were determined, and the results are expressed in Table 4.23. The cumulative scores ranged from 4.5 to 117 with the mean score of 42.5. The maximum food insecurity score that could have been generated is 175, indicating severe food insecurity, with the minimum as 0, indicating food security. The higher the score the greater the prevalence of food insecurity, and the lower the score the less food insecure the households are. The most commonly used coping strategy was "only eat two meals a day" with a mean of 9.51, and to "reduce size of meals" with a mean score of 8.78 thirdly "use grant or pension money to buy food" with a mean of 6.13 were employed as a coping strategy by the group (n=249).

Table 4.23: Individual coping strategies (mean) and the cumulative foods security index (n=249).

Participants (n= 249)	**Do odd jobs for money**	**Eat at friends/ relatives**	**Use grant or pension money to buy food**	**Use tokens/ vouchers/ stokvelfor money to**	**Borrow food from tuck shop**	**Borrow money from friends or**	**Reduce size of meals**	**Only eat 2 meals a day**	**Skip food for a day**	**Get food from a soup kitchen**	**Cumulative index**
	Frequency x severity										(min-max)
	(0-7)~x1º (max score 7)	(0-7)~x3º (max score 21)	(0-7)~x1º (max score 7)	(0-7)~x2º (max score 14)	(0-7)~x2º (Max score 14)	(0-7)~x2º (max score 14)	(0-7)~x3º (max score 21)	(0-7)~x3º (max score 21)	(0-7)~x4º (max score 28)	(0-7)~x4º (Max score 28)	
Mean food security score	1.02	5.14	6.13	0.69	1.67	1.86	8.78	9.51	3.64	4.08	0.69-9.51

~ **Frequency scoring**: 0 never (zero times per week); 0.5 hardly at all (once or fewer times per week); 1.5 Once in a while (1 to 2 per week);
4.5 Pretty often (3-6 times per week); 7 (All the time/every day).

º **Severity weight**: Based on ordinal ranking by focus group respondents (1 least severe and 4 most severe).

Individual coping strategies (mean) and the cumulative foods security index by household income group were determined, and the results are expressed in Table 4.24. Each income group utilizes different coping strategies, however, all income groups crucial strategy for coping is to only eat 2 meals per day, with a mean severity score for middle income (>R3000 per month), low middle income (R2001-R3000 per month), low income (R1001-R2000) per month and very low income (<R1000 per month) at 9, 5.35, 8.81 and 10.0 respectively.

The middle income groups (primary coping strategies are to "skip food for a day" with a mean severity score of 9 or to "only consume 2 meals per day" (mean=9). The next most frequently used strategy is to "reduce the size of the meals" with a mean of 6.75, followed by "using grant/pension money to buy food" (mean =3.5), followed by "getting food from a soup kitchen" (mean=3). The middle income group did not partake in "making use of tokens/ vouchers" or "stokvel money to buy food"; nor "do odd jobs for money", or "eat at friends' or relatives' houses".

The low to middle income group coped by only "consuming two meals a day" (mean=10.36), followed by "reducing the size of their meals" (mean =9.47); and "using grant/pension money to buy food" (mean=6.35).The rest of the strategies were used to a lesser frequency.

The low income group primarily coped by "only consuming two meals a day" (mean =8.82), followed by "reducing the size of their meals" (mean=8.35), using "grant/pension money to buy food was used to a lesser mean frequency of 6.45.

The very low income group primarily coped by "only consuming two meals a day" (mean=6.17), followed by "reducing the size of their meals" (mean=5.33); and "using grant/ pension money to buy food" with a mean frequency of 3.82. The rest of the strategies were used to a lesser extent.

Table 4.24: Individual coping strategies and the mean cumulative food security index by household income group (n=249).

Strategy	Do odd jobs for money	Eat at friends/ relatives houses	Use grant or pension money to buy food	Use tokens/ vouchers/ stock fell for money to buy food	Borrow food from tuck shop	Borrow money from friends or relatives	Reduce size of meals	Only eat 2 meals a day	Skip food for a day	Get food from a soup kitchen	Cumulative index

Income group#	Frequency x severity										4.5-117
	(0-7)~x1º (max score 7)	(0-7)~x3º (max score 21)	(0-7)~x1º (max score 7)	(0-7)~x2º (max score 14)	(0-7)~x2º (Max score 14)	(0-7)~x2º (max score 14)	(0-7)~x3º (max score21)	(0-7)~x3º (max score 21)	(0-7)~x4º (max score 28)	(0-7)~x4º (Max score 28)	(min-max)
M	1.00	5.31	5.94	0.44	1.52	1.72	8.92	9.73	4.15	5.31	mean:4.40
LM	1.05	4.12	6.35	0.75	2.25	1.64	9.47	10.36	2.88	4.75	mean:4.36
L	1.01	4.26	6.49	0.82	1.24	2.23	8.35	8.82	3.89	2.22	mean:3.93
VL	0.94	2.33	3.28	1.67	2.11	2.11	5.33	6.17	2.44	1.33	mean:2.77

~ **Frequency scoring**: 0 never (zero times per week); 0.5 hardly at all (once or fewer times per week); 1.5 Once in a while (1 to 2 per week);
4.5 Pretty often (3-6 times per week); 7 (All the time/every day).
º **Severity weight**: Based on ordinal ranking by focus group respondents (1 least severe and 4 most severe).
Income group: M: middle income >R2001; LM: Low-middle income R1001 to R2000; L: Low income R501 to R1000; VL: Very low income <R500

4.2.5 ANTHROPOMETRIC INDICATORS

The BMI of the respondents reported in Table 4.25 indicated that 28% (n=70) of the respondents were classified as being overweight, 94.3% of those classified as being overweight were women compared to 21.4% men. Twenty two percent (n=56) of the respondents was deemed to have normal weight, women contributing 78.6% and men contributing to the remaining 21.4%. It is interesting to note that 20% (n=49) of the respondents were classified as obese class I, 17 % (n=42) as obese class II and 11% (n=27) as obese class III all of which were women. Two percent (n=5) of the respondents were classified as underweight, out of which 40% were women and 60% were men.

Table 4.25: Summary of Body Mass Index (BMI)

PARAMETER	CLASSIFICATION	TOTAL (n=249)	Percentage (%)	Percentage (%) **MEN (n=19)**	Percentage (%) **WOMEN (n=230)**
BMI Classifications, WHO (1995).					
BODY MASS INDEX	UNDERWEIGHT <18.5	5.0	2.0	60.0	40.0
	NORMAL WEIGHT >18.5- 24.99	56.0	22.0	21.4	78.6
	OVERWEIGHT 25-29.99	70.0	28.0	5.7	94.3
	OBESE CLASS I 30-34.99	49.0	20.0	0.0	100.0
	OBESE CLASS II 35-39.99	42.0	17.0	0.0	100.0

	OBESES CLASS III ≥40	27.0	11.0	0.0	100.0

4.3 CORRELATIONS

There is a significant relationship between the numbers of people per household to the BMI (*p*=0.000), household income (*p*=0.00), money spent on food per month (*p*=0.000) and the household food security score (*p*=0.014) as indicated in Table 4.26. Other correlations that were deemed to have a strong relationship but were not significant were as follows: money spent on food per month and BMI (*p*=0.356), household food security score and BMI (*p*=0.426), cumulative household food security score and household income (*p*=0.145), cumulative household food security score and the amount of money spent on food per month (*p*=0.929).

Table 4.26: Relationship between the number of people per household to other variables (Spearman's rho correlations).

Variable	Relationship (r value)	Significance (p value)
BMI	.256**	0.000
House hold income	-.241**	0.000
Money spent on food per month	.318**	0.000
House hold food security score	.155*	.014

* Correlation is significant at the 0.05 level (2-tailed)

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

4.4 DISCUSSION

The wealth of data collected in this research illustrates the most comprehensive nutritional status and dietary intake patterns of the community residing in The Valley of a Thousand Hills in Kwa-Zulu Natal. The results analyzed in this chapter clearly indicate that the high prevalence of poverty and levels of food insecurity and poor nutritional status compromises the quality of life of the respondents. Socio-economic status plays a major role in quality of life, including in the food choices that the respondents are able to make.

Socio-demographic data

The socio-demographic profile of this community reflected that 81.5% of the respondents were able to read and write which is in line with the 91.9% reported in the General Household Survey (GHS) of 2011 (Stats SA, 2011). Thirty seven point three percent of the community members only achieved a standard 8 which could contribute to the inability to find employment and may indicate a lack of nutritional knowledge to prepare foods.

It was however found that only 31.7% lived in houses that they owned, the average homeownership for South Africa is 53.6% placing this community at a disadvantage, it was also reported that 20.5% of the respondents lived in houses that needed repair. The high level of poverty accounts for this as the respondents do not have funds available for repair and/or restoration which has resulted in12.5% of the homes being in a bad condition and 12.1% having leaks. The GHS reported that 82.7%of South Africans had access to electricity and 89.5% access to piped water, it is similar in this community as 71.9% of the respondents reported using electricity for cooking purposes and 58.6% had a tap in the house to access water. More than halve (58.2%) of the participants had access to a toilet that flushes and 64% had access to waste removal. The country statistics indicates that there are still 5.7% of South Africans that either have no toilets or used the bucket system but that 61.0% of South Africans had access to refuse removal(Stats SA, 2011)..

Food insecurity is very prevalent, as a consequence of the extreme poverty faced by this community as the majority (87.1%) of the respondents were unemployed and 37.3% earned less than R500pm, and 48.6% of the respondents sometimes ran out of money to buy food. The situation in this community is worse than the country wide averages reported by the GHS that indicate that the majority (62.6%) of South Africans relied on income from salaries whereas 44.8% relied on grants. Less than 20% of South Africans had inadequate access to food (Stats SA, 2011). A study conducted by Faber, Witten and Drimie (2011) indicates that women in KZN considered affordability as a major constraint to the consumption of fruit and vegetables, and that in a rural village in KZN, vitamin A rich vegetables were not offered in the local stores, hence the reason for minimal or no consumption, Seventy seven respondents (31%) did not consume any vitamin A rich vegetables.

According to Labadarios, Mchiza, Steyn, Gericke, Maunder, Davids and Parker (2011), the 1999 and 2005 National Food Consumption Surveys (NFCS) and the 2008 South African Social Attitudes Survey showed a comparatively large decrease in food insecurity between 1999 and 2008. Even though research reveals that the prevalence of food insecurity is declining in South Africa, it is still rife and a daily challenge in the Valley of a Thousand Hills. The results from this study and the revelation of the vast number of micro nutrients deficiencies indicates that the poverty in this community is forcing household to consume inferior diets that are of low nutritive value

Top food items consumed and dietary intake

The majority of the respondents (86%, n=214) purchased food once a month which impacts on the quantity of perishable items that one can procure as 49% (n=124) of the respondents

had refrigerators and only 6.4% (n=16) had freezer's. The majority of respondents (88%, n=219) purchased foods from supermarkets in urban areas versus the minority that purchased foods from the local tuckshop (4%, n=10) and street vendors alike (0.4%, n=1) which could be a tactic to save money as rural counterparts can pay as much as 15% for the same food basket as urban counterparts.

The diet consumed by the respondents is representative of their income, with staples being cheap and energy dense carbohydrates. More expensive food items such as meats and dairy products were consumed in lesser amounts in addition to the inability for prolonged storage, this is also reflected in a study by Oldewage-Theron and Kruger (2008) in Gauteng in an elderly community where carbohydrates made up the main part of the diet with maize meal porridge and brown bread appearing at 2 and 3 on the top 20 most commonly consumed food. Fruit appeared at number 9 and 10 with vegetables at number 19 and 20 on the list of the same study which is very similar to the current study with vegetables appearing at number 11, 16 and 18 on the list. According to Nel and Steyn (2002) the food most commonly consumed by the South African community was also carbohydrate based as maize, sugar, brown and white bread appeared as number 1, 2, 4 and 5 on the top 20 consumed foods which is similar to findings from this study.

Protein is also presented on the list of consumed foods with beef and chicken appearing early on the list in Oldewage-Theron and Kruger (2008) and Nel and Steyn (2002) study. In the current study chicken and in some groups beef is presented early on the list as well. The portion sizes of the foods consumed by this community were significantly less than the portion sizes consumed in the Nel and Steyn (2002) study, indicating a greater prevalence of food insecurity and poverty.

Dietary diversity

The 1999 NFCS revealed that households that were deemed food secure consumed an average of 16 different food items per 24 hours, while poorer households spent not as much money on food and consumed less than 8 different food items. Moreover, children had low mean scores for dietary diversity (3.58; standard deviation, SD: ± 1.37) and dietary variety (5.52; SD, ± 2.54) scores. The findings from the current study illustrated that the highest number of individual foods, consumed by the majority of the respondents was between 13- 18 individual foods (25.8%, n=64), and the mean Food Variety Scores (FVS) (±SD) for all foods consumed from the food groups during seven days was 22.45 (±10.32), indicating a low food variety score.

A mega analysis conducted by Labadarios, Steyn and Nel (2011) revealed that generally South African's consumed diets that were of low diversity (40.8% of KZN residents experienced poor dietary diversity) with cereals/roots; meat/fish and dairy products being most consumed and eggs; legumes; and vitamin A rich fruits and vegetables being least consumed, and of low food variety, which is not coherent with the food based dietary guidelines promoted by the Department of Health. The same study indicates that the most neglected food group was vitamin A rich fruit and vegetables, legumes and nuts. The findings from the current study were consistent with the findings of Labadarios *et al.* (2011) with vitamin A rich vegetables, legumes, nuts and eggs being the most neglected food groups and being least consumed. The vegetable group reported the highest individual mean FVS (±SD) of 4.35 (±2.247)followed by, starches, fruits, flesh products, vitamin A rich groups, dairy, legumes and eggs, which too is not consistent with the food based dietary guidelines.

The results from this study revealed that the food group diversity is summarized as the majority of the respondents (91.1%,n=226) could be classified with a good dietary diversity score using 6-9 food groups. A major challenge experienced by this community is that participation in subsistence farming was not possible as a result of not having funds available for fencing, without fencing other community members/cattle/goats/hares and other wild animals would consume/ steal the crops. This would also explain the very low fruit and vegetable consumption. The WHO guidelines indicate that >400g/day of fruit and vegetables should be consumed whereas the women <50 years of age had a mean consumption of 89.56g, women >50 mean consumption of 87.32g, men <50 consumed 72.11g and men> 50 consumed 40.00g.

The majority of the respondents were deemed to have a low food variety score. The diets are reflected as being balanced according to the WHO dietary factor goals with reference to macro nutrients, however, lack variety and do not consume sufficient amounts of fruit and vegetables daily, therefore, provoking deficiencies in many micro nutrients and are unable to meet the daily recommended intakes. The primary macro nutrient for energy consumption was carbohydrates.

Trace elements are required for the proper functioning of the human body and as a result micronutrient malnutrition negatively impacts individual wellbeing, social welfare and economic productivity owing to debilitating diseases, absenteeism and lethargy therefore effecting individual productivity and personal earnings (Stein, 2010).

Horton *et al.* (2008) reveals that deficiencies in iron, zinc and iodine negatively impacts on one's health. Iron is required as it carries oxygen and is a component for haemoglobin and numerous enzymes and deficiencies thereof include anaemia (IOM, 2001). Zinc is required for regulation of gene expression (IOM, 2001), and iodine is a component of thyroid hormones which regulates cell activity and growth in virtually all tissues and prevents goitre and cretinism (IOM, 2001). Black *et al.* (2008) reveals that deficiencies in calcium and selenium indicate public health issues. Calcium is essential for blood clotting, muscle contractions, nerve transmission and bone and tooth formation therefore used for structural functionalities, electrophysiological function and intracellular regulator whereas selenium functions as a component of enzymes involved in antioxidant protection and thyroid hormone metabolism (IOM, 2001).

Chromium helps maintain normal blood sugar levels; copper is required for the normal absorption, storage and metabolism of iron; fluorine prevents dental caries and stimulates formation of bone; magnesium is a fundamental in over 300 enzymatic reactions; manganese prevents tissue damage and activates cartilage formation; phosphorus is required for maintaining pH and transferring of energy and potassium is required for cellular function and deficiencies can result in high blood pressure, glucose intolerance, high bone turnover, risk of cardiac diseases and muscle weakness (IOM, 2001).

Food coping strategies

The community embarks on efforts to cope with the temporary food insecurity situation (as a result of the extreme poverty and the lack of subsistence farming), or tries to reduce the prevalence as much as possible, by adapting coping strategies. The extreme poverty is owing to the fact that 87.2% (n=217) of the respondents were unemployed, as a result 48.6% (n=121) of the respondents sometimes did not have enough money for food, and 27.7% (n=69) always didn't have enough money for food. Eighty eight percent (n=219) of the respondents consumed most of their meals at home with 11.6% (n=29) of the respondents consuming most of their meals at friends homes. The primary coping strategy that is used by 53% (n=132) of the respondents and in all the income categories is to only consume two meals per day that is also reflected as a coping strategy in various other studies (Maxwell, 1996).

Some of the coping strategies reflected in food insecure communities across the world as reported by Maxwell (1996) include temporary dietary changes i.e. consuming less expensive or less preferred food; decreasing or restricting consumption i.e. limiting portion size, skipping meals or skipping food for an entire day; heightened use of credit facilities for consumption

tenacities and borrowing food or money to purchase foods is also prevalent in this community with various severity weights. Changing household composition; changing intra-household food dispersal; exhaustion of food stores,; heightened dependence on wild foods; temporary labour relocation; temporary changes to crop and livestock fabrication; selling of assets,; maternal buffering i.e. mothers deliberately reduce their intake to ensure that children get enough food; stealing food; abandoning children and distress migration or migration back to rural areas are further strategies adopted in food insecure communities (Maxwell, 1996).

Alternative strategies used in the Valley of Thousand Hills community includes the use grant or pension money to buy food; get food from a soup kitchen; ; do odd jobs for money; and lastly use tokens/vouchers/stockvel money to buy food.

Other coping strategies that were identified in the literature review but not engaged by this community were gathering foods from crops (owing to lack of funds for fencing), bartering and trading, including sex work and remaining in abusive relationships and sending children to schools with feeding schemes.

Anthropometric findings

Hoelsher and Evans (2012) apprise that even though the impression of food insecurity and obesity may seem incongruous, it has been supported by many studies. Therefore the BMI results from this study are in accordance with what the literature is prescribing. The meal consumption patterns of only consuming two meals a day, which are extremely energy dense, can be the precursor for the heightened BMI. According to Melhorne *et al.* (2010) larger meals are interrelated with heightened retroperitoneal depot weight and fat cell number and not with total food consumption; correspondingly meal size confidently correlates to adiposity, whereas caloric intake does not, therefore, meal size may be the best prognosticator of adiposity.

The findings from Shisana , Labadarios , Rehle , Simbayi , Zuma , Dhansay , Reddy , Parker , Hoosain , Naidoo , Hongoro , Mchiza , Steyn , Dwane , Makoae , Maluleke , Ramlagan , Zungu , Evans Jacobs, Faber and SANHANES-1 Team (2013) confirms that the trend for South African females BMI to increase has remained intact and that 22.6% of South African are overweight and 258% are obese. The same study revealed that between 2003 and 2007, female obesity increased from 27% to 39.2%.

Seventy six percent of the respondents were classified as being overweight, all of which were women. Twenty percent of which fell into the obese class I category, 17% of which fell into the obese class II category, and 11% fell into the obese class III category. The prevalence of obesity is directly related to the dietary patterns and the food choices made by the community members.

The study conducted by Atinmo *et al.* (2009) in Northern Africa and the Middle-East reported that female obesity existed and that 13.5% of females in Algeria were obese, as is 45.6% in Egypt, 22.4% in Libya, 20.6% in Morocco and 30.1% in Tunisia. Male obesity was also prevalent but only in the minority with 5.3% in Algeria, 22.1% in Egypt, 11.5% in Libya, 3.7% in Morocco and 7.7% in Tunisia.

4.5 CONCLUSION

In this chapter the results of the study were presented in accordance to the objectives to identify various nutrition related problems faced by the respondents based on the diets.

CHAPTER 5- CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

The main aim of the study was to determine the food security status and coping strategies of community members of a community in The Valley of a Thousand Hills in Kwa-Zulu Natal. This was achieved through measuring the current socio-economic, food security status, coping strategies used and dietary intake of this populace. Food security is a global concern, and the insecurity thereof is prevalent in South Africa even though the country is deemed to be secure in terms of food availability (Faber, 2011).

The key determinants for food security consider a variety of inter related activities including availability, access, cultural appropriateness and wholesomeness. Food defence and food safety are directly associated with wholesomeness of food; as in their absence the wholesomeness of food is reduced. It is also important to realize that unsafe food as well as not having sufficient access to food both result in compromised nutrition, reduced energy, and poor immune system owing to insufficient intakes of required nutrients.

5.2 LIMITATIONS OF THE STUDY

The full sample size could not be achieved due to 6 participants being under the age of 18 and therefore had to be eliminated from the study, 2 further respondents did not complete all required surveys as a consequence of disinterest and exhaustion from standing in queues at the various field worker stations. As a result only the data from 249 respondents were used in the results chapter.

5.3 MAIN FINDINGS

5.3.1 Literature

The wealth of literature illustrates that South Africa is food secure in terms of availability; nonetheless many South Africans still suffer from food insecurity and malnutrition. A number of elements contribute to the prevalence of food insecurity including economic factors, social and cultural factors, environmental and biological factors, political factors and scientific and technological factors which without an intervention from policy makers and government, an improvement in the employment rate and public services offered, and an improvement in the inequalities faced by the poor; the rural poor will continue to be crippled with food insecurity and malnutrition.

The literature further reports that hunger and obesity can exist within the same household and is especially true for low-income households which is clearly reflected in this community. Nevertheless there is evidence that higher rates of obesity are associated with low incomes and low education levels, particularly among women. The impact of higher food prices and low household income implicates individual's food choices, dietary habits and diet quality, therefore rending a diet that is high in the consumption of energy-dense foods, particularly staple foods to elongate the food budget. Staple foods are more affordable, therefore allowing for a greater consumption, as a result household food insecurity and poor dietary intake results in micronutrient deficiencies.

Those that are troubled with food insecurity engage in coping strategies, adaptive strategies and trade-offs to try and alleviate the temporary short comings, all of which contribute to malnutrition and micro nutrient deficiencies and exacerbate the prevalence and severity of illness and disease. The global rate of population growth, climate change, scarcity of water and natural resources is making all South Africans vulnerable to food insecurity.

5.3.2 Socio-demographic

The socio-demographic survey indicated that the majority of the households had access to amenities and services however extreme poverty exists as a magnitude of the high

unemployment rate and low monthly income of the respondents. The highest education level of the majority (75.5%) of the participants were standard eight or lower which could be a contributing factor to the low income rate in this community.

The majority of the respondents relied on state grants to subsidise income. The employment rate and income level of the caregivers contribute to the food insecurity in the households.

5.3.3 Dietary intakes and nutrient adequacy

The findings of this study confirmed that the total range of individual food items consumed by an individual during the seven day data collection period was 3-66 foods. It is evident that the majority of the respondents consumed a diet of low food variety. In this study the food group diversity is summarized as the majority of the respondents (91.1%, n=226) being classified with a good dietary diversity score using 6-9 food groups. Although the Dietary Diversity is good the food variety is low and the intake is below the required DRIs in all the micronutrients, this is also reflected in the 24-hour recall nutrient analysis indicated a deficient intake by both men and women in all of the nutrients (100% of the men and women could not meet the DRI's for energy and calcium) except for the mean (±SD) carbohydrate intake by men aged 19-50 (214.71 ± 80.22).

The main source of food intake was from the carbohydrate food group with an insufficient intake of animal products, dairy products and fruits and vegetables respectively; contributing to the macro and micro nutrient inadequacies.One can conclude that in order to ensure nutrient adequacy a good food variety within each of the nine food groups is required.

5.3.4 Food security status and coping strategies used

Ninety six percent of this community experienced some level of food insecurity with the worst Coping Strategy Index food insecurity score being 117 out of a possible 175. Four percent of this community was classified as being food secure with 0.4% mostly experiencing food security. The best CSI food insecurity score that was established was 4.5. The most severe coping strategy (severity ranking of 3) that was wildly adopted by the community was to consume only two meals per day. There is a significant relationship between the cumulative household food security score and the number of people that reside in a household. The food security status of a household can be impacted positively or negatively by the number of individuals that reside in a household depending on how many of those individuals generate income either by being employed or by being eligible for grants i.e.: the greater the level of income generation the less likely the prevalence of food insecurity, likewise the greater the

number of individual that do not contribute to income generation the worse the prevalence of food security.

5.3.5 Anthropometric indicators

The results of this study illustrated that overweight and obesity were the most exceptional anthropometric features by the women respondents with 26.5% (n=66) being overweight and 57% (n=142) obese. The men's anthropometric features were predominantly normal weight except for 12% (n=3) underweight and 20% (n=5) overweight individuals.

5.4 CONCLUSION

This study has established poverty and unemployment as being the principal contributors for the food insecurity experienced by the populace and poor dietary intakes. The low food variety diet consumed by the respondents resulted in the DRI's not achieved for most nutrients. The majority of the respondents only consumed two meals a day as a coping strategy to reduce/prevent temporary food insecurity.

5.5 RECOMMENDATIONS

5.5.1 Recommendation 1: policy makers

- Policy frameworks should be more gender specific in that they should focus more on targeting female headed households.
- An improved system of social protection is required. This improved system should address stabilizing food consumption by improved efforts to stabilize food prices, the philanthropic antics of social grants and ensuring that all of those that are eligible to receive them, are doing so.

5.5.2 Recommendation 2: nutrition education intervention

- Nutrition education interventions should be implemented to explain the importance of dietary diversity, and their role in alleviating nutritional problems and related diseases.
- Nutrition education needs to focus on food procurement, preparation and storage methods to address the micronutrient deficiencies experience by this community.
- A sustainable nutrition education programme would assist in choosing foods that fit within their budgets, are of higher nutritive value and are prepared in the correct manner to improve bioavailability.

- Fruit, vegetables, dairy products as well as whole grains and legumes should be promoted to meet the DRI's required for optimal health.

5.5.3 Recommendation 3: agricultural interventions

Kimokoti and Hamer (2008) suggests that households diversification is a requirement and should target achieving a balanced range of basic essential food production and availability in food insecure households similar to those of this community.

- The primary reason for this community not partaking in agricultural activities was due to a lack of funds available for fencing; they required fencing to prevent neighbours and wild animals from stealing their crops.
- Perhaps community gardens could be funded by businesses, churches, non-profit organisations or even government whereby one garden gets initiated to feed 30 households, who would then be responsible for all agricultural activities.
- Raising chickens for meat and eggs, and goats/cows for milk will also help ensure sustainability within the community and could be explored as a possible intervention.

5.5.4 Recommendations for future research

- Long term home gardening intervention studies to address food insecurity and malnourishment are recommended.
- Biochemical analysis should be conducted to verify scientifically whether these intervention studies are ascertaining to be effective at refining the nutritional and health status of the individuals.
- Investigate the nutrient knowledge of the community members.
- Establish a relationship between the chosen cooking techniques and the prevalence of high BMI, possibly promote healthier cooking methods
- Community support programmes or community based interventions to improve the nutritional status of the community.

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ANNEXURE A

DURBAN UNIVERSITY of TECHNOLOGY

Dear Volunteer,

Welcome and thank you for taking the time to read through this document.
My name is Leigh Owen and I am currently doing my master degree through the Durban University of Technology whereby I am conducting a nutrition research project in your community. I am requiring volunteers to take part in this research project. This projects plan is to analyze the food security status of your community with the focus being on the coping strategies that community members may take at times of food shortage.

Field workers will be working with me, and they will explain to you the content of this letter in Zulu.

WHAT IS THIS PROJECT?

The main aim of the study is to determine the food security status and coping strategies of community members, of a community in a Valley of a Thousand Hills.

Other objectives include: to determine the socio-demographic status of the community by administering a socio-demographic questionnaire. To determine the food intake of the community by means of a 24hr recall, to determine the food variety consumed by the population by using a food frequency questionnaire, to determine the food security status of the community by using a food security status questionnaire, to determine the coping strategies by administering the coping strategies index.

WHY IS THIS PROJECT IMPORTANT?

As quoted by Global Food Security (2010) "a perfect storm" of factors have now combined to make food security one of the preeminent challenges facing humankind". The Human Science Research Council (HSRC) (2007) gives evidence to verify the afore mentioned quote by Global Food Security in that HSRC suggests that South Africa encounters household food insecurity in selected households with the primary causes being chronic poverty and unemployment. To add to the predicament, another challenge that South Africa faces is that there are no specific measures of food security and currently there are no measures put into place to regularize the monitoring of food security.

This research project should have an impact on South Africa's food security policy by providing the government with current information regarding the sustainability and feasibility of their food security policy.

PROCEDURE

1. Gain permission from the counselor to conduct this study in the local community.
2. Volunteers to sign letter of consent.
3. Conduct a focus group discussion with 10 community members
4. Complete the socio demographic questionnaire
5. Complete the food frequency questionnaire
6. Complete the 24 hour food recall, you will be required to remember what you ate and drank over 3 days (Sunday, Monday, Tuesday)
7. Complete the food security status questionnaire, including coping strategies.
8. Measure weight and Height to determine nutritional status through means of BMI

WHAT WILL BE MEASURED IN THE PROJECT?

- Eating and drinking habits will be measured and used to establish nutritional intake through Questionnaires
- Food insecurity coping strategies and measures of severity will be measured through Questionnaires
- Weight and height will be measured to establish anthropometric status; these measurements will indicate your nutritional status

WHO MAY PARTICIPATE?

The care giver or person responsible for preparing and purchasing the food for the household. This includes both Male and Female community members that reside within the community within The Valley of a Thousand Hills.

WHAT ARE THE BENEFITS FOR YOU?

The results from this study will be explained to the community members. Vegetable gardens can be initiated, planting of annual or weather resistant crops can be started in order to try and increase their micronutrient intake which can prevent infections and micronutrients deficiencies associated with malnutrition.

WHAT DO WE EXPECT OF YOU?

- **To come to this Hall on either 11/12/13/14 July, as per appointment time.**
- Please bring your code number, as from this point onwards your personal identity will be unknown to the field workers.
- We will appreciate your punctuality for your allocated appointment time.
- You will be asked to sign a form giving consent to participate in the project if you have not signed one already.
- Then you will receive a **reference number** for the project.
- You will be weighed and measured.
- You will be questioned in detail about your personal and households eating habits.
- You will receive refreshments for taking up time to partake in this study.
- Please keep in mind that you do not have to take part in this study it is strictly on a voluntary basis.
- You are also allowed to withdraw from the project at any time without penalty.

If you have any questions about the project, please do not hesitate to ask any one of the field workers at any time.

Thank you for your participation.

Leigh Owen
Researcher

ANNEXURE B

FIELD WORKER MANUAL

Why am I here?

The Department of Food and Nutrition Consumer Sciences has a variety of research projects in communities around Durban. Research fieldwork in communities cannot be conducted without the assistance of fieldworkers.

What is a Field Worker?

The field worker is an extremely important person in this project. In fact, this research would not be possible without the field workers. The field workers are the people who must interview the subjects (the people chosen to take part in the research) and get correct and accurate information from them. The subjects must feel at ease with the field worker so that they will not feel threatened or intimidated and will willingly answer the questions to the best of his or her ability.

How should I behave?

In order to be a successful interviewer, a field worker must have (or develop) the following characteristics:

1. Friendliness: the field worker must be able to make each subject feel relaxed and not threatened in any way. The subject must feel that the field worker sees him or her as a person, not just another number that must be dealt with.

2. Respect: the subject must be treated with respect at all times. For example, he must be greeted politely, thanked for his time and co-operation; he must not be forced to answer a question that he is not willing to answer. The field worker must never show if she disagrees with something the subject has said.

3. Patience: each subject has to be asked the same questions in the same way. This means that the field worker must ask the same questions over and over, which can be very tiring and irritating. However, the field worker may never show that she is impatient or irritated even when the subjects are slow to answer or when they do not understand the questions. She must be able to control her own feelings and hide them when necessary.

4. Reliability: the field worker must be reliable, she must pay attention to detail, record all answers accurately, not skip over questions or make up answers herself.

5. Enthusiastic and Motivated: the field worker must be enthusiastic about the research. She should be doing it because she really wants to and not just because it's just a job.

6. Flexible: a good field worker is able to adapt to circumstances. She is aware that things do not always work out as planned and sometimes she will have to work under difficult and uncomfortable conditions.

8. Neat Appearance: the field worker must always look neat and well groomed, but never overdressed. The following guidelines for dress should be followed:
   - wear neat, simple and comfortable clothes

- do not wear badges or emblems of organisations, churches, etc. as these may influence the way subjects answer.
- *dress so that the subject will concentrate on the interview and not on the way you are dressed.*

How do I interview the subject?

If the subjects in a project are children, the parents and/or caregivers will need to be involved in the interview process to verify information that is needed for the questionnaires. If the subjects are adolescents they can usually remember what they ate and can answer their own questions. If the questions need to be translated the interviewers must be careful not to change the focus of the question.

1. How do I begin?

- ✖ Greet the subject politely and introduce yourself.
- ✖ Ask what language the subject would prefer to speak.
- ✖ Explain what the interview is about. Let the subject ask questions about the research. Reassure the subject that the answers are confidential and that neither the subject nor his or her address will be identified.
- ✖ Put the subject at ease. Be flexible and sensitive to the subject. Some subjects may be tense or apprehensive. In such cases, talking about something general, e.g. the weather may put the subject at ease.

2. How do I conduct the interview?

- During the interview direct the questions to the subject, but if it is a child and he or she cannot answer, ask the parent/caregiver for the information needed.
- Ask the questions exactly as they are written on the questionnaire. Try even to keep your tone of voice the same for each subject so as not to lead the subject or to give him an idea of how you want him to answer. You may have to explain a question or use different wording if the subject cannot understand it.
- Ask the questions in the order that they appear on the questionnaire. If the subject refuses to answer the question, record the lack of response and go on to the next question.
- Follow the instructions on the questionnaire. Sometimes it may seem that a subject has already answered a question when he answered a previous one, but the interviewer must still answer the question. For example, the questions about polony and atchaar. Start the question: "We have already mentioned this, but...".
- Do not lead the respondents. Do not try to influence the way the subject answers. Keep your facial expression friendly, but neutral. Never show surprise or shock or approval to the subject's answers. Try to avoid unconscious reactions such as nodding the head, frowning, raising the eyebrows. Never give your own opinions.
- Keep the tone of the interview conversational. Be friendly and courteous. Do not make the subject feel as if he or she is taking an examination or is on trial be familiar with the questionnaire so that you can ask questions conversationally rather than reading them stiffly. The questionnaire is designed to keep the amount of writing to a minimum. However, if a subject gives a long response to an 'other' question, say, 'excuse me while I write that down'. Don't make the subject feel as though you have forgotten he is there.
- Keep control of the interview. Do not let the subject go off into irrelevant conversation. If he or she does, bring him or her gently back to the interview.

- Allow the subject time to think; do not hurry him to answer. However, if he is silent for too long, repeat the question, or 'prompt' him. For example, say 'you have told me how you cook cabbage; now please tell me how you cook pumpkin.
- Follow the instructions on the questionnaire for recording the responses. Record all responses, including negative responses or refusals to answer.
- **Make sure that you have written in the subject's number.**

3. How do I end the interview?

Tell the subject that you have finished the interview.
Reassure him that everything he has told you is confidential.
Thank him for his time and cooperation. Direct him to the next stage. Greet him.

Interview for the 24-Hour Recall Questionnaire.

The 24-hour recall is a questionnaire on what the subject has eaten the day before over a 24 hour period. Often the 24-hour recall is used to establish whether the QFFQ is valid or not. It is important to think of the 24-hour recall questionnaire as being a totally separate questionnaire and not a cross-reference to the QFFQ. Therefore, the answers to the questionnaire need to be very detailed. You will need to ask what is eaten and drunk, what type of food or drink is consumed, the brand name, the preparation method and the quantity consumed. Remember to include spreads, sugar and milk to tea / coffee, snacks, sweets, juices, sauces, salts and other condiments.

Example: The subject is asked what she has in the morning on waking up.

I: What do you have in the morning when you wake up?
S: I drink tea and then have porridge.
I: How do you take your tea?
S: With 2 sugars and a little milk.
I: How big is the spoon and is it level or heaped? (*Showing the teaspoon*).
S: It is like that spoon and I also have it heaped.
I: What type of porridge did you eat and how much did you have? (*Showing a bowl or cup*).
S: I had soft mealie meal porridge and I had about 2 of those cups to the fill in a bowl.
I: *Do you put anything else in the porridge?*
S: Yes, 2 spoons of sugar, like my tea, and a little margarine about 1 spoon.
I: At about what time was this meal?
S: At 6 am.
I: Where did you have this meal?
S: At home.

Time (approximately)	*Place (Home, school, etc)*	*Description of food and preparation method.*	*Amount*	*Amount in g (office use Only)*	*Code (office use only)*
From waking up to going to work, or starting day's activities					
6 am	Home	Tea, rooibos	1 cup/mug		
		With milk, full cream	little milk – 2 tablespoons		
		And sugar, white	2 heaped tsp		

		Soft mealie meal porridge	2 cups		
		With sugar, white	2 heaped tsp		
		And margarine, hard brick	1 tsp		

Portion sizes

FOOD	Smaller than smallest	Between small and medium	Between medium and large	Between large and very large	Larger than large/very large
Stiff porridge	125 g	275 g	425 g	600 g	800 g
Soft porridge	125 g	275 g	425 g		575 g
Samp and beans	100 g	200 g	375 g	600 g	800 g
Rice	70 g	105 g	190 g		310 g
French fries	30 g	90 g	185 g		340 g
Fried beef	15 g	45 g	80 g		120 g
Beef with bone	45 g	75 g	120 g		180 g
Meat stew	55 g	165 g	275 g		385 g
Sausage/ Wors	20 g	50 g	90 g		135 g
Offal	20 g	60 g	100 g		140 g
Pilchards	15 g	45 g	90 g		150 g
Mashed pilchards	15 g	45 g	90 g		240 g
Fried fish	50 g	70 g	105 g		155 g
Cabbage, potato and onion	15 g	45 g	75 g		105 g
Spinach, potato	15 g	45 g	75 g		105 g
Tomato and onion gravy	10 g	30 g	60 g		100 g

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FOOD	Smaller than smallest	Between small and medium	Between medium and large	Between large and very large	Larger than large/very large
Pumpkin	15 g	35 g	60 g		80 g
Carrots, potato	45 g	65 g	80 g		95 g
Green mealie	50 g	110 g	180 g		260 g
Beetroot salad	10 g	30 g	65 g		85 g
Fat cake	20 g	50 g	70 g		90 g
Bread	15 g	45 g	80 g		120 g
Margarine	2,5 g	7,5 g	12,5 g		17,5 g
Dumpling	20 g	70 g	125 g		175 g
Apple	70 g	130 g	195 g		265 g
Banana	40 g	60 g	95 g		130 g
Canned peaches	30 + 10 g	70 + 15 g	110 + 25 g		150 +35 g
Custard	5 g	20 g	35 g		65 g
Atjar	10 g	45 g	80 g		120 g
Polony	5 g	15 g	30 g		45 g
Peanuts	5 g	20 g	60 g		105 g
Cheese curls	6 g	18 g	38 g		62 g

Other questionnaires

We may also use any of the following questionnaires:

Food Frequency Questionnaire

Socio-demographic questionnaire

Nutrition knowledge questionnaires

Health questionnaires

Smaller questionnaires drawn up by each individual researcher e.g. lunch box content of school children.

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Food and Nutrition Consumer Sciences

SOCIO-DEMOGRAPHIC QUESTIONNAIRE

This questionnaire covers certain aspects of your life, including work and personal details, health and illness, lifestyle and social life that is relevant to health. The answers to these questions will be kept strictly confidential and the information will not be identifiable from any reports or publications.

1. GENERAL INFORMATION

Subject number:..... Date: .....

Fieldworker name: .....

Please answer all questions by marking the correct answer with **X**, except where otherwise indicated.

Where do you live?

.....

2. PERSONAL INFORMATION

2.1 Your role in the family

Mother	Grandmother	Father	Grandfather	Other, specify.....

2.2 When were you born? Year: Month: Day:

2.3 How old are you? _____ years

2.4 Gender:

Male	Female

3. ACCOMMODATION AND FAMILY COMPOSITION

3.1 Do you live in?

Town/City	Farm	Squatter camp	Rural village	Hostel	Township	Other, specify.....

3.2 Do other people live in your house?

Yes
No

3.3 How many people are living in your house?

1	2	3	4	5	6	7	8	9	10	10+

3.4. Please **complete** the table below on all members of the household

Name of household member	Age (yrs)	Gender M / F	Family relationship	Level of schooling	Does this person eat and sleep in this house at least 4 days a week?

3.5 Are all members' permanent residents in this house?

Yes	No

3.6 If yes, how long have you been staying permanent in this house?

< 1 year	1-5 years	>5 years

3.7 Has any children in your household died in the past?

Yes	No

Reason: .....

3.8 In what type of house are you staying?

Brick	Clay	Grass	Wood	Zinc/shack

3.9 How many rooms does your house have?

< 2 rooms	3-4 rooms	> 4 rooms

3.10 Are there other houses/shacks within the same yard of the main house?

Yes	No

3.11 . How are you currently living?

Homeless	
Living with relatives	
Living with friends	
Hostel accommodation	
Squatter home	
Rented house/flat	
Own house/flat	
Employees Properties	
Other, specify.....	

3.12 Do you have the following facilities at home?

3.12.1 Water

Tap in the house	
Tap outside the house (in yard)	
Borehole	
Spring / river / dam water	
Fetch water from elsewhere	

3.12.2 Toilet facilities

None	
Pit latrine	
Flush / sewage	
Bucket system	
Other, specify.....	

3.12.3	Waste removal	Yes	No	
3.12.4	Tarred road in front of house		Yes	No
3.12.5	Gravel road in front of house		Yes	No

3.13 To what extent do you have problems with the state of your house (e.g. too small, repairs, damp, etc.)?

.....
.....

3.14 Do you have problems with the following?

Mice/ Rats	
Cockroaches	
Ants	
Flees	
Mosquitoes	
Geckos	
Frogs	
Snakes	
Bed Bugs	

3.15. What is the floor inside your house made of?

Cement	
Tiles	
Carpet	
Dirt	
Sand/mud	
Dung	
Other, please state	

4. WORK STATUS AND INCOME

4.1. Are you currently employed?

Yes	No

If YES, go to Question 4.5.

4.2. If NO, how would you describe your current status (tick one box only)?

Unemployed	Retired	Housewife	Student	Other, specify.....

4.3. Are you actively looking for paid employment at the moment?

Yes	No

4.4. How long have you been unemployed?

< 6 months	6-12 months	1-3 years	> 3 years

4.5. If YES (question 4.1) is your current job a:

Permanent position	Temporary position	Fixed term contract	Other, specify.....

4.6. Are you doing part time jobs on weekends and school vacations?

Yes	No

4.7 What is the exact title of your current job?
(Including self-employed)

4.8. What is the total income in the household per month?

< R500	R501-R1000	R1001-R1500	R1501-R2000	R2001-R2500	R2501-R3000
R3001-R3500	R3501-R4000	R4501-R5000	R5501-R6000	>R6001	

4.9. Please specify the monthly income in the household (if willing).....

4.10. How often does it happen that you do not have enough money to buy food? for you and your family?

Always	Often	Sometimes	Seldom	Never

4.11. How many people e.g. partner, relatives & others (including yourself) contributed to your household income from any source, (including wages/salary from paid employment, money from second or odd jobs income from savings investments, pension, rent or property, benefits and or maintenance etc.) in the last 12 months?

People	0	1	2	3	4	5	6	7	8	9

4.12. How often do you buy food?

Every day	Once a week	Once a month	Other, specify.....

4.13. Where do you buy food?

Tuck shop	Street vendor	Wholesalers	Supermarket	Other, specify.....

4.14. What type of transport do you use to get around?

Taxi	
Bus	
Train	
Own vehicle	
Other Specify	

4.15. How much money is spent on food PER MONTH? (Tick only one box)

R 0 – R 50	R 51 – R 100	R 101 – R 150	R 151 – R 200	R 201 – R 250	R 251 – R 300	> R 500	I do not know

5 EDUCATION AND LANGUAGE

5.1. What is your highest education level?

None	Primary School	Standard 8	Standard 10	College/FET	Other post school

5.2 What language is spoken mostly in the house?

Zulu	Xhosa	English	Afrikaans	Other, specify.....

5.3 How many children (in the household) have birth certificates?

None	1	2	3	4	5	6	7	8	All

5.4 How many children have completed their immunisation schedule?

None	1	2	3	4	5	6	7	8	All

5.5 Number of children attending school

None	1	2	3	4	5	6	7	8	All

5.6 How do the children get to school?

Walk	Bus	Taxi	Lift	Other, specify.....

Tick one block for every question:	Father	Mother	Sibling	Grandma	Grandpa	Aunt	Uncle	Cousin	Friend	Other
5.7 Who is mainly responsible for food preparation in the house?										
5.8 Who decides on what type of food is bought for the household?										
5.9 Who is mainly responsible for feeding/serving the child?										
5.10 Who is the head of this household?										
5.11 Who decides how much is spent on food?										

5.12 How many meals do you eat per day?

0	1	2	3	>3

5.13 Where do you eat most of your meals?

Home	Friends	Work	School	Other, specify.....

5.14 Where do your children eat most of their meals?

Home	Friends	School	Other, specify.....

6. ASSETS

6.1 Does your home have the following items and how many?

	Yes	No	Quantity
Electrical stove			
Gas stove			
Telephone / Cell phone			
Primus or paraffin stove			
Microwave			
Hot plate			
Radio			
Television			
Refrigerator			
Freezer			
Bed with mattress			
Mattress only			
Lounge suite			
Dining room suite			
Electrical iron			
Electrical, kettle			
Car			
Bicycle / Motorbike			

6.2 What type of fuel do you usually use for food preparation?

Wood fire	Paraffin	Electricity	Gas	Coal/Charcoal	Other, specify.....

6.3 What type/s of material are your pots made off (tick all relevant options)?

Cast iron	Aluminium	Stainless steel	Clay	Other, specify.....

Thank you very much for your co-operation. We appreciate the time.

ANNEXURE D

24 – HOUR RECALL

Subject date of birth : _____ Age: _____ Gender: Male/Female

Interviewer: _____

Name: _____ Date: _____ / _____ / 2003

Address: _____

Tick what the day was yesterday:

Monday	Tuesday	Wednesday	Thursday	Friday

Would you describe the food that you ate yesterday as typical of your habitual food intake?

Yes	1	No	2

If not, why? _____

I want to find out about everything you ate or drank yesterday, including food you pick from the veld. Please tell me everything you ate from the time you woke up to the time you went to sleep. I will also ask you where you ate the food and how much you ate.

Time (approximately)	Place (Home, school, etc)	Description of food and preparation method.	Amount	Amount in g (office use Only)	Code (office use only)
From waking up to going to work, or starting day's activities					

During the morning at work or at home					

Time (approximately	Place (Home, school, etc)	Description of food and Preparation method.	Amount	Amount in g (office use Only)	Code (office use only)
Middle of the day (Lunch time)					
During the afternoon					
At night (dinner time)					

Time (approximately	Place (Home, school, etc)	Description of food and preparation method.	Amount	Amount in g (office use Only)	Code (office use only)
After dinner, before going to sleep					
* Do you take any vitamins (tablets or syrup)		Yes	1	No	2
Give the brand name and dose of the vitamin/tonic:					

ANNEXURE E

DURBAN UNIVERSITY of TECHNOLOGY

FOOD AND NUTRITION CONSUMER SCIENCES.

FFQ LIST OF FOODS AND FOOD GROUPS DIVERSITY

PLEASE INDICATE THE FOOD YOU ATE DURING THE PAST SEVEN (7) DAYS BY AN (X)

GROUP 1: Flesh Foods (Meat, Poultry, Fish) Diversity	Y	N
Meat (Chicken)		
Meat (Beef)		
Meat (Mutton, Lamb)		
Meat (Pork)		
Meat (Goat)		
Dried Meat (Biltong)		
All Mince		
All Tribe/Offals/Runners and Heads		
Fish (fresh / whole)		
Tinned Fish (Pilchards/Tuna)		
Processed Meats (Viennas / Polony, Russians, Boerewors Sausage)		
Seafood (Prawns, Mussel's, Calamari, Crab, Shrimp, Crayfish)		
GROUP 2: Eggs Diversity	**Y**	**N**
Eggs		
GROUP 3: Dairy Products Diversity	**Y**	**N**
All Milk		
Evaporated milk (Unsweetened)		
Condensed milk		
Maas/ Inkomasi		
All Cheese		
Custard		
Ice Cream		
GROUP 4: Cereals, Roots and Tubers Diversity	**Y**	**N**
All Rice		
Maize (Pap, Mealie Rice, Mealie Meal, Samp, Porridge, Corn on the cob, Popcorn, Sweet Corn)		
Macaroni/Pasta/Spaghetti		
All Bread (White/ Brown/ Whole Wheat)		
Dumpling/Steamed Bread/Fat Koek		
Scones/Biscuits		
Mageu		
Breakfast Cereals (Corn Flakes, Oats, Weet Bix, Matabela)		

All Tubers/Roots (Amadumbe, Sweet Potato)	Y	N
Potatoes		
GROUP 5: Legumes and Nuts	**Y**	**N**
All Beans Dried		
Dried Peas		
Lentils		
Peanuts and Nuts		
Soya		
GROUP 6: Vitamin A Rich Fruits and Vegetables Diversity	**Y**	**N**
Pumpkin		
Carrots		
Wild Leafy Vegetables Fresh and Dried		
Spinach		
Butternut		
Apricots (Appelkoos)		
Peach (yellow cling)		
Mango		
GROUP 7: Other Fruits (and juices) Diversity	**Y**	**N**
Deciduous Fruits		
Apple		
Peaches		
Pear		
Grapes (black/green)		
Plum		
Sub – Tropical Fruit	**Y**	**N**
Lemon		
Orange		
Naartjie		
Banana		
Pineapple		
Avocado		
Kiwi fruit		
Watermelon		
Guava		
Paw- Paw		
Juices	**Y**	**N**
Juice (100% pure juice e.g. Ceres/Liquifruit)		
GROUP 8: Other Vegetables Diversity	**Y**	**N**
Onions		
Cabbage		
Beetroot		
Tomatoes	Y	N

Green beans (fresh)		
Peas (fresh)		
Cauliflower		
Chili (red/green)		
Lettuce		
Green\ Yellow\ Red Pepper		
Frozen Vegetables (Mixed)		
Ginger & Garlic (Fresh)		
GROUP 9: Oils and Fats Diversity	**Y**	**N**
Butter		
Sunflower oil		
Margarine		
Lard		
Salad dressing/oil		
Potato Crisps		
Coffee Creamer (Cremora, Ellis Brown)		

ANNEXURE 1

DURBAN UNIVERSITY of TECHNOLOGY

FOOD AND NUTRITION CONSUMER SCIENCES

COPING STRATEGY INDEX FOR A VALLEY OF A THOUSAND HILLS COMMUNITY

Subject number: _____ Date: _____

Interviewer: _____

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? Every day	Pretty often? 3-6 */week	Once in a while? 1-2 */week	Hardly at all? <1* /week	Never	Raw /score	Severity weight	Score = Relative Frequency x weight
Relative frequency score	7	4.5	1.5	0.5	0			
1.Clean gardens/ wash clothes/ wash taxis/ make & sell arts & crafts							1	
2.Eat at friends/relatives houses							3	
3. Use grant / pension money to buy food							1	
4. Use tokens/ vouchers/ stock fell for money to buy food							2	
5. Borrow food from tuckshop							2	
6. Borrow money from a friend or relative							2	
7. Reduce size of meals							3	
8. Only eat 2 meals a day							3	
9. Skip food for a day							4	
10.Get food from a soup kitchen							4	
TOTAL HOUSEHOLD SCORE								

Severity weight: 1=least severe; 4=most severe

DURBAN UNIVERSITY of TECHNOLOGY

FOOD AND NUTRITION CONSUMER SCIENCES

Anthropometric Measurements

Section A:

1. Number/Name of the caregiver.....

2. Community:.....

3. Date of birth	Year	Month	Day

4. Gender	Male	Female

Section B:

1. Body weight (kg)	1. Body weight (kg)	2. Height/Length (cm)	2. Height/Length (cm)
kg	kg	cm	cm

3. Waist circumference	3. Waist Circumference	4. Blood pressure	4. Blood pressure
cm	cm	/	/

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