DETERMINING THE NUTRITIONAL STATUS OF CHILDREN FROM AGRI-BUSINESS FAMILIES IN THE EASTERN CAPE, SOUTH AFRICA

by

AWONKE SONANDI

Thesis submitted

in fulfilment of the requirements for the degree

PHILOSOPHIAE DOCTOR

in the

Centre for Sustainable Agriculture and Rural Development

Faculty of Natural and Agricultural Sciences

University of the Free State

Bloemfontein

South Africa

Promoter: Professor E.M. Zwane

Co-promoter: Doctor J.A. Van Niekerk

June 2018

DECLARATION

I, Awonke Sonandi, hereby declare that to the best of my knowledge and belief, the work presented in this thesis is original, except as acknowledged in the text, and that the material has not been submitted, either wholly or in part, for a degree at this or any other institution.

Signature: …………………………….

AWONKE SONANDI

Date: …………………………………..

ACKNOWLEDGEMENTS

"*Travel only with thy equals, or thy betters; if there are none, travel alone*" – The Dhammapada.

Fortunately, in this study, the research journey, though long, was made easier by good company. I therefore wish to express my gratitude to the following people without whom this research journey would not have been started, let alone completed:

- Professor Elliot Zwane, my promoter, for his enormous dedication in providing guidance, supervision, and encouragement to this study. His maddening attention to detail during the final stages of this study was remarkable.
- Dr Johan van Niekerk, my co-promoter, whose generosity with financial and reading material support, and ideas, made it possible for me to conceive and eventually undertake this research journey with the University of the Free State.
- My employer, the Eastern Cape's Department of Rural Development and Agrarian Reform (DRDAR), for having confidence in me to preside over her food security programmes. Without this privileged exposure to the subject of food security, it would have been virtually impossible to contemplate a research journey of this magnitude. Further gratitude is extended to the employees of DRDAR who assisted me with the collection of data (Messrs Justine Mkukwana, Bongile Kaba and Vuyisa Magengenene) and various logistics of writing the thesis (Mr Simphiwe Nobatyi and Ms Amanda Mtshamba). No volume of words can express my gratitude towards your invaluable contribution to this research journey, expect to say '*ubuntu mabande'*.
- The Eastern Cape's Department of Social Development and Special Projects (DOSDSP) who have been coordinating the province's Anti-Poverty and Food Security Strategy. My participation in rolling-out the strategy broadened my understanding of nutrition security in relation to food security. Accordingly, I am indebted to various colleagues who constituted the steering committee for the strategy for their enriching company. These are Dr Leocadia Zhou and Dr Lovemore Musemwa (University of Fort Hare), Dr Alice Zambodla-Barlouw

(Conservation South Africa), Reverend Vika and Ms Vuyelwa Sogoni (DOSDSP), Ms N Kama (Department of Health), and Dr Simba Ndhleve (Water Sisulu University). To the latter, special thanks is also extended for insightful comments and intriguing questions on the research methodology of this study.

- Mr Clegg Naude of Walter Sisulu University for his assistance with Statistical Package for Social Sciences.
- Ms Malory Links of the Food Science Nutrition of the Medical Research Council of South Africa for her assistance in the acquisition and use of food composition tables and FoodFinder III nutritional software in this study.
- Health workers of the Eastern Cape's Department of Health, for the provision of training in measuring anthropometric dimensions.
- My mother, Ms Ruth Sonandi, and my sisters for being supportive and encouraging in all the studies that I have had to go through, including this one.

Lastly, but by no means the least, I am grateful to my partner, Ms Noxolo Tsewu, who in many incidences felt the agonising backlash of the excruciating and daunting journey of my two doctoral studies. It must have been love.

EXECUTIVE SUMMARY

Since the dawn of the new democratic South Africa in 1994, the subject of food, and food security, thereof, has received serious attention, especially among previously disadvantaged groups. Farming communities from these previously disadvantaged groups have continuously received support from the government and other roleplaying organisations in agricultural development in order to strengthen their capacity to produce food for their communities and for the nation at large. However, very little or virtually nothing is known of the state of nutrition (in)security or nutritional status of many of these farming communities, particularly those that are involved in agri-business ventures. Instead, these communities are presumed nutrition secure or having elevated nutritional status by virtue of being food producers.

In view of the information gap outlined above, the purpose of this study was to investigate the current state of nutrition security / nutritional status among children from agri-business families. Accordingly, the objectives of this study were to, namely; establish baseline data for nutrition security / nutritional status of children from agri-business families, establish the extent to which children from agri-business families are nutrition secure, using a multiple of scientifically proven research methods of measuring nutrition security, identify and understand short-comings to achieving nutrition security or good nutritional status among children from agri-business families, and draw recommendations based on the findings of the study.

This study's research population was agri-business families who operated and resided in Umzimvubu and Ntabankulu Local Municipalities of Alfred Nzo District Municipality in the Eastern Cape Province. Precisely, the target group was previously disadvantaged agri-business owners / managers whose individual or collective annual turnover was between R150 000 and R4 000 000. Such agri-businesses are statutorily classified as very small or small or medium agricultural enterprises. After the objective and scientific selection process, a purposeful research sample of 124 agri-businesses that were operated by 263 agri-business owners / managers was achieved. The agri-business owners / managers

were from 263 households. Each of the 263 agri-business households were represented by a caregiver, to whom questions that relate to nutritional knowledge, attitudes and feeding and general care of children were directed. A total of 327 children aged 5-14 years from the agri-business households participated in this study. Collection of data from the abovementioned respondents was carried out in a theoretical, methodological and analytical manner. This involved use of mixed research methods that included; a socio-economic questionnaire, and other questionnaires on nutritional knowledge and attitudes, nutritional practices, anthropometric measurements, and 24h dietary recall method, and a food frequency questionnaire.

The outcomes of parametric and non-parametric statistical analyses, and content analysis, showed that the caregivers had fairly good nutritional knowledge on a wide range of issues. However, their children enjoyed rather modest nutritional practices that were often characterised with intake of low quantities of foods, deprivation of breakfast and some meals, high consumption of carbohydrates-rich foods, and low consumption of fruits and vegetables. Food variety and dietary diversity scores which are indicative of nutritional status were low and conservatively high, respectively.

The above scores and feeding patterns in general, influenced the intake of 24 nutrients under investigation. When compared with their dietary reference intake (DRI) values, the intake of these nutrients varied from low to high, with nutrients such as iodine and dietary fibre, and carbohydrates and vitamin A, reported at low and high intake levels, respectively. Most of the children had good nutritional status, in as far as their anthropometric dimensions are concerned. However, the creeping problem of overweight / obesity was concerning, while stunting and wasting were at low levels.

The causes of nutrition insecurity / low nutritional status among the children from agri-business families were identified. Among these causes, the key ones which were hypothesised and subsequently tested were; low farm and non-farm income, low expenditure on food, and low educational status of caregivers. Based on the above findings, conclusions were drawn, the most important being that quantities and varieties of food items produced or financially accessed by agri-business families were not sufficient to yield high food variety scores and unequivocally high dietary diversity scores which would be indicative of high nutrition security / nutritional status for their children. A similar conclusion held true with respect to the low intake of some nutrients against their dietary reference intake.

Also drawn from this study's findings were recommendations, the emphasis being on nutrition education, and an integrated and systematic approach to addressing food and nutrition insecurity among agri-business families.

This nutrition-sensitive food security study which was targeted at families of owners / managers of very small, small and medium agricultural enterprises is the first of its kind to be conducted in South Africa. To this end, this study brought ground breaking contributions, thereby adding value to the general paucity of literature of the concept of food and nutrition security. It also made similar contributions in the policy and professional spheres of this contemporary concept.

ACRONYMS

ABET	Adult Basic Education and Training
AFSUN	African Food Security Urban Network
AI	Adequate Intake
ANOVA	Analysis of Variance
APAP	Agricultural Policy for Action Plan
AUSAID	Australian Agency for International Development
BMI	Body Mass Index
BMIZ	Body Mass Index for Age Z score
CASP	Comprehensive Agricultural Support Programme
CFS	Committee on World Food Security
COGTA	Cooperative Governance and Traditional Affairs
CP	Cropping Programme
DAAF	Department of Agriculture, Forestry and Fisheries
DDS	Dietary Diversity Score
DRDAR	Department of Rural Development and Agrarian Reform
DRDLR	Department of Rural Development and Land Reform
DRI	Dietary Reference Intake
DV	Dietary Value
DEDEAT	Department of Economic Development and Tourism

DLGTA	Department of Local Government and Traditional Affairs
DOE	Department of Education
DOH	Department of Health
DOSDSP	Department of Social Development and Special Projects
EAR	Estimated Average Requirement
ECAFSS	Eastern Cape Anti-poverty and Food Security Strategy
ECSECC	Eastern Cape Socio-Economic Consultative Council
EER	Estimated Energy Requirement
FANTA	Food and Nutrition Technical Assistance
FAO	Food and Agriculture Organisation
FFQ	Food Frequency Questionnaire
FNS	Food and Nutrition Security
FVS	Food Variety Score
GFFA	Global Forum for Food and Agriculture
HAZ	Height-for-Age Z score
HDDS	Household Dietary Diversity Score
HFIAS	Household Food Insecurity Access Score
HFIAP	Household Food Insecurity Access Prevalence Indicator
HSRC	Human Science Research Council
IFPRI	International Food Policy Research Institute
IFSS	Integrated Food Security Strategy

IoM	Institute of Medicine
LSRO	Life Sciences Research Office
MDG	Millennium Development Goal
MFPP	Massive Food Production Programme
NHANES	National Health and Nutrition Examination Survey
NICUS	Nutrition Information Centre of the University of Stellenbosch
NSNP	National School Nutrition Programme
OPHA	Ontario Public Health Association
PAL	Physical Activity Level
PDA	Provincial Department of Agriculture
PHABC	Public Health Association of British Columbia
RDA	Recommended Dietary Allowance
REDHUBS	Rural Enterprise Development
SADC	Southern African Development Community
SD	Standard Deviation
SP	Siyakhula Programme
SPSS	Statistical Package for Social Sciences
UK	United Kingdom
UL	Tolerable Upper Intake Level
UN	United Nations
UNICEF	United Nations Children’s Fund

US	United States
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
WAZ	Weight-for-Age Z score
WFP	World Food Programme
WFS	World Food Summit
WHO	World Health Organisation

TABLE OF CONTENTS

CONTENTS **PAGE**

LIST OF TABLES

LIST OF FIGURES

LIST OF ANNEXURES

ANNEXURES

CHAPTER 1
ORIENTATION OF THE STUDY

1.1 INTRODUCTION

Food security exists when all people always have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life [Food and Agriculture Organisation (FAO), 1996]. Food security remains critical and necessary in achieving nutrition security (Ruel, 2006). Contrary to this positive assertion, in 2005, the number of undernourished people around the world was estimated at 852 million by the FAO (2005). Ten years later, global hunger has since declined to 795 million people (FAO, 2015). Food insecurity, which is largely driven by poverty is expected to remain a global problem, particularly in Africa, Indonesia, the Middle East, and South Asia, Australian Agency for International Development (AusAID, 2012). This is against FAO's commitment to end hunger and poverty by 2030 (FAO, 2016).

Food insecurity affects many people in South Africa, particularly the poor. The Eastern Cape Province happens to be one of the poorest provinces of South Africa where hunger is known to confront many communities, particularly those from the rural establishments. In response to the problem of food insecurity, the South African government had put in place numerous food security policies and programmes. Many previously disadvantaged agri-business families had in one way or another benefited from these food security policies and programmes. The current study's point of attraction was understanding the nutritional status of children from these previously disadvantaged agri-business families. The current chapter outlines methodological and scientific approaches employed to fulfil the aforementioned purpose of the study.

First and foremost, this chapter provides a review of the literature on food security, its origin and evolution, the definition and pillars of this concept as well as giving a picture of various regions' experiences of food security initiatives, policies and programmes. It also covers some fundamental principles of human nutrition in brief, and direct and indirect methods of measuring nutritional status. These discussions provided basis for the formulation of the study's research problem, purpose, objectives and its rationale, among many elements.

1.2 FOOD SECURITY

This section provides a review of the literature on food security, its origin, evolution of food security, the definition and pillars of this concept as well as giving a picture of various regions' experiences of food security initiatives.

1.2.1 The origin and evolution of the concept of food security

Concerns about hunger and malnutrition started to receive serious international attention in the 1930's through the then League of Nations (Simon, 2012). In the 1940s, particularly the post-World War II period, food supply remained a major concern in developed countries. In response to food shortage, many countries in North America and Europe reviewed and adjusted their agricultural policies in favour of promoting self-sufficiency and increased agricultural production. These countries met in the Hot Springs, Virginia, where according to the Committee on World Food Security (CFS, 2012) they discussed and concluded that 'freedom from want' meant a secure, adequate and suitable supply of food for every man, woman and child, where 'secure' referred to the accessibility of the food, 'adequate' referred to the quantitative sufficiency of the food supply and 'suitable' referred to the nutrient content of the food supply. These resolutions laid a cornerstone for today's concept of 'food security', and the corresponding agricultural policies. The new direction of these agricultural policies was further informed by the findings of the newly established FAO's first World Food Survey which was conducted in 1946 (Simon, 2012).

In the 1950s and 1960s, the concept of food security was characterised by agricultural policies which led to self- sufficiency and food surplus in the West (Makenete, Ortmann & Darroch, 1998). The latter resulted in food aid, which was advanced and employed by the US as either a carrot or a weapon in war-stricken areas (Zurayk, 2013).

The 1970s marked the shortage of food and the inception of the following first official definition of food security which would evolve to other definitions in the years to come (FAO, 2012b);

> *"Availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices*".

The concept of food security was endowed with new theories in the 1980s. The World Bank (1986) founded two kinds of food insecurity, namely chronic and transitory food insecurity. The former refers to households or individuals being unable to meet food requirements over a lengthy period of time, while the latter entails shocks that supress levels of food consumption below food requirements. Furthermore, an Indian scholar, Amartya Sen, developed theoretical themes on food accessibility. These themes pointed out that in the Horn of Africa and Afghanistan, food accessibility, not food availability, was the main cause of the famine in these areas (Simon, 2012).

Meanwhile, the 1990s was characterised with the international reaffirmation of human rights to accessing adequate food and nutrition (Simon, 2012), reduction of food aid that was advanced in the 1950s and 1960s, and improvement of techniques of measuring food insecurity (Hels, Hassan, Tetens & Thilsted, 2003).

In the 2000s, milestones for decreasing food insecurity were put in place. The FAO reports on these milestones on an annual basis, and they are used across the world, including in South Africa.

1.2.2 Definition of food security

As demonstrated in the previous section, food security is a flexible and dynamic discipline that has continuously evolved since it was founded in 1974. As indicated earlier, the first definition of food security from its inception in the World Food Conference in 1974 is;

"*Availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices".*

Following the World Food Summit in 1996, the following definition of food security was adopted (CFS, 2012);

"Food security exists when all people at all times have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life".

According to CFS (2012), the above definition has since been adjusted to include the word 'social'. Therefore, following the 2009 Declaration of the World Summit on Food Security, the official and commonly used definition of this concept is;

"Food security exists when all people, at all times, have physical, 'social' and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life".

The 'social' dimension of this definition covers a wide range of soft aspects which include morals, ethics and cultures. Within this 'social' dimension, food can be employed as a weapon to punish people or as a carrot to lure them. For example, in many war-torn or conflict-stricken areas, withholding food supplies is often used by opponents. In the Eastern Cape, and in many parts of developing countries, food is also employed to attract people to cultural gatherings, including rituals. In these gatherings, food is served for free, something that is highly appreciated by many communities that are severely affected by hunger.

However, notwithstanding the official definition of food security, this concept has numerous other definitions, because it is interpreted and implemented in various ways by different people across the world. Smith, Pointing and Maxwell (1995) identified 194 definitions of food security from a wide range of sectors and countries, while Gentilini (2002); cited by Simon (2012) reported 205 definitions. By and large, these definitions, many of which were made prior to the 21st century subscribe to the obsolete view that a country's sufficient food production, especially grain, is a prerequisite to achieving her food security. South African food security programmes of the Department of Agriculture, Forestry and Fisheries (DAFF) are the case in point. These programmes are briefly discussed in the subsequent sections of this chapter. Lastly, many of the definitions of food security confine the definition of this concept at national level and seldom at individual level, as the official definition by FAO dictates. This high-level view of food security often does not take cognisance of nutrition and nutrition security, which have received sizable attention in the contemporary research in the concept (Herforth & Ahmed, 2015; Pingali, 2015).

The Southern African Development Community (SADC) defines food security as;

> … *ensuring that all members of a household, nation or region have access to an adequate diet to live an active and normal life* (Hay & Rukuni,1988).

According to CFS (2012), SADC's understanding of food security reflects the region's shift of understanding of this concept from a 'self-sufficiency' perspective to the one of 'food availability' and 'access to food'. Noticeably, 'self-sufficiency' was one of the critical pillars that underlined discussions among the North American and European countries between 1950s and 1960s (Simon, 2012).

In the face of the various understandings, interpretations and contrasting definitions of food security, consensus on the definition of this concept does not appear to be imminent. It is equally unlikely that exhaustive interrogation of the definition of food security will result in a comprehensive understanding of the concept, let alone its successful implementation. Notwithstanding this, Hay and Rukuni (1988) cautioned that in the SADC context, the many interpretations of food security make it run the danger of being a 'catch all concept'. This situation has a potential to jeopardise dedicated efforts of successful implementation of the concept.

1.2.3 The pillars of food security

In line with the official and comprehensive definition of food security that has been discussed in the previous section, this concept comprises of four pillars (Ecker & Breisinger, 2012),

- Food availability;
- Food accessibility;
- Food utilisation; and
- Stability.

1.2.3.1. Food availability

The WFS (2009) defines food availability as,

> "*The amount of food that is present in a country or area through all forms of domestic production, imports, food stocks and food aid".*

During the period of about half a century, the growth of agricultural production had exceeded population growth to the extent that the amount of available food commodities in the world far outweighed the world's population (Yeldah, 2011; Simon, 2012). In the mid-1940s, food availability was deemed critical in many European and North American countries in addressing the problem of 'food' through sufficiency and increased food production (Simon, 2012). This approach to addressing food insecurity is still relevant and applicable today in many areas across the world. For example, the Australia's approach to food security is centred on increasing the availability of food through increased agricultural production and trade, through investments in agricultural productivity, distribution systems and policy reform (AusAID, 2012). The Eastern Cape's Department of Rural Development and Agrarian Reform (DRDAR) also embraces the above Australian approach with respect to Massive Food Production Programme (MFPP), Siyakhula Programme (SP) and the current Cropping Programme (CP) which are predominantly focused on the massive production of maize.

However, in some countries of east Africa, the pillar of food availability has collapsed largely due to drought and other climatic conditions within the context of climate change (African Studies Centre, 2011). Other reported barriers to food availability include lack of storage facilities and quick depletion of food resources due to pressing needs at household level (Obamiro, Dopper & Kormawa, 2003).

1.2.3.2. Food accessibility

Food accessibility is defined by the WFS (2009) as;

> "*A household's ability to acquire adequate amount of food regularly through a combination of purchases, barter, borrowings, food assistance or gifts*".

As indicated by Amartha Sen, food availability does not necessarily guarantee food accessibility (Sachs, 1998). In fact, many people cannot sustainably access food, hence the prevalence of food insecurity across the world (Yeldah, 2011). The case in point is South Africa which is food secure at national level, yet at individual level, 35.6 percent of the country's population is food secure and is reflective of the national food security status (HSRC, 2013).

According to Simon (2012), food can be accessed through the following three elements, physical, financial, and socio-cultural. However, poverty is one of the main barriers to accessing food (Yeldah, 2011). There is a particular need in rural areas to increase the poor's ability to access food by strengthening markets and market access, among other factors (AusAid, 2012). Food accessibility is a critical pillar of the concept of food security to the extent that in the past it has received enormous research attention. It also received similar attention in this study.

1.2.3.3. Food utilisation

According to WFS (2009), food utilisation refers to;

> *"Safe and nutritious food which meets their dietary needs*".

This nutritional dimension is the integral part of the concept of food security (FAO, 2009; CFS, 2012). Research on this pillar often covers food security indicators such as dietary diversity and /or food variety, or nutrient intake (Oldewage-Theron & Kruger, 2008; Labadarios, Steyn & Nel, 2011). Other studies go a step further to include food absorption which gives a more accurate measure of food utilisation and state of food insecurity (Yeldah, 2011).

Other components of food utilisation include nutrition education, safe water, sanitation and health care (Simon, 2012). In order to improve food utilisation, these complementary components need to be attended to wholly (Obamiro *et al*. 2003).

The investigations on the current study had focused on various elements of food utilisation which are; food variety, dietary diversity, nutrient adequacy, anthropometric measurements and nutritional knowledge, attitudes and practices among families of food producers at Alfred Nzo District Municipality.

1.2.3.4. Stability

The WFS (2009) states that this dimension implies;

> "*Food security at all times".*

To be food secure, a population, household or individual must have access to adequate food at all times. The concept of stability can therefore refer to both the 'food availability' and 'food accessibility' dimensions of food security (FAO, 2006).

The investigations in this study covered all four pillars of the concept of food security, and how these pillars affect nutritional status from agri-business of owners / managers at Alfred Nzo District Municipality. As alluded in the previous subsection, special emphasis was given to food utilisation.

1.3 HUMAN NUTRITION AND MEASUREMENT OF NUTRITIONAL STATUS

This section presents fundamental principles of human nutrition that are relevant to this study. It also reviews methods of measuring nutritional status.

1.3.1 Human nutrition

Foods contain different nutrients that include, carbohydrates, protein, fats, fibre, minerals, vitamins and water. Nutrition refers to how food is utilised for a person's growth, reproduction and maintenance of health (Department of Health, 2007). A person is considered nutrition secure when she or he has a nutritionally adequate diet that meets various biological needs such as growth, physical work and maintenance (Frankenberger, Oshaug & Smith, 1997; Pangaribowo, Gerber & Torero, 2013). Nutrition and health are key determinants of an individual's nutrition security or nutritional status. The current study focused on the effect of the former to nutritional status.

1.3.2 Measurement of nutritional status

The current study seeks to measure the nutritional status of children of agri-business owners / managers at Alfred Nzo District Municipality. Basically, nutritional status is measured using two methods, namely; direct and indirect methods. The former measures one's nutritional status using a set of objective criteria, while the latter deals with community health and socio-economic indices that are reflective of various nutritional factors and influences.

1.3.2.1. Direct methods

There are four methods of direct nutritional assessment, namely; dietary evaluation methods, anthropometric methods, clinical methods, and biochemical and laboratory methods. This study used dietary evaluation and anthropometric methods; a choice which has been informed by the research objectives, questions, costs, expertise and logistics.

1.3.2.1.1 Dietary evaluation

In the literature, dietary evaluation methods are classified as a 24h dietary recall method, food frequency questionnaire (FFQ), dietary records, dietary history and observed food consumption. The first two methods (a 24h dietary recall method and FFQ) possess properties that can reasonably address this study's objectives and research questions. Costs, length of time, expertise and logistics were also considered when choosing the two research instruments.

1.3.2.1.1.1 24h dietary recall method

A 24h dietary recall is a retrospective quantitative research method that is used in nutritional assessment. It entails asking individuals to recall foods and drinks they had consumed over the previous 24h period prior to the interview.

In the current study, a 24h dietary recall was administered trice for each respondent - twice on weekdays and once on a day of a weekend. Further improvement of the accuracy of this method's results was achieved by complementing this method with FFQ, as well as the use of well-trained interviewers. Complementary strengths and weaknesses of a 24h dietary recall method are well covered in the literature (Dwyer, Krall & Coleman, 1987; Nelson & Bingham, 1992; Lee & Nieman, 1996; Wrieden, Peace, Armstrong & Barton, 2003).

1.3.2.1.1.2 Food frequency questionnaire

FFQ is a printed list of foods from which individuals are asked to indicate the typical frequency of consumption, and to state the average amounts consumed per day in household measurements (Nelson & Bingham, 1992). This retrospective method asks respondents to report their usual frequency of consumption of each food from a list of foods over a specific period of time. Over and above the collection of information on frequency of consumption of food, this method also takes stock of the quantities of foods consumed in order to make estimation of energy and nutrient intakes. In the current study, a qualitative FFQ was used to establish feeding patterns of agri-business families over a 7-day period.

A combination of a 24h dietary recall method and FFQ produces a hybrid instrument that increases the accuracy and validity of dietary assessment (Andersen, Bere, Kolbjornsen & Klepp, 2004; Kristjansdottir, Anderson, Haraldsdottir, de Almeida & Thorsdottir, 2006; Amend, Melkus, Chyun, Galasso & Wylie-Rosett, 2007). In support of this hybrid instrument, Barrett (2010) asserted that no single instrument can measure a complex item like nutrition status.

1.3.2.1.2 Anthropometric measurements

Anthropometry is the measurement of body height, weight and proportions. In the literature, the bulk of anthropometric studies cover infants, children and pregnant women, because of the strength of anthropometric methods in doing clinical examinations on these segments of the population (Wellman & Kamp (2008). However, in this study, anthropometric measurements were undertaken among children of agri-business owners / managers to evaluate both their under and over nutrition with a view to reflecting on their nutritional status. In achieving this purpose, the following measurements were undertaken, namely; weight-for-age, height-for-age and BMI-for-age (Wellman & Kamp, 2008).

1.3.2.2 Indirect methods

Indirect methods of nutritional assessment include three categories, namely; ecological variables, socio-economic factors and vital health statistics. Again, in view of this study's objectives, research questions and other logistical considerations, the first two methods were used – ecological variables and socio-economic factors.

Although not directly measuring the children's nutritional status, these methods were used to make meaningful inferences and shed more light on their nutritional status. Accordingly, the following research instruments were used, namely; socio-economic questionnaire; nutritional knowledge and attitudes questionnaire; nutritional practices questionnaire.

Having discussed the concept of food security in terms of its origin, evolution into other forms food security which include nutrition security, and the measurement of nutritional status, thereof, the subsequent section of this proposal is devoted to discussing experiences of food security in the world, Southern Africa, and South Africa.

1.4 EXPERIENCES OF FOOD (IN)SECURITY IN THE WORLD

Reports of the previous years on food insecurity suggest that the world is still battling to feed millions of its habitants. For example, in the 2007, 75 million more people were reported food insecure (FAO, 2008). According to Van Eeckhou (2010); cited by Sasson (2012) in 2010, the regional distribution of people suffering from hunger was the following; 578 million in the Asia Pacific region, 239 million in sub-Saharan Africa, 53 million in Latin America and the Caribbean, 37 million in North Africa, and 19 million in developing countries.

In 2011–13, a total of 842 million people, or around one in eight people in the world, were estimated to be suffering from chronic hunger, regularly not getting enough food to conduct an active life (FAO, 2013). Worthy to mention, subsequent to the commitment of developing countries towards the Millennium Development Goal (MDG) of halving the number of undernourished people in the world by 2015, progress has since been made. Indeed, 72 developing countries reached this goal; owing to stable political condition, economic growth, and sound social protection networks (FAO, 2015). Southern Asia and sub-Saharan Africa were two regions where reduction of hunger was still slow. However, Western Africa was the most successful region in Africa where the number of undernourished people fell by 24.5 percent since 1990-91 (FAO, 2015).

Notwithstanding the serious world-wide problem of hunger that has been outlined above, there is still strong determination to turn around this situation. In his 2030 vision, the UN's Secretary General, Ban Ki Moon, declared that 2016 is the year of `traction' which should be used to accelerate the process of ending poverty and hunger by 2030, Global Forum for Food and Agriculture (GFFA, 2016). In achieving this mammoth task, due diligence should be made in improving food systems in both rural and urban areas.

1.5 EXPERIENCES OF FOOD (IN)SECURITY IN SOUTHERN AFRICA

Over the years, efforts and initiatives to combat hunger and malnutrition in Africa have gained momentum at all geographic levels - local, national, continental, and international, International Food Policy Research Institute (IFPRI, 2004). Yet, there are still many examples of food insecurity in sub-Saharan Africa, some of them having reached catastrophic dimensions. The case in point is the Horn of Africa and southern Madagascar (Sasson, 2012).

At the national level, only a few Southern Africa countries produce enough food to meet their own needs (e.g. South Africa). The rest depend on their capacity to purchase imported food (e.g. Namibia and Botswana) or on food aid as it is the case in countries such as Lesotho, Malawi and Zimbabwe (Drimie, Arntzen, Dube, Ingram, Mano, Matanya, Muchero & Ziervogel, 2011). In line with this view, studies conducted by Crush, Hovorka and Tevera (2011) in selected cities of Southern Africa showed that most communities and that many more households residing in these cities rely on supermarkets and the informal sector to access food, because urban food production is not particularly significant in them. In their extensive work, these authors (Crush *et al*., 2011) measured food insecurity in terms of the following measuring tools, namely; Household Food Insecurity Access Scale (HFIAS), Household Food Insecurity Access Prevalence Indicator (HFIAP), and Household Dietary Diversity Scale (HDDS).

1.6 EXPERIENCES OF FOOD (IN)SECURITY IN SOUTH AFRICA

1.6.1 Integrated Food Security Strategy

In order to consolidates and reinforce its efforts for combating food insecurity, in 2002 the democratic South African government came up with an Integrated Food Security Strategy (Department of Agriculture, 2002) whose objectives are:

- Increased household production and trading;
- Improved income generation and job creation opportunities;
- Improved nutrition and food safety; and
- Increased safety nets and food emergency management systems.

DAFF is a leading department in implementing the first pillar of IFSS – increased household production and trading. It is supported by the Departments of Rural Development and Land Reform (DRDLR), Health, Public Works, Water Affairs, and Trade and Industry.

This pillar is implemented through various food security programmes.

1.6.2 Food security programmes

Since the inception of IFSS in 2002, DAFF has had numerous supportive food security programmes which included Ilima / Letsema, Zero-hunger, Fetsa Tlala, and the Agricultural Policy Action Plan (APAP).

1.6.2.1 Ilima / Letsema

DAFF incepted Ilima / Letsema in 2006 with a view to increasing food production and rehabilitating irrigation schemes and other value adding projects (DAFF, 2014b). The programme is funded by about 10 percent of Comprehensive Agricultural Support Programme (CASP).

Noticeably, Ilima / Letsema focused on the supply side of food production, especially production of staple grains. The researcher believes that this focus is largely due to poor understanding of the concept of food security among many policy makers and implementers in government. In line with this view, Pingali (2015) asserts that food security policies of most countries still interpret food security in terms of staple grain self-sufficiency, while dietary diversity needs of the middle class as well as those of the poor are not adequately addressed. The impact of many food security policies on human nutrition and diet related non-communicable diseases is not well known (The M & E Harmonisation Group of Food Security Partners, 2013).

Ilima / Letsema is still operational.

1.6.2.2 Zero-hunger

This programme was adopted from Brazil and introduced by DAFF in 2012 with the view to achieving the following objectives**:**

- Ensure access to food by poor and vulnerable members of the society;
- Improve food production capacity of households and poor resourced owners / operators;
- Improve nutrition security of citizens;
- Develop market channels through bulk government procurement of food linked to the emerging agricultural sector; and
- Fostering partnerships with relevant stakeholders within the food supply chain.

Unlike Ilima / Letsema, Zero-hunger recognised the importance of human nutrition in food security. This nutrition-sensitive intervention is applauded in the contemporary literature of food security (Powell, Thilsted, Ickowitz, Termote, Sunderland & Herforth, 2015; Herforth & Ahmed, 2015; Pingali, 2015; Institute of Food Research, 2015).

However, Zero-hunger had two critical flaws of scholarly interest. Firstly, it regarded food security as the problem of the poor only, yet food security affects all people everywhere (Pingali, 2015). Secondly, it disregarded the already existing free market channels by creating parallel market structures that sought to link farm produce from smallholder owners / operators to government institutions. In a free market economy this arrangement is problematic.

Zero-hunger never got off the ground due to lack of political support.

1.6.2.3 Fetsa Tlala Food Production Initiative

Fetsa Tlala came into the picture towards the end of 2013. This programme was put in place in order to address key challenges that affect the South African society as outlined in the National Development Plan. These challenges include poverty, unemployment and inequality (DAFF, 2014b). Fetsa Tlala is very similar to Ilima / Letsema in that it focuses on crop production. In fact, by the 2018/19 production season, the programme has set to cultivate one million hectares of land. In achieving this goal, 70 percent of the CASP infrastructure grant had to be reprioritised towards Fetsa Tlala. This reprioritisation also serves to augment the Ilima / Letsema Programme.

The researcher's views on Fetsa Tlala are in accordance with those expressed on Ilima / Letsema. That is, biasness towards production of staple food. Nonetheless, Fetsa Tlala is still being rolled out.

1.6.2.4 Agricultural Policy Action Plan

The Agricultural Policy Action Plan (APAP) was introduced in 2014, and it has its origins and aspirations in the National Development Plan, New Growth Path, and Medium Term Strategic Framework. Accordingly, it seeks to achieve an equitable, productive, competitive, profitable, and sustainable agriculture, forestry and fisheries sectors. Like the Industrial Policy Action Plan (IPAP), APAP is based on sectoral key action programmes or commodities (DAFF, 2014a). These commodities include:

- Red meat integrated value chain;
- Poultry integrated value chain;

- Fruit and vegetables;
- Wine;
- Wheat;
- Forestry;
- Fisheries; and
- Biofuels.

Unlike DAFF's other food security programmes that have been discussed earlier, APAP is not confined to production of staple food. It involves a wide range of commodities, and it embraces trade and agri-business development. In so doing, it promotes food security not only through food production / food availability, but also through food accessibility.

APAP is a five-year programme that is expected to be reviewed annually. Individual Provincial Departments of Agriculture (PDAs) are at liberty to formulate their own implementation strategies and corresponding branding. Branding is often based on reviving Africanism, the culture of hard work, unity and *ubuntu*. For example, Mpumalanga has '*Masibuyele eMasimini'*, while the Eastern Cape has '*Siyazondla'*.

In line with the objectives of IFSS, in 2012 the Eastern Cape government further formulated an Eastern Cape Anti-poverty and Food Security Strategy (ECAFSS). The programmes and activities of ECAFSS are coordinated by the provincial Department of Social Development and Special Projects (DOSDSP, 2012) through collaboration with other government departments, public entities, civil society, institutions of higher learning and social partners.

1.6.3 Scale of food (in)security

Notwithstanding the enormous strides made in developing food security policies and programmes that are welcome by PDAs for implementation, food insecurity remains a serious problem that has been on the rise in South Africa during the past decades. About eight years after the dawn of the new democratic South Africa, 35 per cent of the population, 14.3 million people, were vulnerable to food insecurity. Women, children and the elderly are the most vulnerable to food insecurity (Department of Agriculture, 2002a). This situation is connected to the high level of poverty, unemployment and inequality that exists in the country, particularly in rural areas.

In 2009, the findings of the general household survey conducted by Stats SA (2009) reported that an estimated 20 percent of South African households have inadequate or severely inadequate food access. The survey report indicates further that during 2008 food access problems were mostly serious in Free State where 33.5 percent of the households have inadequate food access. They were followed by household in KwaZulu-Natal with 23 percent, Eastern Cape 21.4 percent and Mpumalanga 21.5 percent. Limpopo (11.9 percent) and Western Cape (14.5 percent) had the least food security problems in 2008.

A subsequent survey conducted by HSRC (2013) on 7 500 households throughout the country shows that the state of food insecurity has remained fairly the same since 2008/9. That is, 45.6 percent of the population was food secure, while 28.3 percent were at risk of food insecurity, and 26.0 percent were food insecure. The largest percentage of participants who experienced food insecurity was in formal rural areas (37.0 percent) and urban informal (32.4 percent).

Interestingly, the Eastern Cape and Limpopo were the only two provinces with food insecurity levels higher than 30 percent. In terms of races black Africans had the highest prevalence of food insecurity (30.3 percent), followed by the coloured population (13.1 percent). In the Eastern Cape, vulnerability to food insecurity is widespread, particularly among households in Alfred Nzo District Municipality (86 percent) followed by Chris Hani District Municipality (83 percent), OR Tambo District Municipality (81 percent), and Western District Municipality at a relatively lower (66 percent). Further analysis of the characteristics of food insecure households suggest that there is less prevalent of food insecurity the Western regions of the Eastern Cape. Furthermore, most of the food insecure households in the province are found in rural areas, and food insecurity prevalence is high amongst black African households, particularly those that are headed by females and have larger family sizes (DEDEAT, 2013).

1.7 RESEARCH PROBLEM

The problem investigated in this study is informed by various studies on food security which have shown some gaps. These studies, which targeted survivalist rural farming and non-farming households, tend to be descriptive and evaluative in their approach to studying food security (see Table 1.1 for these studies). Notwithstanding the importance and contribution made by many of these food security studies, there are still many gaps identified.

Firstly, studies on the nutritional status of children of non-survivalist, but prospectively thriving black agri-business families are lacking in South Africa. It is presumed that by being dependants of food producers, they are food and nutrition secure. However, adequate food availability or food production which is one of the critically important pillars of food security do not necessarily renders one nutrition secure.

Secondly, and correspondingly with the above, many studies on food security which have been conducted by agricultural researchers put either little emphasis on nutrition security or none. In view of this gap, data on food security status of these families remain debatable as it rarely encompasses the bottom line, nutrition security. Yet, the contemporary definition of food security covers and recognises the importance of this component. This view is held by many authors in the literature (Powell et al., 2015; Herforth & Ahmed, 2015; Pingali, 2015; Institute of Food Research, 2015).

Research questions that emanate from the above identified gaps are outlined in Table 1.1.

In the light of the above gaps that have been identified in the literature, this study poses the following research questions:

- To what extent are children from agri-business families nutrition secure?
- Alternatively, what is the nutritional status of children from agri-business families?

- What key socio-economic attributes influence nutrition security status of children from agri-business families?

That is:

- Is there a relationship between an agri-business family's non-farm income and its children's nutritional status?
- Is there a relationship between an agri-business family's food expenditure and its children's nutritional status?
- Is there a relationship between an agri-business family's farm income and its children's nutritional status?
- Is there a relationship between a caregiver's educational qualifications and his / her children's nutritional status?

Accordingly, the following research hypotheses were formulated to respond to research questions and objectives:

Null and alternative hypotheses No. 1

H_0: Higher agri-business family's monthly non-farm income does not lead to its children' better nutritional status.

H_1: Higher agri-business family's monthly non-farm income leads to its children' better nutritional status.

Null and alternative hypotheses No. 2

H_0: Higher agri-business family's monthly food expenditure does not lead to its children' better nutritional status.

H_2: Higher agri-business family's monthly food expenditure leads to its children' better nutritional status.

Null and alternative hypotheses No. 3

H_0: Higher agri-business family's farm income does not lead to its children' better nutritional status.

H_3: Higher agri-business family's farm income leads to its children' better nutritional status.

Null and alternative hypotheses No. 4

H_0: Higher educational qualifications of a caregiver do not lead to his/her children' better nutritional status.

H_4: Higher educational qualifications of a caregiver lead to his/her children' better nutritional status.

Table 1.1 Identification of gaps in the literature and the corresponding research questions

Identified gaps in the literature	Authors from whose studies gaps were identified	Research questions
➢ Food security studies on black agri-business families which exclude survivalist farming families are rare in South Africa. Many local food security studies which are conducted by agricultural researchers on smallholder farmers put either little emphasis or none on the nutrition facet of food security. ➢ Children of agri-business families are presumed nutrition secure, by virtue of being dependants of food producers.	Monde (2003); Dirwayi (2010); Tregurtha (2012); Ndhleve, Musemwa & Zhou (2013); Oni, Maliwichi & Obadire (2013); Kahsay & Mulugeta (2014); Abate, Shiferaw, Menkir, Wegary, Kebede, Tesfaye, Kassie, Bogale, Tadesse & Keno (2015).	➢ To what extent are children from agri-business families nutrition secure? ➢ Alternatively, what is the nutritional status of children from agri-business families? ➢ What key socio-economic attributes influence nutritional status of children from agri-business families?
➢ Notwithstanding its fundamental importance, food security is no guarantee to achieving the ultimate nutrition security.	Dirwayi (2010); Tregurtha (2012); Ndhleve *et al*. (2013); Oni *et al.* (2013); Kahsay & Mulugata, 2014; Abate *et al.* (2015).	The three research questions outlined above are still applicable.

1.8 PURPOSE AND OBJECTIVES OF THE STUDY

In the face of the gaps on nutrition security that have been identified in the literature, the purpose of this study is to investigate the current state of nutritional security / nutritional status amongst children from agri-business families, thereby contributing towards further understanding of the concept of nutrition security, its application, and implication to various role players and stakeholders in the Eastern Cape Province, in particular, and in the South Africa in general.

Accordingly, the research objectives of the study are to:

- Establish baseline data for nutrition security / nutritional status of children from agri-business families.
- Establish the extent to which children from agri-business families are nutrition secure, using a multiple of scientifically proven research methods of measuring nutrition security.
- Identify and understand short-comings to achieving nutrition security or good nutritional status among children from agri-business families.
- Draw recommendations based on the findings of the study.

1.9 RATIONALE FOR THE STUDY

Food insecurity which is mainly caused by poverty is a concern of both developed and underdeveloped countries, including South Africa. In the Eastern Cape Province, there are various programmes and initiatives which sought to address the problem of food insecurity, particularly among many improvised rural communities. These food security initiatives have in the past sparked a lot of research interest which tended to focus on low income and survivalist rural farming households and on food production which is the supply end of the concept of food security (see Table 1.1 for these studies). Similar studies on children from agri-business families are scarce.

The studies referred to above often fell short in providing information on the nutrition security of households. Yet, Pothukuchi (2004) advised that food assessment, which is part of nutrition security or food utilisation, is the first step for planning household food security programmes. Food assessment is also of critical importance in providing accurate indications on food (in)security after food security programmes have been implemented (Steyn, Nel, Nantel, Kennedy & Labadarios, 2006). In heeding this advice, in the current study food assessment was undertaken on meals that were consumed by children from agri-business families. This undertaking makes this study one of its kind in the Eastern Cape.

However, elsewhere there are studies conducted to assess households' food security status after consideration has been made of various components of food security, including nutrition security. Such studies were conducted in many Asian developing countries such as India (Sharma, Lal, & Gupta, 2006; Waghmare & Tilekar, 2012), and Bangladesh (Hels *et al.,* 2003). In Africa such studies were conducted in Burkina Faso (Savy, Martin-Prével, Traissac, Eymard-Duvernay & Delpeuch, 2006), Malawi (Madziakapita, 2008), Botswana (Tembwe, 2010), and Kenya (Ndiku, Jaceldo-Sieg, Singh & Sabaté, 2011).

In South Africa, similar studies were carried out by Walsh, Dannhauser & Joubert (2002), Steyn *et al*. (2006), Crush *et al*. (2011), De Cock, Haese, Vink, van Rooyen, Staelens, Schönfeldt & Haese (2013), among other authors. None of these studies were conducted on children from agri-business families.

Accordingly, the researcher is motivated to conduct this study for the following reasons:

- In South Africa there are no food security studies conducted on agri-business families. Such studies are limited to low income, survivalist farming households.
- Studies on the food security status of households often overlook investigations into food utilisation which is the integral part of the contemporary concept of food security.
- As a result of the above situation, critical information on food intake, nutrient intake, food variety, dietary diversity, anthropometric dimensions, nutritional knowledge, attitudes and practices, and ultimately nutritional status of children of agri-business

families is evidently missing in these studies. Yet, nutritional status is one of the accurate measurements of food and nutrition security.

- Factors that are related to food utilisation which promote or hinder food and security among children from agri-business families are not known.

1.10 SIGNIFICANCE OF THE STUDY

This study has significance for the following reasons:

- It is a food and nutrition security study of its kind to investigate food and nutrition security status of children from agri-business families. In this study, the participants have been members of agri-business families who feed and provide other forms of care to children. They are referred to as caregivers. Agri-business owners / managers and their children also participated in this study.
- Children from agri-business families are presumed food and nutrition secure by virtue of having parents that are operating at the supply end – food production - of food security. This study has demonstrated that food and nutrition security is not the subject that should concern the poor only. Instead, it should concern everyone, including agri-business families, whose nutrition adequacy is not known.
- In line with the above assertion, this study provided baseline data on the food and nutrition security status of children from agri-business families.
- Poverty is the key driver of food and nutrition insecurity. This study has shed more light on the extent to which children from agri-business families are vulnerable to food and nutrition insecurity in areas that are poverty stricken. Alfred Nzo District Municipality, being the poorest district municipality in the Eastern Cape, presented itself as the suitable place for this study.
- Generally, the results of this study have implications that go beyond the research population that has participated in this research. To this end, they have implications for policy and project implementation.

1.11 DELIMITATIONS OF THE STUDY

This study has the following delimitations:

- Comparison of results among the six districts of the Eastern Cape should be done cautiously, taking cognisance of many differences among them (e.g. demographics, support systems, climatic and business environmental conditions).
- It is advisable that further caution be exercised when generalising the findings of this study to children of black agri-business families outside the Eastern Cape as agricultural performance of farmers in other provinces may differ. Their eating behaviour is also expected to vary, subject to socio-economic conditions.
- Subsistence farmers or survivalists whose scale of production is below micro enterprises were not included in this study. This very low entry level for participation in this study posed a huge challenge in achieving a purposeful research sample that is bigger than 263 agri-business households in a poverty-stricken area like Alfred Nzo District Municipality.

1.12 RESEARCH DESIGN AND METHODOLOGY

Most scientists select appropriate research designs that would yield reliable observations that can help with the understanding of a phenomenon (Castillo, 2009). In line with the above principle, the research design for this study was a participatory action research. Action research is referred to by many other names such as participatory research, action learning, contextual action research, collaborative inquiry, and emancipator research (O'Brien, 2001).

In this study, participatory action research was used to gain an in-depth understanding of various elements of food and nutrition security which included food intake, nutrient intake, food variety, dietary diversity, anthropometric dimensions, nutritional knowledge, attitudes and practices, and ultimately nutritional status of children from agri-business families.

Quantitative and qualitative data was collected by means of questionnaires (socio-economic profile, 24h dietary recall method, qualitative FFQ, and nutritional knowledge, attitudes and practices), face-to-face semi-structured interviews, direct observation, and application of theory.

In this study, the population was agri-business families who operate and reside in Umzimvubu and Ntabankulu Local Municipalities of Alfred Nzo District Municipality in the Eastern Cape Province. Specifically, it targeted previously disadvantaged smallholder agri-business owners / managers whose individual or collective annual turnover is between R150 000 and R4 000 000. Smallholder agri-businesses which generated this turnover were classified by the Department of Trade and Industry (1996) in the South African National Small Business Act No. 102 of 1996 as small, micro and medium enterprises (SMMEs) [see Table 1.2]. All owners / managers who met this criterion were purposefully selected from a farmer database that was made available by local agricultural extension officers. After the exclusion of survivalist farming families (annual turnover less than R150 000), this study included the remaining purposeful research sample of 124 agri-businesses that were operated by 263 agri-business owners / managers from 263 households. Three hundred and twenty-seven (327) children aged 5-14 years from the agri-business households participated in this study. From each of the 263 agri-business households, questions that relate to nutritional knowledge, attitudes and feeding and general care of children were directed to caregivers who lived in these households.

Various mechanisms were put in place to ensure reliability and validity of the research results. Quantitative data was analysed using parametric and non-parametric statistics, while qualitative data was analysed by content analysis.

Table 1.2 Categories of enterprise sizes in the agricultural sector

Size or class	Total full-time equivalent of paid employees	Total annual turnover	Total gross assets (fixed property excluded)
	Less than:	*Less than:*	*Less than:*
Medium	100	R4-million	R4-million
Small	50	R2-million	R2-million
Very small	10	R0.4-million	R0.4-million
Micro	5	R0.15-million	R0.10-million

Source: Department of Trade and Industry (1996)

1.13 STRUCTURE OF THE STUDY

This study was structured in the following eight chapters (see Figure 1):

Chapter 1 Orientation of the study

This chapter describes the background to, purpose and objectives, and research design and methodology of the study.

Chapter 2 The concept of food security, nutrition, and measurement of nutritional status

The second chapter contains a literature survey on food security, fundamental principles of human nutrition, and scientifically proven methods of measuring nutritional status. It starts with an extensive review of the definition of food security, its origin and how it has evolved to various forms since its inception. Subsequently, selected elements of human nutrition are discussed with direct and indirect methods of measuring nutritional status.

Chapter 3 The state of food (in)security

This chapter takes stock of the state and scale of food (in)security worldwide, with special emphasis to countries in Southern Africa, South Africa, Eastern Cape and Alfred Nzo District Municipality. It also covers food security policies and programmes of South Africa and the Eastern Cape Province.

Chapter 4 Research design and methodology

This chapter discusses the research design and methodology that is used in the study population.

Chapter 5 Data on socio-economic aspects, and nutritional knowledge, attitudes and practices of caregivers

The fifth chapter contains predominantly qualitative results from which the nutritional status of children is inferred. These results come from the socio-economic questionnaire, nutritional knowledge and attitudes questionnaire, and nutritional practices questionnaire.

Chapter 6 Data on the 24h dietary recall method, food frequency questionnaire and anthropometric measurements

This chapter contains a presentation of quantitative data on nutritional status of children from agri-business families. The data was sourced from 24h dietary recall and qualitative FFQ, and anthropometric measurements.

Chapter 7 Discussion of results

In this chapter, interpretations and discussions of results presented in the two previous chapters are made.

Chapter 8 Summary, conclusions, and recommendations

This chapter makes a summary of discussions that had unfolded in the previous chapters. It also draws conclusions based on findings obtained from the outcomes of the previous chapters. The contribution of the study and recommendations are also presented.

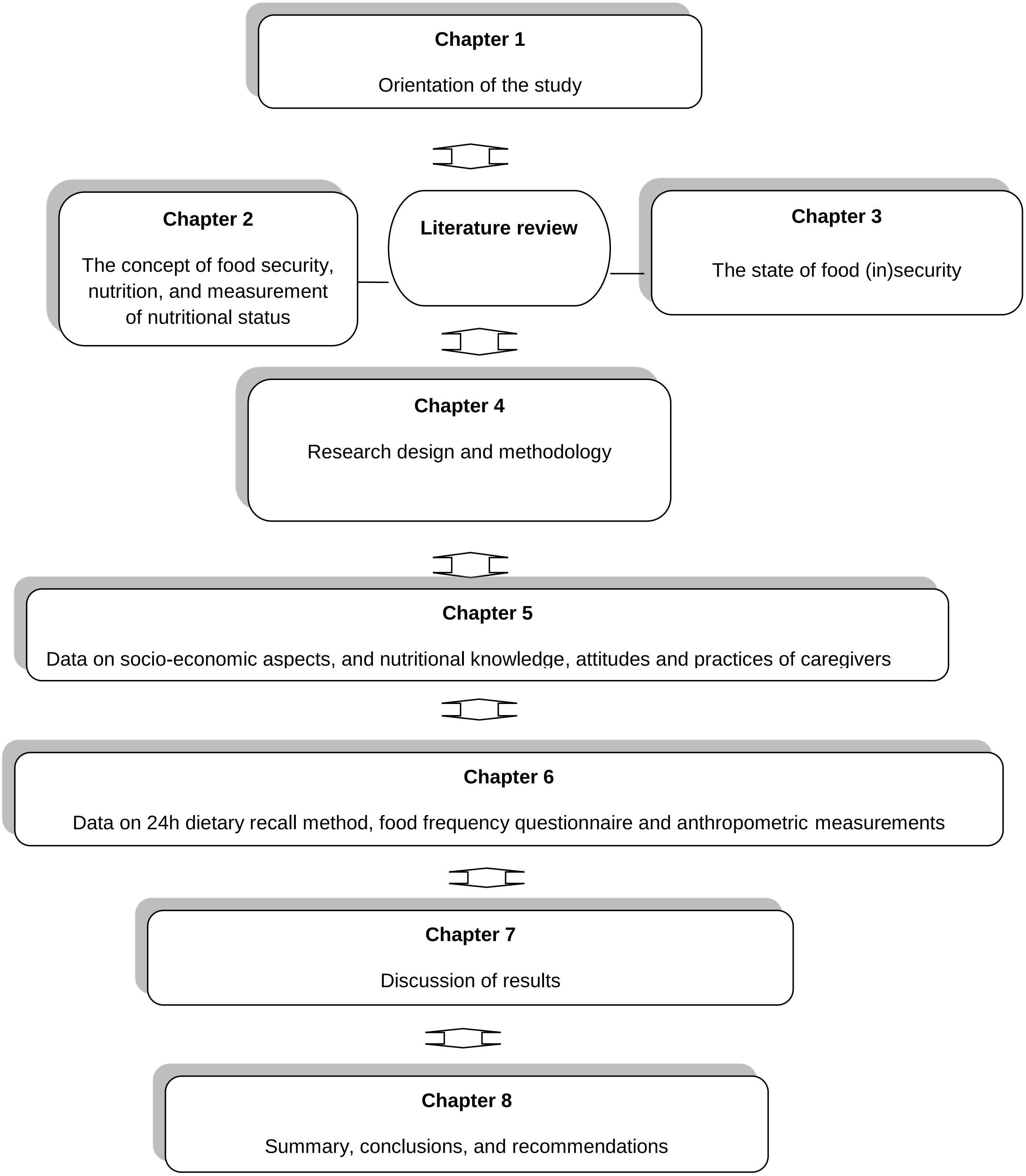


Figure 1 Structure of the study

1.14 CHAPTER SUMMARY

This chapter described the background to; purpose, significance, and research design and methodology of the study.

Chapter 2 covers the literature review conducted for the study.

CHAPTER 2
THE CONCEPT OF FOOD SECURITY, NUTRITION, AND MEASUREMENT OF NUTRITIONAL STATUS

2.1 INTRODUCTION

The world's population is expected to grow and reach 9.6 billion people by 2050, thus creating an enormous challenge for provision of extra food in order to ensure adequate food and nutrition security (Capone, El Bilali, Debs, Cardone & Driouech, 2014). In the years leading up to 2050, food security is expected to assume a centre stage in many parts of the world, including South Africa. Accordingly, this chapter is dedicated towards describing the concept of food security, its origin and components, and the manner in which this concept has evolved since its inception.

2.2 UNDERSTANDING FOOD SECURITY

The concept of food security is based on the food substance. Food is a composition of nutrients in the form that can be eaten and ultimately utilised by the body to provide the consumer with good nutrition and health status. The main components of food are outlined in Figure 2.1. The functions of these components and their daily requirements by children are discussed at length in the later sections of this chapter. The adequate consumption of these components by an individual child constitutes that child's state of food and nutrition security. A total of nine food groups and 25 macro and micro nutrients which are related to the main food components that are outlined in Figure 2.1 formed part of this study's investigation.

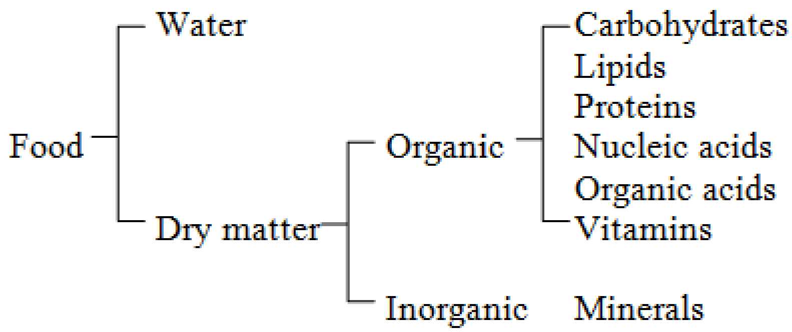


Figure 2.1 The main components of food

The food security referred to above is as complicated as the food substance in that it is a broad and multifaceted issue that is interconnected with many economic, social, political and health-related concerns (The Economist, 2014). As briefly discussed in the previous chapter, the concept of food security has evolved since its inception in 1974. Its current official definition is (FAO, 2012b)**:**

> "*Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life".*

In implementing food security, some organisations whose names are contained in Table 2.1 use their own definitions of this concept. Evidently, definitions from Life Sciences Research Office (LSRO), World Health Organisation (WHO) and City of Toronto are fairly similar to the abovementioned FAO official definition of this concept in that they embrace the four pillars of food security that have been discussed in the previous chapter, namely; food availability, food accessibility, food utilisation and stability. Noticeably, organisations such as Ontario Public Health Association (OPHA) and Public Health Association of British Columbia (PHABC) put emphasis on 'community' when defining food security. Further discussion on `community food security' is provided on the subsequent sentences of this chapter.

Table 2.1 Examples of definitions of food security by different international organisations

Definition	Organisation
Access by all people at all times to ensure enough food for an active, healthy life and includes at a minimum. ➢ The ready availability of nutritionally adequate and safe foods, and ➢ The assured ability to acquire acceptable food in socially acceptable ways (e.g. without resorting to emergency food supplies, scavenging, stealing, and other coping strategies).	Life Sciences Research Office (LSRO, 1990)
Food is available at all times; that all persons have means of access to it; that it is nutritionally adequate in terms of quantity, quality and variety; and that it is acceptable within the given culture. Only when all these conditions are in place can a population be considered food secure.	FAO (1996)
All people at all times have physical and economic access to sufficient, safe and nutritious foods to meet their dietary needs and food preferences for an active healthy life.	Rome Declaration on World Food Security (Committee on World Food Security, 2012). Adopted by: ➢ UN, ➢ Government of Canada, ➢ World Health Organisation (WHO), and ➢ 183 participating nations.

Table 2.1 Examples of definitions of food security by different international organisations (continued)

Definition	Organisation
➢ The availability of variety of foods at a reasonable cost. ➢ Ready access to quality grocery stores, food service operations, or alternative food sources. ➢ Sufficient personal income to buy adequate food for each household member each day. ➢ The freedom to choose personally and culturally acceptable foods. ➢ Legitimate confidence in the quality of foods available. ➢ Easy access to understandable, accurate information about food and nutrition. ➢ The assurance of a viable and sustainable food production system	City of Toronto (2000)
Community food security is a strategy for ensuring secure access to adequate amounts of safe, nutritious, culturally appropriate food for everyone, produced in an environmentally sustainable way, and provided in a manner that promotes human dignity.	Ontario Public Health Association (OPHA, 2002)
Community food security exists when all citizens obtain a safe, personally acceptable, nutritious diet through a sustainable food system that maximises healthy choices, community self-reliance and equal access for everyone.	Public Health Association of British Columbia (PHABC, 2004)

Source: Health and Welfare Canada (1986)

2.3 THE ORIGIN OF THE CONCEPT OF FOOD SECURITY

Having introduced the concept of food security in the previous sub-section, the next sub-section of this chapter will focus on the origins of this concept.

In the early 1930s, the disastrous effects of the Great Depression on consumer purchasing power and on the incomes of primary producers were characterised by hunger and malnutrition. This situation prompted the need for various forms of intergovernmental cooperation for improving supplies and sharing of staple foodstuffs between nations (Shaw, 2007). The then League of Nations coordinated the intergovernmental cooperation over food (Simon, 2012).

In the 1940's, particularly the post-World War II period, food supply remained a major concern in developed countries. In response to food shortage, many countries in North America and Europe reviewed and adjusted their agricultural policies in favour of promoting self-sufficiency and increased agricultural production. In his State of the Union address on 6 January 1941, before the United States entered the war, President Franklin D Roosevelt had identified four essential freedoms for the whole world, namely:

- Freedom of speech;
- Freedom of worship;
- Freedom from fear, and
- Freedom from want.

About two years later (May / June 1943), Franklin D. Roosevelt convened the UN Conference on FAO at Hot Springs, Virginia, USA. This conference led to the formation of the FAO of the UN (CFS, 2012). During the conference participating countries concluded that 'freedom from want' meant a secure, adequate and suitable supply of food for every man, woman and child, where 'secure' referred to the accessibility of the food, 'adequate' referred to the quantitative sufficiency of the food supply and 'suitable' referred to the nutrient content of the food supply.

The conference also made critical declarations which laid a cornerstone for today's concept of food security (Shaw, 2007). Firstly, it declared that:

"…*meeting in the midst of the greatest war ever waged, in full confidence of victory, has considered the world problems of food and agriculture and declares its belief that the goal of freedom from want of food, suitable and adequate for the health and strength of all peoples can be achieved*".

According Shaw (2007), this declaration recognises poverty as the primary cause of malnutrition and hunger. To this end, it asserts that there must be an expansion of the whole world economy to provide the purchasing power sufficient to maintain an adequate diet for all. With full employment in all countries, enlarged industrial production, the absence of exploitation, an increasing flow of trade within and between countries, an orderly management of domestic and international investment and currencies, and sustained internal and international economic equilibrium, the food which is produced can be made available to all people.

The 1943 UN Conference on FAO also declared that:

> "*The first steps towards freedom from want of food must not await the final solution of all other problems. Each advance made in one field will strengthen and quicken advance in all others. Work already begun must be continued. Once the war has been won decisive steps can be taken. We must make ready now".*

Based on this declaration and other conclusions reached during the 1943 UN Conference on FAO, there was a general agreement amongst the participating countries to establish the FAO in order to implement the resolutions of the conference. Thereafter, the FAO held its first conference in Quebec, Canada in 1945 (FAO, 1945). Some of the key underpinnings that featured in the constitution of the FAO during this very first conference involved:

- Raising levels of nutrition and standards of living of the people under their respective jurisdictions;
- Securing improvements in the efficiency of the production and distribution of all food and agricultural products;
- Bettering the condition of rural populations; and thus
- Contributing towards an expanding world economy and ensuring humanity's freedom from hunger.

The constitution also spelt out the core functions of the FAO as:

- To collect, analyse, interpret and disseminate information relating to nutrition, food and agriculture.
- To promote and, where appropriate, recommend national and international action concerning the following, namely:
    - The scientific, technological, social, and economic research relating to nutrition, food and agriculture,
    - The improvement of education and administration, relating to nutrition, food and agriculture, and the spread of public knowledge of nutritional and agricultural science and practice,
    - The conservation of natural resources and the adoption of improved methods of agricultural production,
    - The improvement of the processing, marketing and distribution of food and agricultural products,
    - The adoption of policies for the provision of adequate agricultural credit, at national and international levels,
    - The adoption of international policies with respect to agricultural commodity arrangements.
    - Furnishing such technical assistance as governments may request,
    - Organising, in cooperation with the governments concerned, such missions as may be needed to assist them to fulfil the obligations arising from their acceptance of the recommendations of the UN Conference on FAO and of FAO's constitution; and
    - Generally, to take all necessary and appropriate action to implement the purposes of FAO.

Indeed, a lot of information that was used to guide the researcher through the course of this study had been generated by the FAO. This includes the used research methods and tools, and literature. Some food materials that the researcher analysed for nutritive value were fortified in accordance with guidelines from FAO. These food materials include maize meal, bread and breakfast cereals, and salt. South Africa's IFSS which is introduced in Chapter 3 of this thesis has its roots in FAO's universal definition of food security.

Nevertheless, back to the discussion on the origin of the concept of food security. The new direction of future agricultural policies was largely informed by the undertakings of the FAO (Simon, 2012). In the second conference of the FAO which was held in September 1946 in Copenhagen, Denmark, the FAO submitted a survey of existing and proposed international organisations designed to meet long-term problems concerned with the production, distribution, and consumption of food and agricultural products, including the risk of accumulating surpluses. The FAO also made proposals to the conference on any extension of the functions of existing organisations or any new organisations which the survey identified as necessary (Shaw, 2007).

The results of the FAO's first world food survey of 1946 estimated that 1 billion people consumed less than 2250 calories a day. Interestingly, during the same period, average intake per person in the United Kingdom was 2750 calories even with acute food shortages. However, the intake of other foodstuffs (e.g. animal products, fruits and vegetables) which contain other nutrients (e.g. proteins, minerals and vitamins) which are necessary for achieving an adequate food was unknown.

At this point the researcher asserts that many key decision-makers in developing countries still move along with the 1940s out-dated understanding of the concept of food security that developed countries have long abandoned. That expired understanding is that 'food security is the problem of the poor only, and production and consumption of energy-rich staple food is the key to addressing food insecurity'. In this study, the children' intake of energy / calories was measured against their energy requirements. Similar measurements were extended to 24 other macro and micro nutrients. These endeavours were undertaken in order to establish the nutritional status of children from agri-business families in accordance with the contemporary international practices.

However, the FAO survey fell short in accurately estimating how much the production of each of the main foodstuffs would need to be increased by to provide adequate foods for the world's population, since various countries' statistics were either absent or unreliable (Shaw, 2007). As if not enough, the future state of human nutrition and the prosperity of agriculture were also interdependent with the volume of trade. Food could be treated as a normal tradable commodity, but it was also an essential of life. According to Shaw (2007), both sides of the equation had to be balanced, and reflected in the formulated agricultural policies.

Between the 1950s and the 1960s, the subject of 'food' received intense, systemic and organised attention from many countries in North America and Europe. This attention translated into new agricultural policies and legislations which sought to achieve self-sufficiency, increased food production, and food trade between various countries. For example, the governments of Australia, New Zealand, South Africa and the United Kingdom established a Joint Organisation to undertake the marketing of accumulated wool surpluses (Shaw, 2007). These developments also led to the introduction of food aid whose primary objective was to dispose of the surplus of various food commodities (Makenete et al., 1998). Food aid, which was spearheaded by the US, as it is the case to date, is spread throughout the world, particularly in war-torn areas. Food has and is still being used as a powerful weapon of siege or as a tool of control (Zurayk, 2013). However, in the 1960s, it was found that food aid has some bad unintended consequences; the major consequences being constrained self-sufficiency (Shaw, 2007) and emergency of dependence syndrome (Madziakapita, 2008), among the recipients. In response to this undesirable situation, the concept of food for development was introduced and institutionalised. The creation of the World Food Programme (WFP) in 1963 is the case in point (Hall, 1998).

The early 1970s were characterised by poor harvests worldwide, thus resulting in severely reduced grain stocks, market shortages, and rising food prices, among other challenges. As a result, food security insurance schemes, which assured international access to physical food supplies, were developed in the 1970s (Weingằrtner, 2004). This crisis was discussed in the World Food Conference that was held in Rome in 1974. During this conference, the concept of food security was hatched, and it carried the following food supply-based definition (FAO, 2012b);

"*Availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices*".

In the 1980s the Green Revolution has had success in many parts of the world, particularly in the West. Consequently, there was massive increase in food production in these areas. However, during the same period, in other parts of the world the subject of food and food security took another turn. For example, in Africa, there was severe drought and the resultant food shortage and famine in many countries located in east Africa (Simon, 2012). There was also instability in Afghanistan and Cambodia which put enormous pressure on international food aid due to afflux of refugees (Simon, 2012). Subsequent to these challenges, the World Bank (1986) distinguished between two kinds of food insecurity, namely chronic and transitory food insecurity. The former refers to households or individuals being unable to meet food requirements over a lengthy period of time, while the latter entails shocks that supress levels of food consumption below food requirements. Chronic food insecurity is largely caused by poverty (World Bank, 1986), while its transitory counterpart is caused by factors such as instability of food prices, food production and or income. The 1980s also saw the emergence of new theories in the subject of food security. The case in point is Amartya Sen, the Indian philosopher's assertion that during the famine referred to in the early 1980s, the main problem was not so much of lack of food, but rather the impossibility for poor people to access it (Simon, 2012; Burchi & De Muro, 2016).

In the current study, food production levels of agri-business families were investigated. Further investigations were extended to their abilities to use farm and non-farm proceeds to access food materials, particularly those they cannot produce. In the final analysis, accessed quantities of food; be it physically or economically, were used to assess the nutritional status of children of agri-business families. Furthermore, at the time of conducting this study, the Eastern Cape, including Alfred Nzo District was going through a drought period. The food insecurity status (chronic or transitory) of children understudy had to be viewed against this climatic status quo.

Nonetheless, the 1990s were also characterised with numerous developments on food security. Key to these developments was the 1992 food crisis in Africa which was caused by unfavourable climatic conditions. According to Simon (2012), the food crisis had its roots on the 'availability dimension' of food security. To this end, logistical resources were assigned to deal with the logistical problems that relate to limited availability of food commodities in various affected countries. The human right to adequate food and nutrition was internationally reaffirmed, so is the commitment of national governments to more proactive approaches to food security. There was also a reduction in the international public support of donor agencies in favour of establishing measures to manage and prevent the frequency of occurrence of the food crisis (Weingȁrtner, 2004). In 1996, a lot of progress had been made across the world with regards to alleviating food insecurity. Still in 1996, further progress was made during the World Food Summit with regards to improving systems and techniques of measuring food insecurity (Hels, Hassan, Tetens & Thilsted, 2003).

In the 2000s, some targets that are necessary for tackling food insecurity were set. For example, in 1996 the CFS set to reduce the number of malnourished people in the world by half not later than 2015 (Simon, 2012). However, at the World Food Summit which was held in Rome in 2002, and subsequently at the meeting of CFS held in 2006, the number of malnourished people had in fact increased. In 2012, the number of undernourished people around the world was estimated at 870 million (FAO, 2012a). This problem is expected to affect many countries across the world in many years to come (AusAID, 2012). In 2013, a total of 842 million people, or around one in eight people in the world, were estimated to be suffering from chronic hunger, regularly not getting enough food to conduct an active life (FAO, 2013). The challenge of feeding the growing world population, which is expected to reach 9 billion people in 2050, remains (Capone *et al*., 2014).

Today, food security concerns include not only the problems of physical availability of food stocks as well as economic and physical access to food stocks, but also biological utilisation of food consumed. That is, environmental conditions such as availability or otherwise of safe drinking water and sanitation as well as nutritional practices and knowledge that can help or hinder the absorption of food into the body form part of the more inclusive contemporary conception of food security (Swaminathan, 2008). Indeed, in the current study, the agri-business families' nutritional practices and knowledge, and drinking water and sanitation was investigated.

Finally, since its inception, the concept of food security has evolved to other forms and levels, owing to global research interest and work that has been done on this concept. The following section is dedicated to discussing such evolution.

2.4 THE EVOLUTION OF FOOD SECURITY

In the literature there is consensus that the 1940s Universal Declaration of Human Rights which recognised the right to food as a pre-request to adequate standard of living laid the foundation for the concept of food security (Frankenberger, 1992; Hall, 1998 Swaminathan, 2008). There is also similar consensus that food security was conceptualised and institutionalised in the 1970s. During this founding period, food security was focused mainly in building food stocks at national and international levels.

However, the manner in which the concept of food security has evolved since its inception is captured differently by various authors. For example, Swaminathan (1998) demonstrated the post-war evolution of the concept of food security in four phases which are mainly from an Indian perspective (see Figure 2.2). Meanwhile, the demonstration (see Figure 2.3) by Maxwell (1996) suggest that the concept of food security has over the years evolved in terms of physical, social, economic and environmental access. Weingärtner (2004) demonstrated the evolution of the concept of food security since its inception in five phases (see Figure 2.4). During the very first decade (1940-50s) when food received serious international attention through the establishment of the FAO, there was food surplus in the world which was disposed through food aid programmes. In the 1960s, a new approach to food aid was hatched through the formation of the World Food Programme. Food aid was used to eliminate the need for food aid through supporting social and economic development.

In the 1970s, the concept of food security progressed into another dimension. It incorporated food security insurance schemes which sought to offset excessively unstable food supplies and prices. In order to be effective, these schemes had to promote cooperation and coordination between donor organisations, agencies and food availability surveillance in recipient countries. Nowadays, food security insurance schemes play a very critical role in the light of Africa's struggle to cope with the impacts of climatic changes (Sasson, 2012; Louw, Wilson, Janion, Veldtman, Davies & Addison, 2014).

In the 1980s, experienced gained from Africa's famine of 1984/5 showed that food availability / production alone does not assure food security. Economic access to food was found to be a critical pillar of food security. By so doing, food security was broadened in scope to include both physical and economic access to food supply. During the same decade, reduction of poverty and the role of women in development received serious attention.

In the 1990s, the human right to adequate food and nutrition received international reaffirmation and support from various national governments, whilst in the 2000s, there were concerted efforts to tackle global food insecurity and pay particular attention to human nutrition.

Lastly, as outlined in these discussions, there are various perspectives to the evolution of the concept of food security. In line with these differentiated perspectives, the understanding and definition of food security differ with authors as it has been alluded in the previous subsections of this chapter. However, what is undisputable are critical events that had over the years driven the evolution of food security (see Table 2.2). Some of these events which include the 1943 Hot Springs Conference on Food and Agriculture, were covered in subsection 2.3 of this chapter. Evidently, it is through these events that the concept of food security has evolved into what it is today. This evolution has brought about new terminologies and other levels of food security such as community food security, household and individual food security, and nutrition security, which is the subject of this study's investigation.

The next section is devoted to discussing the abovementioned forms and levels of food security.

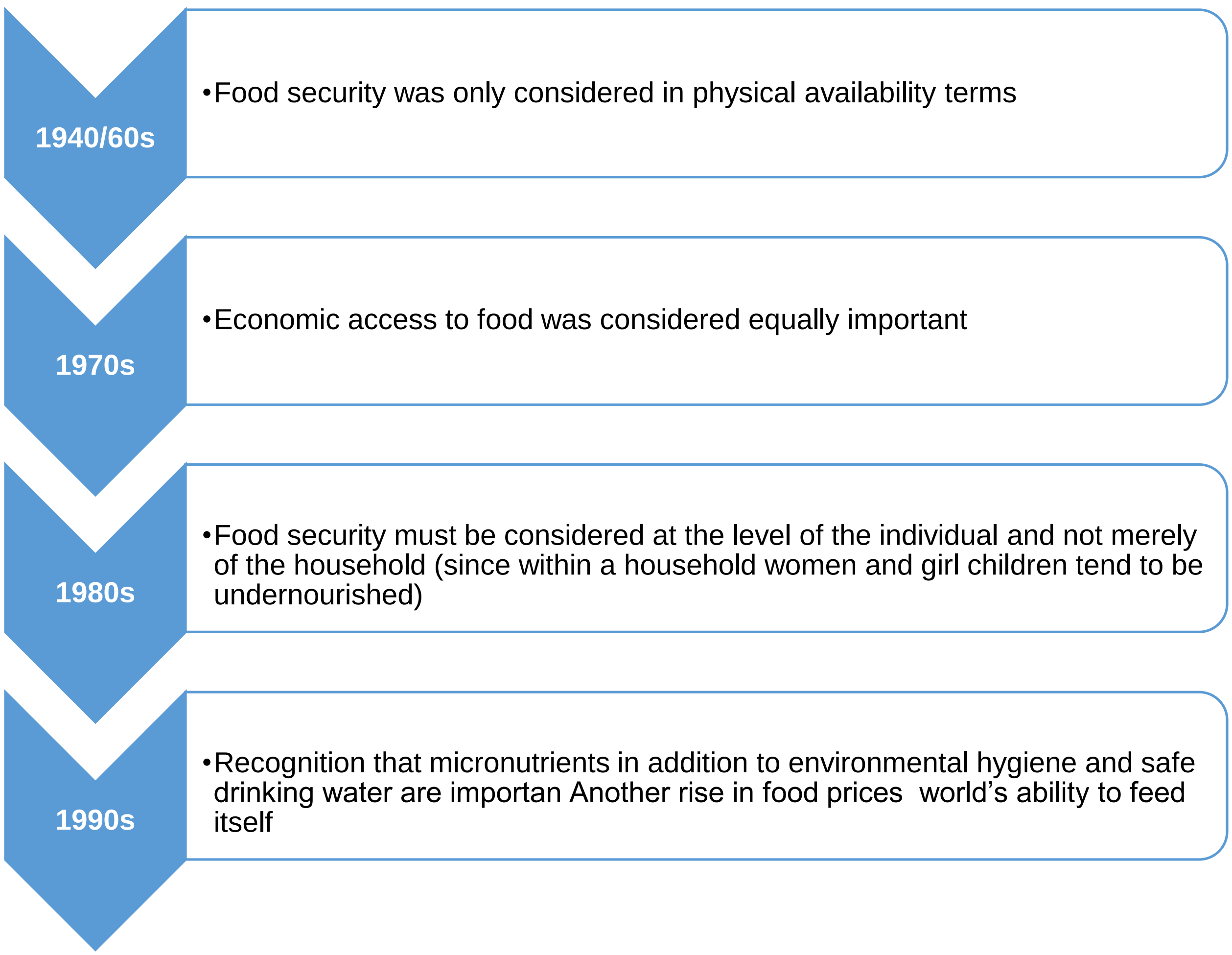


Figure 2.2 The four phases of evolution

Source: Swaminathan (1998).

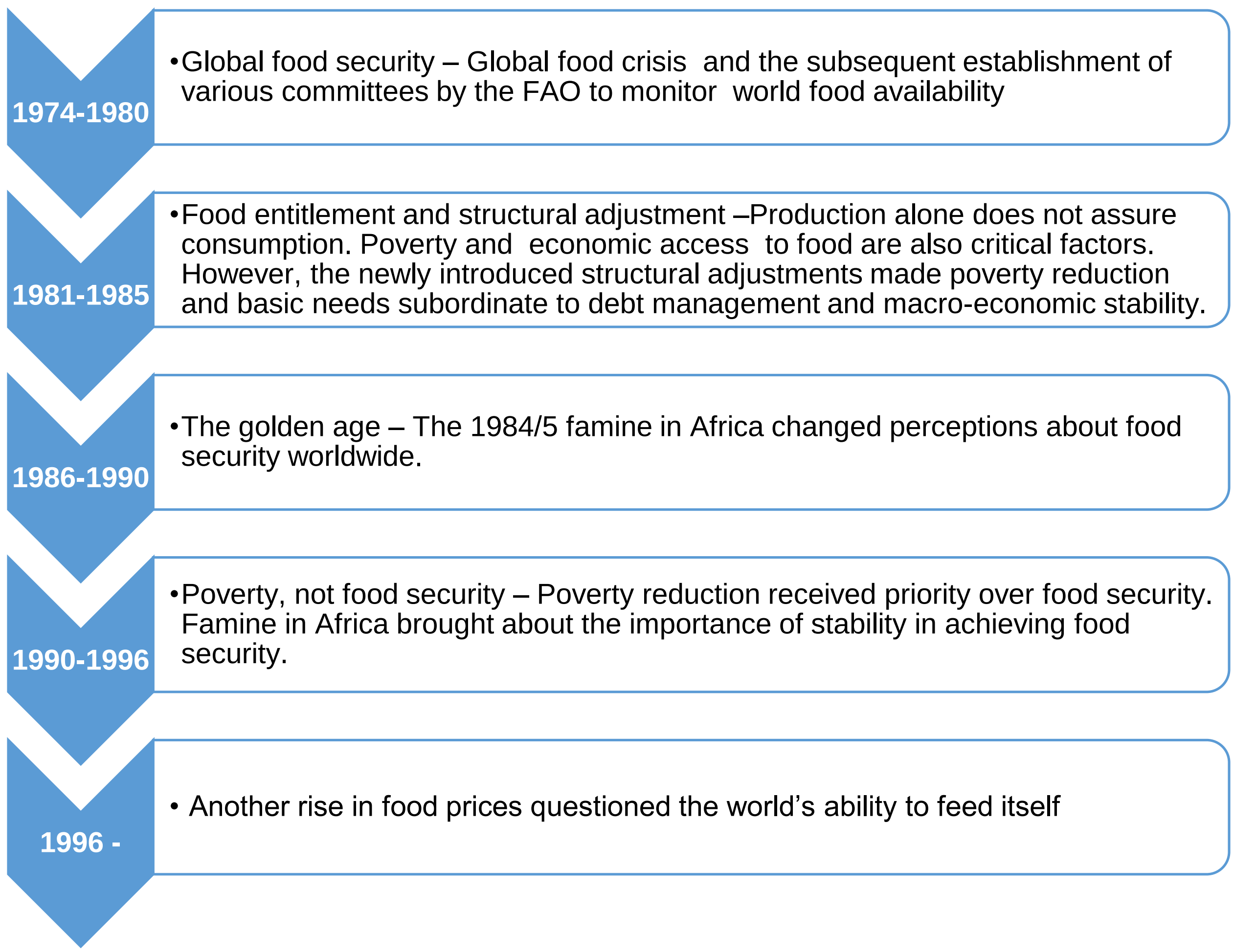


Figure 2.3 The five phases of evolution of the concept of food security

Source: Maxwell (1996).

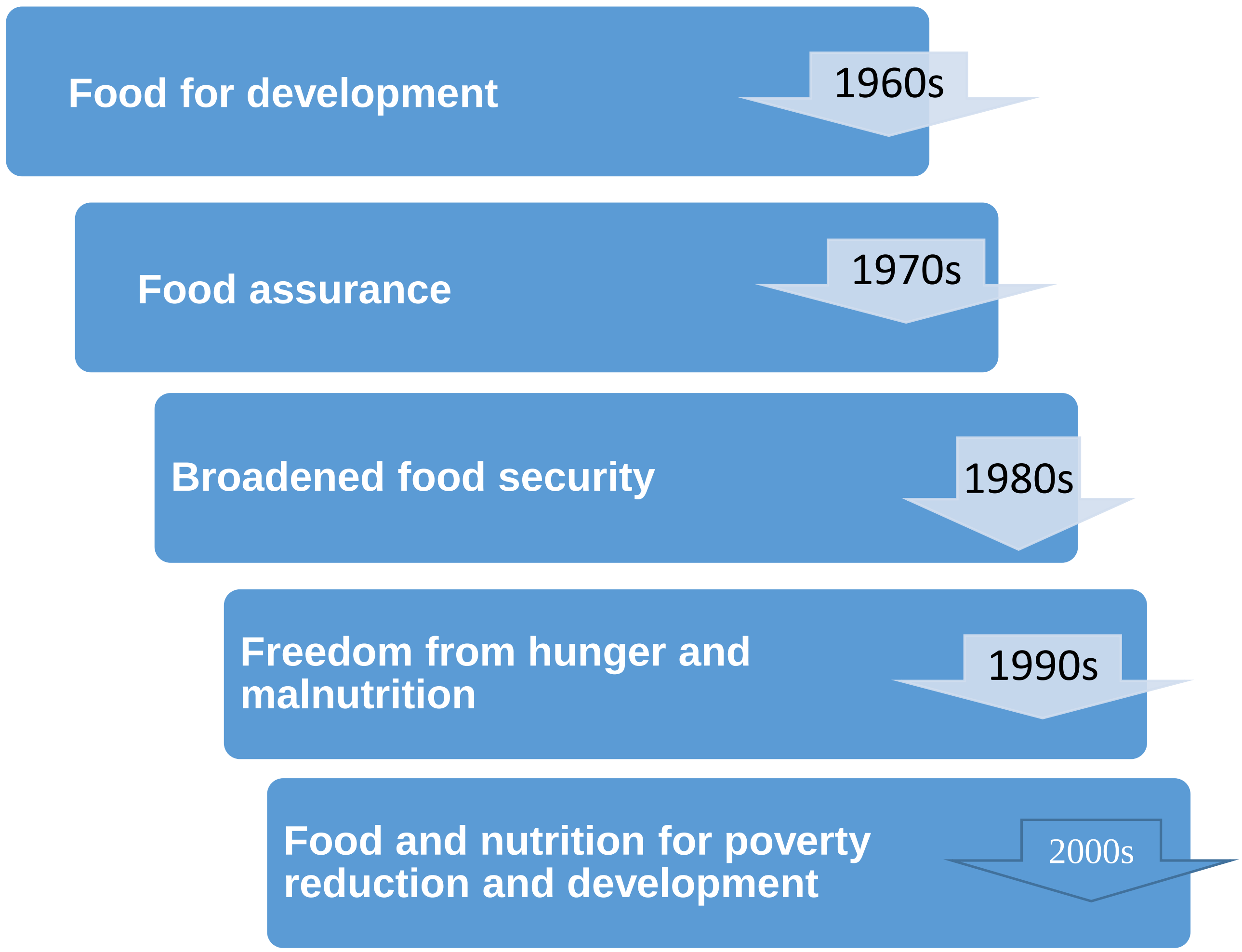


Figure 2.4 The evolution of food and nutrition concerns

Source: Weingärtner (2004)

Table 2.2 Historically critical events and organisations for the evolution of the concept of food security

Year	Historical event
1943	Hot Springs Conference on Food and Agriculture
1945	FAO established
1946	UNICEF (United Nations Children's Fund) established
1948	Universal Declaration of Human Rights
1963	World Food Programme established
1966	International Convention on Economic, Social and Cultural Rights
1967	First Food Aid Conference
1974	World Food Conference. Universal Declaration on the Eradication of Hunger and Malnutrition
	World Food Council established
1974	FAO Committee on World Food Security established
1975	FAO Global Information and Early Warning System (GIEWS) established
1975	International Emergency Food Reserve (IEFR)
1976	Club du Sahel established in OECD
1978	FAO Regional Food Plan for Africa
1980	OAU Lagos Plan of Action
1981	European Community 'Plan of Action to Combat Hunger in the World' and Initiation of Food Strategies in Four Countries
1981	IMF Compensatory Financing Facility extended to cereals
1983	Broadened concepts of food security adopted by FAO
1984	Lome III Convention gives central place to food security

Table 2.2 Historically critical events and organisations for the evolution of the concept of food security (continued)

Year	Historical event
1985	USAID's Famine Early Warning System (FEWS) established World Food Security Compact (FAO)
1987	Mandate of FAO's Food Security Assistance Service broadened to focus more on national policy
1988	World Bank taskforce report 'The Challenge of Hunger in Africa – a call to action and initiation of World Bank food security studies in Africa'
1989	Conversation on the Rights of the Child adopted by the General Assembly of the United Nations.
1989	Initiation of FAO food security planning in four Africa countries
1989	Bellagio Declaration: Ending half of the world's hunger by the year 2000
1989	WFC Cairo Declaration and Programme of Cooperative Action
1990	Food Aid Charter for the Countries of the Sahel
1990	World Summit for Children (UNICEF)

Source: Phillips & Taylor (1991)

2.4.1 Community food security

In the 1980s the concept of food security evolved to levels of 'community food security' and 'household and individual food security'. The latter is covered in the subsequent section.

According to Hall (1998), these conceptual developments were influenced by emergency of the concept of 'food entitlement' and the undertaking made worldwide where food was viewed as a basic human right which should be available at adequate levels. Community food security is closely related to household and individual food security in that they share a lot of common components (e.g. quantity of food, quality of food, stability, universality and dignity in the supply of food). However, community food security stresses the importance of economic, environmental and social aspects of the food system. It also touches on the importance of sustainability of food systems, social justice, self-reliance and community economic development (Hall, 1998).

Defining community food security is difficult to the extent that there is no consensus in the literature on the definition of this concept. The first challenge comes from defining community. Whilst there is broad understanding that a community is a group of people whose members are defined by common characteristics, there is disagreement on the nature of these common characteristics. Etzioni (1997) said such common characteristics are social in nature (e.g. shared set of values and culture), while Sarason (1974) argued that they are psychological. Rubin and Rubin (2001) used a geographical definition of community for purposes of sustainable community development.

Like in food security, the definition of community food security must bear the components that constitute it. For example, Holben (2002) tried to define community food security based on the original concept of food security by broadening the meaning of 'food accessibility of food security' to include 'readily availability of nutritionally adequate safe foods and the assured ability to acquire them in socially acceptable ways'. Noticeably, this level of food security appears appealing to many food security programmes of the South African and Eastern Cape governments. In these programmes, communities are encouraged to group and work together towards achieving a common goal of tackling food insecurity.

Nevertheless, Hamm and Bellows (2003) defined community food security as:

> '*A situation in which all community residents obtain a safe, culturally acceptance, nutritionally adequate diet through a sustainable food system that maximises community self-reliance and social justice'.*

In line with Hamm and Bellows's definition of community food security, Lutz, Swisher & Brennan (2013) identified seven components that best define community food security (see Figure 2.5). These components are described by Lutz *et al.* (2013) as follows:

- Food access: readily availability of nutritionally adequate safe foods and the assured ability to acquire them in socially acceptable ways.
- Food safety: includes both the safety of foods being sold and the knowledge of community members on how to safely prepare foods so as to avoid food borne illness.
- Nutrition: includes a balanced diet of foods that are healthy and wholesome.
- Sustainable agriculture: refers to the provisions of a more profitable income for farmers and producers while promoting responsible environmental management.
- Community food systems: collaborative efforts to build locally based food economies that emphasise social health, environmentally sustainable practices, and economic strength through their food production and processing practices.
- Culturally acceptable foods: refers to both the type of food consumed and the manner in which the food was obtained.
- Social justice: refers to injustice of hunger and food insecurity as well as the adequacy of wages and working conditions for all those who earn their livelihoods from the food system.

With the above components in mind, Hamm and Bellows (2003) asserted that community food security can be achieved through strengthening food security at household and individual levels.

The concept of household and individual food security is discussed in the following subsection of this chapter.

Figure 2.5 The concept of community food security

Source: Lutz *et al.* (2013)

2.4.2 Household and individual food security

Like community food security, household and individual food security was brought about in the 1980s following the introduction of the concept of food entitlement and the global reaffirmation of food as a basic human right. During this period (1980s), households and individuals were seen as important levels of analysis of food (in)security. According to Hall (1998), the analysis of food (in)security at household and individual level is concerned primarily with the experiences of hunger and less severe experiences of compromises in the quantity and quality of diets. This level of food security is linked to environmental considerations and to the role genders relations determine intra-household resource allocations (Smith *et al.,* 1995).

Household and individual food security is as difficult to define as the highest-level concept of food security. Maxwell and Smith (1992) said there are about 30 definitions of household and individual food security. These authors lifted key words from these definitions which best define household and individual food security (see Table 2.3). The common components or meanings in the definitions of household and individual food security and community food security reinforce the view that the former is key to achieving the latter. These common components or meanings include; cultural acceptability, sustainability, social justice / respected rights / entitlement and nutrition / a diet adequate in quality. Nutrition and diet adequacy are points of attraction in this study. Direct methods of nutritional assessment which include dietary evaluation were employed.

Table 2.3 Keywords that define household and individual food security

Key words	
Present security	Efficient
Future security	Resilient
Perceived security	Sustainable
Buffered against risks	Consistent with livelihood strategy
Entitlement	Equitably distributed within the household
Culturally acceptable	A diet adequate in quality
Procured with dignity	Adaptable to uncertainty
Cost effective	Rights respected, protected and fulfilled by the state.

Source: Maxwell and Smith (1992)

In this study, food and nutrition (in)security was measured at household and individual levels targeting families of food producers at Alfred Nzo District Municipality. Measurements were undertaken in line with guidelines from the literature (Bickel, Nord, Price, Hamilton & Cook, 2000; United States Department of Agriculture [USDA], 2000; Rahim, Saeed, Rasool & Saeed, 2011).

Lastly, in measuring household and individual food and nutrition (in)security of the target group at Alfred Nzo District Municipality, this study took records of the types and quantities of foods consumed against the nutrient requirements of this target group. In so doing, this study also covered some critical aspects of nutrition security, which is the integral part of the concept of food security.

2.4.3 Nutrition security

Various processes and circumstances that have led to the evolution of concepts of food security, community food security and household and individual food security have been covered in the previous sections of this chapter. Of the abovementioned forms of food security, household and individual food security is the closet to nutrition security, because an individual's ability to reach his or her full personal and economic potential is largely determined by his or her level of 'nutrition security (IFPR, 2004). Accordingly, in 2006 the World Bank defined nutrition security as follows (CFS, 2012):

> *"Nutrition security exists when food security is combined with a sanitary environment, adequate health services, and proper care and feeding practices to ensure a healthy life for all household members*".

Like other forms of food security, there are compelling reasons and rationale for the emergent term 'nutrition security'. Firstly, in the 1970s the focus of nutrition policies and programmes was not placed only on energy and protein deficiencies, but also acknowledged the role played by minerals and vitamins in improving individual's nutritional status. This new development made nutrition security to focus on food consumption by the household or the individual and on how that food is utilised by the body. To this end, in 1995 UNICEF and subsequently IFPRI proposed the following definition of nutrition security (CFS, 2012):

> "*Nutrition security can be defined as adequate nutritional status in terms of protein, energy, vitamins, and minerals for all household members at all times".*

This new understanding of nutrition security in the discipline of nutrition resulted in the promotion of supplementation and fortification programmes to treat deficiencies, such as vitamin A which causes night blindness, and iodine which leads to goitre (Burchi, Fanzo & Frison, 2011). In the Eastern Cape such supplementation and fortification programmes are promoted by the province's Department of Health to combat severe cases of food insecurity among affected children.

As a result of the above developments, the term 'nutrition security' was officially adopted in the in the mid-1990s after it was introduced by UNICEF (CFS, 2012). Subsequently, CSF (2012) defined it as:

> *"Nutrition security is achieved when secure access to an appropriately nutritious diet is coupled with a sanitary environment, adequate health services and care, to ensure a healthy and active life for all household members".*

In the latter years, attempts were made by various researchers and organisations to broaden the definition of nutrition security in order to make it inclusive of all the relevant elements that promote the individual's nutritional status. For example, the FAO (2012b) asserted that:

> *"Nutrition security exists when all people at all times consume food of sufficient quantity and quality in terms of variety, diversity, nutrient content and safety to meet their dietary needs and food preferences for an active and healthy life, coupled with a sanitary environment, adequate health, education and care.*"

According to CFS (2012), this broadened definition of nutrition security has long been advocated by the nutrition and health communities for a better understanding of key determinants of good nutrition and their inclusion in achieving development objectives.

This has led to new initiatives to mainstream nutrition considerations more effectively. These initiatives include the Scaling-Up Nutrition (SUN) Movement which was established in 2010 by a range of stakeholders concerned with the lack of progress towards the reduction in hunger and under-nutrition and the achievement of food and nutrition security for all.

Notwithstanding the above outlined stages of evolution of food security and the subsequent emerging nutrition security, some organisations prefer to use the term ‘food and nutrition security’, instead of ‘nutrition security’, because the former best reflects the conceptual linkages between food security and nutrition security, while also expressing a single integrated development goal to help guide policy and programmatic action effectively (CFS, 2012). Furthermore, the phrase ‘food and nutrition security’ has been used to combine the concepts of food security and good nutrition, and employ food security as a precondition to adequate nutrition (Capone *et al.* 2014). Household and individual food security is critically important for achieving adequate nutrition especially if households and individuals have the knowledge and supportive health and environmental conditions necessary to obtain adequate nutritional benefits from the food (Capone *et al*. 2014).

Many organisations define the term ‘food and nutrition security’ differently. For example, UNICEF (2008) said:

> “*Food and nutrition security is achieved when adequate food (quantity, quality, safety, socio-cultural acceptability) is available and accessible for and satisfactorily used and utilised by all individuals at all times to live a healthy and active life”.*

Meanwhile, the FAO (2011) defined the term as follows:
“*Food and nutrition security exists when all people at all times have physical, social and economic access to food of sufficient quantity and quality in terms of variety, diversity, nutrient content and safety to meet their dietary needs and food preferences for an active and healthy life, coupled with a sanitary environment, adequate health, education and care*”.

Notwithstanding that nutrition security is understood and interpreted differently in the literature by different authors, there seem to be common understanding that this concept does not only deal with food quantities only, but with food qualities, nutrients and how they relate dietary requirements. That is, nutrition security is part of food security which puts strong emphasis on human nutrition.

Having discussed the origins of the concept of food security and the subsequent evolution of this concept into other forms and levels of food security, the next subsection is dedicated towards outlining the basic components that best describe and constitute food security. Accordingly, the later part of this chapter is devoted to discussing human nutrition and measurement of nutritional status.

2.5 COMPONENTS OF FOOD SECURITY

Food security comprises of four components; namely; food availability, food accessibility, food utilisation and stability (see Figure 2.6). These components are reflected in the widely used definition of food security which emerged from the 2009 Declaration of the World Summit on Food Security.

That is:

> "Food security exists when all people [**stability**], at all times [**food availability**], have physical, social and economic access [**food accessibility**] to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life [**food utilisation**]".

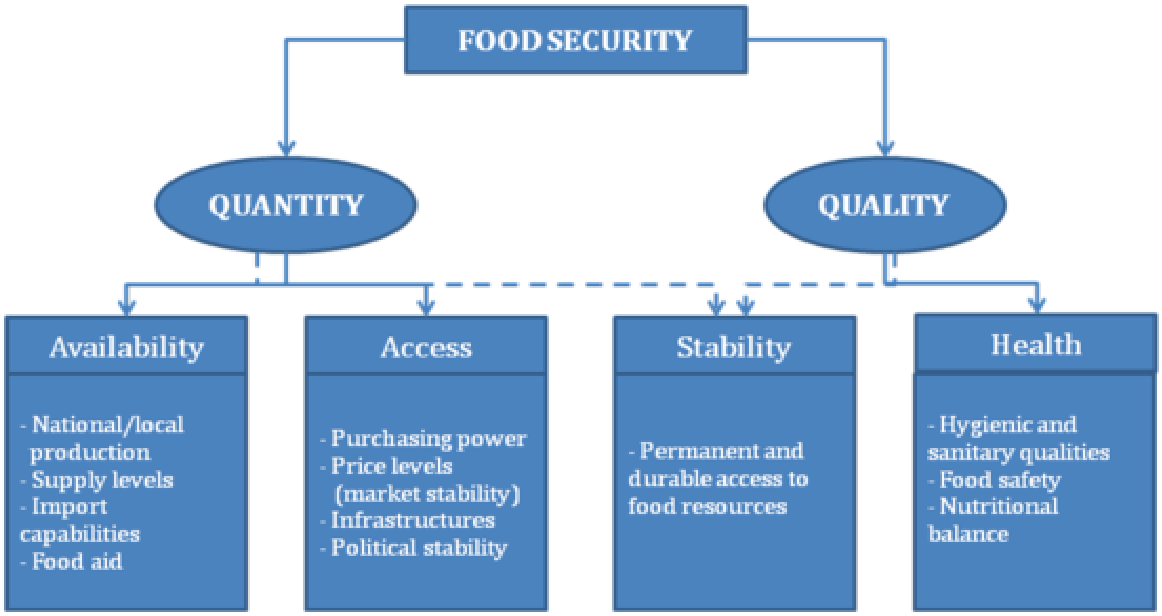


Figure 2.6 The components of food security

Source: FAO (2012a)

2.5.1 Food availability

Food availability addresses the 'supply side' of food security and is determined by the level of food production, stock levels and net trade (FAO, 2008). It means the availability of good quality and nutritious food from local, regional and international sources. It therefore includes issues of food production and processing; trade imports and exports; availability of food stocks and food aid (Ruane & Sonnino, 2011).

Food availability is the essential factor to be considered in ensuring a sustainable food security system (Nguema & Ella, 2014). This sustainable food security system need not be achieved through food production only, but through improving the distribution of food and by integrating the system of transportation, trade, markets, food prices and people's income. Countries like Singapore and Japan achieve sustainable food security system by relying on their well-established systems of food accessibility and distribution, more than on food production.

There can be no food security without its availability (Olaoye, 2014). However, adequate supply of food at the national or international level does not in itself guarantee household level food security (FAO, 2008). For example, in 2004, despite a good harvest, two million of Ethiopians were reported in food crisis. This problem comes from the difficulties to transport food from where it is in abundance to area that experience food crisis (Nguema & Ella, 2014).

Nevertheless, in order to satisfy human requirements for food, global food production needs to increase by 70 to 100 percent by 2050 (Nandan, Sharma & Kumar, 2013). This projected increase in food production is threatened by numerous factors which include:

- Increasing population (Nguema & Ella, 2014; Aborisade & Bach, 2014; Louw *et al*., 2014);
- Poverty and HIV / AIDS (Aborisade & Bach, 2014; Egbe, 2015; Gillespie, van den Bold & Hodge, 2015);
- Gender inequality (Aborisade & Bach, 2014);
- Urbanisation (Nguema & Ella, 2014; Darrouzet-Nardi & Masters, 2015); and
- Climate change (Sasson, 2012; Louw *et al*. 2014).

In addition to the above factors, the availability of food is threatened by emerging biofuel industry. There is likely to be competition over productive resources between crops that are meant for human consumption and those that are grown for biofuel production. This undesirable competition is likely to result to a rise in food prices, thereby creating growing concerns about food security since access to food is determined primarily by people's income and food prices (Pingali, Terri & Wiebe, 2008).

2.5.2 Food accessibility

Holben (2002) defines food accessibility as the ready availability of nutritionally adequate safe foods and the assured ability to acquire them in socially acceptable manner. It is ensured when households and all individuals within them have adequate resources to obtain appropriate foods for a nutritious diet. Access to food depends on income available to the household, on the distribution of income within the household, and on the price of food (Riely, Mock, Cogill, Bailey & Kenefick, 1999). Food accessibility also includes the ability of a household to acquire enough food to support life, health, and activity. Characteristics such as the distance that one must travel to a supermarket or the availability of transportation to food outlets can be factors in adequate food access (Lutz *et al.,* 2013). The accessibility dimension embraces Amartha Sen's core thesis that food availability does not guarantee that everyone is free from hunger (Sen, 1981). Even today, it remains true that food insecurity was little affected by the increase in global food production (Pangaribowo, Gerber & Terero, 2013).

Food accessibility has four components which are, namely; physical access, economic access, social access, and technological access.

- Physical access – this refers to the availability of physical infrastructure such as markets, road transport facilities and food distribution. It has been covered in many studies (Godfray, Charles, Beddington, Crute, Haddad, Muir & Toulmin, 2010; Nguema & Ella, 2014).

- Economic access – refers to the affordability of food. It centres on whether people have the money to purchase or grow their own food. Economic access has also been reported by Nguema and Ella (2014).

- Social or cultural access – refers to food that is culturally acceptable or that fits into the diet of the community. Various studies reported social or cultural access (Godfray *et al*. 2010).

- Technological access – refers to the technological facilities that a household has to prepare or preserve food. Innovative measures on this component of food accessibility has been reported in the literature (Olaoye & Onilude, 2010; Olaoye, Idowu & Lawrence, 2014).

Fairly recently, Nguema and Ella (2014) reported that physical access and economic access are the key components of food accessibility in Africa. With regards to physical access, these authors said that physical infrastructure, natural and geographical factors are the main determinants of access to food. For example, 35 percent of the African population lives in landlocked territory, thus making the costs of trade in landlocked countries very high. According to these authors (Nguema & Ella, 2014), the transport cost of the landlocked Malawi is between $0.065 and $0.075 per km, thus making it two or three times higher than the situation in South Africa.

With regards to the other key component of food accessibility in Africa – economic access – poverty, per capita income, income inequalities, domestic food prices index are the main indicators of access to food by the households (Nguema & Ella, 2014). However, this view is disputed by Webb, Coates, Frongillo, Rogers, Swindale and Bilinsky (2006) who assert that there are no exact measures of food access.

2.5.3 Food utilisation

Food utilisation is the proper biological use of food, requiring a diet providing sufficient energy and essential nutrients, potable water, and adequate sanitation (Ruane & Sonnino, 2011). Effective food utilisation depends in large measure on knowledge within the household of food storage and processing techniques, basic principles of nutrition and proper child care, and illness management (Riely *et al*., 1999). It refers to the way the body makes the most of various nutrients in the food. Sufficient energy and nutrient intake by individuals is the result of good care and feeding practices, food preparation, diversity of the diet and intra-household distribution of food. Combined with good biological utilisation of food consumed, this determines the nutritional status of individuals (FAO, 2008).

According to WFP (2009), food utilisation by households depends on:

- The facilities they have for food storage and processing.
- Their knowledge and practices in relation to food preparation, the feeding of young children and other dependent individuals including sick and elderly people which may be impaired by low education of mothers and care givers, cultural beliefs and taboos.

- How food is shared within the household.
- The state of health of each individual which may be impaired by disease, poor hygiene, water, sanitation, and lack of access to health facilities and health care.

2.5.4 Stability

The fourth dimension of food security covers the fact that to be food secure, a population, household or individual should have access to adequate food at all times and should not risk losing access to food as a consequence of sudden shocks (e.g. an economic or climatic crisis or cyclical events). This dimension is increasing in importance with the economic and climate change related challenges facing the world, especially in developing countries (Ruane & Sonnino, 2011).

Vulnerability to natural disasters and other shocks can influence food security temporarily or for an extended period. The inability to meet food needs for a temporary period is known as transient food insecurity. A sudden natural or technological disaster, a slow onset disaster, price or market shocks, health epidemics, civil conflicts etc. can all lead to transient food insecurity (WFP, 2009). Transient food insecurity can affect one or all dimensions of food security (i.e. food availability, food access and/or food utilisation).

In this study, various instruments of measuring food and nutrition security were used to determine the role played by each of the four dimensions discussed above in the nutrition status of families of food producers at Alfred Nzo District Municipality. Such an exercise was in line with the purpose and objectives of this study.

2.6 HUMAN NUTRITION AND MEASUREMENT OF NUTRITIONAL STATUS

This section covers selected aspects of human nutrition which are relevant to the objectives and research questions of this study. It also outlines a multiple of methods for measuring nutritional status, which were employed to achieve and respond to research objectives and questions, respectively.

2.6.1 Human nutrition

Foods contain different nutrients that include, carbohydrates, protein, fats, fibre, minerals, vitamins and water. Nutrition refers to how these nutrients are utilised by human beings for growth, reproduction and maintenance of health (Department of Health, 2007). A person is considered nutrition secure when he or she has a nutritionally adequate diet and the food consumed is biologically utilised such that adequate performance is maintained in growth, resisting or recovering from disease, pregnancy, lactation and physical work (Frankenberger, Oshaug & Smith, 1997). Immediate causes of a particular nutritional status at a level of an individual human being are dietary intake and health status (Pangaribowo *et al*., 2013). The current study focuses on the effect of the former to nutritional status.

Accordingly, this section makes a brief discussion on guidelines for children's nutrient intakes and requirements, and on food components that provide nutrients. Functions of various nutrients are discussed as well.

2.6.1.1 Nutrient requirements of children

Nutrient requirements of human beings are not static, but vary based on factors such as age, gender, height, weight, pregnancy or lactation, and how much activity or exercise human beings participate in [Institute of Medicine (IoM), 2000]. In view of this notion, establishing nutrient requirements means that public health and clinical significance of intake levels and associated disease patterns for each nutrient needs to be thoroughly reviewed by the World Health Organisation (WHO, 2016). However, in South Africa, the catch is that there is no national data on the dietary intake of adult South Africans. The situation is better for nutrition of children, because the only and last national dietary study that was done in children was in 1999 (Mchiza *et al*., 2015). This means, South Africa, like many other countries must depend on WHO and FAO to establish and disseminate this information, which they adopt as part of their national dietary allowances. Others use it as a base for their standards. Every ten to fifteen years, enough research is completed, and new evidence accumulated to warrant WHO and FAO undertaking a revision of at least the major nutrient requirements and recommended intakes.

In order to establish nutritional status of children aged 5-14 years, this study made use of WHO and FAO guidelines for their dietary reference intakes. Accordingly, all 327 children who participated in this study were grouped into three age groups in line with their dietary reference intakes, namely; 4-8 years, 9-13 years and 14-18 years (IoM, 2003). The dietary reference intakes for these age groups are contained in Table 2.4. The presentation of the 327 children's nutrient intakes against their dietary reference intakes was arranged according to the above age groups and outlined in Chapter 6 of this thesis.

2.6.1.2 Dietary reference intakes

Dietary Reference Intakes (DRI) are reference values that are quantitative estimates of nutrient intakes to be used for planning and assessing diets for healthy people. DRI is used to determine the Daily Value of foods, which is printed on nutrition facts labels (as %DV). According to the Nutrition Information Centre of the University of Stellenbosch, NICUS (2003), DRI has a framework that incorporates the following into its objectives:

- The formulation of recommendations to meet a variety of uses;
- The contribution by nutrients in the risk reduction of chronic disease;
- The inclusion and review of other food components;
- The use and the rationale for functional end points; and
- The assessment of estimates of upper safe levels of nutrient intake.

The DRI are categorised into four nutrient-based reference values which reflect on the average daily nutrient intake. These values are namely; the Recommended Dietary Allowance (RDA), Adequate Intake (AI), Tolerable Upper Intake Level (UL), and Estimated Average Requirement (EAR). The description and use of these values is covered in the literature (IoM, 1998; NICUS, 2003; Murphy & Barr, 2006; WHO, 2016).

(a) RDA

This value is an average daily dietary intake level that is sufficient to meet the nutrient requirement of nearly all (97 to 98 percent) healthy individuals in a group. The process for setting the RDA depends on being able to set an EAR.

(b) EAR

The EAR is the daily intake value of a nutrient that is estimated to meet the nutrient requirement of half the healthy individuals in a life stage and gender group. Before setting the EAR, a specific criterion of adequacy is selected, based on a careful review of the literature.

(c) AI

This value is based on observed or experimentally determined approximations of nutrient intake by a group (or groups) of healthy people, and is used when an RDA cannot be determined.

(d) UL

The UL value represents the highest level of daily nutrient intake that is likely to pose no risk of adverse health effects to almost all individuals in the general population. As intake increases above the UL, the risk of adverse effects increases.

In the current study, the dietary reference intakes that were used in presenting nutrients intakes were RDA/AI. However, for energy, the estimated energy requirement (EER) was used. This is dietary energy intake that is predicted to maintain energy balance in healthy, normal weight individuals of a defined age, gender, weight, height, and level of physical activity consistent with good health (WHO, 2000).

Table 2.4 RDA/AI of macro and micro nutrients for children aged 5-14 years

Nutrient	4-8 years		9-13 years		14-18 years	
	Male	Female	Male	Female	Male	Female
Carbohydrates, g	130.00	130.00	130.00	130.00	130.00	130.00
Protein, g	20..00	20.00	40.00	35.00	65.00	45.00
Total fibre, g	18.00	18.00	24.00	20.00	38.00	26.00
Calcium, mg	700.00	700.00	1300.00	1300.00	1300.00	1300.00
Iron, mg	10.00	10.00	8.00	8.00	11.00	15.00
Magnesium, mg	130.00	130.00	240.00	240.00	410.00	360.00
Phosphorus, mg	500.00	500.00	1250.00	1250.00	1250.00	1250.00
Zinc, mg	4.00	4.00	8.00	8.00	11.00	9.00
Chromium, mg	15.00	15.00	25.00	21.00	35.00	24.00
Selenium, µg	30.00	30.00	50.00	50.00	70.00	60.00
Iodine, µg	90.00	90.00	120.00	120.00	150.00	150.00
Vitamin A, µg	400.00	400.00	600.00	600.00	900.00	700.00
Vitamin B6, mg	0.60	0.60	1.00	1.00	1.30	1.20
Vitamin B12, mg	1.20	1.20	1.80	1.80	2.40	2.40
Vitamin C, mg	25.00	25.00	45.00	45.00	75.00	65.00
Vitamin D, µg	5.00	5.00	5.00	5.00	5.00	5.00
Vitamin E, mg	7.00	7.00	11.00	11.00	15.00	15.00
Vitamin K, µg	55.00	55.00	60.00	60.00	75.55	75.00
Thiamin, mg	0.60	0.60	0.90	0.90	1.20	1.00
Riboflavin, mg	0.60	0.60	0.90	0.90	1.30	1.00
Niacin, mg	8.00	8.00	12.00	12.00	16.00	14.00
Folate, µg	200.00	200.00	300.00	300.00	400.00	400.00
Pantothenic acid, µg	3.00	3.00	4.00	4.00	5.00	5.00
Biotin, µg	12.00	12.00	20.00	20.00	25.00	25.00

Source: IoM (2003)

2.6.1.3 Food components

The following food components are discussed in the following sub-section, namely; carbohydrates, protein, fats, fibre, minerals, vitamins and water.

2.6.1.3.1 Carbohydrates

Carbohydrates are fundamental to life and their primary function is to provide energy for the body (Green, 2015). Most people should get between 35 and 70 percent of their energy intake from carbohydrates (USDA, 2005). The RDA and AI for carbohydrates is set at 130g per day for all children aged 5-14 years, depending on how much physical activity or exercise they do, among other factors (IoM, 2000). Carbohydrates are divided into simple and complex carbohydrates. Amylase is the enzyme that digests carbohydrates into glucose which get absorbed in the body for the supply of energy. Sources of simple carbohydrates include processed grains, fruit and sugar, while complex carbohydrates are found in foodstuffs such as whole grains, root or tuber vegetables. These sources of complex carbohydrates do not only supply energy, but dietary fibre which is important for proper food digestion, among other functions.

Excessive deficiency of carbohydrates may lead to malnutrition (Pillai & Ortiz-Rodriguez, 2015), while excessive consumption of simple carbohydrates may contribute towards obesity, the onset of type 2 diabetes (Vorvick, 2012) and dental caries (Stephen, Alles, de Graaf, Hadjilucas, Isaacs, Maffeis, Zeinstra, Matthys & Gill, 2012).

In the current study, the children's feeding patterns on the carbohydrates-rich food items from the `cereals, roots and tubers' food group was a subject of investigation.

2.6.1.3.2 Protein

Proteins are large molecules that are made up of smaller chemicals called amino acids. They should make up 10-23percent of the bodies' intake for energy (USDA, 2005). The RDA and AI for protein vary from 20g to 65g per day for children aged 5-14 years, depending on their exact age and gender (see Table 2.4). Unlike carbohydrates, proteins work as building blocks needed for growth, repair of worn out body tissues, and manufacturing of enzymes and hormones that are critically important for various metabolic body processes (IoM, 2003).

Proteins are categorised into complete proteins and incomplete proteins. The former, whose origin is animal products (e.g. beef, chicken, fish) contains all the essential amino acids that are needed for proper functioning of the body. The latter contains limited numbers of essential amino acids. Plant products which supply these types of protein include beans, peas and soya.

Prolonged deficiency of dietary protein may lead to kwashiorkor (Öeinfeld, 2013; Schuna, 2015), shocks and eventually death (Annigan, 2015). On the other hand, excessive dietary protein consumption may trigger weight gain, reduced liver and brain, and increased blood cholesterol levels (Appleby, 2014).

The scope of the current research also covered protein-rich ‘flesh foods’.

2.6.1.3.3 Fats

Notwithstanding widespread negative reports and perceptions about fats in human nutrition, they are a good source of energy (Wellman & Kamp, 2008), and assist the body with the absorption of fat-soluble vitamins (USDA, 2005). Fats should make up 20-45percent of the bodies’ energy intake.

Basically, there are two categories of fats, namely; unsaturated and saturated fats. The former, which is healthier than the latter is further divided into mono-unsaturated and polyunsaturated fats. Mono-saturated fats are highly concentrated in nuts, pumpkin and sesame seeds, olive, peanut, to mention a few. The latter (polyunsaturated fat) is abundant in fish, sunflower, soybean and flaxseed oils, among many.

Saturated fats which are commonly found in abundance in beef and dairy products are linked to bad human health. For example, their intake has been associated with increased risk of cardiovascular cholesterol (Sri-Tarino, Sun, Hu & Krauss, 2010). Excessive consumption of saturated fat is also associated with impaired insulin action and type 2 diabetes (Rivellese, De Natale & Lilli, 2002).

The consumption patterns of food items from the 'fats and oils' food group formed part of this investigation. However, the actual fat intakes fell outside the scope of this investigation.

2.6.1.3.4 Dietary fibre

Dietary fibre plays an important role in smoothening the process of food digestion in the in the digestive tract. It is divided into the soluble and insoluble fibre. Sources of dietary fibre include vegetables, fruits and grain. Nowadays, there tend to be low fibre content in human diets largely due to excessive refining of processed foods and limited consumption of vegetables and fruits, particularly among poor communities. The RDA / AI for children aged 4-8 is 18g/person/day, while that of children aged 9-18 years ranges between 20g/person/day and 38g/person/day, depending on age and gender (IoM, 2003). Adequate dietary fibre intake is associated with reducing risks of constipation and heart diseases, and lowering of cholesterol levels (Mann, 2006).

2.6.1.3.5 Minerals

Minerals are inorganic substances that are present in all body tissues and fluids and their presence is necessary for the maintenance of certain physicochemical processes which are essential to life (Soetan, Olaiya & Oyewole, 2010). Minerals are divided into macro and micro minerals. Macro minerals include calcium, chlorine, magnesium, phosphorus, potassium, sodium, and sulphur (Eruvbetine, 2003). Micro minerals are often referred to as trace minerals, meaning they are present at low levels in the body or required in smaller amounts in human diets (Murray, Granner, Mayes & Rodwell, 2000). Mineral deficiencies can result in serious health conditions such as brittle bones and poor blood oxygenation. Like vitamins, overdosing of minerals can result in life threatening conditions - for example, a potassium overdose can cause improper kidney function. Minerals are found in a variety of foods including dairy and meat products.

Tables 2.5 and 2.6 respectively, give a list of minerals and vitamins that are critically important in human nutrition, and a brief outline of their functions and foodstuffs that produce them. The information presented in these tables was used to interpret and discuss the children's nutrient intakes in Chapters 6-7 of this thesis.

2.6.1.3.6 Vitamins

Many vitamins are essential for health and thus considered primary components of nutrition. Essential vitamins include vitamins A, B complex, C, D, E, K and folate. A vitamin deficiency can cause osteoporosis, scurvy, a weakened immune system, premature aging and even certain cancers. Consuming too much of a vitamin can also result in serious toxicity, such as vitamin B-6 or vitamin A. Many fruits and vegetables have high vitamin content, as well as fortified dairy and bread products. As result, the extent of intake of various vitamins from a wide range of fruits and vegetables that can possibly be consumed by children was a subject of investigation in this study.

Table 2.5 Functions and sources of minerals for human beings

Mineral	Key functions	Source(s)
Calcium	➢ Maintaining strength of bones and teeth. ➢ Muscle contraction. ➢ Nerve function. ➢ Normal blood clotting. ➢ May lower blood pressure.	Low fat dairy products, calcium fortified juice, dark leafy greens, and broccoli.
Phosphorus	➢ Important role in energy metabolism, affecting carbohydrate, fat, and protein.	Red meat, poultry, fish, and dairy products and cereal grains
Magnesium	➢ Energy utilisation. ➢ Muscle ➢ Contraction. ➢ Nerve function. ➢ May lower blood pressure.	Whole wheat bread, low fat dairy products, lean meats, beans.
Iron	➢ Transport of oxygen and carbon dioxide. ➢ Immune function.	Organ meats, shellfish, lean meats, poultry, fish, beans, egg yolks, whole grain and enriched breads and cereals
Iodine	➢ Needed to make thyroid hormones, which are necessary for maintaining normal metabolism in all cells of the body.	Iodised salt and seafood
Zinc	➢ Immune function ➢ Protein synthesis ➢ Maintaining taste acuity	Lean meats, low fat dairy products, beans, peanut butter, grain products
Selenium	➢ Mineral antioxidant in human nutrition. ➢ Role in reducing muscular oxidative stress	Meat, fish, seafood, whole grain foods and nuts
Chromium	➢ Helping cells use glucose.	Whole grain breads and cereals, and meats

Table 2.6 Functions and sources of vitamins for human beings

Vitamin	Key functions	Source(s)
Thiamine	➢ Help the body convert food (carbohydrates) into fuel (glucose). ➢ Help the body metabolise fats and protein. ➢ Necessary for healthy skin, hair, eyes, and liver ➢ Help the nervous system function properly ➢ Are necessary for optimal brain function.	Asparagus, lettuce, mushrooms, spinach, sunflower seeds, tuna, green peas, tomatoes, eggplant and brussels sprouts.
Riboflavin	➢ Maintain the mucous membranes that are located throughout the digestive tract. ➢ Necessary for proper formation of red blood cells. ➢ Helps the body produce antibodies. ➢ Benefits skin, hair, finger, and toenails and the connective tissues.	Mushrooms, and calf liver, spinach, lettuce, asparagus, chard, mustard greens, broccoli, turnip greens, chicken eggs, yogurt and cow’s milk.
Niacin	➢ Cell respiration. ➢ Helps in the release of energy and metabolism of carbohydrate-s, fats, and proteins. ➢ Proper circulation and healthy skin. ➢ Functioning of the nervous system. ➢ Normal secretion of bile and stomach fluids. ➢ It is used in the synthesis of sex hormones, treating schizophrenia and other mental illnesses.	Meat, poultry, fish, whole grain and enriched cereal grains.
Vitamin B6	➢ Nerve function ➢ May help prevent heart disease.	Lean meats, nuts, beans, bananas

Table 2.6 Functions and sources of vitamins for human beings (continued)

Vitamin	Key functions	Source(s)
Folate	➢ Red blood cell formation. ➢ Cell growth and division. ➢ May help prevent heart disease.	Fortified cereals, green leafy vegetables, beans, beets, oranges, orange juice
Vitamin B12	➢ Cell growth division. ➢ ➢ Red blood cell formation. ➢ Nerve function. ➢ May help prevent heart disease.	Lean meats, low fat milk, eggs
Pantothenic Acid	➢ Metabolism of carbohydrates, proteins and fats. ➢ Supply energy from foods. ➢ Synthesis of essential lipids, sterols, hormones, neurotransmitters, and porphyrin. ➢ Metabolism of drugs and alcohol detoxification.	Mushrooms, cauliflower, broccoli, calf's liver, turnip greens, sunflower seeds, tomato, strawberries, yogurt, eggs, winter squash, and sweet corn.
Biotin	➢ Used in energy and amino acid metabolism, fat, synthesis and fat breakdown. ➢ Helps the body use blood sugar.	Swiss chard, tomatoes, lettuce, and carrots, almonds, chicken eggs, onions, cabbage, cucumber, cauliflower, goat's milk, raspberries, strawberries, halibut, oats, and walnuts.
Vitamin C	➢ Immune function ➢ Wound healing ➢ Antioxidant	Red peppers, oranges, orange juice, broccoli, sweet potatoes, tomatoes and tomato sauce

Table 2.6 Functions and sources of vitamins for human beings (continued)

Vitamin	Key functions	Source(s)
Vitamin A	➢ Helping eyes adjust to light changes. ➢ Plays an important role in bone growth, tooth development, reproduction, cell division and gene expression ➢ The skin, eyes and mucous membranes of the mouth, nose, throat and lungs depend on vitamin A to remain moist. ➢ An important antioxidant that helps the body fight the harmful effects of free radicals.	Carrots, spinach, bell peppers, sweet potatoes, pumpkins, winter squash, apricots, green beans and beef liver.
Vitamin D	➢ Needed by the body for the absorption and use of calcium, and vitamin D also regulates the body's use of phosphorous ➢ It increases the amount of calcium absorbed from the small intestine and helps form and maintain bones.	Milk and other dairy products fortified with vitamin D, salmon, cod liver oil, mackerel, fortified breakfast cereals, eggs, milk, and tuna.
Vitamin E	➢ An antioxidant, protecting vitamins A and C, red blood cells and essential fatty acids from free radicals. ➢ Maintaining a healthy reproductive system and nerves. ➢ Promotes healthy skin.	Vegetables oils and margarines, fruits and vegetables, grains, nuts, seeds and fortified cereals.
Vitamin K	➢ Used by the body for blood clotting and to make bone and kidney tissues. ➢ Essential for healthy bones, especially in the elderly.	Green vegetables such as turnip greens, spinach, cauliflower, cabbage and broccoli, and certain vegetables oils including soybean oil, canola oil and olive oil.

2.6.1.3.7 Water

Water is necessary to maintain proper bodily function. Depending on their gender, it is recommended that children aged 4-8 years drink an average of 1.7*l* per day, while those aged 9-13 years and 14-18 years drink 2.1*l*-2.4*l* and 2.3*l*-3.3*l* per day, respectively (IoM, 2003).

The scope of this study did not cover water intake. Instead, it was confined to an investigation into sources of water for domestic use, basic hygiene and sanitary measures used by agri-business families, all of which are components of food utilisation and nutritional status.

Having concluded discussions on selected aspects of human nutrition, the following and last sub-section of this chapter reviews methods that were employed in determining children's nutritional status.

2.6.2 Measurement of nutritional status

The current study seeks to measure nutritional status of children from agri-business families at Alfred Nzo District Municipality using scientifically proven methods of nutritional assessment. Basically, these methods are divided into two categories, namely; direct and indirect methods. The former encompasses an individual's measure of nutritional status using a set of objective criteria, while the latter deals with community health indices that are reflective of various nutritional factors and influences.

2.6.2.1 Direct methods of nutritional assessment

There are four methods of direct nutritional assessment, namely; dietary evaluation methods, anthropometric methods, clinical methods, and biochemical and laboratory methods. This study employed dietary evaluation and anthropometric methods. The choice of these methods was largely motivated by their capacity and suitability to address this study's objectives and research questions. Furthermore, the expertise of the research team was compatible with dietary evaluation and anthropometric methods than with biochemical and laboratory methods and clinical methods. Costs, risks and other logistical factors were also considered when choosing these methods for this study.

2.6.2.1.1 Dietary evaluation methods

In the literature, dietary evaluation methods are classified as a 24h dietary recall, Food Frequency Questionnaire (FFQ), dietary records, dietary history and observed food consumption. The first two methods – a 24h dietary recall and FFQ – possess properties that can reasonably address this study's objectives and research questions. Various logistical considerations and costs were also put to the fore when choosing these two methods at the expense of others.

2.6.2.1.1.1 A 24h dietary recall method

a) <u>Description</u>

A 24h dietary recall method is a retrospective quantitative research method that is used in nutritional assessment. It entails asking individuals to recall foods and drinks they had consumed over the previous 24h period prior to the interview. During the interview, the interviewer should assist the respondent to recall the type and quantities of foods and drinks that he/she has consumed over the past 24h period. Responses from the respondents are recorded by the interviewer. At the end of the interview, the interviewer checks the recorded responses from the respondents for possible error and/or omissions (Wrieden, Peace, Armstrong & Barton, 2003).

In addition to estimating a respondent's energy and nutrient intakes, in this study the 24h recall method was also used to determine food variety and dietary diversity. The former is the number of food items consumed over a period of time, while the latter refers to the number of food groups consumed over a period of time (Ruel & Menon, 2002). Dietary diversity scores for individual respondents were calculated in order to reflect on the dietary quality of foods and drinks consumed by respondents (Kennedy, Ballard & Dop, 2011). Indeed, the use of the 24h dietary recall method in establishing food variety and dietary diversity has been extensively documented in the literature (Ruel, 2006; Acham, Oldewage-Theron & Egal, 2012).

The main limitation with this approach is that a single day is seldom representative of a respondent's usual intake due to day- to- day variation of a respondent's consumption for food and drinks. In order to mitigate this variation with a view to achieving more accurate results, it is recommended that this method be administered more than once for each respondent (Rankin, 2008). To this end, some authors recommend that this method be administered between three and seven times to each respondent (Posner, Martin-Munley, Smigelski, Cupples, Cobb, Schaefer, Miller & D'Agostino, 1992). However, Bernard (2006) argued that administering the method twice for each respondent is reasonable.

In view of the above, in the current study a 24h dietary recall was administered trice for each respondent - twice on weekdays and once on a day of a weekend. Further improvement of the accuracy of this method's results was achieved by complementing it with FFQ, and use of well-trained interviewers. Complementary strengths and weaknesses of a 24h dietary recall methods are well covered in the literature (Dwyer *et al*., 1987, Nelson & Bingham, 1992; Lee & Nieman, 1996; Wrieden *et al*., 2003).

b) <u>Strengths</u>

- Low respondent burden;
- It is easy and quick to the extent that it can be administered by telephone;
- It is relatively inexpensive;
- It is suitable for large scale surveys;
- It is reliable and its results are fairly repeatable; and
- It can be used to give a good estimate of nutrient intake of food groups.

c) <u>Weaknesses</u>

- It is memory dependent;
- A single observation provides poor measure of individual's usual food intake;
- It is bias in recording foods that may be 'good or bad'; and
- There is a possibility of over-reporting low intakes and under-reporting high intakes of foods.

2.6.2.1.1.2 Food frequency questionnaire

a) <u>Description</u>

A FFQ is a printed list of food from which individuals are asked to indicate the typical frequency of consumption, and to state in household measurements, the average amounts consumed per day (Nelson & Bingham, 1992). This retrospective method asks respondents to report their usual frequency of consumption of each food from a list of foods over a specific period of time. Over and above the collection of information on frequency of consumption of food, this method also takes stock of the quantities of foods consumed in order to make estimation of energy and nutrient intakes.

The choice of FFQ for this study was motivated by some of the attractive elements of this method which include its ability to estimate a respondent's habitual food intake over period of time (Thedford, Archer, Shayka, Gamhofer, Peters, Gowan, Johnson & Van Hom, 1999). These attributes are compatible with the objectives of this study.

b) <u>Strengths</u>

- Low respondent burden;
- It is suitable for large scale surveys;
- It can be self-administered;
- It is quick; and
- It can be posted.

c) Weaknesses

- Estimation of portion sizes;
- Possible over-reporting of ‘healthy’ foods; and
- Requires to be validated in relation to reference method.

A combination of a 24h dietary recall and FFQ is widely used across the world in many countries such as the US (Taren, de Tobar, Ritenbaugh, Graver, Whitacre & Aiken, 2000), UK (Mouratidou, Ford & Fraser, 2006), Japan (Takachi, Ishihara, Iwasaki, Hosoi, Ishii, Sasazuki, Shimazu, Inoue & Tsugane, 2011), Norway (Hjartaker, Anderson & Lund, 2007) and Australia (Lassale, Guilbert, Keogh, Syrette, Lange & Cox, 2009). In line with the objectives of the current study, they have also been used in by renown programmes such as NHANES (National Health and Nutrition Examination Survey) in establishing nutritional status of various groups of people (Arimond & Ruel, 2006; Ndiku, Jaceldo-Siegl, Singh & Sabate, 2011). These hybrid instruments increase the accuracy and validity of dietary assessment (Andersen, Bere, Kolbjornsen & Klepp, 2004; Kristjansdottir, Anderson, Haraldsdottir, de Almeida & Thorsdottir, 2006; Amend, Melkus, Chyun, Galasso & Wylie-Rosett, 2007).

2.6.2.1.2 Anthropometric methods

Anthropometry is the measurement of body height, weight and proportions (WHO, 2000). In the literature, the bulk of anthropometric studies cover infants, children and pregnant women, since the strength of anthropometric methods is found in doing clinical examinations on these segments of the population. In this study, anthropometric measurements were undertaken amongst children from agri-business families in order to reflect on their nutritional status. These anthropometric measurements are briefly outlined below.

2.6.2.1.2.1 Body mass index

a) Description

Body Mass Index (BMI) is the international standard for assessing body size. According to Wellman and Kamp (2008), BMI is a simple index of weight-for-height that is clinically and most frequently used to classify underweight, overweight and obesity.

BMI is computed using the following:

Weight (kg) / Height (m^2).

The children's BMI is classified according to the classifications that are shown in Table 2.7. Like other methods of measuring nutritional status, anthropometric methods have strengths and weaknesses too.

b) Strengths

- Objective with high specificity and sensitivity;
- Measures many variables of nutritional significance;
- Readings are numerical and gradable on standard growth charts
- Readings are reproducible;
- Fast and easy to perform; and
- Inexpensive and non-invasive.

c) Weaknesses

- Does not detect early cases;
- Arbitrary statistical cut-off levels for what is considered as abnormal values;
- Problems with reference standards – local versus international standards;
- Limited nutritional diagnosis; and
- Inter-observers' errors in measurement.

Table 2.7 BMI Classification

BMI cut-off points	Classification
< 18.5	Under weight
18.5 – 24.99	Healthy weight range
25 – 29.99	Overweight (Grade 1 obesity)
30 – 34.99	Obese (Grade 2 obesity)
> 40	Very obese (morbid or Grade 3 obesity)

Source: WHO (1995)

In view of the above limitations of BMI, this study employed other complementary anthropometric methods, namely; weight-for-age, height-for-age, and BMI-for-age.

2.6.2.1.2.2 Weight-for-age

This anthropometric standard, also called underweight, is an indicator for nutritional status which is used to measure weight of children in relation to their age, and can reflect wasting. The cut-off point is < –2 standard deviations (SD), with <-3SD and ≥-3SD<-2SD indicating \`severely underweight' and \`underweight', respectively (WHO, 1995). This condition is usually caused by acute starvation and low nutrient intake (Müller & Krawinkel, 2005). Weight-for-age is used in children not older than 10years (Faber & Wenhold, 2007). In the current study it was used in 146 children who were aged 5-8 years.

2.6.2.1.2.3 Height-for-age

This standard is used to measure a child's height in relation to his/her age, and is used to reflect stunting at the cut-off point below -2 z-score (WHO, 2007). Z-scores of <-3SD and ≥-3SD<-2SD represent 'severely stunting' and 'stunting', respectively. Stunting is caused by chronic malnutrition. This measurement was undertaken on all 327 children of the current study.

2.6.2.1.2.4 BMI-for-age

BMI-for-age is used to determine over-nutrition in children. According to Wenhold and Faber (2007), a BMI-for-age above 85th percentile for appropriate gender and age is recommended as a cut-off point for risk of overweight and above the 95th percentile as overweight. A Z-score of >-2SD to <+1SD indicates `normal' body weight, below which there is <-2SD to >3SD (wasting) and <-3SD (severely wasting). On the other extreme, above `normal' body weight, there is >+1SD to <+2SD (possible risk of overweight), >+2SD to <+3SD (overweight) and >+3SD (obese). The causes of low BMI-for-age are chronic and acute malnutrition (Wenhold & Faber, 2007. This measurement was undertaken to all 327 children of the current study.

2.6.2.2 Indirect methods of nutritional assessment

Indirect methods of nutritional assessment include three categories, namely; ecological variables, economic factors and vital health statistics. Again, in view of this study's objectives, research questions and other logistical considerations the first two methods were used – ecological variables and economic factors. Accordingly, a socio-economic questionnaire was formulated and administered to the study population.

Although not directly measuring the nutritional status of children from agri-business families, these methods were used to make meaningful inferences and shed more light on their nutritional status.

2.7 CHAPTER SUMMARY

This chapter sought to establish a better understanding of the concept of food security. In doing so, it had first and foremost established the origin of this concept and how it has evolved into other forms and levels of food security since its inception. These forms and levels are namely; community food security, household and individual food security, and nutrition security. Also discussed were the four fundamental pillars of the concept of food security which are reflected in the definition of this concept. These pillars are namely; food availability, food accessibility, food utilisation and stability. The chapter was also dedicated to reviewing some fundamental principles of human nutrition, and numerous scientifically proven methods for measuring nutritional status.

In addition to the discussions on the fundamentals of the concept of food and nutrition security, principles of human nutrition and measurement of nutritional status, the next chapter takes stock of the state of food and nutrition security in the following geographic areas: worldwide, within the SADC region, South Africa, Eastern Cape, and Alfred Nzo District Municipality.

CHAPTER 3
THE STATE OF FOOD (IN)SECURITY

3.1 INTRODUCTION

Food insecurity refers to limited or uncertain availability of nutritionally adequate and safe foods, or limited or uncertain ability to acquire food in socially acceptable ways (Anderson, 1990; quoted by Hasan, Ahmed & Chowdhury, 2013). It is one of the major problems related to nutritional status. Famine is the most severe and acute form of food insecurity and is a process often resulting from drought. Food insecurity is not just about insufficient food production, availability, and intake, it is also about the poor quality or nutritional value of the food. The detrimental situation of women and children is particularly serious, as well as the situation among female teenagers, who receive less food than their male counterparts in the same households (Sasson, 2012). Food insecurity is associated with detrimental physical, psychological, behavioural, social, and educational functioning in children and adults (Nalty, Sharkey & Dean, 2013). It is also associated with numerous chronic diseases, particularly among low-income households (Seligman, Laraia & Kushel, 2010).

Having made a brief outline on the importance of food insecurity, this chapter is devoted to taking stock of the scale of food insecurity worldwide, with special reference to some SADC countries. It also discusses the scale of food insecurity and the corresponding food security policies and programmes in South Africa and the Eastern Cape, the country's poorest province.

3.2 THE STATE OF FOOD (IN)SECURITY IN THE WORLD

Food insecurity is a global problem to date, as much as it has been in the 1940s when there was establishment of the Universal Declaration of Human Rights which recognised the right to food as pre-condition to adequate standard of living. Reports of the previous years on food insecurity suggest that the world is still battling to feed millions of its habitants. For example, in the 2007, 75 million more people were reported (FAO, 2008).

In 2009, the FAO estimated that 1.02 billion people were undernourished worldwide (FAO, 2009). This represents more hungry people than at any time since 1970 and a worsening of the unsatisfactory trends that were present even before the economic crisis of 2008. The increase in food insecurity was not a result of poor crop harvests. It was due to reduced access to food by the poor, which in turn was caused by high domestic food prices, lower incomes and increasing unemployment. In other words, any benefits realised from falling world cereal prices have been more than offset by the global economic downturn (FAO, 2009).

According to Van Eeckhou (2010); cited by Sasson (2012) in 2010, the regional distribution of people suffering from hunger was the following:

- 578 million in the Asia Pacific region;
- 239 million in sub-Saharan Africa;
- 53 million in Latin America and the Caribbean;
- 37 million in North Africa; and
- 19 million in developing countries.

In 2011–13 a total of 842 million people, or around one in eight people in the world, were estimated to be suffering from chronic hunger, regularly not getting enough food to conduct an active life (FAO, 2013). This figure (842 million people) is lower than the 868 million reported in 2010–12 (FAO, 2012a). In fact, the total number and proportion of undernourished people has declined by 17 percent since 1990–92, but they remain unacceptably high (FAO, 2010).

In 2012 the state of food insecurity in the world presented new estimates of the number and proportion of undernourished people going back to 1990. These estimates were defined in terms of the distribution of dietary energy supply. Approximately 870 million people were chronically undernourished in 2010–12. The vast majority lived in developing countries, where about 850 million people, or slightly fewer than 15 percent of the population, are estimated to be undernourished (FAO, 2012a).

Developing countries as a whole has registered significant progress towards the Millennium Development Goal hunger target of halving the number of undernourished people in the world by 2015. However, the food and economic crises have had enormous setbacks on efforts of achieving the 2015 hunger targets. Other factors that appeared to threaten the 2015 hunger targets were reported in the literature as soaring food prices, climate change, and limited natural resources (Nandan, Sharma & Kumar, 2013; Capone *et al*., 2014; World Bank, 2014).

Nevertheless, 72 developing countries reached the 2015 MDG target of halving the proportion of hungry people; owing to stable political condition, economic growth, and sound social protection networks (FAO, 2015). Southern Asia and sub-Saharan Africa were two regions where reduction of hunger was still slow. However, Western Africa was the most successful region in Africa where the number of undernourished people fell by 24.5 percent since 1990-91 (FAO, 2015).

3.3 THE STATE OF FOOD (IN)SECURITY IN SOUTHERN AFRICA

Over the years, efforts and initiatives to combat hunger and malnutrition in Africa have gained momentum at all geographic levels - local, national, continental, and international. Yet, there are many examples of food insecurity in sub-Saharan Africa, some of them having reached catastrophic dimensions. The case in point is the Horn of Africa and southern Madagascar (Sasson, 2012).

At the national level, only a few Southern Africa countries produce enough food to meet their own needs (e.g. South Africa). The rest are dependent on their capacity to purchase imported food (e.g. Namibia and Botswana) or on food aid (e.g. Lesotho, Malawi and Zimbabwe) (Drimie *et al*., 2011). In line with this view, studies conducted by Crush, *et al*. (2011) in selected cities of Southern Africa showed that most communities and that many more households residing in these cities rely on supermarkets and the informal sector to access food, because urban food production is not particularly significant in them. In their extensive work, these authors (Crush *et al*., 2011) measured food insecurity in terms of the following measuring tools, namely; Household Food Insecurity Access Scale (HFIAS), Household Food Insecurity Access Prevalence Indicator (HFIAP), and Household Dietary Diversity Scale (HDDS).

By description, a HFIAS score is a continuous measure of the degree of food (in)security – access - in the household in the previous month. A HFIAS score is calculated for each household based on answers to nine 'frequency-of-occurrence' questions. The minimum score is 0 and the maximum is 27. The higher the score, the more food insecurity the household experienced. The lower the score, the less food insecurity a household experienced.

Meanwhile, HFIAP is a food (in)security indicator that categorises households into four levels of household food insecurity - access -, namely; food secure, and mild, moderately and severely food insecure.

HDDS refers to how many food groups were consumed within the household in the previous 24 hours. The FAO classification for Africa identifies 12 distinct food groups, and as such the scale ranges from a minimum of 0 to a maximum of 12. An increase in the average number of different food groups consumed provides a quantifiable measure of improved household food access.

In the current study HDDS was one of many techniques that were used to measure nutritional status.

3.3.1 Zimbabwe

In Zimbabwe, it is estimated that 70 percent of the country's population live below poverty line (Jongwe, 2014). It is further estimated that 600 000 to 4.1 million Zimbabweans are food insecure (Burke, Lass, Thistle, Katumbe, Tetha, Scharz, Bolotin, Barker, Simor & Silverman, 2014). The key drivers of food insecurity are high food prices and escalating inflation, food shortages, increasing joblessness and erosion of purchasing power of wages and pensions (Jongwe, 2014).

In a survey conducted by Tawodzera, Riley and Crush (2012), the HFIAS scores showed that households in Harare were amongst the most food insecure in the region (see Table 3.1). The HFIAS range in Harare was from 0 to 27 with a mean of 14.7 and a median of 16.0. When compared with other 11 cities in the SADC region, only households in Manzini, Swaziland, had similar levels of food insecurity (mean of 14.9 and median of

14.7). Furthermore, as shown in Table 3.3, the surveyed households in Harare scored worse on the HFIAP indicator than those in any other city. Only two percent of the Harare households were food secure, the lowest proportion of all eleven cities (Tawodzera et al. 2012).

Lastly, the HDDS shows that dietary diversity was very poor for most of the surveyed households in Harare (Tawodzera *et al*. 2012). As many as two thirds of the households (68 percent) had eaten from five or fewer of the twelve different FAO food groups in the 24 hours prior to the survey.

Table 3.1 Comparative HFIAS scores in selected cities of South Africa

City	Mean	Median	N
Manzini, Swaziland	14.9	14.7	489
Harare, Zimbabwe	14.7	16.0	454
Maseru, Lesotho	12.8	13.0	795
Lusaka, Zambia	11.5	11.0	386
Msunduzi, South Africa	**11.3**	**11.0**	**548**
Gaborone, Botswana	10.8	11.0	391
Cape Town, South Africa	**10.7**	**11.0**	**1 026**
Maputo, Mozambique	10.4	10.0	389
Windhoek, Namibia	9.3	9.0	442
Blantyre, Malawi	5.3	3.7	431
Johannesburg, South Africa	**4.7**	**1.5**	**976**

Source: Tawodzera *et al.* (2012)

Table 3.2 Comparative HDDS scores in selected cities of Southern Africa

City	HDDS	Percent of households with HDDS of 6 or less
Johannesburg, South Africa	**7.61**	**32**
Cape Town, South Africa	**6.75**	**46**
Gaborone, Botswana	6.52	43
Blantyre, Malawi	6.05	61
Windhoek, Namibia	5.94	58
Maputo, Mozambique	5.67	68
Msunduzi, South Africa	**5.48**	**71**
Lusaka, Zambia	4.85	60
Harare, Zimbabwe	4.77	79
Manzini, Swaziland	4.09	83
Maseru, Lesotho	3.43	91

Source: Tawodzera *et al.* (2012)

Table 3.3 Comparative HFIAP scores in selected cities of Southern Africa

Level of food (in)security (%)	City									
	Windhoek	Gaborone	Maseru	Manzini	Blantyre	Lusaka	Harare	**Cape Town**	**Msunduzi**	**Johannesburg**
Food security	18	12	5	6	34	4	2	**15**	**7**	**44**
Mildly food insecure	5	6	6	3	14	3	3	**5**	**6**	**14**
Moderately food insecure	14	19	25	13	30	24	24	**12**	**27**	**15**
Severely food insecure	63	63	65	79	21	72	72	**68**	**60**	**27**

Source: Tawodzera *et al.* (2012)

3.3.2 Zambia

In Zambia, food insecurity is a serious problem to the extent that in 2010-2012 the FAO estimated that 47 percent of the country's human population is undernourished (Bibler & Lauterbach, 2012; FAO, 2012a; and Davies, 2015). This situation is likely to be worsened by the country's escalating food prices. A recent example showed that 50 percent increase in maize prices could lead to an average consumption decrease of 17 percent amongst Zambian households, resulting in overall poverty rising from 68 to 70 percent fairly quickly at national level (Caracciolo, Depalo & Macias, 2014).

Poverty levels remain high not only in rural areas of Zambia, but in Lusaka as well (Mulenga, 2013). The average HFIAS score for the surveyed households of Lusaka was 11.5 out of 27 (Table 3.1). The Lusaka score was worse (i.e. higher) than six of the other cities surveyed by African Food Security Urban Network (AFSUN) [Blantyre, Cape Town, Gaborone, Johannesburg, Windhoek and Maputo] and better than only three (Harare, Manzini and Maseru, all of which have particularly acute food insecurity). Over two-thirds were severely food insecure (see Table 3.3). Furthermore, the majority of households (60 percent) consumed foods from no more than five food types out of a possible 12. Their diets were dominated by cereals, vegetables, sugar and other foods. The consumption of fruits, eggs, milk and milk products and even meat and poultry were low. Thus, the diets were likely to be deficient in essential vitamins, minerals and proteins (Mulenga, 2013). In the context of the current study, these findings spell nutrition insecurity or poor nutritional status.

3.3.3 Swaziland

The majority of Swaziland's population is chronically food insecure to the extent that in 2011 one in four Swazis required food aid from WFP (Fielding-Miller, Mnisi, Adams, Baral & Kennedy, 2014). Two-thirds of Swazis live below the national poverty line of $1.25 per day (Field-Miller *et al*, 2014). The problem of food insecurity in Swaziland is exacerbated by a dual epidemic of HIV/AIDS and tuberculosis (WFP, 2013). The country records the world's highest prevalence rates for both diseases. Currently, 42 percent of pregnant women attending antenatal care centres are HIV-positive, while 26.5 percent of the population aged between 15 and 49 years are HIV-positive (WFP, 2013).

The survey conducted by Tevera, Simelane, Peter and Salam (2012) showed that the average HFIAS score for Manzini was 14.86. Manzini's mean HFIAS was the highest of all eleven cities surveyed (see Table 3.1). What this means, in effect, is that Manzini's poor households have the highest levels of food insecurity in the entire regional study. The survey found that only 18 percent of households had always had enough food in the previous year (Trevera *et al*., 2012). Thirty three percent had gone without sufficient food several times while the rest (49 percent) had gone without many times or always.

On the HFIAP scale, over three-quarters of the surveyed households in Manzini were severely food insecure, with very few households having a moderate level of food insecurity (13 percent), and a mild level of food insecurity (3 percent). Only six percent of households were food secure (see Table 3.2). Furthermore, Tevera *et al*. (2012) reported that four percent of households had 'poor' food consumption, 10 percent had 'borderline' food consumption, 23 percent had 'acceptable' consumption and 64 percent had 'good' food consumption in terms of dietary diversity and food frequency (Tevera *et al*., 2012).

3.3.4 Malawi

More than half of Malawi population is classified as poor and the vast majority of the poor make a living out of smallholder farming (Harris, Meerman & Aberman, 2015). Over 1.63 million people, or 11 percent of the population, are facing severe food shortages (WFP, 2013). In fact, chronic food insecurity is considered to be one of the most important challenges facing the people and government of Malawi (Mvula & Chiweza, 2013). Factors that positively correlate with household food insecurity are price of maize, price of fertiliser, number of household members, and distance to markets (Fisher & Lewin, 2013).

Studies conducted by Mvula and Chiweza (2013) found that 34 percent of the sampled population of Blantyre is completely food secure (see Table 3.3), while the other 65 percent is generally food insecure but with varying levels of food insecurity Mvula & Chiweza, 2013). The study further established that household dietary diversity is very low with most consuming a monotonous diet dominated by grain foods, especially maize (see Table 3.2). The lack of income means poor access to other micronutrient-rich food groups, and eventually nutrition insecurity.

3.3.5 Namibia

In Namibia, the food security situation is characterised by extreme variability in levels of food production, large volumes of coarse grain imports and disparity in household income levels. The 2013 Global Hunger Index, published by the International Food Policy Research Institute (IFPRI), ranks Namibia at 53 out of 120 countries assessed, with an index score of 18.4, indicating a ‘serious food problem’ (WFP, 2013).

The number of food insecure people for the 2013/2014 consumption year is above the last year and the 5-year average in Namibia. Revised estimates show that some 463,600 people are severely food insecure in Namibia, up from 330,300 in May 2013 (IFPRI, 2013).

Following the severe deterioration in food security last year, on account of the reduced domestic 2013 production and consequently poor household food stocks, many households depleted their own production supplies by July 2013. The situation is expected to improve with new supplies from the current harvest (FAO, 2014). In total, approximately 780 000 people were estimated to be food-insecure, following the impact of the 2013 drought, and of those the number of people requiring food assistance was estimated to be 463 581 persons (IFPRI, 2013).

Namibia is a country that is urbanising rapidly. As population growth rises, there is urgent need for urban policies that will promote food security (Pendleton, Crush & Nickanor, 2014). Moreover, Pendleton, Nickanor and Pomuti (2012) found that 63 percent of the surveyed population of Windhoek is severely food insecure (see Table 3.2), while 58 percent had dietary diversity score of 5.94 (out of 12). Thus, Windhoek is the third highest food insecure city amongst the 11 cities of the SADC region.

3.3.6 Mozambique

In Mozambique, about 55 percent of the population is living in poverty, nearly half are illiterate, about 40 percent is undernourished, and 47 percent have access to safe water, with a life expectancy at birth of 48 year Mozambique ranked 165th out of 169 countries in the human development index. It is estimated that 64 percent of the population is food insecure (FAO, 2010). If not effectively addressed, the problem of food insecurity in Mozambique is likely to be felt heavily in urban areas. According to United National Human Settlements Programme (UN HABITAT, 2008), the proportion of the population that is urban will rise further to 46percent by 2020 and exceed 50 percent for the first time during the 2020s. By 2030, an estimated 54 percent of the population is projected to be living in towns and cities.

Already problems of food insecurity are starting to show in the capital city of Mozambique – Maputo. In the surveyed households of this city, Raimundo, Crush and Pendleton (2014) found a HFIAS score 10.4, which is very close to the average for the region as a whole (10.3) (Table 3.1). However, Maputo's poor would also appear to be less food insecure than those in most other cities surveyed including the South African cities of Cape Town (10.7) and Msunduzi (11.3). Furthermore, the average surveyed household scored 5.67 out of 12 (see Table 3.2). Nearly half of the households (47percent) had a score of 5 or lower. Comparatively, this puts Maputo in a better place than cities such as Harare, Lusaka and Msunduzi but worse than cities such as Johannesburg, Cape Town, Blantyre and Windhoek (Raimundo *et al.*, 2014).

3.3.7 Lesotho

In Lesotho, of the population of two million people, 44 percent live on less than $1.25 a day. This has resulted in 39 percent stunted growth and a life expectance of only 48 years (Lentz-Marino, 2014). Around 36 percent of the population suffer from food insecurity. Food produced from agricultural activities is not sufficient to cover the household requirements (Leduka, Crush, Frayne, McCordic, Matobo, Makoe, Mphale, Phaila & Letsie, 2015). In a similar fashion as in Swaziland, food insecurity in Lesotho is excarbated by high prevalence of HIV/AIDS. Lesotho has the third highest rate of HIV/AIDS in the world at 23 percent of its population (Lentz-Marino, 2014).

In a survey conducted by various authors, the HFIAS scores show that surveyed households in Maseru had the third highest HFIAS score of 12.8 out of 27 after Manzini and Harare (Frayne, Pendleton, Crush, Acquah, Battersby, Bras, Chiweza, Fincham, Kroll, Leduka, Mosha, Mulenga, Mvula, Pomuti, Raimundo, Rudolph, Ruysenna, Tevera, Tsoka & Tawodzera, 2010). Furthermore, the overwhelming majority of the surveyed population (96 percent) were food insecure (see Tables 3.1 & 3.3). The seriousness of food insecurity in Maseru is demonstrated by the HDDS (see Table 3.2). The HDDS shows that dietary diversity was the lowest (3.43 out of 12) amongst the surveyed household of the 11 cities of the SADC region. This food insecurity situation affected 91 percent of the surveyed households in Maseru.

3.3.8 Botswana

Botswana has Africa's most robust food security status after South Africa, the country from which it imports more than 80 percent of its food bill, a study released this week indicates. Botswana's food security situation compares favourably on the continent. The country is ranked 47th worldwide and second in Africa, with its major food supplier and continental powerhouse, South Africa, coming 40th worldwide and first in Africa.

A survey contacted by Acquash, Kapunda, Legwegoh, Gwebu, Modie-Morok, Gobotswang and Mosha (2013) in Botwana showed that the mean HFIAS score of 10.8 (see Table 3.1) in Gaborone proved to be marginally better than in several other cities surveyed (including Manzini, Harare, Maseru, Lusaka and Msunduzi). The HFIAP indicator (see Table 3.3) showed that 63 percent of the surveyed population was severely food insecure. According to Acquash *et al*. (2013) food insecurity appeared to be endemic in the poorer parts of Gaborone. These authors found that approximately four out of five households in the survey reported severe or moderate food insecurity. The data show a significant correlation between household income and food security, with the poorest households being most severely affected by food insecurity (Acquash *et al*. 2013). The short- and long-term impacts of chronic food insecurity on Gaborone's population are likely to be considerable unless this problem is urgently addressed. The problem is in some sense invisible because there appears to be no shortage of food in the shops and on the streets of this booming city. The challenge is not one of food supply but food accessibility and food quality (Acquash *et al*. 2013).

3.4 THE STATE OF FOOD (IN)SECURITY IN SOUTH AFRICA

This subsection briefly covers South Africa's approaches to food security, and the scale of food (in)security. South Africa is an upper-middle income country with adequate capacity to produce sufficient amounts of food to feed its population and ability to import food should there be deficits. Generally, volumes of food produced and imported make South Africa food secure at national level.

3.4.1 Food security strategy

In order to consolidate and reinforce its efforts for combating food insecurity, in 2002 the democratic South African government came up with IFSS whose objectives are:

- Increased household production and trading;
- Improved income generation and job creation opportunities;
- Improved nutrition and food safety; and
- Increased safety nets and food emergency management systems; and

The IFSS has four pillars, namely; production and trading, income opportunities, nutrition and food safety, safety nets and food emergency, and information and communication (Department of Agriculture, 2002b).

3.4.1.1 Pillars of the Integrated Food Security Strategy

3.4.1.1.1 Production and trade

DAFF is a leading department in this pillar, and is supported by the Departments of Rural Development and Land Reform (DRDLR), Health, Public Works, Water Affairs, and Trade and Industry. The areas of action by these departments on this pillar are mainly to increase access to production assets (including credit), increasing access to technologies (including food processing), supporting agriculture extension services, and improving infrastructure and trade relations (Department of Agriculture, 2002b).

3.4.1.1.2 Income opportunities

This pillar supports a labour-intensive and diversified agricultural sector with strong links to the economic sectors. This pillar, whose objectives are to increase income and job opportunities, is led by the Departments of Trade and Industry and others in the same cluster (DAFF, Public Works, Water Affairs, Minerals, Energy, Transport and Communication). The key policy actions of the programme of this pillar are related to access to credit, skills and training, local economic development, public works programmes, strengthening market systems with information and infrastructure, and livelihood diversification, including off-farm income generation (Department of Agriculture, 2002b).

3.4.1.1.3 Nutrition and food safety, and safety nets

This pillar seeks to ensure that food security programmes yield good nutrition status of South Africans (Koch, 2011). In order to achieve this end, a multi-pronged approach to achieving good nutrition status was developed in the IFSS through improving nutrition and food safety. The Departments of Health and Basic Education lead in this pillar with the assistance of other departments (DAFF, Water Affairs, and Trade and Industry). The main programme for this pillar is the National School Nutrition Programme (NSNP) which seeks to provide well-balanced meals to learners in the hope that their concentration and performance levels will improve, ultimately influencing their learning process (Koch, 2011).

The main areas of intervention in this pillar include public education, improvement of food and nutrition monitoring methods, targeted nutrition interventions for chronically vulnerable groups, and training to integrate food and nutrition concerns into development programmes. The targeted population consists of nutritionally vulnerable communities and groups, and within these areas the priority target groups for nutrition interventions have been identified as:

- Children under six years of age;
- At-risk pregnant and lactating women;
- Primary school children from poor households;

- People suffering from chronic diseases of lifestyle or communicable diseases; and
- At-risk elderly persons.

3.4.1.1.4 Safety nets and food emergency

The underlying principle of IFSS is that South Africa's previously disadvantaged groups and the poor should be placed into the economic mainstream so as to ensure that they have food security (Koch, 2011). However, some poor groups still fall outside the economic mainstream, thus making them vulnerable to hunger. Accordingly, provision of public goods such as safety nets, information management systems, and emergency management systems were established. This pillar is led by the Departments of Social Development and Local Government and Traditional Affairs with the assistance of other departments (DAFF, Public Works, and Water Affairs). The main programme for this pillar is the national comprehensive social protection. The key actions include the safety nets, information and data management, mapping techniques, information dissemination and emergency relief operations. The targeted population consists of vulnerable groups, mainly children, the elderly, the disabled, and the destitute (Koch, 2011).

3.4.2 Food security programmes

Since the inception of IFSS in 2002, DAFF have had numerous supportive food security programmes which included Ilima / Letsema, Zero-hunger, Fetsa Tlala, and the Agricultural Policy Action Plan (APAP). These programmes, which are connected to the 'food production and trade' pillar of IFSS are aimed at providing post-settlement support to the targeted beneficiaries of land reform, and to other producers who have acquired land through private means and are engaged in value-adding enterprises for domestic or export markets. These programmes benefit the hungry, subsistence and household food producers, farmers and agricultural macro-systems in the consumer environment (Koch, 2011).

3.4.2.1 Ilima / Letsema

DAFF incepted Ilima / Letsema in 2006 with a view to increasing food production and rehabilitating irrigation schemes and other value adding projects (DAFF, 2014b). The programme is funded by about 10 percent of CASP, and has the following set outputs:

- Number of hectares supported;
- Number of farmers trained;
- Number of tons produced within agricultural through agricultural development initiatives;
- Number of beneficiaries supported;
- Number of newly established irrigation infrastructure plants; and
- Number hectares of rehabilitated and expanded irrigation schemes.

Noticeably, Ilima / Letsema focused on the supply side of food production, especially production of staple grains. The researcher believes that this focus is largely due to poor understanding of the concept of food security among many policy makers and implementers in government. In line with this view Pingali (2015) asserts that food security policies of most countries still interpret food security as staple grain self-sufficiency, while the diet diversity needs of middle class as well as the poor are not adequately addressed. The impact of many food security policies on human nutrition and diet related non-communicable diseases is not well known (The M & E Harmonisation Group of Food Security Partners, 2013). Nevertheless, Ilima / Letsema is still a functional programme.

3.4.2.2 Zero-hunger

This programme was adopted from Brazil and introduced by DAFF in 2012 with the view to achieving the following objectives:

- Ensure access to food by poor and vulnerable members of the society;
- Improve food production capacity of households and poor resourced farmers;
- Improve nutrition security of citizens;
- Develop market channels through bulk government procurement of food linked to the emerging agricultural sector;
- Fostering partnerships with relevant stakeholders within the food supply chain.

Unlike Ilima / Letsema, Zero-hunger recognised the importance of human nutrition in food security. This nutrition-sensitive intervention is applauded in the contemporary literature of food security (Powell, Thilsted, Ickowitz, Termote, Sunderland & Herforth, 2015; Webb, Luo & Gentilini, 2015; Herforth & Ahmed, 2015; Pingali, 2015; Institute of Food Research, 2015). However, Zero-hunger had two critical flaws of scholarly interest. Firstly, it regarded food security as the problem of the poor only, yet food security affects all people everywhere (Pingali, 2015). Secondly, it disregarded the already existing free market channels by creating parallel market structures that sought to link farm produce from smallholder farmers to government institutions. In a free market economy this arrangement is problematic. Zero-hunger never got off the ground due to lack of political support.

3.4.2.3 Fetsa Tlala Food Production Initiative

Fetsa Tlala came into the picture towards the end of 2013. This programme was put in place in order to address key challenges that affect the South African society as outlined in the National Development Plan. These challenges include poverty, unemployment and inequality (DAFF, 2014b). Fetsa Tlala is very similar to Ilima / Letsema in that it focuses on crop production. By 2018/19 production season, the programme has set to cultivate one million hectares of land. In achieving this goal, 70 percent of the CASP infrastructure grant had to be reprioritised towards Fetsa Tlala. This reprioritisation also serves to augment the Ilima / Letsema Programme.

The researcher's views on Fetsa Tlala are similar to those expressed on Ilima / Letsema. That is, biasness towards production of staple food. Fetsa Tlala is still being rolled out.

3.4.2.4 Agricultural Policy Action Plan

The Agricultural Policy Action Plan (APAP) was introduced in 2014, and it has its origins and aspirations in the National Development Plan, New Growth Path, and Medium Term Strategic Framework. Accordingly, it seeks to achieve an equitable, productive, competitive, profitable and sustainable agriculture, forestry and fisheries sectors. Like the Industrial Policy Action Plan (IPAP), APAP is based on sectoral key actions programmes or commodities (DAFF, 2014a). These commodities are:

- Red meat integrated value chain;
- Poultry integrated value chain;
- Fruit and vegetables;
- Wine;
- Wheat;
- Forestry – Category B & C refurbishment and forest protection strategy;
- Fisheries – aquaculture and small-scale fisheries schemes; and
- Biofuels.

Unlike DAFF's other food security programmes that have been discussed earlier, APAP is not confined to production of staple food. It involves a wide range of commodities, and it embraces trade and agri-business development. In so doing, it promotes food security not only through food production / food availability, but also through food accessibility.

APAP is a five-year programme that is expected to be reviewed annually. Furthermore, DAFF's food security programmes that have been presented above are implemented by Provincial Departments of Agriculture (PDAs). Individual PDAs are at liberty to formulate their own implementation strategies and corresponding branding. Branding is often based on reviving Africanism, the culture of hard work, unity and *ubuntu*. For example:

- Mpumalanga has '*Masibuyele eMasimini'* - 'let us go back to the crop fields';
- Eastern Cape has `*Siyazondla'* – we are feeding ourselves.

Notwithstanding the enormous strides made in developing food security policies and programmes that are welcome by PDAs for implementation, food insecurity remains a serious problem that has been on the rise in South Africa during the past decades.

The following sub-section is dedicated towards taking stock of the state of food security in South Africa.

3.4.3 Scale of food (in)security

After 1994 the transition from apartheid to democratic regime was marked among other things by a discourse on food security. This policy shift in favour of food security was meant to address poverty and food insecurity among Black people who have previously been marginalised by the apartheid regime. The importance of food security was enshrined in the democratic South African Bill of Rights which reaffirms in Section 26 and 27 that everyone has the right to sufficient food. This right to food is in line with Article 25.1 of the United Nations Universal Declaration on Human Rights which states that:

> '*Everyone has the right to a standard of living adequate for the health and well-being of himself and his family, including food.'*

In line with the United Nations Universal Declaration on Human Rights and the South African Bill of Rights, South Africa formulated the following FAO aligned vision on food security:

'To attain universal physical, social, economic access to sufficient, safe and nutritious food by all South Africans at all times to meet their dietary and food preferences for an active and healthy lifestyle.'

Despite the political and economic advances seen in South Africa since 1994, household food insecurity is still a serious problem. The key food security challenges facing South Africa are documented in IFSS (Department of Agriculture, 2002b) and include:

- Inadequate safety nets;
- Weak support networks and disaster management systems;
- Inadequate and unstable household food production;
- Lack of purchasing power; and
- Poor nutritional status.

About eight years after the dawn of the new democratic South Africa, 35 percent of the population, 14.3 million people, were vulnerable to food insecurity. Women, children and the elderly are the most vulnerable to food insecurity (Department of Agriculture, 2002a). This situation is connected to the high level of poverty, unemployment and inequality that exists in the country, particularly in rural areas. The government have since responded to these challenges in many ways. The government's most decisive response to these challenges is the social allowance that is granted to the poor, the elderly and the disabled. The 'social grant' issue has been a longstanding controversial debate among all pockets of society, from the rural elderly to the privileged urban middle-class. Although many South Africans rely on this social security for their livelihoods, its direct impact on the eradication of poverty remains unknown. Nonetheless, one can easily infer that with the rising cost of living, its beneficiaries are struggling to keep up.

In 2009, the findings of the general household survey conducted by Stats SA (2009) reported that an estimated 20 percent of South African households have inadequate or severely inadequate food access. The survey report indicates further that during 2008 food access problems were mostly serious in Free State where 33.5 percent of the households have inadequate food access. They were followed by household in KwaZulu-Natal with 23 percent, Eastern Cape 21.4 percent and Mpumalanga 21.5 percent. Limpopo (11.9 percent) and Western Cape (14.5 percent) had the least food security problems in 2008. According to the FAO report (2008), high unemployment rate, inadequate social welfare systems and a high HIV/AIDS infection rate have all contributed to food insecurity in the country.

Food insecurity is a serious challenge that persists in South Africa after 23 years of democracy. Statistics South Africa (Stats SA, 2009) midyear estimates indicate that South Africa had an estimated population of 49 million in 2009 with a population growth rate of 1.7 percent per annum. National foods security indicators reveal that South Africa has been able to meet the food needs of its growing population over the past eight years. However, there are no clear statistics to ascertain that the food insecurity condition is the same at household level, especially in rural areas of South Africa. Literature by various authors confirms South Africa's national food secure status, but suggests that more than 14 million people, or about 35 percent of the population in the country are estimated to be vulnerable to food insecurity (Demetre, Mchiza, Steyn, Gericke, Maunder, Davids & Parker, 2011). It is also reckoned that as many as 1,5 million, or about one quarter, of children under the age of six are to have been stunted by malnutrition. This is supported by Machete (2004) in his study which confirms that food insecurity is more persistent n rural areas. According to the report, the majority of poor people are found in rural areas with roughly 75 percent of those chronically poor.

The latest survey conducted by HSRC (2013) on 7 500 households throughout the country shows that the state of food insecurity has remained fairly the same since 2008/9. That is, 45.6 percent of the population was food secure, while 28.3 percent were at risk of food insecurity, and 26.0 percent were food insecure. The largest percentage of participants who experienced food insecurity was in formal rural areas (37 percent) and urban informal (32.4 percent).

Meanwhile, the highest prevalence of being at risk of being food insecure was in the urban informal areas (36.1 percent), followed by those in rural informal areas (32.8 percent) areas. In contrast, the lowest prevalence of food insecurity was reported in urban formal areas at 19.0 percent (HSRC, 2013). In terms of provinces, the prevalence of food insecurity was the lowest in Western Cape (16.4 percent) and Gauteng (19.2 percent). Interestingly, the Eastern Cape and Limpopo were the only two provinces with food insecurity levels higher than 30 percent. In terms of races, black Africans had the highest prevalence of food insecurity (30.3 percent), followed by the coloured population (13.1 percent). Furthermore, 30.3 percent of the black African population were at risk of food insecurity, followed by 28.5 percent and 25.1 percent of the Indian and Coloured populations respectively. The majority (89.3 percent) of the white population was food secure.

Finally, whilst South Africa is food secure at national level, at community and household levels food security remains elusive (HRSC, 2004). Moreover, South Africa was listed by the World Health Organisation as one of the 36 high-burden countries, home to large numbers of stunted children (FAO, 2008).

3.5 THE PROVINCIAL AND DISTRICT STATE OF FOOD SECURITY

The following subsections are dedicated to providing a brief coverage on the state of food (in)security in the Eastern Cape Province and Alfred Nzo District Municipality. In so doing, it also makes a brief introduction of the province’s food security approaches.

3.5.1 The Eastern Cape Province

The Eastern Cape, which accommodates 1 687 385 households is home to 6.7 million people. This provincial population is equivalent to 12.7 percent of the national population (Stats SA, 2011). The Eastern Cape is comprised of a relatively young population; a declining but higher than national average fertility rate; a working age population that is increasingly female; and a below-average life expectancy rate (DEDEAT, 2013).

3.5.1.1 The state of food (in)security

The Eastern Cape tops the list of poor provinces in terms of exposure to average deprivation both in 2007 and 2011 (Stats SA, 2011). The unemployment in the Eastern Cape has increased from 24.8 percent to 30.8 percent in 2013. Accordingly, the Eastern Cape – together with Limpopo – are the only provinces in South Africa with the hunger prevalence higher than 30 percent (HSRC, 2013).

According to DEDEAT (2013), vulnerability to food insecurity is widespread in the province, particularly among households in Alfred Nzo District Municipality (86 percent) followed by Chris Hani District Municipality (83 percent), OR Tambo District Municipality (81 percent), and Western District Municipality at a relatively lower (66 percent). Further analysis of the characteristics of food insecure households suggest that there is less prevalent of food insecurity the Western regions of the Eastern Cape. Furthermore, the largest proportion of food insecure households in the province are found in rural areas, and food insecurity prevalence is high amongst black African households, particularly those that are headed by females and have larger family sizes (DEDEAT, 2013).

Whilst the researcher does not dispute figures on poverty and unemployment levels at the province and in individual districts (see Figure 3), he has reservations about DEDEAT's exponentially high figures on food insecurity. Nevertheless, the Eastern Cape has approaches and programmes in place, which are used to mitigate the risk of food insecurity. These mitigation approaches and programmes are briefly outlined in the subsequent sub-section.

3.5.1.2 Food security programmes

The Eastern Cape has a wide range of food security programmes that are inspired by the five pillars of IFSS that had been discussed in sub-section 3.5.2. These food security programmes are coordinated by the provincial DOSDSP through Eastern Cape Anti-poverty and Food Security Strategy (ECAFSS) in collaboration with other government departments, public entities, civil society, institutions of higher learning and social partners (DOSDSP, 2012). In brief, the ECAFSS seeks to promote the following areas which are identified as its pillars:

- Social mobilisation;
- Human Development and Integrated Food Security and Nutrition;
- Income Security; and
- Basic Services.

DRDAR has the following food security programmes which are designed to promote 'food production and trade' of IFSS, and the 'food availability' component of the concept of food security that had been discussed in sub-section 2.5.1:

- Siyazondla Homestead Food Production;
- Siyakhula Step-Up Food Production;
- Massive Food Programme;
- Mechanisation Conditional Grant Scheme;
- Mechanisation Conditional Loan Scheme;
- Comprehensive Agriculture Support Programme; and
- Livestock Improvement Scheme;

The Department of Health (DOH) promotes 'food accessibility' and 'food utilisation' through its Early Childhood Programme which promotes supplementary feeding (e.g. vitamin A) in cases where there is malnourishment. Meanwhile, the Department of the Departments of Local Government and Traditional Affairs (DLGTA) and Education (DOE) improve 'food accessibility' among food insecure youth through the School Nutrition Programme. Other than the government departments, various public entities (e.g. National Development Agency), academic institutions, and civil society also play a critically important role in addressing food insecurity in the province in line with the ideals of the provincial ECAFSS that has been referred earlier.

Notwithstanding the enormous efforts and programmes that have outlined above in addressing food insecurity, many of the 1 687 385 households of the province, particularly those residing in the eastern regions, remain food insecure. The effects of these programmes on the food security status of the families of food producers in selected parts of Alfred Nzo District Municipality will be of particular interest in this study. For example, some, if not all of the families of food producers are expected to have benefited from the government food production subsidies at some point, while others may have been suppliers of food materials to programmes such as the School Nutrition Programme.

3.6 ALFRED NZO DISTRICT MUNICIPALITY

Agriculture is the main economic activity in the District. Currently, it is a limited base for economic expansion since the majority of farming is traditional subsistence farming (Alfred Nzo District Municipality, 2014). Commercial farming is limited to the Cedarville area in the north east of the District. The District has favourable conditions for the development of the agriculture sector and it is critical to assess the potential of this industry and devise methods of exploiting this untapped potential.

Yet, Alfred Nzo District Municipality has very low levels of employment and a high percentage of people (43.5 percent) who are not economically active. As indicated earlier, vulnerability to food insecurity is widespread, particularly amongst 86 percent of the district’s households. These in turn account for the high poverty levels and low-income levels. High unemployment rates impact negatively on local municipalities as low affordability levels result in a poor payment rate for services (see Figure 3).

Food producers who operate in parts of Umzimvubu and Ntabankulu Local Municipalities where there is high unemployment and high prevalence of food insecurity were included in this study. Of particular interest is to find out how food producers fare in these poverty-stricken local municipalities, and how their families’ food and nutrition security status is affected by the trying conditions.

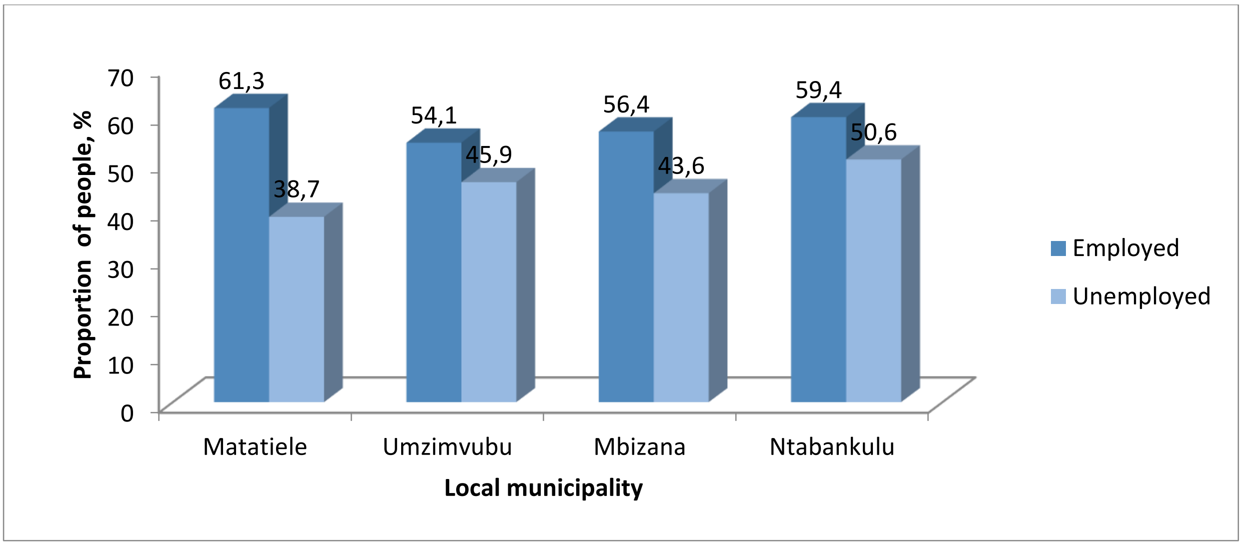


Figure 3 Levels of unemployment at Alfred Nzo District Municipality

Source: Adapted from Alfred Nzo District Municipality (2014)

3.7 CHAPTER SUMMARY

This chapter has provided analysis of the state of food (in)security worldwide. It has paid special emphasis on the SADC regions, South Africa and the Eastern Cape Province. It has also discussed food security approaches that are used by the South African and Eastern Cape governments. The next chapter outlines research design and methodology.

CHAPTER 4
RESEARCH DESIGN AND METHODOLOGY

4.1 INTRODUCTION

This chapter discusses the research design and methodology used to achieve and respond to research objectives and questions, respectively. According to Burns and Grove (1999), a research design is a blueprint for conducting a study that maximises control over factors that could interfere with the credibility of the findings and gives greater control and improves the trustworthiness of a study. In this study, the researcher selected a participatory action design. The design determines the methodology to be used to carry out the study. The methodology includes the setting, population, sampling and sample, data-collection instrument, data collection and analysis, validity and reliability, and ethical considerations. The study was based on the mixed-method approach comprising both qualitative and quantitative components.

4.2 STUDY AREA

The study area refers to the geographical area in which this study was undertaken, namely Alfred Nzo District Municipality. The municipality is situated in the North-Eastern corner of the Eastern Cape Province. It stretches from the Drakensberg Mountains, borders Lesotho in the West Sisonke District Municipality to the North and OR Tambo District Municipality in the East and South (see Figure 4.1).

The total population of Alfred Nzo District Municipality is about 801 344; the majority (54 percent) of which are females (Alfred Nzo District Municipality, 2014). Stats SA (2011) indicates that the population of Alfred Nzo District Municipality is youthful as more than 52.9 percent of the total population falls below the age of 35 years. Approximately 40.9 percent of the total population falls between 0-15 years of age which indicates that more youth is still dependent and possibly still attending schools (Alfred Nzo District Municipality, 2013).

Alfred Nzo District Municipality has low education and literacy levels. That is, eight percent of the population has no education, while 53 percent have only some form of primary school education. Approximately, 14.2 percent of the population have completed Grade 12, while only 4percent of the population has attained academic qualifications that are higher than Grade 12 (Alfred Nzo District Municipality, 2013).

This study was conducted in Umzimvubu and Ntabankulu local municipalities. The geographical location of these municipalities is shown in Figure 4.1.

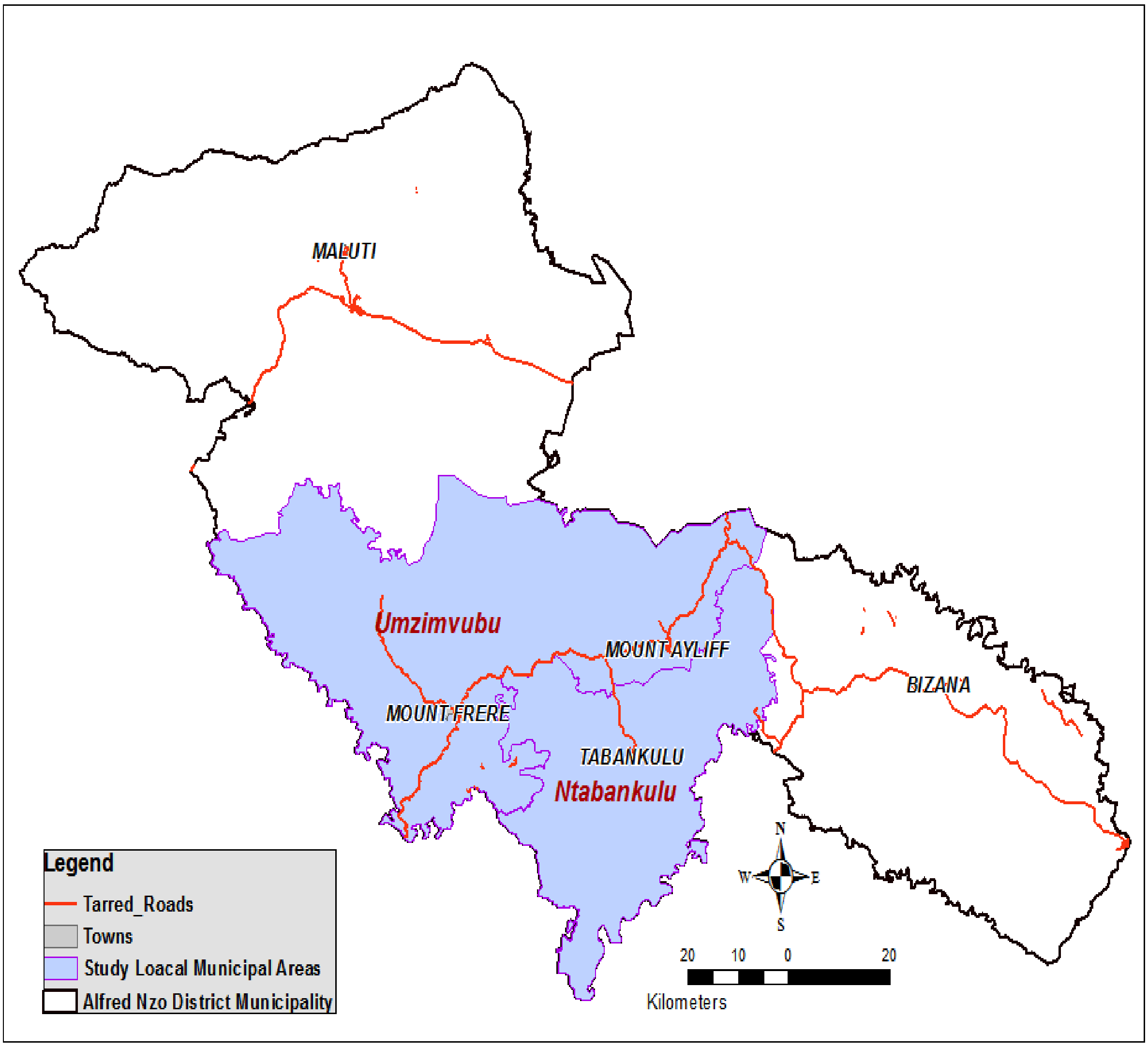


Figure 4.1 The map of Alfred Nzo District Municipality

4.3 RESEARCH PURPOSE AND OBJECTIVES

The purpose of this study is to investigate the current state of food and nutrition security, and nutritional status among children from agri-business families, thereby contributing towards further understanding of the concept of food and nutrition security within this target group in the Eastern Cape Province, in particular, and in South Africa, in general.

Accordingly, the research objectives of the study are to:

- Establish baseline data for nutrition security / nutritional status of children of agri-business families.
- Establish the extent to which children from agri-business families are nutrition secure / nutritional status, using a multiple of scientifically proven research methods of measuring nutrition security.
- Identify and understand short-comings to achieving nutrition security or good nutritional status among children of agri-business families.
- Draw recommendations based on the findings of the study.

4.4 RESEARCH QUESTIONS

Having identified numerous gaps during the literature review, this study identified the following research questions:

- To what extent are children from agri-business families nutrition secure?
- Alternatively, what is the nutritional status of children from agri-business families?
- What key socio-economic attributes influence nutrition security status of children of agri-business families?

That is:

- Is there a relationship between an agri-business family's non-farm income and its children's nutritional status?
- Is there a relationship between an agri-business family's food expenditure and its children's nutritional status?
- Is there a relationship between an agri-business family's farm income and its children's nutritional status?
- Is there a relationship between a caregiver's educational qualifications and his / her children's nutritional status?

4.5 RESEARCH APPROACH

The study used both qualitative and quantitative approaches for complementary reasons.

4.5.1 Qualitative

Kotler and Keller (2006) describe qualitative research as a comparatively unstructured measurement technique that allows a wide range of possible responses. In view of the above description this study used a qualitative research approach for the following reasons:

- Studies on the state of food and nutrition security, and nutritional status among children of agri-business families are scarce. There is, therefore, a dire need to achieve a broader explanation, and understanding, thereof, of these aspects among agri-business families. Quantitative methods alone are not sufficient to achieve this.
- To establish the depth of the agri-business families' nutrition-related practices, knowledge, and perceptions and attitudes on nutrition.
- There is also a need to confirm or explain quantitative findings from the socio-economic questionnaire, 24h dietary recall method, qualitative food frequency questionnaire, and anthropometric measurements. Qualitative methods are well equipped to achieve this end.

Worthy to mention, the researcher is mindful of the fact that, qualitative research is criticised, because of its subjective element and is also said to lack either the reliability or the validity to be considered an objective and acceptable science (Dunnion, 2012). Consequently, advocates of quantitative research question the legitimacy of qualitative research. However, Siegle (2002) states that,

> *"It is unfair to judge qualitative research by a quantitative research paradigm, just as it is unfair to judge quantitative research from the qualitative research paradigm".*

In view of Siegel's assertion and that of the research objectives and questions, the researcher re-iterates the need to complement qualitative research methods with qualitative ones.

4.5.2 Quantitative

Quantitative research involves collecting data that is absolute, such as numerical data, so that it can be examined in as unbiased a manner as possible. In this study, quantitative research methods were used for the following compelling reasons:

- To establish concise data on the food and nutrition security, and nutritional status of children of agri-business families using the socio-economic questionnaire, 24h dietary recall questionnaire, food frequency questionnaire, and anthropometric measurements.
- To test whether there will be any statistical relationship between key variables. This includes a relationship between the socio-economic data and nutritional practices in agri-business families, on one hand, and their food and nutrition security, and nutritional status, on the other hand.
- To infer estimates from the two local municipalities of the study to the large population of the Easter Cape Province.
- To produce evidence to demonstrate the existence of food and nutrition security related opportunities and challenges amongst agri-business families.

4.6 POPULATION

A population refers to the group of individuals, organisations, or events that a researcher is interested in investigating (Kazerooni, 2011). The study population is the group of individuals chosen for study to which a researcher can legitimately apply conclusions (Enarson, Kennedy & Miller, 2004). In this study, the population was agri-business families who operate at Umzimvubu and Ntabankulu areas of Alfred Nzo district in the Eastern Cape Province.

4.7 SAMPLING

Sampling means taking any portion of a population or universe to represent that population or universe (Burns & Grove 1999). This study targeted previously disadvantaged smallholder agri-business owners / managers of Alfred Nzo District of South Africa whose individual or collective annual turnover is between R150 000 and R4 000 000. All owners / managers who met this criterion were purposefully selected from a farmer database that was made available by local agricultural extension officers. This selection process led to the exclusion of survivalist farming families (annual turnover less than R150 000), and the inclusion of the whole remaining purposeful research sample of 124 agri-businesses that were operated by 263 agri-business owners / managers from 263 households / families (see Figure 4,2). Three hundred and twenty-seven (327) children aged 5-14 years from the agri-business households participated in this study. From each of the 263 agri-business households, questions that relate to nutritional knowledge, attitudes and feeding and general care of children were directed to caregivers who lived in these households. In total, from the agri-business households, 590 respondents actively participated in this study (i.e. 263 caregivers plus 327 children) [see Figure 4.3].

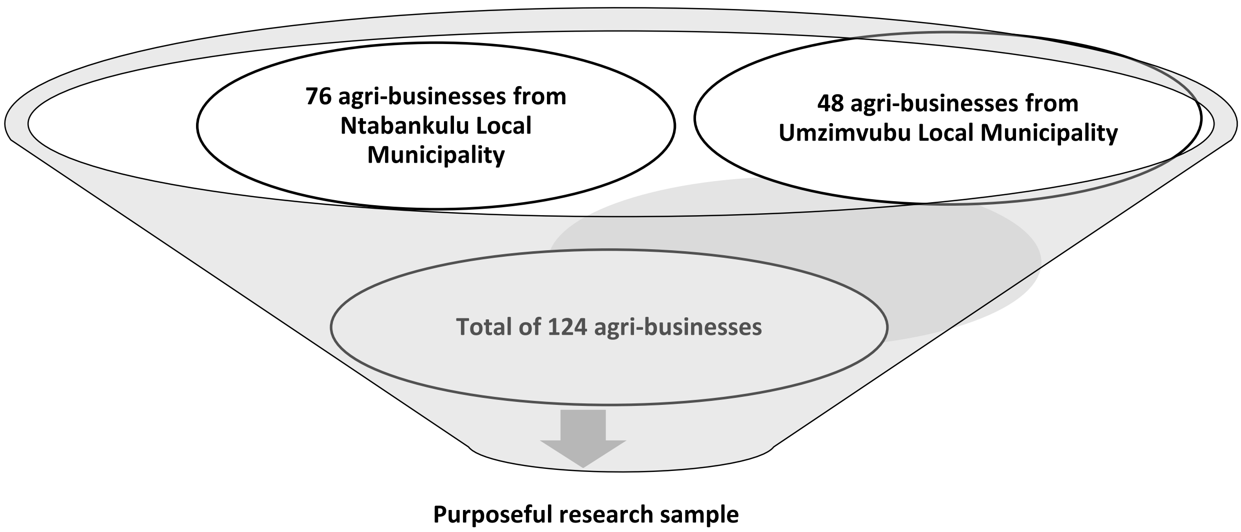


Figure 4.2 Geographical distribution of the agri-businesses

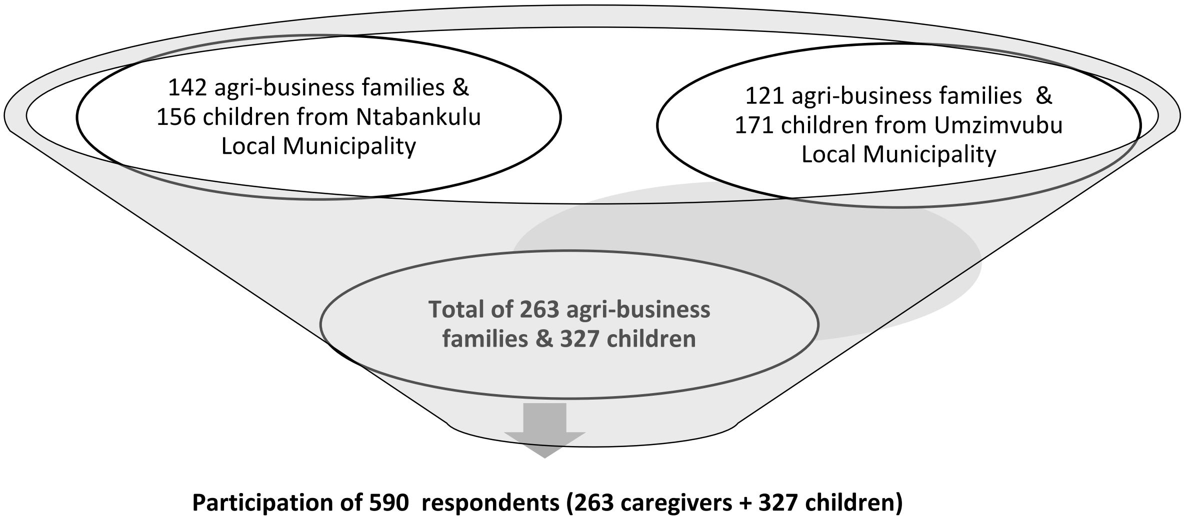


Figure 4.3 Distribution of respondents among the two research sub-samples

4.8 COLLECTION OF DATA

In this study, primary data was collected by means of questionnaires, interviews, and direct observation. Secondary data was sourced from the literature. Various instruments were employed to collect data.

4.8.1 Instruments used in data collection

The choice of research tools or instruments is one of the most critical stages in planning for a research study, because research instruments are critical in ensuring the quality of data collection (Zunyou & Wang, 2010). Research instruments must be selected or developed carefully to fit the research methodology and the plan for data analysis so that the data collected will be useful for answering the research questions (Gaberson, 1997; Palese, Colognese, Pellician & Mecugni, 2012).

In line with the above notion, in this study data was collected by means of:

- Questionnaires;
- Semi-structured interviews;
- Direct observation; and
- Application of theory.

The use of multiple sources of evidence will be employed to enhance the internal validity of the conclusions drawn. El-Kafafi (2006) emphasises that,

> "… no single method adequately solves the problem of rival casual factors… hence, by the use of multiple methods, researchers aspire to reveal the different aspects of empirical reality and at the same time help validate the research findings".

4.8.1.1 Questionnaires

Questionnaires are widely used and there are many modes of administering them, including self-administering (Mellenbergh, 2008). The researcher and fieldworkers were personally delivered the self-administered questionnaires to the agri-business owners / operators and their families under study. Self-administered questionnaires were chosen for the following reasons:

- Personal visits paid to the food producers for self-administering the questionnaires was to ensure that the questionnaires are fully completed by the respondents, thus resulting in 100 percent response rate.
- The situation in turn resulted in a good rapport between the research team (researcher and fieldworkers) and the respondents from the agri-businesses.
- The personal delivery of the questionnaires was further necessitated by the complementary research instruments, namely semi-structured interviews, and direct observation.

In this study, six sets of questionnaires were administered; namely, socio-economic questionnaire; questionnaire on nutrition-related practices; questionnaire on nutrition-related knowledge, attitudes and perceptions; food frequency questionnaire, and anthropometric measurements.

4.8.1.1.1 Socio-economic questionnaire

The socio-economic questionnaire which contains qualitative and quantitative data on various personal and economic aspects of a respondent is shown in Annexure 2. These aspects include a respondent's age, gender, employment status, size of his / her household, monthly expenditure on food, farming activities that produce food, and income derived from these farming activities. Data from this questionnaire was used to directly measure nutrition security/ nutritional status of respondents. Instead, it was used to shed light and make inferences on these variables.

4.8.1.1.2 Nutrition-related practices

Nutrition-related practices are observable actions of an individual that could affect his/her or others' nutrition, such as eating, feeding, washing hands, cooking and selecting foods (FAO, 2014). Specifically, this entails eating habits and preferences of a respondent which include the number of meals taken per day, types of food usually consumed and the frequency of consumption of these foods. It also encompasses water and sanitation. A questionnaire (see Annexure 3) that contains this largely qualitative information was adapted from FAO (2014).

4.8.1.1.3 Nutrition-related knowledge and attitudes

Knowledge refers to an individual's understanding of nutrition, including the intellectual ability to remember and recall food and nutrition-related terminology, specific pieces of information and facts (FAO, 2014). In line with this technical definition, respondents were asked questions that seek to find out whether they know the number of meals they should eat per day, the types of foods that they should be eating and frequency of eating these foods (see Annexure 4).

Respondents were asked questions that are related to their attitudes towards nutrition (see Annexure 4). Attitudes are emotional, motivational, perceptive and cognitive beliefs that positively or negatively influence the behaviour or practice of an individual (FAO, 2014). Attitudes are measured by asking the respondents to judge whether they are positively or negatively inclined towards:

- A health or nutrition problem;
- An ideal or desired nutrition-related practice;
- Following nutrition recommendations or food-based dietary guidelines;
- Food preferences; or
- Food taboos.

4.8.1.1.4 A 24h dietary recall method

A 24h dietary recall method is a retrospective quantitative research method that is used in nutritional assessment. In this study, this questionnaire was administered three times for each respondent; twice on weekdays and once on a day of a weekend (see Annexures 5.1 and 5.2). This instrument was used to determine the actual foodstuffs and their quantities consumed over the past 24h. Food models were used to improve the accuracy of recorded food quantities.

4.8.1.1.5 Food frequency questionnaire

Food frequency questionnaire is a printed list of foods from which individuals are asked to indicate the typical frequency of consumption, and to state in household measurements, the average amounts consumed per day (Nelson & Bingham, 1992). Respondents were asked to report their usual frequency of consumption of food items over a 7-day period. They did not have to quantify food intake, because this was a qualitative FFQ (see Annexure 6).

This method was not to be used to complement the 24h dietary recall only, but it was instrumental in understanding eating patterns of respondents.

4.8.1.1.6 Anthropometric measurements

Anthropometry is the measurement of body height, weight and proportions which was used in this study to establish the 327 children's body condition. Prior to taking the measurements, the researcher and fieldworkers received training from public health workers and guidance from researchers from Walter Sisulu University.

4.8.1.1.6.1 Weight and height measurements

A calibrated electronic scale was used to measure weight. All the children were weighed with their shoes and socks being removed, and with their light clothes put on. Two weight readings were taken within the nearest 0.1kg, and the average of the two readings was recorded if the two readings were different.

Height was measured with a stadiometer, with vertical scale of metres and a sliding headpiece, to the nearest 0.1cm. Children had to put their legs and knees straight together with arms aside, and feet and heels touching together. As with weight, two measurements were taken, and the average recorded if the two measurements were different. Readings were recorded in Annexure 7.

Weight and height recordings were captured on excel. The following anthropometric standards were analysed using WHO Anthro and Anthro Plus software programme, version 1.0.2, namely weight-for-age, height-for-age and BMI-for-age.

4.8.1.1.7 Pilot study or pre-test of the questionnaire

A pilot study was conducted to assess the questionnaires' format and layout, clarity of wording and overall content (Haupt & Whiteman 2004). According to Peat, Mellis, Williams and Xuan (2002), a questionnaire should be pre-tested beforehand in order to:

- Develop and test adequacy of research instruments.
- Assess the feasibility of a full-scale study.
- Identify logistical problems which might occur, using the proposed methods.
- Estimate variability in outcomes to help determine sample size.
- Develop a research question and research plan.
- Train a researcher in as many elements of the research process as possible.

Accordingly, the six questionnaires were piloted at Amathole District of the Eastern Cape. Subsequently, necessary adjustments were made on the questionnaires. Further adjustments were made following feedback from a study supervisor.

4.8.1.2 Semi-structured interviews

Semi-structured interviews are used for various reasons that are outlined in the literature (Schensul, Schensul & LeCompte, 1999; Longfield, 2004; Borg, 2010; Pathak & Intratat, 2012; Schatz, 2012). In this study, face-to-face semi-structured interviews were used to acquire a deeper understanding of the respondents' nutritional practices, knowledge, and perceptions and attitudes towards nutrition. The interviews were also used to verify and interpret quantitative information collected by the questionnaire, and to gather rich insights into the respondents' experiences, opinions, aspirations, attitudes and feelings about food security and nutrition.

The semi-structured interviews were conducted according to the drawn interview guide that is in the literature (Polonsky & Waller, 2010; Williams & Kobak, 2012), and this was done after the respondents had completed responding to questionnaires. This arrangement allowed the interviews to flow smoothly, largely due to the respondents' familiarity with the subject under research (nutrition security). All the respondents were asked the same questions in the same way so that any differences between the answers are the real ones and not the result of the interview situation itself.

4.8.1.3 Direct observation

The study used direct observation to complement the questionnaires and semi-structured interviews. Schensul et al., (1999) define participant observation, which is part of ethnographic research as 'the process of learning through exposure to or involvement in the day-to-day or routine activities of participants in the researcher setting'.

The occasions of the physical visits to the agri-business premises or households made it convenient to carry out direct observation on the same day as administering the questionnaires and semi-structured interviews. Direct observation was done in the respondents' natural setting (Carlson & Morrison 2009).

Direct observations were used as a means of supporting the answers to the questions by relating the analysis derived from the quantitative questionnaire and qualitative interviews (i.e. what the respondents said about their nutrition) to the observations conducted. Unlike the questionnaire and semi-structured interviews, direct observations were not conducted in a structured manner. For example, in some food producers, direct observation will happen as the research team walk inside their premises.

4.8.1.4 Application of theory

The researcher undertook an extensive literature review which has culminated in the formulation of the idea and proposal for the study. Further contributions came from the study supervisors and colleagues in the workplace, and researchers from local universities, South African Medical Research Council and Foods SA.

4.9 RELIABILITY AND VALIDITY

The quality of research is determined by its reliability and validity.

4.9.1 Reliability

Reliability is the consistency of the measurement, or the degree to which an instrument measures the same way each time it is used under the same conditions with the same subjects (Look, Schiffman, Truelove & Ahmda, 2010). It refers to the extent to which a measurement procedure yields the same answers, whenever and however it is carried out (Shepherd & Helms, 1995).

The following mechanisms were used to ensure reliability (Eygelaar, 2004; Ramchander, 2004; Haupt & Whiteman, 2004; El-Kafafi, 2006; Bhat & Rajashekhar, 2009):

- A research sample representative of the population to which the results are generalised was selected.
- All the respondents under study were residents of Mzimvubu and Ntabankulu Local Municipalities under study.
- A structured approach was used to collect data.
- An assessment of food and nutrition security, and nutritional status of each of the 263 agri-business households and 327 children understudy were based on facts, not individual opinion.

In addition, reliability checks were applied to the questionnaire, semi-structured interviews, and direct observation.

4.9.1.1 Reliability of questionnaire

The following reliability mechanisms and checks were used to ensure reliability of the six questionnaires:

- Due diligence was exercised in designing the questionnaires. They were reviewed by the supervisors of the study and colleagues for possible adjustments.
- The questionnaires were pre-tested and further adjusted.
- The respondents were assured of anonymity and confidentiality.

- The questionnaires were applied objectively, consistently and in a structured manner.
- The six questionnaires are widely used instruments of measuring food and nutrition security, and nutritional status.
- The questionnaires were checked by the research team and the respondents to make sure they are completed in full.

4.9.1.2 Reliability of semi-structured interviews

In conducting the face-to-face semi-structured interviews, the interviewers achieved accurate results, because all the interviewers used the same interview guide and reported the same results and were subjected to the same research conditions. To this end, the following measures were taken:

- The interviews were conducted in a systematic way with the use of an interview guide.
- The responses of the interviewees will be written down.
- Answers from the interviews were checked by the research team to make sure that the interview is conducted according to the interview guide.
- Prior to the end of the interview, written responses were read out to the interviewees by the research team to check their correctness.

4.9.1.3 Reliability of the direct observation

The measures used to achieve reliable results from the questionnaire and semi-structured interviews were also applied in acquiring reliable results from the direct observation. Direct observation occurred throughout the day of visit to the premises of agri-business owners / operators.

4.9.2 Validity

Validity refers to the extent to which an empirical measure reflects the real meaning of the concept under consideration (Babbie & Mouton 2001; Gibson, 2007; Andreou, Alexopoulos, Lionis, Varvogli, Gnardellis, Chrousos & Darviri, 2011). The researcher ensured the reliability and validity of the study by means of the following:

- The six questionnaires that were used in this study are validated and legitimised research instruments of measuring food and nutrition security, and nutritional status.
- An extensive literature review was undertaken. The literature review assisted in the development of the questionnaires and the interview guide.
- The use of different research instruments for data collection allowed validation of responses or measurements taken among the instruments. Although, involving extra work and expense, the above approach improved the validity of the findings of the study.
- During the development and pre-testing of the questionnaires, inputs were sought from the supervisors of this study, other academics, colleagues and the respondents in the pilot study. This approach elevated the content validity of the questionnaires.
- The presence of the research team during the process of self-administering the questionnaires allowed them to clarify questions, misunderstandings and have the questionnaire completed in full.
- The presence of the research team in the premises and households of agri-business owners / operators assisted in validating data from the semi-structured interviews, and direct observation. This further assisted in making informed interpretation of data, rich conclusions and recommendations.
- External validity was achieved through representativeness and generalisability of the research results. The results of this study were generalised within Umzimvubu and Ntabankulu Local Municipalities.

4.10 DATA ANALYSIS

Data analysis is a process of bringing order, structure and meaning to the mass of collected data. The research design, questions or hypotheses determine the type of analysis (Chapman & Lown, 2010). In this study, prior to data analysis, further consideration was given to the type of data and research objectives. The quantitative data from the questionnaires was analysed by means of descriptive statistics. Both parametric and non-parametric components of the inferential statistics were used in the analysis of some of the components. The qualitative data from the semi-structured interviews was analysed using content analysis.

4.10.1 Quantitative data

The statistical analyses included descriptive and inferential statistics. The quantitative data was cleaned and coded prior to analysis on the Statistical Package for Social Sciences (SPSS), Version 20.

4.10.1.1 Descriptive statistics

Descriptive statistics was used to describe the basic features of the data from the two local municipalities (Holt & Scariano, 2009; Hall & Vance, 2010).

4.10.1.2 Inferential statistics

Unlike descriptive statistics, inferential statistics deal with drawing conclusions and predictions about the characteristics of a population under investigation based on the data obtained from a sample (Gupta, 2012; Van Epp, 2012). Inferential statistics are frequently used to answer cause-and-effect questions in addition to investigating differences between and amongst groups (Van Epp, 2012).

Inferential statistics were used in this study as follows:

- Analysis of variance (ANOVA) was used to determine whether there are significant differences for various variables between and within the three samples from the two local municipalities.
- Correlation analysis was used to describe the degree of relationship between various variables (Trochim, 2006; Arumugam *et al*, 2008). For example, nutritional status, on the one hand, versus nutritional practices, perceptions, and attitudes on the other hand.
- ANOVA was used to perform various functions, including testing the strength of association between independent and dependent variables (Arumugam, Ooi

& Fong, 2008). A Levene's test of homogeneity of variances was conducted on the following null and alternative hypotheses:

Null and alternative hypotheses No. 1

H_0: Higher agri-business family's monthly non-farm income does not lead to its children' better nutritional status.

H_1: Higher agri-business family's monthly non-farm income leads to its children' better nutritional status.

Null and alternative hypotheses No. 2

H_0: Higher agri-business family's monthly food expenditure does not lead to its children' better nutritional status.

H_2: Higher agri-business family's monthly food expenditure leads to its children' better nutritional status.

Null and alternative hypotheses No. 3

H_0: Higher agri-business family's farm income does not lead to its children' better nutritional status.

H_3: Higher agri-business family's farm income leads to its children' better nutritional status.

Null and alternative hypotheses No. 4

H_0: Higher educational qualifications of a caregiver do not lead to his/her children' better nutritional status.

H_4: Higher educational qualifications of a caregiver lead to his/her children' better nutritional status.

Due to the violation of the assumption of homogeneity of variances and that of normality, non-parametric statistics were performed.

4.10.1.3 Non-parametric statistics

Non-parametric statistics was used to elucidate the outcomes of the parametric t-test (Beukman, 2005; Nordstokke, Zumbo, Cairns & Saklofske, 2011):

- A Mann-Whitney U test was used to explain the outcomes of the parametric t-test.
- Kruskal-Wallis H test was used to compare various variables from the two local municipalities.

4.10.2 Qualitative data

There is no standardised approach to qualitative data analysis (Bryman, 2004). The approaches which were used included thematic, comparative and content analysis.

4.11 ETHICAL CONSIDERATIONS

Ethics deals with matters of right and wrong. Research that involves human beings as subjects should be conducted in an ethical manner to protect their rights. Accordingly, the research team obtained informed consent from the respondents, and respect their right to anonymity and confidentiality, and fair treatment (Burns & Grove 1999) [see Annexure 1]. On the other hand, this study upheld scientific integrity which was overseen by its supervisors.

4.12 CHAPTER SUMMARY

This chapter discussed the research methodology which was used in the study. The methodology included the description of the study area, population, sampling and sample, data-collection instruments, data collection and analysis, validity and reliability, and ethical considerations. The study used qualitative and quantitative research methods and data was analysed by means of parametric and non-parametric statistics.

In Chapter 5, a presentation is made of results from the socio-economic questionnaire, nutritional knowledge and attitude questionnaire, and nutritional practices.

CHAPTER 5

DATA ON SOCIO-ECONOMIC ASPECTS, AND NUTRITIONAL KNOWLEDGE, ATTITUDES AND PRACTICES OF CAREGIVERS

5.1 INTRODUCTION

This chapter presents the quantitative and qualitative results which emanated from the respondents' responses on the following questionnaires, namely socio-economic status, and nutritional knowledge, attitudes and practices.

5.2 RESPONSE RATE

A response rate is the number of people who responded to a survey divide by the total number of people who are included in a sample. It is expressed in percentage (Fincham, 2008). A response rate determines credibility of research findings and drawn conclusions. Generally, a response rate of about 60 percent is acceptable for most surveys (Fincham, 2008). Meanwhile, Evans (1991) recommends a high response rate of over 80 percent for small random samples, and a lower response rate for large samples. However, Lee, Brown, Grant, Belin and Brick (2009) caution that high response rates do not necessarily translate to accurate surveys. These authors contend that response rates are simply one of many ways to summarise the characteristics of a survey and may be a convenient, but not necessarily scientific, tool for summarising non-response bias or data quality.

In the current study, the response rate was 100 percent, owing to the method used to administer the questionnaires. The questionnaires were personally administered in order to ensure that they had been fully completed, and returned for data capturing. However, in view of the assertion made by Lee *et al*. (2009) in the foregoing paragraph, the researcher in the current study did not rely on the high response rate (100 percent) only in order to achieve credible research findings and conclusions. Instead, various other mechanisms were employed which included scientifically sound research approaches, reliability and validity checks, and appropriate statistical analyses.

5.3 SOCIO-ECONOMIC DATA

5.3.1 Introduction

The socio-economic data under discussion in this sub-section include among other things, the caregivers' and /or children's gender, age, marital status, educational qualifications, employment status, household farm and non-farm income, expenditure on food, and household farming activities.

5.3.2 Gender of caregivers and children

In a normal society, men and women are raised and groomed to play specific roles at home and in a society at large. Generally, men are meant or conditioned to be problem solvers who ought to be manly and show less emotions in their behaviour (Fischer, 2018). Contrastingly, women have inherent emotional coping strategies which are necessary for taking care of children and the sick (Calasanti & King, 2007; Lee & Taung, 2013).

In accordance with the above gender norm, it was therefore not surprising that the overwhelming majority of the caregivers (n=250, 94.95%) who were included in this study were women (see Table 5.1).

Of the total number of 327 children aged between five and 14 years, the majority (n = 177; 54.13%) were boys.

Table 5.1 Gender composition of caregivers and children

Gender	Caregivers			Children		
	Local municipality			Local municipality		
	Ntabankulu	Umzimvubu	Total	Ntabankulu	Umzimvubu	Total
Male	5 (3.5%)	8 (6.6%)	13 (5.05%)	99 (63.46%)	78 (45.61%)	177 (54.13%)
Female	137 (96.5)	113 (93.4%)	250 (94.95%)	57 (36.54%)	93 (54.39%)	150 (45.87%)
Total	**142 (100%)**	**121 (100%)**	**263 (100%)**	**156 (100%)**	**171 (100%)**	**327 (100%)**

5.3.3 Caregivers' role in a family and marital status

Most of the caregivers in this study were mothers (n=141, 53.8%), followed by grandmothers (n=97, 36.75%). Caregiver fathers were the fewest (n=4, 1.55%) [Table 5.2].

With respect to their marital status, most caregivers were 'married' (n=125, 47.5%), followed by those who were 'never married' (n=82, 31.2%) and 'widowed' (n=56, 21.3%) [Table 5.3]. Some of the studies conducted on the subject of food security in rural areas of the Eastern Cape also identify the majority of caregivers as 'married' (Adekunle, 2013). Noticeably, most of the caregivers that 'never married' were from Umzimvubu Local Municipality (n=51, 42.1%), while Ntabankulu Local Municipality had the largest number of 'widowed' caregivers (n=51, 35.9%).

In the current study, the relationship between the caregivers' marital status and the nutritional status of their children aged between five and 14 years has been a subject of investigation.

Table 5.2 Caregivers' role in a family

Role in a family	Local municipality		
	Ntabankulu	**Umzimvubu**	**Total**
Father	2 (1.4%)	2 (1.7%)	4 (1.6%)
Mother	73 (51.4%)	68 (56.2%)	141 (53.8%)
Grandfather	7 (4.9%)	5 (4.1%)	12 (4.5%)
Grandmother	54 (38.0%)	43 (35.5%)	97 (36.8%)
Other	6 (4.2%)	3 (2.5%)	9 (3.4%)
Total	**142 (100)**	**121 (100%)**	**263 (100%)**

Table 5.3 Caregivers' marital status

Marital status	Local municipality		
	Ntabankulu	**Umzimvubu**	**Total**
Never married	31 (21.8%)	51 (42.1%)	82 (31.2%)
Married	60 (42.3%)	65 (53.7%)	125 (47.5%)
Widowed	51 (35.9%)	5 (4.1%)	56 (21.3%)
Total	**142 (100%)**	**121 (100%)**	**263 (100%)**

5.3.4 Age of caregivers and children

Most of the caregivers (n=54, 20.5%) included in this study fell in the age group of 36–40 years, followed by those whose age group fell within 46–50 years (n=36, 13.7%). Only 17 (6.5%) and 16 (6.1%) of the caregivers were aged below 30 years and above 70 years, respectively (Table 5.4). The number of those who were above 60 years of age and eligible for government's old age social grants was estimated at 60 (22.8%).

Of the 327 studied children, the majority fell in the age group of 9-13 years (n=156, 47.7%), followed by younger ones in the age group of 4-8 years (n=146, 44.15%). The oldest and fewest were 14 years of age (n=25, 7.65%) [see Table 5.5].

Like the caregivers' marital status that has been discussed in the foregoing sub-section of this thesis, their age and its relationship with nutritional status of their children was investigated in this study.

Table 5.4 Caregivers' age

Age group	Local municipality		
	Ntabankulu	**Umzimvubu**	**Total**
≤ 30	7 (4.9%)	10 (8.3%)	17(6.5%)
31 – 35	4 (2.8%)	7 (5.8%)	11 (4.2%)
36 – 40	25 (17.6%)	29 (24.0%)	54 (20.5%)
41 – 45	10 (7%)	16 (13.2%)	26 (9.9%)
46 – 50	16 (11.3%)	20 (16.5%)	36 (13.7%)
51 – 55	18 (12.7%)	15 (12.4%)	33 (12.5%)
56 – 60	21 (14.8%)	5 (4.1%)	26 (9.9%)
61 – 65	12 (8.5%)	6 (5.0%)	18 (6.8%)
66 – 70	18 (12.7%)	8 (6.6%)	26 (9.9%)
≥ 70	11 (7.7%)	5 (4.1%)	16 (6.1%)
Total	**142 (100%)**	**121 (100%)**	**263 (100%)**

Table 5.5 Children's age

Age group	Local municipality		
	Ntabankulu	Umzimvubu	Total
5 - 8 years	90 (57.69%)	56 (32.75%)	146 (44.15%)
9-13 years	63 (40.38%)	93 (54.39%)	156 (47.70%)
14 years	3 (1.92%)	22 (12.87%)	25 (7.65%)
Total	**156 (100%)**	**171 (100%)**	**327 (100%)**

5.3.5 Caregivers' educational qualifications

In the context of this study, the caregivers' level of education was expected to have a bearing on their income and nutritional status of their children aged 5-14 years. The influence of the caregivers' educational status on their children's nutritional status was a subject of investigation. This subject has been documented in many studies (Lin, Yang, Hang & Pan, 2007; Lin, Hang, Yang & Hung, 2011; Shaaban, Nassar, Shatla, Deifallah, Marzouk & Abogabal, 2014; Vardanjani, Reisi, Javadzade, Pour & Tavassoli, 2015; Sukandar, Khomsan, Anwar, Riyadi & Mudjajanto, 2015).

Nevertheless, most caregivers included in this study had Grade 8-11 academic qualifications (n=66, 25.1%) [Table 5.6]. Forty-one participants (15.6%) had no formal education, while a Bachelor's degree / Diploma was the highest level of education acquired (n=25, 9.5%).

Table 5.6 Caregivers' educational qualifications

Educational qualification	Local municipality		
	Ntabankulu	**Umzimvubu**	**Total**
No education	20 (14.1%)	22 (18.2%)	41 (15.6%)
Adult basic education and training (ABET)	51 (35.9%)	14 (11.6%)	60 (22.8%)
Grade 1-7	5 (3.5%)	24 (19.8%)	31 (11.8%)
Grade 8-11	35 (24.6%)	29 (24.0%)	66 (25.1%)
Grade 12 / N3	20 (14.1%)	18 (14.9%)	40 (15.2%)
Bachelor's degree / Diploma	11 (7.7%)	14 (11.9%)	25 (9.5%)
Total	**142 (100%)**	**121 (100%)**	**263 (100%)**

5.3.6 Size of the caregivers' households

In many studies a size of a household is linked to food security status of members of such household (Buyene & Muche, 2010; Aidoo, Mensah & Tuffour, 2013). In this study, when asked to indicate the number of people who permanently reside in their respective households, most caregivers registered a size of 4-6 people (n=109, 41.4%), followed by 7-9 people (n=68, 25.9%) [Table 5.7]. Only 59 (22.4%) and 27 (10.3%) households accommodated 1-3 people and more than 10 people respectively. The average size of households in the Eastern Cape is 3.9 people (Stats SA, 2011), while that of Alfred Nzo District is 3.7 persons (ECSECC, 2014).

Table 5.7 Number of permanent habitants in the caregivers' households

Number of people	Local municipality		
	Ntabankulu	**Umzimvubu**	**Total**
1-3 people	21 (14.8%)	38 (31.4%)	59 (22.4%)
4-6 people	56 (39.4%)	53 (43.8%)	109 (41.4%)
7-9 people	40 (28.2%)	28 (23.1%)	68 (25.9%)
≥10 people	25 (17.6%)	2 (1.7%)	27 (10.3%)
Total	**142 (100%)**	**121 (100%)**	**263 (100%)**

5.3.7 Employment status of caregivers and other family members

Only a few caregivers included in this study were employed elsewhere outside their agri-businesses (n=34, 12.9%) [Table 5.8]. Of these employed caregivers, most were employed on permanent basis (n=14, 41.2%) [Table 5.9].

The 263 caregivers were asked to indicate the number of persons employed among those with whom they permanently live. Most caregivers (n=258) responded to this question, while very few did not (n=5, 1.9%). The majority (n=143, 54.4%) said they have no employed family members that they permanently live with (Table 5.10). The rest (n=115, 43.7%) reported employed family members, ranging from one to three persons per caregiver's household.

These findings on employment family mirror those of the region at large. That is, in 2014 unemployment in the Eastern Cape Province and Alfred Nzo District was estimated at 28.2 and 24.1%, respectively (ECSECC, 2014). Recently, findings of a survey conducted by the South African Institute of Race Relations (2016) estimate unemployment rate at Alfred Nzo District at 53.1%. In response to these findings, the local newspaper Daily Dispatch published a sensational article titled '*Alfred Nzo Municipality is the worst area to live in SA, survey finds'*.

Table 5.8 Caregivers' employment status

Employment status	Local municipality		
	Ntabankulu	**Umzimvubu**	**Total**
Employed	10 (7.0%)	24 (19.4%)	34 (12.9%)
Unemployed	132 (93.0%)	97 (80.2%)	229 (87.1%)
Total	**142 (100%)**	**121 (100%)**	**263 (100%)**

Table 5.9 Caregivers' type of employment

Type of employment	Local municipality		
	Ntabankulu	**Umzimvubu**	**Total**
Permanent position	3 (30.0%)	8 (33.3%)	11 (32.4%)
Temporary position	2 (20.0%)	12 (50.0%)	14 (41.2%)
Fixed term contract	5 (50.0%)	4 (16.7%)	9 (26.5%)
Total	**10 (100%)**	**24 (100%)**	**34 (100)**

Table 5.10 Number of employed family members who permanently live with the caregivers

Number of persons	Ntabankulu	Umzimvubu	Total
0 person	87 (61.3%)	56 (46.3%)	143 (54.4%)
1 person	34 (23.9%)	50 (41.3%)	84 (31.9%)
2 persons	13 (9.2%)	9 (7.5%)	22 (8.4%)
3 persons	8 (5.6%)	1 (0.8%)	9 (3.4%)
Did not respond	0 (0%)	5 (4.1%)	5 (1.9%)
Total	**142 (100%)**	**121 (100)**	**263 (100%)**

5.3.8 Households' non-farm income and expenditure on food

The non-farm income of households originated from those employed caregivers and their family members with whom they permanently live. It was also sourced from the government's old age and child social grants. When asked to quantify their households' non-farm income, 258 caregivers responded. Most of the caregivers' households (n=85, 32.3%) earned between R1 001 and R1 500, followed by those who earned between R500 and R1 000 (n=55, 20.9%). Some 51 (19.4%) caregivers' households earned more than R2 500 per month (Table 5.11).

With respect to the households' monthly expenditure on food, most spent between R701 and R900 (n=61, 23.2%). Nineteen (7.2%) of the caregivers' households spent R500 or less a month, while 13 (4.9%) reportedly spent R2 000 or more (Table 5.12).

Monthly non-farm income was moderately correlated to food expenditure ($r=0.55$, $p<0.01$). These findings are similar to those reported in a survey that was conducted by ECSECC (2014) at Alfred Nzo District. The survey found that most of the monthly expenditure is used to acquire non-durable goods like food, while very little is used to buy either durable or semi-durable goods. For example, in 2013, from a total household income of R10.3 billion, R9.2 billion was used in household expenditure. ECSECC (2014) concluded that this elevated household expenditure is symptomatic of poverty in the district, as high expenditure on non-durable goods does very little contribution to wealth creation.

Table 5.11 Households' non-farm income

Non-farm income	Local municipality		
	Ntabankulu	**Umzimvubu**	**Total**
R500-R1 000	26 (18.3%)	29 (24.0%)	55 (20.9%)
R1 001-R1500	44 (31.0%)	42 (34.7%)	85 (32.3%)
R1 501-R2 000	8 (5.6%)	18 (14.9%)	26 (9.9%)
R2 001-R2 500	23 (16.2%)	17 (14.1%)	41 (15.6%)
>R2 500	41 (28.9%)	10 (8.3%)	51 (19.4%)
Did not respond	0 (0%)	5 (4.1%)	5 (1.9%)
Total	**142 (100%)**	**121 (100%)**	**263 (100%)**

Table 5.12 Households' expenditure on food

Monthly expenditure on food	Local municipality		
	Ntabankulu	**Umzimvubu**	**Total**
≤R500	4 (2.8%)	14 (11.6%)	19 (7.2%)
R501-700	11 (7.7%)	28 (23.1%)	38 (14.4%)
R701-R900	46 (32.4%)	15 (12.4%)	61 (23.2%)
R901-R1 100	20 (14.1%)	19 (15.7%)	39 (14.8%)
R1 101-R1 200	9 (6.3%)	12 (9.9%)	17 (6.5%)
R1 201-R1 400	16 (11.3%)	12 (9.9%)	32 (12.2%)
R1 401-R1 600	5 (3.5%)	6 (5.00%)	11 (4.2%)
R1 801-R2 000	21 (14.8%)	11 (9.1%)	33 (12.5%)
≥R2 000	10 (7.0%)	4 (3.3%)	13 (4.9%)
Total	**142 (100%)**	**121 (100%)**	**263 (100%)**

5.3.9 Farming operations of the agri-business units

Farming operations that took place in the agri-business units are discussed in terms of; types of farm / agri-business ownership, the main commodities produced, and revenue generated.

5.3.9.1 Types of agri-business / farm ownership

Of the total of 124 agri-business units included in this study, 76 and 48 units were located at Ntabankulu and Umzimvubu Local Municipalities, respectively. When asked to classify their agri-business units, the owners / managers mostly reported to be registered co-operatives (n=46; 37.10%), followed by those classified as community projects (n=41; 33.06%). A few of the agri-business units were classified as individually (n=15; 12.10) or family owned (n=17; 13.71) [see Table 5.13].

During the semi-structured interviews, it transpired that many state departments and non-governmental organisations had an influence in the formation in many agri-business units in accordance with the above outlined classifications, particularly co-operatives and community projects. These types of agri-business ownership are in line with the Eastern Cape provincial government's approach to agricultural development which encouraging to operate as groups than as individuals (Eastern Cape Department of Agriculture, 2010). On average, the membership of family-owned / group- owned agri-business units had 2.6 owners / managers; range being between two and nine owners / managers.

Table 5.13 Type of agri-business / farm ownership

Type of farm ownership	**Local municipality**		
	Ntabankulu	**Umzimvubu**	**Total**
Individual	9 (11.84%)	6 (12.50%)	15 (12.10%)
Family	12 (15.79%)	5 (10.42%)	17 (13.71%)
Co-operative	25 (32.89%)	21(43.75%)	46 (37.10%)
Community project	27 (35.53%)	14 (29.17%)	41 (33.06%)
Closed corporation	3 (3.95%)	2 (4.17%)	5 (4.03%)
Trust	0	0	0
Other	0	0	0
Total	**76 (100%)**	**48 (100%)**	**124 (100%)**

5.3.9.2 Types of agricultural commodities produced

As shown Table 5.14, the core business of the farming units understudy was predominantly crop production (grain, vegetables and fruits) [n=94; 75.80%] followed by poultry and pig production [n=21; 16.94%]. Although some farming units kept cattle, sheep and goats; none of these livestock species formed part of their core business or flagship commodities. Other flagship commodities included epiculture.

The choice of the abovementioned flagship commodities was dictated by mainly the climatic conditions of the area. That is, Alfred Nzo District has many subtropical 'pockets' that are conducive for crop production, rather than livestock production. Citrus production is discouraged due to high risk of citrus greening. Further details of the flagship commodities are outlined in Table 5.15.

Table 5.14 Flagship commodities of the agri-business units

Flagship commodities	**Local municipality**		
	Ntabankulu	**Umzimvubu**	**Total**
Grain	35 (46.05%)	23 (47.92%)	58 (46.77%)
Vegetables	23 (30.26%)	11 (22.92%)	34 (27.42%)
Fruits	1 (1.32%)	1 (2.08%)	2 (1.61%)
Pigs	4 (5.26%)	5 (10.42%)	9 (7.26%)
Poultry	6 (7.89%)	6 (12.50%)	12 (9.68%)
Other	7 (9.21%)	2 (4.17%)	9 (7.26%)
Cattle	0	0	0
Sheep	0	0	0
Goats	0	0	0
Total	**76 (100%)**	**48 (100%)**	**124 (100%)**

Table 5.15 Details of flagship commodities of the agri-business units

Flagship commodities	Products
Grain	Grain referred to such crops as maize, soya and sugar beans.
Vegetables	Vegetable enterprises produced various vegetables such as cabbages, spinach, carrots and tomatoes under irrigation.
Fruits	Fruit production involves peaches.
Pigs	Piggeries referred to enterprises that produced young pigs (piglets) and then sold them to other farmers to grow and later sell as mature pigs. Some of the piglets were raised for slaughter by the original piggeries.
Poultry	Poultry enterprises produced eggs and chicken meat.
Cattle	Cattle enterprises bred cows and raised calves for future slaughter as beef. Mature beef animals were sold either in abattoirs or in informal markets. Occasionally some cattle produced milk for home consumption.
Sheep	Sheep and goats were kept for meat and fibre production.
Other	Other (epiculture) involved production of honey for selling in the local retail shops.

5.3.9.3 Total annual turnover of agri-business units

Having excluded micro agri-businesses (those generating annual turnover of less than R150 000) and the survivalists from this study, most of the 124 enterprises discussed in the previous sub-sections were classified in accordance with the National Small Business Act No. 102 of 1996 (DTI, 1996) as 'very small' (n=109; 87.89%), followed by the 'small' ones (n=15; 12.1%). None of the enterprises were classified as 'medium' sized (see Figure 5). The contents of this Act which are relevant to this study are outlined in Table 1.2 of Chapter 1. According to the contents of this Act, agri-business enterprises that generate annual turnover of less than R400 000, or less than R2 million or less than R4 million are classified as 'very small' or 'small' or 'medium' sized, respectively.

Interestingly, while the family or group-owned agri-businesses had a large membership of owners / managers that ranged between two and nine, many did not appear to generate sufficient income that would adequately support the livelihoods of families of the owners / managers (see Table 5.16). For example, the majority of agri-businesses generated annual gross income of between R150 000 and R200 000 (n=41; 33.06%), followed by those who made between R201 000 and R250 000 (n=24; 19.35%). Only a few made income of between R1 million and R2 million (n=2; 1.62%). Like non-farm income, the farm income was positively strongly correlated to food expenditure ($r=0.48$, $p \leq 0.01$).

The effect of both farm and non-farm income on the nutritional status of children from agri-business families was investigated in this study. The results of such investigation were presented in Chapter 6.

Table 5.16 Total annual turnover of the agri-business units

Annual turnover	Local municipality		
	Ntabankulu	Umzimvubu	Total
R150 000-R200 000	23 (30.26%)	18 (37.50%)	41 (33.06%)
R201 000-R250 000	14 (18.42%)	10 (20.83%)	24 (19.35%)
R251 000-R300 000	15 (19.74%)	5 (10.42%)	20 (16.13%)
R301 000-R350 000	7 (9.21%)	6 (12.50%)	13 (10.48%)
R351 000-R400 000	8 (10.53%)	3 (6.25%)	11 (8.87%)
R401 000-R450 000	4 (5.26%)	4 (8.33%)	8 (6.45%)
R451 000-R500 000	1 (1.32%)	1 (2.08%)	2 (1.61%)
R501 000-R1 million	2 (2.63%)	1 (2.08%)	3 (2.42%)
R1 million-R1.5 million	1 (1.32%)	0	1 (0.81%)
R1.5 million –R2 million	1 (1.32%)	0	1 (0.81%)
> R2 million	0	0	0

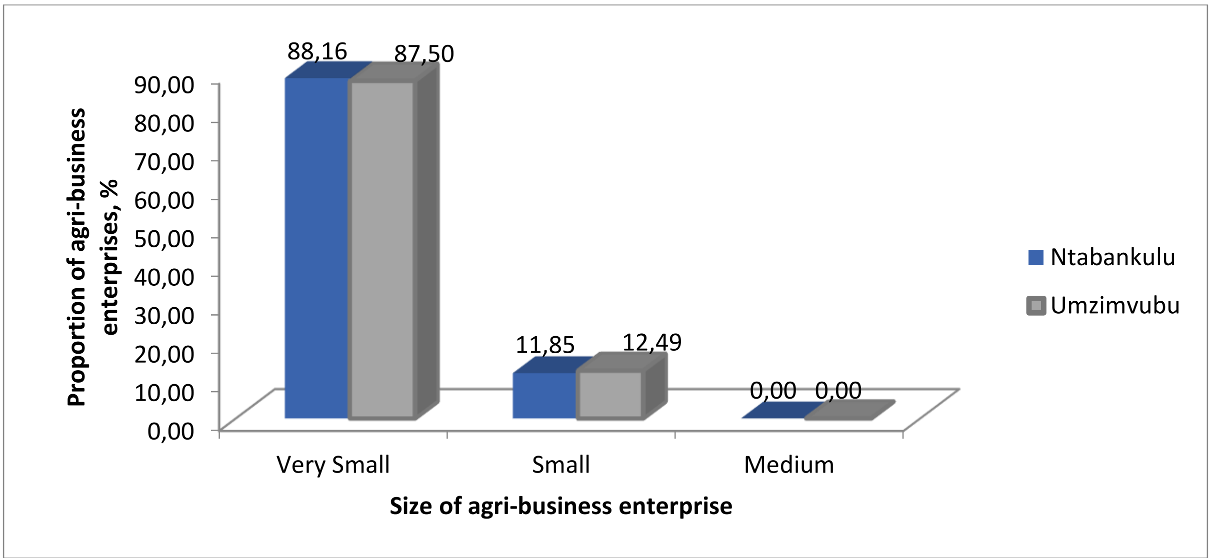


Figure 5 Classification of agri-business enterprises according to their annual turnover

5.4 SUMMARY

This study had high response rate of 100%. Most of caregivers and children included in this study were females and males, respectively. Most of the caregivers were married and played a motherly role, followed by those who played a grandmotherly role. The majority of caregivers fell in the age group of 36-40 years, and most had acquired Grade 8-11, followed by those with ABET educational qualifications. Approximately a quarter of the 263 agri-business households had family size of 7-9 people and more than half had no employed family members. Most had non-farm income and monthly food expenditure of R1 001-R1 500 and R701-R900, respectively. The large majority of the agri-business enterprises were owned / managers by groups in a form of co-operatives and community projects. The core business of most of them was crop production. In terms of their annual turnover, most of the enterprises were ‘very small’.

5.5 NUTRITIONAL KNOWLEDGE, ATTITUDES, AND PRACTICES

5.5.1 Introduction

Having presented the socio-economic status of the 263 agri-business households, the current sub-section presents outcomes from the caregivers' nutritional knowledge, attitudes and practices.

5.5.2 Breakfast consumption

Breakfast consumption makes an important contribution to a day's nutrient intake, yet skipping breakfast is a common practice among adolescents (Gross, Bronner, Welch, Dewberry-Moor & Paige, 2004).

When asked for an opinion on whether it is good giving breakfast to children aged between five and fourteen years before they go to school, the caregivers gave different responses. The majority responded in the 'affirmative' (n=227, 86.3%), while a few (n=8, 3%) said such practice was 'not good' (Table 5.17). Those who responded in the 'affirmative' said that breakfast provides their children with energy that is necessary to enable them to; a) walk to school, b) play at school, and c) concentrate in class. Others felt that by giving children breakfast before going to school, one makes them less interested in other children's lunch packs.

In addition, the caregivers were asked if it was 'difficult' to provide breakfast to their children before they go to school. Most caregivers acknowledged such 'difficulty' (n=153, 58.2%), while 106 (40.3%) said it was 'not difficult' (Table 5.18). Commonly mentioned sources of 'difficulties' in providing breakfast included, a) expensive electricity, and b) expensive food materials that make a good breakfast.

Having asked the caregivers about their opinion on breakfast, further questions on the matter were on the actual breakfast practices followed. Generally, responses to these questions were positive. For example, when asked on the frequency of providing breakfast to their children, the overwhelming majority of caregivers said they 'usually' make such provision (n=211, 80.2%), while the rest (n=52, 19.8%) reported that they 'do not usually' provide breakfast to their children before they go to school (Table 5.19).

When requested to quantify the above frequencies of proving breakfast to their children, about half of the caregivers (n=132, 50.2%) said the provision of breakfast is made ‘every day of the week’. This group of caregivers was followed by those who reportedly provided breakfast ‘four to six times a week’ (n=82, 31.2%), while 21 (8.0%) indicated that they ‘never’ provided breakfast to their children aged five to fourteen years before they go to school (Table 5.20).

Table 5.17 Caregivers’ opinion on the practices of providing breakfast to children aged 5-14 years before they go to school

Caregivers’ opinion	Local municipality		
	Ntabankulu	**Umzimvubu**	**Total**
Good	121 (85.2%)	106 (87.6%)	227 (86.3%)
Not good	6 (4.2%)	2 (1.7%)	8 (3.0%)
Do not know	15 (10.6%)	13 (10.7%)	28 (10.6%)
Total	**142 (100%)**	**121 (100%)**	**263 (100%)**

Table 5.18 Caregivers’ opinion on the difficulty of providing breakfast to children aged 5-14 years before they go to school

Caregivers’ opinion	Local municipality		
	Ntabankulu	**Umzimvubu**	**Total**
Difficult	72 (50.7%)	81 (66.9%)	153 (58.2%)
Not difficult	66 (46.5%)	40 (33.1%)	106 (40.3%)
Do not know	4 (2.8%)	0 (0%)	4 (1.5%)
Total	**142 (100%)**	**121 (100%)**	**263 (100%)**

Table 5.19 Caregivers' responses on the practice of providing breakfast to children aged 5-14 years before they go to school

Caregivers' responses on nutritional practices Local municipality			
	Ntabankulu	**Umzimvubu**	**Total**
Have breakfast	117 (82.4%)	94 (77.7%)	211 (80.2%)
Do not have breakfast	25 (17.6%)	27 (22.3%)	52 (19.8%)
Do not know	0 (0%)	0 (0%)	0 (0%)
Total	**142 (100%)**	**121 (100%)**	**263 (100%)**

Table 5.20 Caregivers' responses on the frequency of having breakfast over a week period

Frequency of having breakfast over a week period	Local municipality		
	Ntabankulu	**Umzimvubu**	**Total**
Every day	65 (45.8%)	67 (55.4%)	132 (50.2%)
Four to six times per week	50 (35.2%)	32 (26.4%)	82 (31.2%)
One to three times per week	15 (10.6%)	13 (10.7%)	28 (10.6%)
Never	12 (8.5%)	9 (7.4%)	21 (8.0%)
Total	**142 (100%)**	**121 (100%)**	**263 (100%)**

5.5.3 Number of meals

Further questions on the knowledge and attitudes of the caregivers regarding nutrition were based on the number of meals that are provided to their children aged between five and 14 years on a daily basis. Accordingly, when asked to indicate the number of meals that their children should have a day, most of the caregivers responded 'three times a day' (n=197, 74.9%), followed by those who said 'more than three times a day' (n=36, 13.7%) [Table 5.21].

A similar line of question was posed on the caregivers regarding their opinion on the practice of providing their children with 'three meals a day and a snack in between'. To this end, many said this is a 'good' practice (n=222, 84.4%), while the rest reported either 'do not know' (n=31, 11.8%) or 'not good' (n=10, 3.8%) [Table 5.22]. Those who responded 'good' felt that a provision of 'three meals a day and a snack in between' would make their children; a) grow fast, and b) perform well at school.

When asked if in reality they 'can afford' providing their children with 'three meals a day and a snack in between', most conceded that they cannot afford to (n=159, 60.5%)

[Table 5.23]. In line with this response, most caregivers admitted that the provision of such meals each day is ‘difficult’ (n=138, 52.5%), while the rest (n=125, 47.5%) said it is ‘not difficult’ (Table 5.24). The most cited sources of ‘difficulties’ in providing children with ‘three meals a day and a snack in between’ were reported as, a) expensive food, and b) drought.

Table 5.21 Caregivers’ opinion on the number of meals per day that should be provided to children aged 5-14 years before they go to school

Number of meals per day	Local municipality		
	Ntabankulu	Umzimvubu	Total
Twice	4 (2.8%)	3 (2.5%)	7 (2.7%)
Three times	96 (67.6%)	101 (83.5%)	197 (74.9%)
More than three times	26 (18.3%)	10 (8.3%)	36 (13.7%)
Do not know	16 (11.3%)	7 (5.8%)	23 (8.7%)
Total	**142 (100%)**	**121 (100%)**	**263 (100%)**

Table 5.22 Caregivers' opinion on providing children aged 5-14 years with three meals per day and a snack in between meals

Caregivers' opinion	Local municipality		
	Ntabankulu	**Umzimvubu**	**Total**
Good	106 (74.6%)	116 (95.9%)	222 (84.4%)
Not good	10 (7.0%)	5 (4.1%)	10 (3.8%)
Do not know	26 (18.3%)	0 (0%)	31 (11.8%)
Total	**142 (100%)**	**121 (100%)**	**263 (100%)**

Table 5.23 Caregivers' responses on the affordability of providing children aged 5-14 years with three meals per day and a snack in between

Caregivers' responses	Local municipality		
	Ntabankulu	**Umzimvubu**	**Total**
Can afford	61 (43.0%)	43 (35.5%)	104 (39.5%)
Cannot afford	81(57.0%)	78 (64.5%)	159 (60.5%)
Total	**142 (100%)**	**121 (100%)**	**263 (100%)**

Table 5.24 Caregivers' responses on the difficulty of providing children aged 5-14 years with three meals per day and a snack in between meals

Caregivers' responses	Local municipality		
	Ntabankulu	**Umzimvubu**	**Total**
Difficult	61 (43.0%)	77 (63.6%)	138 (52.5%)
Not difficult	81 (57.0%)	44 (36.4%)	125 (47.5%)
Total	**142 (100%)**	**121 (100%)**	**263 (100%)**

5.5.4 Variety of meals

This study also sought to make a brief assessment of nutritional knowledge and attitudes of the caregivers on the importance of providing their children aged between five and 14 years with 'different types of meals'. When asked to share their opinion on this practice, the overwhelming majority said this practice was 'good' (n=244, 92.8%), followed by those who said they 'do not know' (n=10, 3.8%) [Table 5.25]. The commonly cited reasons given for providing different types of meals are; a) children do get tired of eating the same food all the time, and b) different meals provide a wide range of nutrients that are needed by the body.

Notwithstanding the above responses on diversity of meals, more than half of the caregivers (n=139, 52.9%) said that it was 'difficult' to provide their children with different types of foods (Table 5.26). Cited causes of this 'difficulty' are; a) high prices of food, and b) unavailability of some foodstuffs in the local shops.

Table 5.25 Caregivers' opinion on providing children aged 5-14 years with different types of foods at meals

Caregivers' responses	Local municipality		
	Ntabankulu	**Umzimvubu**	**Total**
Good	137 (96.5%	107 (88.4%)	244 (92.8%)
Not good	3 (2.1%)	7 (5.8%)	10 (3.8%)
Do not know	2 (1.4%)	7 (5.8%)	9 (3.4%)
Total	**142 (100%)**	**121 (100%)**	**263 (100%)**

Table 5.26 Caregivers' opinion on the difficulty of providing children aged 5-14 years with different types of foods at meals

Caregivers' responses	Local municipality		
	Ntabankulu	**Umzimvubu**	**Total**
Difficult	76 (53.5%)	63 (52.1%)	139 (52.9%)
Not difficult	66 (46.5%)	58 (47.9%)	124 (47.1%)
Do not know	0 (0%)	0 (0%)	0 (0%)
Total	**142 (100%)**	**121 (100%)**	**263 (100%)**

5.5.5 Use of salt in food

Salt is an essential electrolyte in human nutrition and is used in cooking and preservation of food. However, salt is strongly linked to hypertension and cardiovascular mortalities (Ha, 2014). Part of this study was dedicated towards understanding knowledge and attitudes of the caregivers towards dietary salt and the extent to which it should be included in meals. The caregivers were requested to rate in a scale of either 'good' or 'not good' or 'don't know' the practice of preparing meals for children aged between five and 14 years with iodised salt. About 78.7% and 4.2% responded that they think it was a 'good', 'not good' practice, respectively. A further 17.1% said they 'don't know' (Table 5.27).

Further conversation with the caregivers during the field visits showed that generally, they are aware of the health dangers of excessive consumption of salt. The commonly mentioned health dangers were hypertension, and related conditions such stroke and heart attack.

Table 5.27 Caregivers' opinion on the practice of preparing meals for children aged 5-14 years with iodised salt

Caregivers' responses	**Local municipality**		
	Ntabankulu	**Umzimvubu**	**Total**
Good	135 (95.1%)	72 (59.5)	207 (78.7%)
Not good	0 (0%)	11 (9.1%)	11 (4.2%)
Do not know	7 (4.9%)	38 (31.4%)	45 (17.1%)
Total	**142 (100%)**	**121 (100%)**	**263 (100%)**

5.5.6 Overweight and obesity

Notwithstanding the problem of malnutrition which affects many South African communities, the same communities are also confronted with the problem of 'overweight' and 'obesity' (van Graan, Bopape, Phooko, Bourne & Wright, 2013). In fact, South Africans are the most 'overweight' and 'obese' over other populations in the sub-Saharan Africa. Knowledge and attitudes of the caregivers towards ‘overweight’ and ‘obesity’ were areas of interest in this study. Accordingly, they were asked to indicate the state of ‘overweight’ or ‘obesity’, if any, of any of their children aged between five and 14 years. In their responses, small numbers of 0.4% (n = 1) and 4.6% (n = 12) of the caregivers reported their children ‘overweight’ and ‘obese’, respectively. Interestingly, the majority (n = 221; 84.0%) said their children were neither ‘overweight’ nor ‘obese’, while 11% (n = 29) said they ‘don’t know’.

Various reasons were given for the above responses. For example, ‘overweight’ or ‘obese’ children were characterised by; a) big belly and /or big buttocks, b) big face, especially cheeks, c) they tire fast when walking or working, and d) fall drowsy easily. To the contrary, those who were reportedly neither ‘overweight’ nor ‘obese’ were said to; a) have their physical body parts and limbs in right proportions, b) be physically active, and c) be alert.

When requested to explain why their children had become ‘overweight’ or ‘obese’, the following reasons were mentioned, namely; a) excessive intake of energy-dense foods that are high in fat and /or sugar, b) lack or decreased physical activity, c) sleeping during the day after having a meal, d) heredity, and e) hormonal imbalance.

Lastly, the caregivers were asked to come up with preventative measures for ‘overweight’ or ‘obesity’. In their responses, the following preventative measures were mentioned, namely; a) reduction of consumption of energy-dense foods, b) eating more vegetables and fruits, c) eating legumes and whole grain products more often, d) increasing physical activity, e) avoid sleeping during the day, and f) regulate the use of contraceptives among young girls. Contraceptives are believed to be fattening girls.

Nevertheless, the caregivers’ assessment of their children’s body condition was later compared with the results of the anthropometric measurements taken in this study. These anthropometric measurements are presented in sub-section 6.5.2 of Chapter 6 of this thesis.

Table 5.28 Caregivers' classification of body condition of their children aged 5-14 years

Caregivers' responses	Local municipality		
	Ntabankulu	**Umzimvubu**	**Total**
Obese	0 (0%)	1 (0.8%)	12 (4.6%)
Overweight	9 (6.3%)	3 (2.5%)	1 (0.4%)
Do not know	16 (11.3%)	13 (10.7%)	29 (11.00%)
None of the above	117 (82.4%)	104 (86%)	221 (84.0%)
Total	**142 (100%)**	**121 (100%)**	**263 (100%)**

5.5.7 Nutritional advice

The depth of nutrition-related knowledge and attitudes of the caregivers is influenced by many factors including nutrition advice. Regarding this factor, caregivers were asked to indicate whether they receive nutrition advice from agricultural extension officers. Some (n = 110; 41.8%) responded in the affirmative, while the remaining majority (n = 153; 58.2%) responded to the contrary (Table 5.29). The kind of nutritional advice that is reportedly rendered by the agricultural extension officers includes, a) encouraging production of home vegetable gardens for sustainable and cheaper supply of dietary minerals and vitamins, b) and drinking clean water.

Table 5.29 Caregivers' responses on whether they receive nutrition advice from agricultural extension officers

Caregivers' responses	Local municipality		
	Ntabankulu	**Umzimvubu**	**Total**
Receive nutritional advice	95 (66.9%)	15 (12.4%)	110 (41.8%)
Do not receive nutritional advice	47 (33.1%)	106 (87.6%)	153 (58.2%)
Total	**142 (100%)**	**121 (100%)**	**263 (100%)**

Table 5.30 Caregivers' responses on whether they receive nutritional advice from organisations other than DRDAR

Caregivers' responses	Local municipality		
	Ntabankulu	**Umzimvubu**	**Total**
Other organisations provide nutritional advice	131 (92.3%)	108 (89.3%)	239 (90.9%)
No other organisations provide nutritional advice	11 (7.7%)	13 (10.7%)	24 (9.1%)
Total	**142 (100%)**	**121 (100%)**	**263 (100%)**

5.6 NUTRITIONAL PRACTICES

5.6.1 Introduction

This sub-section outlines the actual feeding behaviour that had unfolded in agri-business households understudied. The feeding behaviour is confined to the following elements, namely; consumption vitamin A and C-rich fruits and vegetables, frequency of consumption of breakfast, consumption of protein-rich foods, use of salt and water, and access to nutritional advice.

5.6.2 Consumption of vitamin A-rich fruits

Vitamin A is a fat-soluble compound and its sources are colourful fruits and vegetables, and some animal products (Tang, Qin, Dolnikowski, Russel & Grusak, 2009). The extent to which the caregivers' children aged 5-14 years consumed vitamin A-rich fruits was investigated. This investigation was limited to ripe mango / mango juice, and apricot or apricot juice. Specifically, the caregivers were asked if over the previous 24h period their children had consumed any of the above fruits. A large number of caregivers reported that their children had not consumed any of the abovementioned fruits (n=203, 77.2%), while only 29 (11.0%) and 26 (9.9%) indicated that their children had consumed ripe mango / mango juice or apricot, respectively (Table 5.31).

Table 5.31 Caregivers' responses on whether their children aged 5-14 years had consumed vitamin A-rich fruits during the previous 24h

Consumed Vitamin A rich fruits	Local municipality		Total
	Ntabankulu	Umzimvubu	
Ripe mango or mango juice	13 (9.2%)	16 (13.2%)	29 (11%)
Apricot	21 (14.8%)	5 (4.1%)	26 (9.9%)
Both fruit	0 (0%)	0 (0%)	0 (0%)
None of the above fruits	103 (72.5%)	100 (82.6)	203 (77.2%)
Do not know	5 (3.5%)	0 (0%)	5 (1.9%)
Total	**142 (100%)**	**121 (100%)**	**263 (100%)**

5.6.3 Consumption of vitamin A-rich vegetables

As with vitamin A-rich fruits, a similar investigation was extended to vitamin A-rich vegetables. The vegetables under investigation were pumpkin / squash fruit and carrot. Accordingly, the caregivers were asked to indicate whether over the previous 24h period their children aged between five and 14 years had consumed any of the abovementioned vegetables. In their responses, most caregivers indicated that their children had consumed carrot (n=169, 64.3%), followed pumpkin / squash (n=51, 19.4%) [Table 5.32].

Table 5.32 Caregivers' responses on whether their children aged 5-14 years had consumed vitamin A rich vegetables during the previous 24h

Consumed vitamin A rich vegetables	Local municipality		
	Ntabankulu	**Umzimvubu**	**Total**
Pumpkin / squash fruit	38 (26.8%)	13 (10.7%)	51(19.4%)
Carrot	89 (62.7%)	80 (66.1%)	169 (64.3%)
None of the above vegetables	15 (10.6%)	28 (23.1%)	43 (16.3%)
Total	**142 (100%)**	**121 (100%)**	**263 (100%)**

5.6.4 Consumption of vitamin C-rich fruits

Vitamin C is a compound that has antioxidant properties, and has many functions which include a therapeutic role in protecting brain cells from free radical damage (Riboli & Norat, 2003). In the current study, the frequency of consumption of vitamin C-rich fruits by the caregivers' children aged between five to 14 years was confined to oranges, naartjies, grapefruit and lemons. Firstly, the caregivers were asked if their children usually consume any of the above fruits. The majority responded in the affirmative (n=205, 77.9%) [Table 5.33]. When requested to quantify the frequency of consumption of citrus, most caregivers said the consumption is 'once per week' (n=96, 39.5%), while 42 (16.0%) said it is 'twice per week' [Table 5.34]. Noticeably, responses of a sizeable number of caregivers to this question was 'never' (n=45, 17.1%), while a remarkable number responded 'do not know' (n=22, 8.4%).

Table 5.33 Caregivers' responses on the frequency of consumption of vitamin C fruits by their children aged 5-14 years

Frequency of consumption of vitamin C fruits	Local municipality		
	Ntabankulu	**Umzimvubu**	**Total**
Often	93 (65.5%)	112 (92.6%)	205 (77.9%)
Not often	35 (24.6%)	9 (7.4%)	44 (16.7%)
Do not know	14 (9.9)	0 (0%)	14 (5.3%)
Total	**142 (100%)**	**121 (100%)**	**263 (100%)**

Table 5.34 Caregivers' responses on the number of times per week in which their children aged 5-14 years consume vitamin C-rich fruits

Number of times per week	Local municipality		
	Ntabankulu	**Umzimvubu**	**Total**
Every day	20 (14.1%)	6 (5.0%)	26 (9.9%)
Thrice per week	16 (11.3%)	16 (13.2%)	32 (12.2%)
Twice per week	17 (12.0%)	25 (20.7%)	42 (16.0%)
Once per week	37 (26.1%)	59 (48.8%	96 (36.5%)
Never	32 (22.5%)	13 (10.7%)	45 (17.1%)
Do not know	20 (14.1%)	2 (1.7%)	22 (8.4%)
Total	**142 (100)**	**121 (100%)**	**263 (100%)**

5.6.5 Consumption of protein-rich foods

Also investigated in this study was the consumption of a wide range of protein-rich foods by the caregivers' children age between five to fourteen years. Protein is a nutrient that is made up of amino acids, and is important for growth and maintenance of body tissues (Wellman & Kamp, 2008). The protein-rich foods in question were; a) organ meat (liver, kidney and heart), b) flesh meat (beef, mutton, pork and chicken), and c) fish (fresh fish, canned fish, prawns, mussels, crayfish, crabs and oysters).

The caregivers were asked if their children had consumed any of the abovementioned protein-rich foods over the past 24 hours. With respect to 'organ meat', about half of the caregivers responded that their children had consumed 'organ meat' (n=123, 46.8%), while others said they have consumed 'none of the organ meat' (n=122, 46.4%) [Table 5.35]. Noticeably, liver was the most popular 'organ meat', followed by kidney and heart.

On 'flesh meat', the majority of caregivers reported that their children had consumed 'chicken' (n=160, 60.8%), while a sizeable number (n=83, 31.6%) said their children had consumed 'none of the flesh meat' (Table 5.36). 'Beef' (n=4, 1.5%) and 'pork' (n= 5, 1.9%) consumption was restricted to very few households.

Regarding 'fish', only the consumption of 'canned fish' (n=161, 61.2%) and 'fresh fish' (n=13, 4.9) were registered by the caregivers (Table 5.37). No consumption of seafood (prawns, mussels, crayfish, crabs, oysters) was reported.

Lastly, a question was raised to the caregivers in order to establish their children's taste for the protein-rich foods referred to above. To this end, the majority of caregivers (n=174, 66.2%) indicated that their children 'like' the taste of these protein-rich foods, while 45 (17.1%) said their children dislike it (see Table 5.38).

Table 5.35 Caregivers' responses on whether their children aged 5-14 years had consumed organ meat in the previous 24h

Organ meat consumed	Local municipality		
	Ntabankulu	Umzimvubu	Total
Liver	76 (53.5%)	47 (38.8%)	123 (46.8%)
Kidney	6 (4.2%)	0 (0%)	6 (2.3%)
Heart	5 (3.5%)	7 (5.8%)	12 (4.6%)
None of the above	55 (38.7%)	67 (55.4%)	122 (46.4%)
Total	**142 (100%)**	**121 (100%)**	**263 (100%)**

Table 5.36 Caregivers' responses on whether their children aged 5-14 years had consumed flesh meat in the previous 24h

Flesh meat consumed	Local municipality		
	Ntabankulu	Umzimvubu	Total
Mutton	2 (1.4%)	9 (7.4%)	11 (4.2%)
Beef	3 (2.1%)	1 (0.8%)	4 (1.5%)
Pork	5 (3.5%)	0 (0%)	5 (1.9%)
Chicken	103 (72.5%)	57 (47.1%)	160 (60.8%)
None of the above	29 (20.4%)	54 (44.6%)	83 (31.6%)
Total	**142 (100%)**	**121 (100%)**	**263 (100%)**

Table 5.37 Caregivers' responses on whether their children aged 5-14 years had consumed fish in the previous 24h

Fish consumed	**Local municipality**		
	Ntabankulu	**Umzimvubu**	**Total**
Fresh fish	8 (5.6%)	5 (4.1%)	13 (4.9%)
Canned fish	98 (69.0%)	63 (52.1%)	161 (61.2%)
Sea food	0 (0%)	0 (0%)	0 (0%)
No fish consumed	36 (25.4%)	53 (43.8%)	89 (33.8%)
Total	**142 (100%)**	**121 (100%)**	**263 (100%)**

Table 5.38 Caregivers' responses on whether their children aged 5-14 years like or dislike the taste of protein-rich foods of animal origin

Caregivers' responses on their children' taste for protein-rich foods **Local municipality**			
	Ntabankulu	**Umzimvubu**	**Total**
Like it	88 (62.0%)	86 (71.1%)	174 (66.2%)
Dislike it	15 (10.6%)	30 (24.8%)	45 (17.1%)
Not sure	39 (27.5%)	5 (4.1%)	44 (16.7%)
Total	**142 (100%)**	**121 (100%)**	**263 (100%)**

5.7 CHAPTER SUMMARY

Based on their responses to the nutritional questions asked, most caregivers were found to have good knowledge on various aspects of nutrition. However, their feeding practices were rather modest. That is, most of the caregivers' households could not provide their children with breakfast seven days a week before they go to school or church. Furthermore, most of the households could not provide their children with three meals a day and a snack in between, and the provision of a variety of meals to their children proved difficult. Generally, among of the caregivers' children, there was poor consumption of vitamin A and C-rich fruits, but a good consumption of vitamin A-rich vegetables. Most households had good consumption of flesh meat, particularly chicken, canned fish and organ meat, to a limited extent. Furthermore, most households had access to clean tap water for consumption and sanitary purposes. Notwithstanding their modest feeding practices, the overwhelming majority of caregivers appraised their children's body condition as good.

CHAPTER 6
DATA ON THE 24H DIETARY RECALL METHOD, FOOD FREQUENCY QUESTIONNAIRE, AND ANTHROPOMETRIC MEASUREMENTS

6.1 INTRODUCTION

This chapter presents results on the nutritional status of the caregivers' children aged 5-14 years. These results, which were obtained from the 24h dietary recall method and qualitative food frequency questionnaire (FFQ) led to the generation of food variety scores (FVS), dietary diversity scores (DDS), and nutrient intake, all of which are indicators of nutritional status. The 25 nutrients whose intake was under investigation are, namely; energy, carbohydrates, protein, total dietary fibre, calcium, iron, magnesium, phosphorus, zinc, chromium, selenium, iodine, vitamin A, vitamin B6, vitamin B12, vitamin C, vitamin D, vitamin E, vitamin K, thiamin, riboflavin, niacin, folate, pantothenic acid and biotin.

Further results on the children's nutritional status which were obtained from anthropometric measurements are also presented in this chapter. Towards the end of this chapter, a presentation is made of the results of this study's hypotheses, and the results of association between selected socio-economic status and nutritional variables that have been presented in the previous chapter.

6.2 FOOD CONSUMPTION PATTERNS

This section of the chapter reports on food consumption patterns of 327 children of the 263 caregivers that were under investigation in this study. Generally, the results of food consumption patterns, which culminated to those of FVS and DDS that are outlined in the subsequent sections of this chapter, were similar between the 24h dietary recall and FFQ methods. This situation was confirmation of the accuracy and validity of this study's results (Anderson *et al*., 2004; Kristjansdottir *et al*., 2006 & Amend *et al*., 2007). Worthy to mention, the results from the 24h dietary recall method were quantitative, while those from FFQ method were qualitative. To this end, the results from the former method were used also establish food consumption quantities and adequacy of nutrient intake.

Nevertheless, the food consumption patterns were on 72 identified food items that fall within nine food groups. The food groups and the number of food items that they can possibly consume are namely, cereal, roots and tubers (n = 7); flesh foods (n = 10); dairy products (n = 7); legumes and nuts (n = 5); eggs (n = 1); vitamin A-rich vegetables and fruits (n = 8); others fruits and juices (n = 14); other vegetables (n = 13); and fats and oils (n = 7). The exact names of the 72 food items are outlined later in this sub-section.

During the 3-day 24h dietary recall, the average number of food items consumed by the 327 children, aged 5-14 years was 23.48, range being 4-42 food items (Table 6.1). Among the nine food groups that are listed above, the widest variety of food items that were consumed was recorded from `cereal, roots and tubers' (5.05 ± 0.89), followed by the `other vegetables' (4.03 ± 0.86), `flesh foods' (3.22 ± 1.08) and `vitamin A-rich vegetables and fruits' (3.06 ± 1.20). The `eggs group' had the lowest FVS (0.38 ± 0.49) as a result of having only one food item. The results from FFQ showed fairly similar feeding patterns amongst the nine food groups. However, the overall FVS from FFQ (25.51) was significantly higher ($p \leq 0.05$) than that from the 24h dietary recall method (23.43) [see Table 6.1]

The above aggregated results on food consumption patterns and FVS mirrored those recorded from Ntabankulu and Umzimvubu Local Municipalities (see Tables 6.2.1 – 6.2.2). With respect to the 24h dietary recall method, the former municipal area had a slightly higher FVS of 23.48 than the latter's 23.36 ($p \geq 0.05$). A similar trend was observed with FFQ where FVS from Ntabankulu were higher ($p \leq 0.05$) than those from Umzimvubu.

Table 6.3 lists several food items from each of the nine food groups that a caregiver's household can possibly feed to a child aged between five and 14 years. Further discussions on food consumption patterns and FVS are made in the subsequent sub-section wherein all nine food groups are covered individually. Again, the food consumption patterns among the nine food groups were similar on both the 24h dietary recall method and FFQ.

Table 6.1 The 24h dietary recall and FFQ's aggregated food variety scores within food groups

Food Group	24h dietary recall		FFQ	
	Mean	SD	Mean	SD
Cereal, roots and tubers	5.05	0.89	5.26	1.01
Fleshy foods	3.22	1.08	3.34	0.92
Dairy products	1.97	1.14	2.30	0.84
Legumes and nuts	1.00	0.58	1.08	0.63
Eggs	0.38	0.49	0.31	0.21
Vitamin A-rich vegetables and fruits	3.06	1.20	3.80	0.97
Other fruits and juices	2.85	1.93	2.80	1.02
Other vegetables	4.03	2.48	4.59	1.98
Fats and oils	1.86	0.86	2.03	0.74
Total Food Items	**23.43**		**25.51**	

Table 6.2.1 The 24h dietary recall's summary of food variety scores within food groups from Ntabankulu and Umzimvubu Local Municipalities

Food Group	Local municipality			
	Ntabankulu		Umzimvubu	
	Mean	SD	Mean	SD
Cereal, roots and tubers	4..8	0.75	5.28	0.99
Flesh foods	3.32	1.10	3.11	1.05
Dairy products	2.04	1.18	1.89	1.10
Legumes and nuts	0.96	0.57	1.06	0.58
Eggs	0.54	0.50	0.20	0.40
Vitamin A-rich vegetables and fruits	3.13	1.09	2.97	1.31
Other fruits and juices	2.78	1.93	2.93	1.93
Other vegetables	4.04	2.46	4.02	1.31
Fats and oils	1.82	0.84	1.91	0.88
Total number of food items	**23.48**		**23.36**	

Table 6.2.2 FFQ's summary of food variety scores within food groups from Ntabankulu and Umzimvubu Local Municipalities

Food Group	Local municipality			
	Ntabankulu		Umzimvubu	
	Mean	SD	Mean	SD
Cereal, roots and tubers	5.60	1.20	4.92	1.40
Flesh foods	3.47	0.74	3.20	0.99
Dairy products	2.50	0.56	2.10	0.82
Legumes and nuts	0.84	0.48	1.31	0.64
Eggs	0.42	0.39	0.19	0.23
Vitamin A-rich vegetables and fruits	4.3	1.20	3.30	1.22
Other fruits and juices	2.80	1.32	2.83	1.35
Other vegetables	5.2	1.89	3.97	1.41
Fats and oils	2.1	0.72	1.96	0.61
Total number of food items	**27.23**		**23.75**	

Table 6.3 The 24h dietary recall and FFQ's aggregated household food access measured by the food variety within the food groups consumed (n=263)

NB: Unshaded column - 24h dietary recall;

Cereal, roots & tubers (n=7)			**Cereal, roots & tubers (n=7)**			**Flesh foods (n=10)**			**Flesh foods (n=10)**			
No. of food items	**N**	**% of n**	**No. of food items**	**N**	**% of n**	**No. of food items**	**N**	**% of n**	**No. of food items**	**N**	**% of n**	**No. of food items**
0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0
1	0	0.0	1	0	0.0	1	21	8.0	1	20	7.6	1
2	0	0.0	2	0	0.0	2	38	14.4	2	36	13.7	2
3	8	3.0	3	5	1.9	3	94	35.7	3	97	36.9	3
4	58	22.1	4	53	20.6	4	81	30.8	4	72	27.4	4
5	127	48.3	5	130	49.4	5	29	11.0	5	38	14.4	5
6	54	20.5	6	56	21.3	6	0	0.0	6	0	0.0	6
7	16	6.1	7	18	6.8	7	0	0.0	7	0	0.0	7
						8	0	0.0	8	0	0.0	8
						9	0	0.0	9	0	0.0	9
						10	0	0.0	10	0	0.0	10

Shaded column - FFQ

Table 6.3 The 24h dietary recall and FFQ's aggregated household food access measured by the food variety within the food groups consumed (n=263) [continued]

Dairy products (n=7)			Dairy products (n=7)			Legumes & nuts (n=5)			Legumes & nuts (n=5)		
No. of food items	N	% of n	No. of food items	N	% of n	No. of food items	N	% of n	No. of food items	N	% of n
0	13	4.9	0	9	3.4	0	31	11.8	0	26	9.9
1	56	22.1	1	49	18.6	1	212	80.6	1	221	84.0
2	163	62.0	2	179	68.1	2	8	3.0	2	6	2.3
3	5	1.9	3	6	2.3	3	12	4.6	3	10	3.8
4	9	3.4	4	7	2.7	4	0	0.0	4	0	0.0
5	7	2.7	5	7	2.7	5	0	0.0	5	0	0.0
6	8	3.0	6	6	2.3						
7	0	0.0	7	0	0.0						

Table 6.3 The 24h dietary recall and FFQ's aggregated household food access measured by the food variety within the food groups consumed (n=263) [continued]

Eggs (n=1)			Eggs (n=1)			Vitamin A-rich vegetables and fruits (n=8)			Vitamin A-rich vegetables and fruits (n=8)			
No. of food items	**N**	**% of n**	**No. of food items**	**N**	**% of n**	**No. of food items**	**N**	**% of n**	**No. of food items**	**N**	**% of n**	**No. of food items**
0	163	62.0	0	169	64.3	0	13	4.9	0		18	6.8
1	100	38.0	1	94	35.7	1	14	5.3	1		16	6.1
						2	39	14.8	2		42	16.0
						3	98	37.3	3		92	35.0
						4	77	29.3	4		72	27.4
						5	22	8.4	5		23	8.7
						6	0	0.0	6		0	0.0
						7	0	0.0	7		0	0.0
						8	0	0.0	8		0	0.0

Table 6.3 The 24h dietary recall and FFQ's aggregated household food access measured by the food variety within the food groups consumed (n=263) [continued]

Other fruits and juices (n=14)			Other fruits and juices (n=14)			Other vegetables (n=13)			Other vegetables (n=13)		
No. of food items	N	% of n	No. of food items	N	% of n	No. of food items	N	% of n	No. of food items	N	% of n
0	28	10.6	0	29	11.0	0	13	4.9	0	10	3.8
1	45	17.1	1	43	16.3	1	39	14.8	1	37	14.1
2	50	19.0	2	53	20.2	2	29	11.0	2	30	11.4
3	52	19.8	3	49	18.6	3	26	9.9	3	24	9.1
4	29	11.0	4	28	10.6	4	46	17.5	4	48	18.3
5	36	13.7	5	40	15.2	5	51	19.4	5	50	19.0
6	14	5.3	6	21	8.0	6	17	6.5	6	22	8.4
7	3	1.1	7	3	1.1	7	16	6.1	7	18	6.8
8	6	2.3	8	6	2.3	8	10	3.8	8	9	3.4
9	0	0.0	9	0	0.0	9	9	3.4	9	9	3.4
10	0	0.0	10	0	0.0	10	6	2.3	10	4	1.5
11	0	0.0	11	0	0.0	11	1	0.4	11	2	0.8
12	0	0.0	12	0	0.0	12	0	0.0	12	0	0.0
13	0	0.0	13	0	0.0	13	0	0.0	13	0	0.0
14	0	0.0	14	0	0.0						
15	0	0.0	15	0	0.0						
16	0	0.0	16	0	0.0						

Table 6.3 The 24h dietary recall and FFQ's aggregated household food access measured by the food variety within the food groups consumed (n=263) [continued]

Fats & oils (n=7)			Fats & oils (n=7)		
No. of food items	**N**	**% of n**	**No. of food items**	**N**	**% of n**
0	26	9.9	0	19	7.0
1	28	10.6	1	32	12.2
2	176	66.9	2	184	70.0
3	22	8.4	3	19	7.2
4	11	4.2	4	9	3.4
5	0	0.0	5	0	0.0
6	0	0.0	6	0	0.0
7	0	0.0	7	0	0.0

6.2.1 Cereal, roots and tubers

The `cereal, roots and tubers' group comprises of the following seven food items**:**

- Maize (mealie meal, mealie rice, pap, porridge, sweet corn, corn on the cob);
- All tubers / roots (potatoes, sweet potatoes, and *amadumbe*);
- All bread (white, brown or whole wheat)
- Dumpling, steamed bread and *vetkoek* (fat cake)
- Scones and biscuits
- *Amarhewu*
- Breakfast cereals (corn flakes, oats weet bix, matabela, morvite)

Table 6.3 shows that in both the 24h dietary recall and FFQ, with the exception of the `eggs' group, which does not have a variety of food items (n = 1), the `cereal, roots and tubers' was the only food group wherein the consumption of all seven food items was recorded. With respect to the 24h dietary recall, a minimum of three food items were consumed by 3% (n = 8) of the caregivers' households, while a maximum of seven was consumed by 6.1% (n = 16). The majority of caregivers' households (n = 127; 48.3%) consumed five food items.

These results were not surprising, because food items from this food group were a source of energy-rich staple food which featured high in the list of the 20 top food items that were consumed during the 3-day 24h dietary recall and 7-day qualitative FFQ (Tables 6.4 and 6.5).

6.2.2 Flesh foods

The following food items constitute `flesh foods'**:**

- Beef;
- Mutton, lamb;
- Pork;
- Minced meat;
- Dried meat (*biltong*);
- Offal/tribe/heads/feet;
- Fresh fish;
- Seafood (calamari, prawns, mussels, crab, shrimp, crayfish);
- Canned fish (sardines, pilchards, tuna); and
- Processed meat (russians, *boerewors*, sausage, polony, viennas)

Unlike the `cereal, roots and tubers' food group that has been discussed in the previous sub-section, five out of ten food items were consumed from `flesh foods' during the 3-day 24h dietary recall. Furthermore, food items from this food group fell at the bottom of the table of the list of top 20 most consumed food items (Table 6.4). The large majority of caregivers' households (n = 94; 35.7%) consumed three food items followed by those (n = 81; 30.8%) who consumed four food items. Noticeably, canned fish was the most consumed source of animal protein, followed by chicken. The results from the qualitative FFQ mirrored fairly similar consumption patterns of food items of the `flesh food' group wherein canned fish, chicken and processed meat (e.g. russians) was respectively consumed by 89.29%, 84.41% and 82.14% of the caregivers' households (Table 6.5). Only a few caregivers' households could afford beef (39.29%) or mutton / lamb (25.00%) among `flesh foods'. Seafood (e.g. calamari, prawns) was not consumed at all.

6.2.3 Dairy products

Outlined below are food items of `dairy products'**:**

- Fresh milk;
- Amasi / Maas;
- Powdered milk (unsweetened);
- Condensed milk;
- Cheese;
- Ice cream; and
- Custard

The majority of `dairy products' (85.71%) were consumed during the 3-day 24h dietary recall (Table 6.3). Similar feeding patterns were observed on FFQ scale. Fresh milk and sour milk (*amasi)* were among the list of top 20 most consumed food items (Table 6.4). The former was linked to drinking of tea, while the latter was consumed with crumbed maize meal (*umphokoqo*), both of which also befittingly featured in the list of top 20 most consumed foods items.

6.2.4 Legumes and nuts

The `legumes and nuts' food group comprise of the following food items**:**

- Whole dried beans;
- Dried peas;
- Lentils;
- Soya; and
- Peanuts and nuts

During the 3-day 24h dietary recall, three out of five food items were consumed from this food group (Table 6.3). The overwhelming majority of caregivers' households (n=212; 80.6%) consumed one food item which was largely dried beans that were often prepared with maize samp of the `cereal, roots and tubers' food group. The results from the qualitative FFQ showed that most caregivers' households (n = 225; 85.71%) consumed dried beans, followed by peanuts and nuts (n = 19; 7.14%), and dried peas (n =9; 3,57%). Soya and lentils were not consumed (Table 6.5).

6.2.5 Eggs

As indicated earlier in this chapter, the `eggs' food group has one food item only, the eggs.

Results from both the 24h dietary recall and qualitative FFQ showed a fairly poor consumption of eggs among the caregivers' households. The former method showed that most households (n= 212; 80.6%) did not consume eggs (Table 6.3), while the latter method indicated that 122 (46.39%) did not consumed this food item over a 7-day period under investigation (Table 6.5). Consequently, eggs fell outside the list of top 20 most consumed food items.

6.2.6 Vitamin A-rich vegetables and fruits

The vegetables and fruits that comprise this food group are listed as follows:

- Carrots;
- Pumpkin;
- Butternut;
- Spinach;
- Wild leafy vegetables, fresh and dried;
- Apricot;
- Peach (yellow cling); and
- Mango.

The results of the 24h dietary recall showed that most of the caregivers' households (n = 98; 37.3%) consumed three food items from this food group (Table 6.3). Carrots were the most popular food item, and they featured in the list of top 20 most consumed food items (see Table 6.4). The results from the qualitative FFQ showed high consumption of carrots (n = 231; 87.83%), spinach (n = 219; 83.27%) and pumpkin (n = 194; 73.76%) and very poor consumption of fruits such as apricot (n = 8; 3.04%) and mango (n = 27; 10.27%), among others (Table 6.5). No consumption of wild leafy vegetables was recorded.

Worthy to mention, the results on the high consumption of carrots and low consumption apricot and mango are consistent with those presented in the previous chapter wherein the households' nutritional knowledge, attitudes and practices were discussed.

6.2.7 Other fruits and juices

The `other fruits and juices' food group is made up of the following food items**:**

- Apples;
- Pear;
- Peaches;
- Grapes (red / green);
- Plum;
- Orange;
- Lemon;
- Naartjie;
- Banana;
- Pineapple;
- Avocado;
- Kiwi fruit;
- Watermelon;
- Guava;
- Pap-paw; and
- Juice (100% juice; e.g. liquifruit, ceres)

Results from the 3-day 24h dietary recall indicated that eight out of fourteen food items were consumed from this food group. A fairly even numbers of caregivers' households consumed two (n=50; 19%) and three (n=52; 19.8%) food items (Table 6.3). None of the food items from this food group appeared in the list of the top 20 most consumed food items. According to findings from the qualitative FFQ, apples (n = 150; 57.14%) were the most consumed fruit, followed by oranges (n = 141; 53.7%) and naartjies (n = 85; 32.14%). The consumption of bananas was low (n = 75; 28.57%) against the expectation that it would be high due to the proximity of the studied population to banana plantations of the province of KwaZulu-Natal.

6.2.8 Other vegetables

The following food items constitute the `other vegetables' food group**:**

- Cabbage;
- Cauliflower;
- Broccoli;
- Onions;
- Beetroot;
- Tomatoes;
- Fresh green beans;
- Fresh peas;
- Lettuce;
- Chilli (red / green);
- Green / yellow / red pepper;
- Frozen vegetables (mixed); and
- Ginger and garlic (fresh).

Unlike the `other fruits and juices' food group, results of the 24h dietary recall showed that a wider range of food items were consumed in the `other vegetables' food group. That is, 84.6% of the food items were consumed. The majority (n = 51; 19.4%) of caregivers' households consumed five food items, followed by those (n = 46; 17.5%) who consumed four food items (Table 6.3). Cabbage was the most popular food item in this group, and it appeared in the list of top 20 most consumed food items. Results of the qualitative FFQ echoed those from the 24h dietary recall. That is, most of the caregivers' households consumed cabbage (n = 237; 90.11%), followed by the consumption of tomatoes (n = 148; 56.27%) and onions (n = 150; 57.14%). The latter featured in the top 20 most consumed food items, because it was linked to preparation of meals that include canned fish and chicken which also appeared in the list in question.

6.2.9 Fats and oils

The following food items make the `fats and oils' food group**:**

- Butter;
- Margarine;
- Sunflower oil;
- Lard;
- Salad dressing / oil;
- Potato crisps; and
- Coffee creamer (e.g. Cremora, Eliis Brown).

Findings from the 24h dietary recall showed that four out of seven food items were consumed from this food group. The majority (n = 176; 66.9%) of caregivers' households consumed two food items, while 26 (9.9%) consumed none (Table 6.3). Sunflower oil was the most popular food items in this food group, and it appeared in the list of top 20 most consumed food items (Table 6.4). Sunflower oil was linked to preparation of meals that are based on some food items which also appeared in the list referred to above. The food items are canned fish, chicken, maize samp, among many. The qualitative FFQ also recorded sunflower oil as the most consumed food items in the caregivers' households (n = 225; 85.71%), followed by coffee creamer (n = 199; 75.66%) which also appeared in the list of top 20 most popular food items.

Table 6.4 The top 20 most consumed food items measured by the 24h dietary recall and qualitative FFQ

	24h dietary recall		FFQ	
Rank	**Food item**	**Mean food intake, g/person/day**	**Rank**	**Food item**
1	Maize meal soft porridge	99.23±74.56	1	White sugar
2	Instant tea	182.14±131.38	2	Maize meal stiff pap
3	White sugar	19.99±7.05	3	Sweetened cold drink
4	Maize meal stiff pap	123.49±72.79	4	Brown bread/rolls
5	Brown bread/rolls	27.58±30.81	5	Maize meal soft porridge
6	*Amarhewu*	176.78±174.66	6	Instant tea
7	Crumbed maize meal (*umphokoqo*)	107.67±105.07	7	A*marhewu*
8	Fresh milk	21.85±26.34	8	Coffee creamer
9	Potatoes	21.38±14.34	9	Crumbed maize meal (*umphokoqo*)
10	Samp	156.63±139.91	10	Fresh milk
11	Rice	64.86±36.03	11	Rice
12	Sour milk (*amasi*)	128.57±118.77	12	Potatoes
13	Carrot	14.28±10.94	13	Samp
14	Baked bread, homemade	49.16±50.43	14	Sunflower oil
15	Cabbage	10.64±12.47	15	Amasi
16	Spinash	10.17±14.89	16	Carrot
17	Onion	8.78±11.74	17	Baked bread, homemade
18	Sunflower oil	23.85±32.99	18	Cabbage
19	Canned fish	13.66±17.56	19	Canned fish
20	Chicken	33.81±39.95	20	Spinach

Table 6.5 Food groups, food varieties and the number of caregivers' households who consumed the food items by FFQ (n=263)

Food Group	Food varieties	N
Cereal, roots and tubers	Maize meal	254 (96.43%)
	Potatoes	248 (94.30%)
	Brown bread/ rolls	244 (92.86%)
	Dumpling, steamed break and fat koek	225 (85.71%)
	Scones, biscuits	28 (10.71%)
	Amarhewu	212 (80.61%)
	Breakfast cereals (corn flakes, oats. Sweet corn, weet bix, matabela,	32 (10.65%)
Flesh Foods	Beef	103 (39.29%)
	Mutton, lamb	66 (25.00%)
	Pork	38 (14.29%)
	Chicken	222 (84.41%)
	Minced meat	47 (17.86%)
	Dried meat (biltong)	9 (3.57%)
	Offal/tribe/heads/feet	160 (60.71%)
	Fresh fish	19 (7.14%)
	Seafood (Calamari, prawns, mussels, crab, shrimp, crayfish)	0 (0%)
	Canned fish (sardines, pilchards, tuna)	235 (89.29%)
	Processed meat (Russians, boerewors sausage, polony, viennas)	216 (82.14%)
Dairy products	Fresh milk	197 (75.00%)
	Sour milk (*amasi*)	230 (87.45%)
	Powdered milk (unsweetened)	7 (2.66%)
	Condensed milk	0 (0%)
	Cheese	38 (14.29%)
	Ice cream	26 (9.89%)
	Custard	28 (10.71%)
Legumes and nuts	Whole dried beans	225 (85.71%)
	Dried peas	9 (3.57%)
	Lentils	0 (0%)
	Soya	0 (0%)
	Peanuts and nuts	19 (7.14%)

Table 6.5 Food groups, food varieties and the number of caregivers' households who consumed the food items by FFQ (n=263)[continued]

Food group	Food varieties	N
Eggs	Eggs	141 (53.57%)
Vitamin A-rich vegetables and fruits	Carrots	231 (87.83%)
	Pumpkin	194 (73.76%)
	Butternut	85 (32.14%)
	Spinach	219 (83.27%)
	Wild leafy vegetables, fresh and dried	0 (0%)
	Apricot	8 (3.04%)
	Peach (yellow cling)	66 (25.00%)
	Mango	27 (10.27%)
Other fruits and juices	Apples	150 (57.14%)
	Pear	19 (7.14%)
	Peaches	47 (17.86%)
	Grapes (red / green)	11 (4.18%)
	Plum	0 (0%)
	Orange	141 (53.57%)
	Lemon	5 (1.90%)
	Naartjies	85 (32.14%)
	Banana	75 (28.57%)
	Pineapple	18 (6.84%)
	Avocado	16 (6.08%)
	Kiwi fruit	0 (0%)
	Watermelon	28 (10.71%)
	Guava	0 (0%)
	Pap-paw	0 (0%)
	Juice (100% juice; e.g. liquifruit, ceres)	0 (0%)

Table 6.5 Food groups, food varieties and the number of caregivers' households who consumed the food items measured by FFQ (n = 263) [continued]

Food group	Food varieties	N
Other vegetables	Cabbage	237 (90.11%)
	Cauliflower	15 (5.70%)
	Broccoli	85 (32.14%)
	Onions	150 (57.14%)
	Beetroot	122 (46.43%)
	Tomatoes	148 (56.27%)
	Fresh green beans	6 (2.28%)
	Fresh peas	0 (0%)
	Lettuce	18 (6.84%)
	Chilli (red / green)	56 (21.43%)
	Green / yellow / red pepper	103 (39.29%)
	Frozen vegetables (mixed)	111 (42.21%)
	Ginger and garlic (fresh)	12 (4.56%)
Oils and fats	Butter	19 (7.14%)
	Margarine	188 (71.43%)
	Sunflower oil	225 (85.71%)
	Lard	10 (3.80%)
	Salad dressing / oil	17 (6.46%)
	Potato crisps	12 (4.56%)
	Coffee creamer (e.g. Cremora, Eliis Brown)	199 (75.66)

6.3 FOOD VARIETY SCORES

In a similar work conducted by Matlala (2008) in the Gauteng Province of South Africa, FVS were classifies as following; a) < 30 food items consumed – Low FVS; b) 30-60 food items consumed – Medium FVS; and > 60 food items consumed – High FVS.

In view of the FVS results that have been presented in Tables 6.1-6.3 and in consideration of the aforementioned classification of FVS, the 24h dietary recall method showed that most of the caregivers' households (n = 215; 81.7%) had Low FVS, followed by those with Medium FVS (n = 48; 18.3%) [see Figure 6.3.1]. None were in the High FVS category. A similar trend was observed on the FFQ scale wherein most households were in low FVS (n=197; 74.9%) and fewer were found in medium FVS (n=66; 25.1%) [see Figure 6.3.2]. This overall picture on the FVS of the 263 caregivers' households is reflective of a similar picture observed on the two municipality areas of Ntabankulu and Umzimvubu, irrespective of dietary assessment method used (see Figures 6.1.1-6.1.2, and Figures 6.2.1-6.2.2).

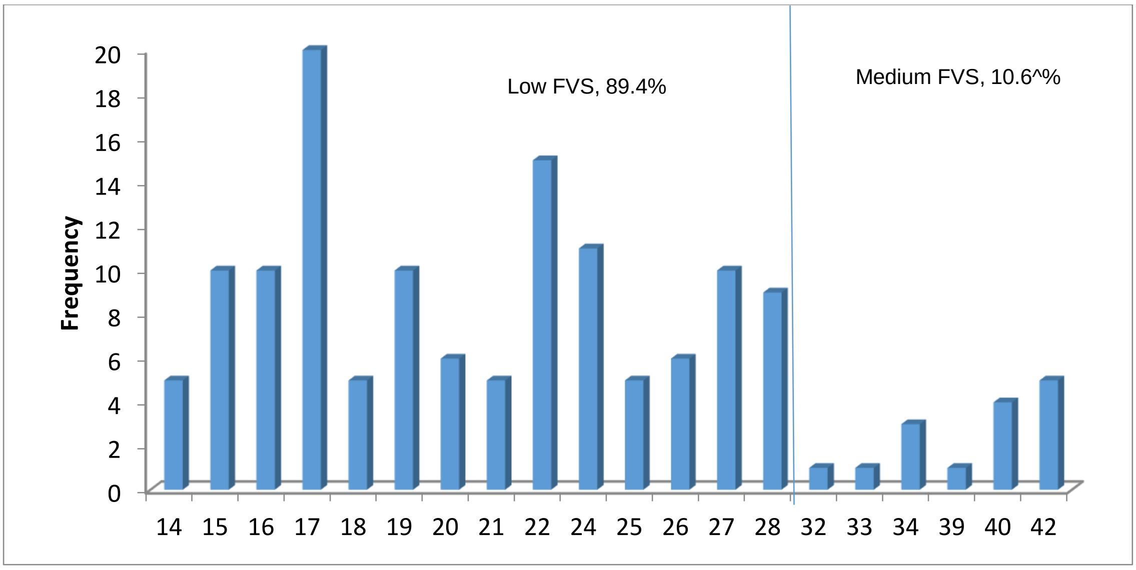


Figure 6.1.1 The 24h dietary recall's summary of distribution of food variety scores from the caregivers' households of Ntabankulu Local Municipality

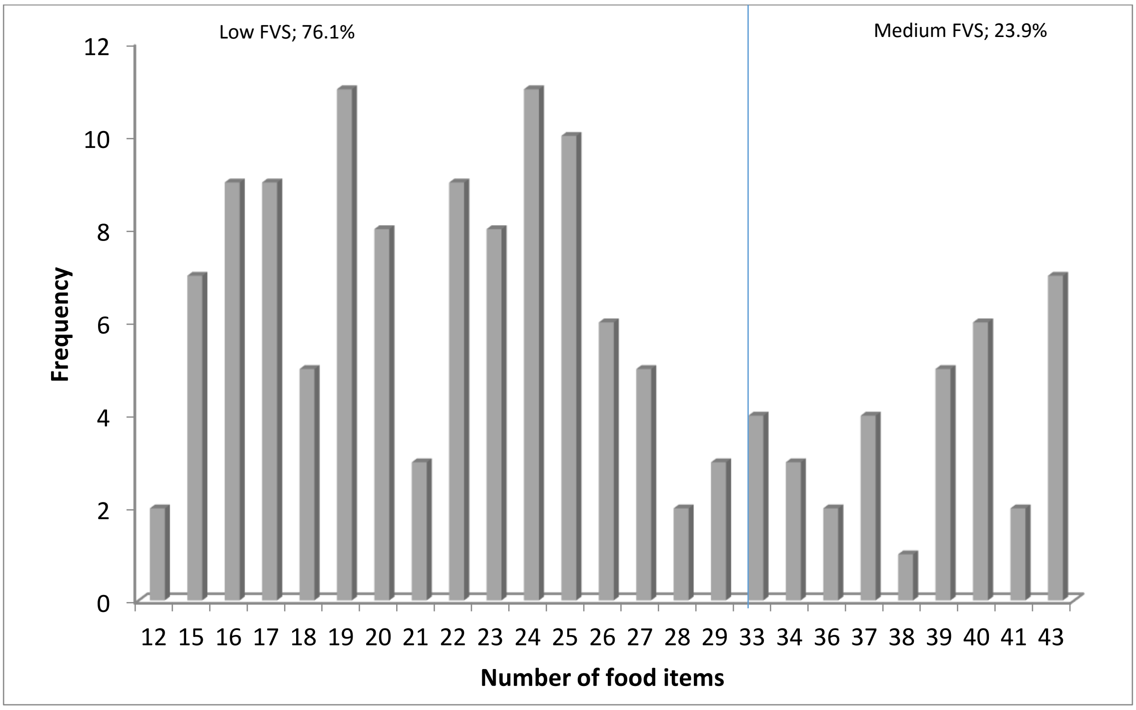


Figure 6.1.2 FFQ's summary of distribution of food variety scores from the caregivers' households of Ntabankulu Local Municipality

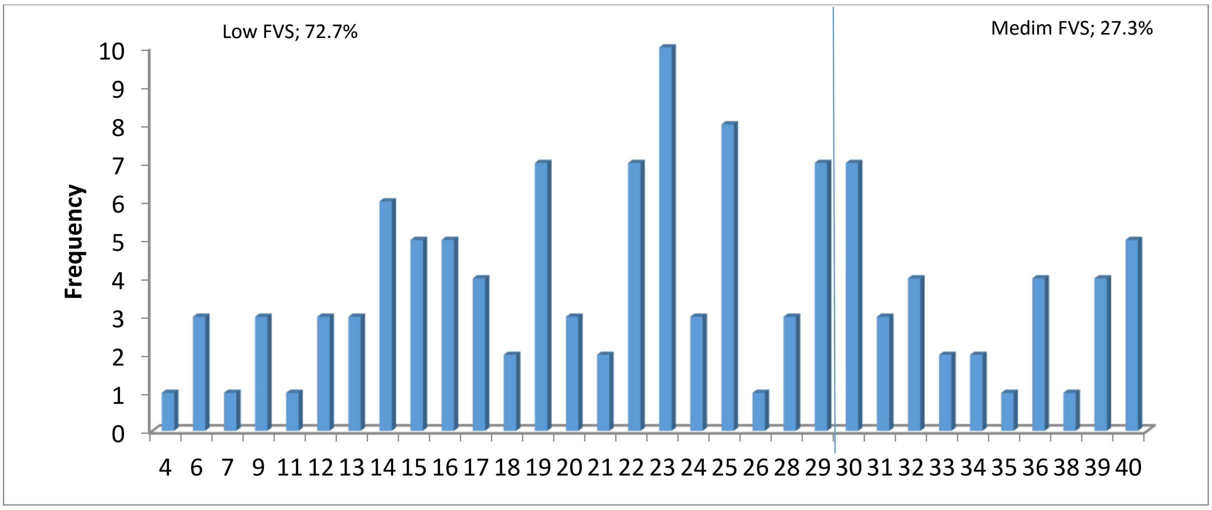


Figure 6.2.1 The 24h dietary recall's summary of distribution of food variety scores from the caregivers' households of Umzimvubu Local Municipality

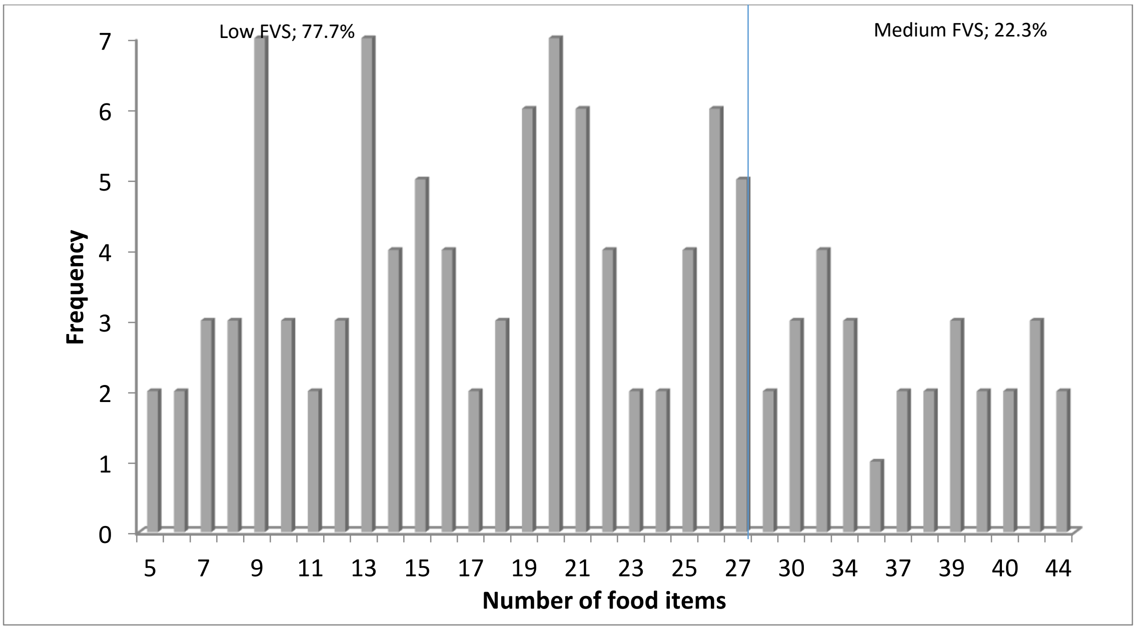


Figure 6.2.2 FFQ's summary of distribution of food variety scores from the caregivers' households of Umzimvubu Local Municipality

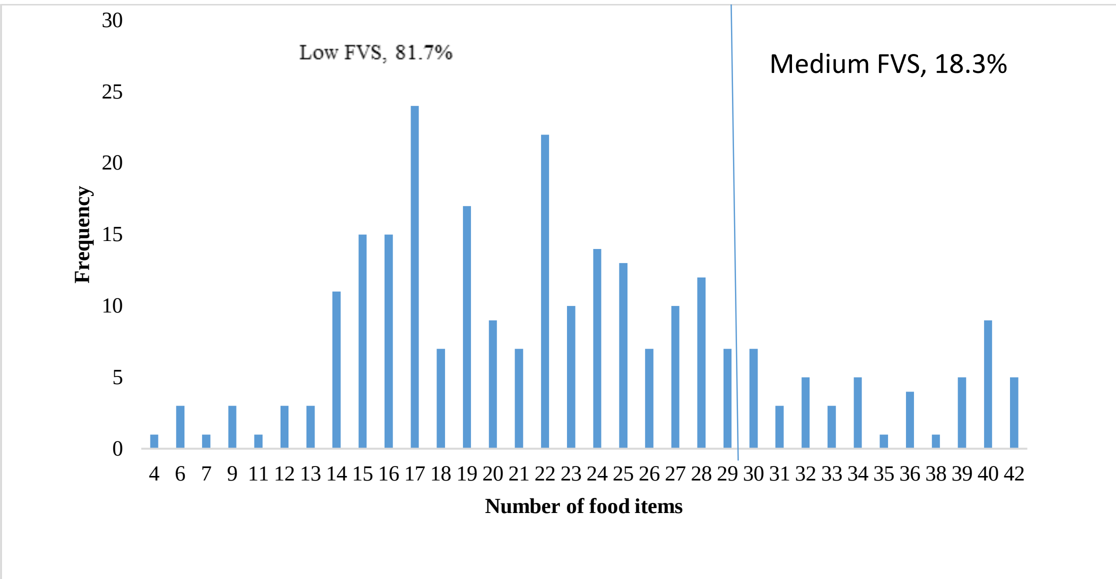


Figure 6.3.1 The 24h dietary recall's summary distribution of food variety scores from the caregivers' households

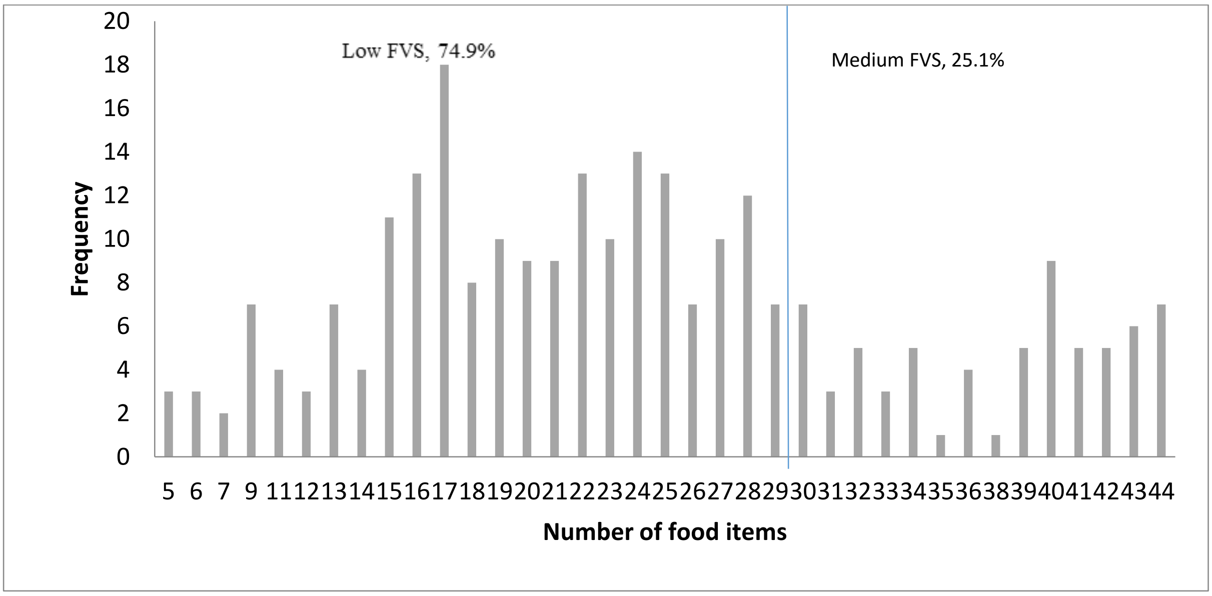


Figure 6.3.2 FFQ's overall distribution of food variety scores from the caregivers' households

Having discussed food consumption patterns of various food items from the nine food groups, and the resultant food variety scores, the next sub-section is dedicated towards discussing dietary diversity (as opposed to food variety). Such discussion will yield DDS, as opposed to FVS.

6.4 DISCUSSION ON DIETARY DIVERSITY SCORES

Dietary diversity is simply the number of food groups consumed over a period of time (Ruel, 2006). In this study, the dietary diversity that is under discussion was measured by a 3-day 24h dietary recall method and FFQ over the nine groups of foods that have been presented in the previous sub-section of this chapter.

Tables 6.6.1-6.6.3 provide details of the number of food groups that were reportedly consumed by the 263 caregivers' households during the 3-day and 7-day periods under the 24h dietary recall and FFQ, respectively. On the former method, most of the caregivers' households (n = 88; 33.5%) consumed foods from eight food groups, followed by those (n = 71; 27.0%) who consumed foods from all nine foods groups. Three food groups were the lowest number consumed (n = 5; 1.9%). The mean DDS on the 24h dietary recall and FFQ were 7.82 and 8.12, respectively.

Generally, most of the caregivers' households from Ntabankulu Local Municipality consumed foods from a larger number of food groups when compared to their counterparts from Umzimvubu Local Municipality. Technically, this situation put the children of the former in a higher plane of nutrition. Consequently, on the 24h dietary recall, the mean DDS at Ntabankulu Local Municipality was significantly higher ($p \leq 0.01$) at 8.11 in comparison to Umzimvubu's DDS of 7.49. Similar trends were observed on FFQ.

Table 6.6.1 Ntabankulu Local Municipality's results of dietary diversity from the 24h dietary recall and FFQ (n = 263)

Number of Food Groups Consumed, n=9	Frequency		Percentage	
	24h dietary recall	**FFQ**	**24h dietary recall**	**FFQ**
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	1	3	0.7	2.1
5	8	6	5.6	4.2
6	15	11	10.6	7.7
7	11	11	7.7	7.7
8	61	59	43.0	41.5
9	46	52	32.4	36.6
Total	**142**	**121**	**100**	**100**

Table 6.6.2 Umzimvubu Local Municipality's results of dietary diversity from the 24h dietary recall and FFQ (n = 263)

Number of Food Groups Consumed, n=9	Frequency		Percentage	
	24h dietary recall	FFQ	24h dietary recall	FFQ
1	0	0	0	0
2	0	0	0	0
3	5	3	4.1	2.5
4	5	2	4.1	1.7
5	9	6	7.4	5.0
6	36	38	29.8	31.4
7	14	16	11.6	13.2
8	27	36	22.3	29.8
9	25	20	20.7	16.5
Total	**121**	**121**	**100**	**100**

Table 6.6.3 Overall results of dietary diversity from the 24h dietary recall and FFQ (n = 263)

Number of Food Groups Consumed, n=9	**Frequency**		**Percentage**	
	24h dietary recall	**FFQ**	**24h dietary recall**	**FFQ**
1	0	0	0	0
2	0	0	0	0
3	5	3	1.9	1.1
4	6	5	2.3	1.9
5	17	12	6.3	4.6
6	51	49	19.4	18.6
7	25	27	9.5	10.3
8	88	95	33.5	36.1
9	71	72	27.0	27.4
Total	**263**	**263**	**100**	**100**

The results presented in Tables 6.6.1-6.6.3 were summarised in Figures 6.4–6.6. According to Matla (2008), DDS in the range of 1-4 and 5-6 food groups suggests low and medium dietary diversity, respectively. Meanwhile a DDS of 7-9 food groups is indicative of a high dietary diversity. In line with Matla's classification of DDS, on the 24h recall scale, the majority of the caregivers' households (n = 184; 70%) had high DDS, followed by those with medium DDS (n=68; 25.7%) and low DDS (n=11; 4.2%) [see Figure 6.6]. On the FFQ scale a higher majority of households (n=194; 73.8%) had high DDS followed by those with medium DDS (n=61; 23.2%) and those with low DDS (n=8; 3.0%).

With respect to the two municipality areas, on the 24h dietary recall scale, a larger number of caregivers' households from Ntabankulu (n = 118; 83.1%) than from Umzimvubu (n = 66; 54.6%) had high DDS (see Figures 6.4 and 6.5). Similar trends were made on FFQ.

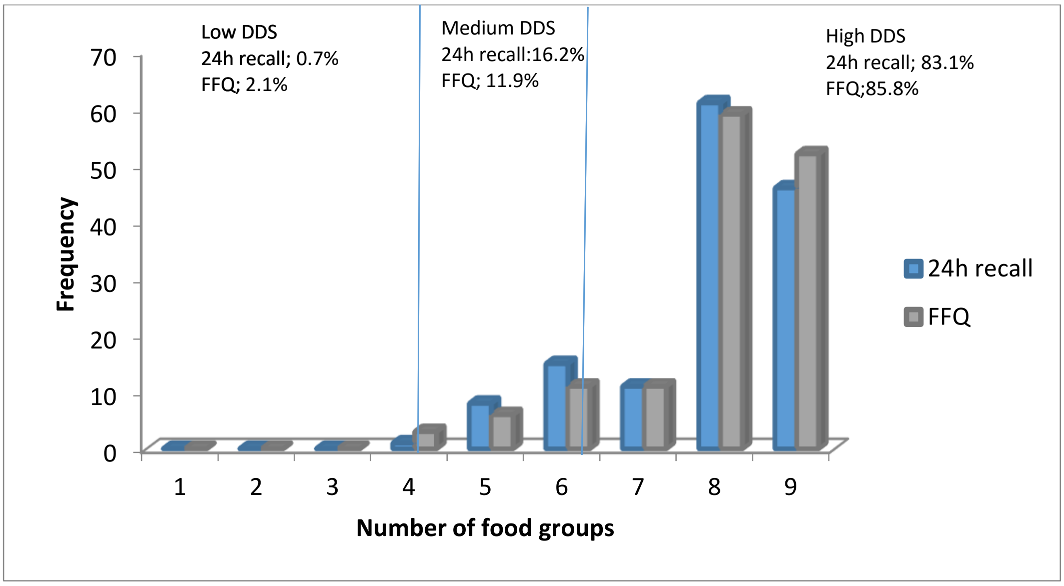


Figure 6.4 Summary of distribution of dietary diversity scores from the caregivers' households of Ntabankulu Local Municipality

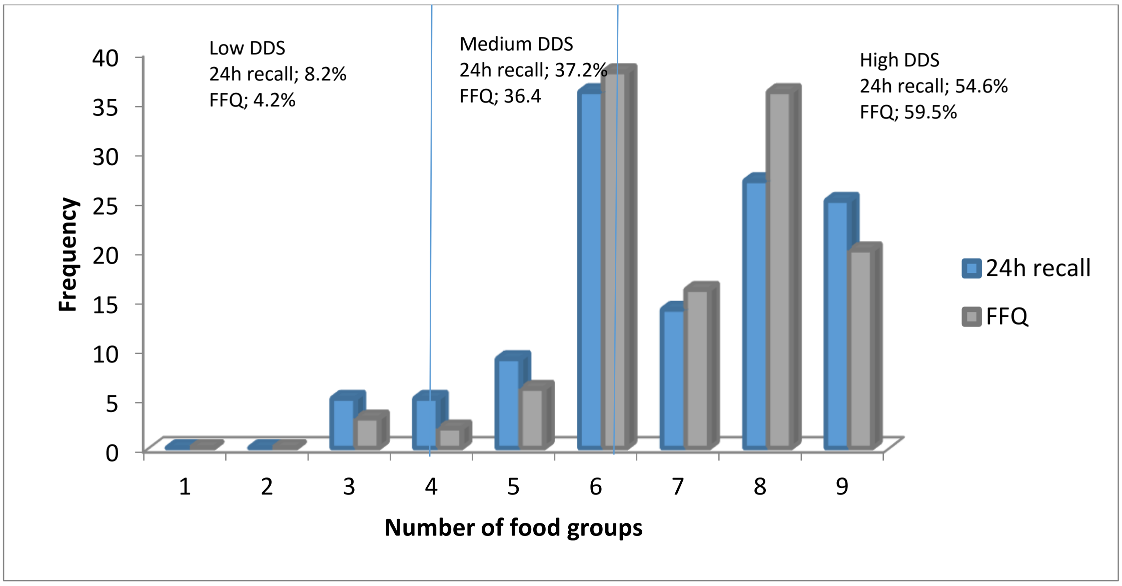


Figure 6.5 Summary of distribution of dietary diversity scores from the caregivers' households of Umzimvubu Local Municipality

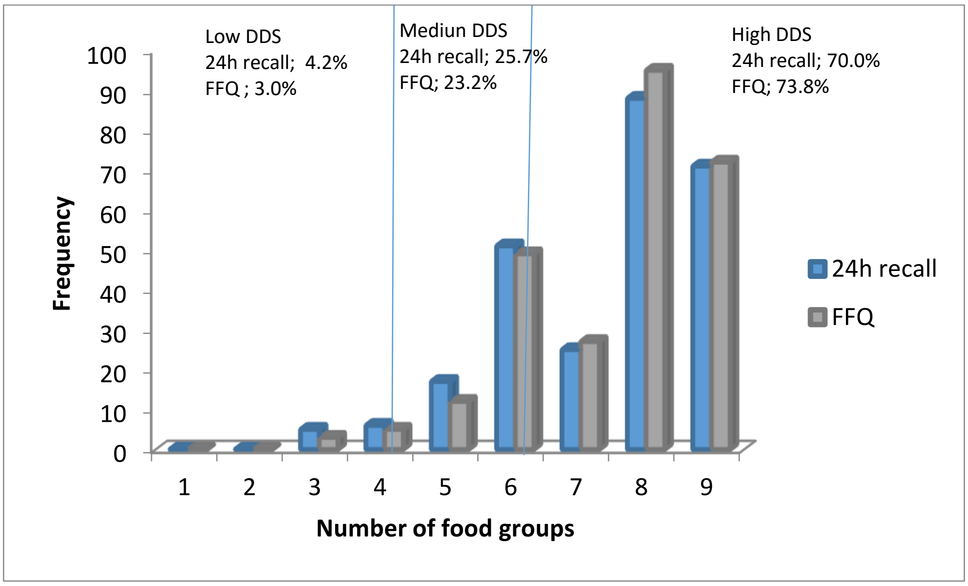


Figure 6.6 Overall distribution of dietary diversity scores from the caregivers' households

6.5 NUTRIENT INTAKE

Food consumption patterns, FVS and DDS that have been discussed in the previous sections of this chapter are directly linked to nutrient intake which is under discussion in the current section (Badari, Arcot, Haron, Paim, Sulaiman & Masud, 2012; Ongosi, Gericke, Mbuthia & Oelofse, 2014). In establishing nutrient intake of children aged 5-14 years, due technical nutritional and statistical processes were followed. The processes of the former included computing of nutrient intake from the internationally acclaimed FoodFinder III nutritional software of the South African Medical Research Council. Data of nutrient intake was comparatively tabulated and discussed alongside DRI / RDA of the Institute of Medicine (IoM, 2003).

Among statistical processes, non-parametric analyses which involved Mann-Whitney U tests and Kruskal–Wallis H tests were employed on the basis of violation of two key assumptions, namely; a) assumption of normality, and b) assumption of homogeneity of variances of the 25 nutrients under investigation (Beukman, 2005; Nordstokke, Zumbo, Cairns & Saklofske, 2011).

Nevertheless, subsequent to the above briefly outlined statistical processes, median intake of a total of 25 macro and micro-nutrients by the 327 children aged 5-14 years was computed and presented in Table 6.7. The outcomes of the statistical analyses referred to above indicated that nutrient intakes between children of Ntabankulu and Umzimvubu Local Municipalities were either statistically significant ($p \leq 0.05$) or highly significant ($p \leq 0.01$) in all nutrients except carbohydrates, iron, magnesium, phosphorus, selenium, vitamin E, niacin, and folate (Table 6.8). Differences in nutrient intake between male and female children were highly significant ($p \leq 0.01$) in nutrients with the exception in calcium where these differences were significant ($p \leq 0.05$) [Table 6.9]. There were also highly significant ($p \leq 0.01$) differences in nutrient intake among children aged 4-8 years, 9-13 years and 14 years (Table 6.10), with the exception in vitamin K where these differences were non-significant ($p \geq 0.05$).

Table 6.7 Summary of median nutrient intake among children aged 5-14 years from Ntabankulu and Umzimvubu Local Municipalities

Nutrient, p/d	Local Municipality		
	Ntabankulu (n = 156)	Umzimvubu (n =171)	Overall (n = 327)
Energy, kJ	6426.21	5951.00	6359.67
Carbohydrates, g	236.11	231.00	240.86
Protein, g	55.57	42.21	55.25
Total fibre, g	12.65	9.29	11.37
Calcium, mg	620.77	720.00	720.00
Iron, mg	10.41	9.20	10.66
Magnesium, mg	216.86	219.00	238.03
Phosphorus, mg	809.63	754.54	820.00
Zinc, mg	6.26	4.87	6.26
Chromium, mg	10.67	8.00	8.66
Selenium, µg	24.50	13.00	19.30
Iodine, µg	10.60	6.00	9.48
Vitamin A, µg	565.38	655.06	655.06
Vitamin B6, mg	0.70	0.45	0.59
Vitamin B12, mg	4.78	4.30	4.91
Vitamin C, mg	44.75	16.78	26.92
Vitamin D, µg	2.55	2.20	2.63
Vitamin E, mg	8.97	8.30	9.05
Vitamin K, µg	66.00	44.30	66.00
Thiamin, mg	1.12	0.78	1.07
Riboflavin, mg	0.97	0.89	0.97
Niacin, mg	11.37	12.40	13.00
Folate, µg	147.12	130.00	142.31
Pantothenic acid, µg	3.43	2.90	3.36
Biotin, µg	26.64	16.99	21.12

Table 6.8 Presentation of Mann-Whitney U test results on differences in nutrient intake between children of Ntabankulu and Umzimvubu Local Municipalities

Nutrient	Statistical components			
	Mann-Whitney U	Wilcoxon W	Z	p value (2-tailed)
Energy, kJ	11148.000	25176.000	-1.971	.049*
Carbohydrates, g	11520.000	25548.000	-1.520	.128 NS
Protein, g	11085.000	25113.000	-2.047	.041*
Total fibre, g	10185.000	24213.000	-3.137	.002**
Calcium, mg	10959.000	22740.000	-2.199	.028*
Iron, mg	11533.500	25561.500	-1.505	.132 NS
Magnesium, mg	11278.500	25306.500	-1.812	.070 NS
Phosphorus, mg	12180.000	26208.000	-.721	.471 NS
Zinc, mg	9810.000	23838.000	-3.591	.000**
Chromium, mg	9603.000	23631.000	-3.841	.000**
Selenium, µg	11610.000	25638.000	-1.411	.158 NS
Iodine, µg	9235.500	23263.500	-4.286	.000**
Vitamin A, µg	10932.000	24960.000	-2.232	.026*
Vitamin B6, mg	9453.000	23481.000	-4.026	.000**
Vitamin B12, mg	10233.000	24261.000	-3.078	.002**
Vitamin C, mg	8976.000	23004.000	-4.602	.000**
Vitamin D, µg	10254.000	24282.000	-3.053	.002**
Vitamin E, mg	11400.000	25428.000	-1.665	.096 NS
Vitamin K, µg	9180.000	23208.000	-4.353	.000**
Thiamin, mg	9541.500	23569.500	-3.916	.000**
Riboflavin, mg	10881.000	24909.000	-2.294	.022*
Niacin, mg	12394.500	26422.500	-.461	.645 NS
Folate, µg	12165.000	26193.000	-.739	.460 NS
Pantothenic acid, µg	10065.000	24093.000	-3.282	.001**
Biotin, µg	11103.000	25131.000	-2.025	.043*

NB: * = $p \leq 0.05$ (significant);

** = $p \leq 0.01$ (highly significant);

NS= $p \geq 0.05$ (non-significant).

Table 6.9 **Presentation of Mann-Whitney U test results on differences in nutrient intake between male and female children**

Nutrient	Statistical components		
	df	**Chi-square**	**Asymp. Sig.**
Energy, kJ	2	31.100	.000**
Carbohydrates, g	2	19.200	.000**
Protein, g	2	26.216	.000**
Total fibre, g	2	28.736	.000**
Calcium, mg	2	6.075	.048*
Iron, mg	2	17.619	.000**
Magnesium, mg	2	19.894	.000**
Phosphorus, mg	2	23.152	.000**
Zinc, mg	2	26.066	.000**
Chromium, mg	2	36.044	.000**
Selenium, µg	2	24.987	.000**
Iodine, µg	2	37.034	.000**
Vitamin A, µg	2	22.647	.000**
Vitamin B6, mg	2	33.863	.000**
Vitamin B12, mg	2	33.588	.000**
Vitamin C, mg	2	31.572	.000**
Vitamin D, µg	2	52.539	.000**
Vitamin E, mg	2	12.725	.002**
Vitamin K, µg	2	19.277	.000**
Thiamin, mg	2	45.276	.000**
Riboflavin, mg	2	36.846	.000**
Niacin, mg	2	11.631	.003**
Folate, µg	2	24.345	.000**
Pantothenic acid, µg	2	11.565	.003**
Biotin, µg	2	22.829	.000**

Table 6.10 **Summary of results of Kruskal-Wallis H test on differences in nutrient intake among children aged 4-8 years, 9-13 years and 14 years**

Nutrient	Statistical components			
	Mann-Whitney U	**Wilcoxon W**	**Z**	**p value (2-tailed)**
Energy, kJ	8653.500	19978.500	-4.965	.000**
Carbohydrates, g	7714.500	19039.500	-6.103	.000**
Protein, g	7647.500	18972.500	-6.184	.000**
Total fibre, g	8236.500	19561.500	-5.471	.000**
Calcium, mg	7813.500	19138.500	-5.983	.000**
Iron, mg	7687.500	19012.500	-6.139	.000***
Magnesium, mg	9028.500	20353.500	-4.510	.000**
Phosphorus, mg	7251.500	18576.500	-6.664	.000**
Zinc, mg	7560.500	18885.500	-6.290	.000**
Chromium, mg	10085.500	21410.500	-3.229	.000**
Selenium, µg	8994.500	20319.500	-4.552	.000**
Iodine, µg	7955.000	19280.000	-5.812	.000**
Vitamin A, µg	9648.000	20973.000	-3.760	.000**
Vitamin B6, mg	9323.000	20648.000	-4.157	.000**
Vitamin B12, mg	8325.500	19650.500	-5.362	.000**
Vitamin C, mg	10957.500	22282.500	-2.173	.000**
Vitamin D, µg	7943.000	19268.000	-5.826	.000**
Vitamin E, mg	10063.500	21388.500	-3.256	.001**
Vitamin K, µg	12243.500	26778.500	-.614	.539^{NS}
Thiamin, mg	8410.500	19735.500	-5.260	.000**
Riboflavin, mg	10011.500	21336.500	-3.319	.001**
Niacin, mg	8934.000	20259.000	-4.625	.000**
Folate, µg	9817.500	21142.500	-3.554	.000**
Pantothenic acid, µg	9205.500	20530.500	-4.296	.000**
Biotin, µg	8674.500	19999.500	-4.939	.000**

6.5.1 Energy

The human body requires energy for all bodily physical and physiological functions. In children, energy is essential for growth (FAO, 2003). Carbohydrates, fats and protein are macro-nutrients that yield energy from various food items of the `cereal, roots and tubers', 'fats and oils', and `flesh foods' groups.

The results from this study indicate that generally, most children, particularly those that are 8-14 years of age had energy intake that was lower than their requirements (see Table 6.11). Possibly this was due to the reported feeding practice of skipping breakfast by some children and the limited number of meals a day that caregivers can afford to provide to their children (see Chapter 5). Another possibility is the consumption of rather small food quantities in some households (see food intake and standard deviations in Table 6.4). There is also a possibility of under-reporting of food quantities consumed, particularly among children aged 13 years.

Table 6.11 Energy intake of children aged 5-14 years

Age, years	Median energy intake, g/d		EER		Percentage of children whose median intake is > 67% of EER	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
5	8107.27	6305.03	6267.85	5783.71	100	100
6	6600.85	4896.61	6989.67	6560.19	52.3	68.2
7	9649.48	8095.24	7423.10	6992.40	72.4	75.5
8	7666.37	6042.13	7812.75	7276.12	46.8	62.4
9	6715.12	5012.88	8346.54	7780.93	10.8	5.2
10	6712.05	4989.81	8863.32	8112.04	4.6	3.4
11	7332.23	5657.99	9355.78	8473.92	0	4.2
12	6846.25	5060.82	9912.38	8912.77	0	8.7
13	3737.12	1942.88	10576.77	9371.26	0	0
14	7214.34	5551.42	11259.89	9823.51	0	0

6.5.2 Carbohydrates

Basically, carbohydrates provide energy, store energy, build macromolecules, and spare protein and fat for other uses (Laville & Nazare, 2009; Hardy, Brand-Miller, Brown, Thomas & Copeland, 2015).

Carbohydrates are the only nutrients among the 25 investigated in this study where median intake in all groups of children exceeded 67% of the RDA (Table 6.12). The intake of carbohydrates was the highest among male children aged 14 years (337g/p/d), followed by male children aged 4-8 years (300g/p/d). Evidently, the high intake of carbohydrates was supported by high consumption of a wide variety of carbohydrates-rich food items that belonged in the `cereal, roots and tubers' food group. These food items which include maize products, bread, rice and sugar featured strongly in the list of top 20 most consumed food items.

As alluded in the previous subsection, the high consumption of carbohydrates-rich food items did not necessarily translate into adequate energy intake.

Table 6.12 Carbohydrates intake of children aged 5-14 years

Age group, years	**Median carbohydrates intake, g/p/d**		**RDA/AI**		**Percentage of children whose median intake is > 67% of RDA/AI**	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
4-8	300.00	227.38	130.00	130.00	100	100
9-13	240.00	210.00	130.00	130.00	100	100
14	337.16	269.00	130.00	130.00	100	100

6.5.3 Protein

Proteins are fundamental in building blood cells, body tissue, hormones, muscle, and other important substance (Lee, Redfern & Orengo, 2007). Generally, the children understudy had adequate protein intake, particularly those aged 4-8 years and 14 years, whose median intake surpassed two-thirds of RDA for protein (see Table 6.13). Chicken and canned fish appeared two the most consumed sources of protein.

Table 6.13 Protein intake of children aged 5-14 years

Age group, years	Median protein intake, g/p/d		RDA/AI		Percentage of children whose median intake is > 67% of RDA/AI	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
4-8	69.70	49.86	20..00	20.00	100	100
9-13	50.00	39.00	40.00	35.00	95.38	91.67
14	71.32	70.00	65.00	45.00	100	100

6.5.4 Total fibre

Dietary fibre plays an important role in the digestive process, regulation of blood sugar levels, and in the lowering of cholesterol, thus reducing the risk of heart diseases (Schneeman, 1999).

Median intake of total fibre was very low among all groups of children with the exception of male children aged 4-8 years (Table 6.14). All those aged 14 years had median intake that was below 67% of the RDA for fibre. More than three-quarter of children aged 9-13 years had similar dietary fibre intakes that were below the benchmark.

Notably rich sources of dietary fibre that were consumed during the 24h dietary recall and qualitative FFQ were grains such as whole maize and dried beans, and vegetables such as cabbage and spinach. Broccoli, which is a good source of fibre was consumed in very few households.

Table 6.14 Total fibre intake of children aged 5-14 years

Age group, years	Median total fibre intake, g/p/d		RDA/AI		Percentage of children whose median intake is > 67% of RDA/AI	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
4-8	14.34	10.29	18.00	18.00	68.42	29.41
9-13	10.56	10.29	24.00	20.00	13.85	23.81
14	13.85	12.00	38.00	26.00	0	0

6.5.5 Calcium

Calcium is a macro-mineral whose many of its functions include maintaining strength of bones and teeth, muscle contraction, nerve function, normal blood clotting, and lowering of blood pressure (Anderson, 2001; Abrams, 2010).

Generally, calcium intake was low among many children that were included in this study. At the worst, none of female children aged 14 years had calcium intake that exceeded 67% of the RDA. Only 30.77% and 16.67% of the male and female children aged 9-13 years, respectively, achieved more than 67% of the RDA for calcium (Table 6.15).

The supply of calcium most likely came from consumed dairy products such as fresh milk and sour milk, and non-dairy products in the name of spinach and canned fish. Other calcium-rich foods such as cheese and fortified cereal were consumed in few households.

Table 6.15 Calcium intake of children aged 5-14 years

Age group, years	**Median calcium intake, mg/p/d**		**RDA/AI**		**Percentage of children whose median intake is > 67% of RDA/AI**	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
4-8	817.38	420.91	700.00	700.00	90.53	49.02
9-13	623.75	638.93	1300.00	1300.00	30.77	16.67
14	1064	380.00	1300.00	1300.00	70	0

6.5.6 Iron

Iron is associated with transportation of oxygen and carbon dioxide, and supporting the normal functioning of the immune system (Abbaspour, Hurrell & Kelishad, 2014; Scheinberg & Chen, 2013).

Generally, there was high intake of iron in all groups of children, especially males aged 4-8 years and 14 years wherein all children in these groups had iron intake that exceeded 67% of the RDA for this nutrient (Table 6.16).

Iron-rich foods such as spinach, beans, rice and liver were among those reportedly consumed by the households under investigation using a 24h dietary recall method and qualitative FFQ. The remarkable consumption of liver was further confirmed when administering a questionnaire on nutritional practices. To this end, 46.8% of the caregivers' households said their children had consumed liver during the previous 24h under investigation (see Table 5.35 of Chapter 5). Beef and lamb which are also rich sources of iron were consumed sparingly, hence it is presumed that their supply of iron was limited.

Table 6.16 Iron intake of children aged 5-14 years

Age group, years	Median iron intake, mg/p/d		RDA/AI		Percentage of children whose median intake is > 67% of RDA/AI	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
4-8	12.00	10.35	10.00	10.00	100	88.24
9-13	10.46	8.80	8.00	8.00	90.77	88.10
14	14.24	12.00	11.00	15.00	100	60

6.5.7 Magnesium

This mineral helps to maintain normal muscle and nerve function. It also supports a healthy immune system, and keeps the heart beat steady, and helps bones remain strong. It also helps to regulate blood glucose levels and aids in the production of energy and protein (Houston, 2011).

With the exception of children aged 14 years, there was high intake of magnesium, especially among those aged 4-8 years whose median intake of magnesium was greater than 67% of the RDA for this nutrient (Table 6.17). To the contrary, all females aged 14 years had magnesium intake that fell below this benchmark.

Notable good sources of magnesium that were consumed during the 24h dietary recall and qualitative FFQ were spinach, dried beans and sour milk. The consumption of avocados and bananas which are also rich sources of magnesium was very minimal.

Table 6.17 Magnesium intake of children aged 5-14 years

Age group, years	**Median magnesium intake, mg/p/d**		**RDA/AI**		**Percentage of children whose median intake is > 67% of RDA/AI**	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
4-8	312.00	176.00	130.00	130.00	100	100
9-13	213.11	182.78	240.00	240.00	70.77	82.14
14	256.30	236.00	410.00	360.00	30	0

6.5.8 Phosphorus

Phosphorus is used for growth and repair of body cells and tissues. It is also used in the metabolism of carbohydrates, fats and protein (Takeda, Yamamoto, Yamanaka-Okumura & Taketani, 2014).

The results from this study showed that all children aged 4-8 years and males aged 14 years had median intake of phosphorus that exceeded two-thirds of RDA for this nutrient (Table 6.18). Of concern was very low intake of phosphorus among female children aged 9-13 years and 14 years wherein only 20.24% of the former group exceeded 67% of the RDA, while none of the latter exceeded this benchmark.

Based on the results of the 24h dietary recall and qualitative FFQ, the most likely main sources of phosphorus for the households under study were dried beans, fresh milk and sour milk. Other good sources of phosphorus were consumed in small quantities by fewer households – pork and beef.

Table 6.18 Phosphorus intake of children aged 5-14 years

Age group, years	Median phosphorus intake, mg/p/d		RDA/AI		Percentage of children whose median intake is > 67% of RDA/AI	
	Male	Female	Male	Female	Male	Female
4-8	1144.44	660.00	500.00	500.00	100	100
9-13	898.64	750.00	1250.00	1250.00	53.85	20.24
14	1070.85	820.00	1250.00	1250.00	100	0

6.5.9 Zinc

Zinc is an important mineral for promoting protein synthesis and normal functioning of an immune system (Meunier, O'Connor, Maiani, Cashman, Secker, Ferry, Roussel & Coudray, 2005).

Zinc intake was the highest among children aged 4-8 years as median zinc intake from this group surpassed more than two-thirds of the RDA (Table 6.19). To the contrary, only a limited number of female children aged 9-13 years (34.52%) and male children aged 14 years (30%) had median intake of zinc that exceeded two-thirds of the RDA.

The supply of zinc must have come mainly from chicken, spinach and dried beans, and to a limited extent from beef, lamb and pork. The consumption of these animal products was minimal. Seafood would have provided ample supply of zinc, but was not consumed in any of the 263 households included in this study.

Table 6.19 Zinc intake of children aged 5-14 years

Age group, years	Median zinc intake, mg/p/d		RDA/AI		Percentage of children whose median intake is > 67% RDA/AI	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
4-8	8.50	6.10	4.00	4.00	100	100
9-13	6.30	4.36	8.00	8.00	66.15	34.52
14	6.35	7.00	11.00	9.00	30	60

6.5.10 Chromium

Chromium is important in the metabolism of fats and carbohydrates, and in the regulation of blood sugar levels (Lukaski, 2000). The intake of chromium was adequate among all children aged 4-8 years, but severely limited among female children aged 9-13 years (Table 6.20). Bread and other wheat products, and whole maize products appeared the main sources of chromium for the children understudy, presumably because they are affordable.

Table 6.20 Chromium intake of children aged 5-14 years

Age group, years	Median chromium intake, mg/p/d		RDA/AI, mcg/p/d		Percentage of children whose median intake is > 67% of RDA/AI	
	Male	Female	Male	Female	Male	Female
4-8	26.27	8.04	15	15	32.2	35.4
9-13	7.55	8.20	25	21	17.7	11.9
14	8.66	14.00	35	24	30.0	0

6.5.11 Selenium

Selenium is a mineral that has antioxidant properties that reduce muscular oxidative stress (Broome, McArdle, Kyle, Andrews, Lowe, Hart, Arthur & Jackson, 2004).

The intake of selenium was moderate and high among female and male children aged 4-8 years, respectively. However, it was low among children aged 9-13 years, because a few males (18.46%) and females (15.48%) had median intake that surpassed 67% of the RDA for selenium (Table 6.21). The situation was severe among children aged 14 years, because none of them had median selenium intake that exceeded 67% of the RDA.

The main food items contributing to the supply of selenium must have been canned fish and chicken. Further contributing food items must have been eggs, pork, and beef. These food items are rich in selenium, but the results of the 24h dietary recall and qualitative FFQ showed that they were consumed in fewer households and in small quantities.

Table 6.21 Selenium intake of children aged 5-14 years

Age group, years	Median selenium intake, µg/p/d		RDA/AI		Percentage of children whose median intake is > 67% of RDA/AI	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
4-8	26.00	24.50	30.00	30.00	74.74	54.90
9-13	19.30	12.22	50.00	50.00	18.46	15.48
14	16.90	37.00	70.00	60.00	0	0

6.5.12 Iodine

This mineral is needed to make thyroid hormones, which are necessary for maintaining normal metabolism in all cells of the body (Smyth, 2003; Ahad & Ganie, 2010).

Of all the 25 nutrients that were under investigation in this study, iodine was found a nutrient of serious concern. The median intake of all groups of children under study was below 67% of the RDA for iodine (Table 6.22).

Food items such as sea vegetables, shrimp and cranberries are one of rich sources of iodine, but are not easily economically accessible. Fairly rich sources of iodine which were reportedly consumed during the 24h dietary recall and qualitative FFQ are canned fish, fresh milk, eggs, bananas and iodized salt.

Table 6.22 Iodine intake of children aged 5-14 years

Age group, years	**Median iodine intake, µg/p/d**		**RDA/AI**		**Percentage of children whose median intake is > 67% of RDA/AI**	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
4-8	19.84	7.37	90.00	90.00	0	0
9-13	8.84	5.37	120.00	120.00	0	0
14	8.84	10.00	150.00	150.00	0	0

6.5.13 Vitamin A

Vitamin A is known for its role in maintaining good vision. Irrespective of age and gender, at least 60% of children had median vitamin A intake that was greater than 67% of RDA (Table 6.23). Noticeably, all males aged 4-8 years and 14 years had median intake of greater than 67% of the RDA for this nutrient.

The results of high median intake of vitamin A are attributable largely to high consumption of vitamin A-rich carrots and spinach which featured in the top 20 most consumed food items that was gathered through the 24h dietary recall and qualitative FFQ. The high intake is also attributable to nutritional practices of the caregivers which is linked to low intake of vitamin A-rich fruits (Table 5.31 of Chapter 5) and high consumption of vitamin A-rich spinach, carrots and pumpkin / squash fruits. About 64.3% and 19.4% of caregivers reportedly respectively consumed carrots and pumpkin / squash fruits during the previous 24h under investigation.

Table 6.23 Vitamin A intake of children aged 5-14 years

Age group, years	Median Vitamin A intake, µg/p/d		RDA/AI		Percentage of children whose median intake is > 67% of RDA/AI	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
4-8	787.00	467.09	400.00	400.00	100	74.51
9-13	541.27	657.03	600.00	600.00	63.08	69.05
14	655.06	502.00	900.00	700.00	100	60

6.5.14 Vitamin B6

This vitamin is known to play a crucial role in supporting nerve functioning, and preventing heart diseases (Theodoratou, Farrington, Tenesa, McNeill, Cetnarskyj, Barnetson, Porteous, Dunlop & Campbell, 2008).

Median intake of vitamin B6 was between moderate to high, except among female children aged 9-13 years and male children aged 14 years (Table 6.24). In these groups only 26.19% and 30%, respectively, had median intake of vitamin B6 that exceeded 67% of the RDA for this nutrient. Distinguishable consumed rich sources of vitamin B6 were chicken and spinach. Other rich sources were consumed in few households – pork, beef, bananas and avocados.

Table 6.24 Vitamin B6 intake of children aged 5-14 years

Age group, years	Median Vitamin B6 intake, mg/p/d		RDA/AI		Percentage of children whose median intake is > 67% of RDA/AI	
	Male	Female	Male	Female	Male	Female
4-8	0.80	0.59	0.60	0.60	100	86.27
9-13	0.59	0.44	1.00	1.00	49.23	26.19
14	0.59	1.00	1.30	1.20	30	60

6.5.15 Vitamin B12

Vitamin B12 promotes nerve functioning, and assists in preventing diseases. It supports growth of cells and formation red blood cells (Ryan-Harshman & Aldoori, 2008).

Generally, there was high intake of vitamin B12 among the groups of children, except among male children aged 14 years (Table 6.25). In the latter group, only 30% of children exceeded two-thirds of the RDA for vitamin B12. The supply of vitamin B12 for the children must have come from various animal products that are rich in this nutrient. These included chicken, fresh milk, sour milk, canned fish and eggs. Other contributing rich sources of vitamin B12 which were reportedly consumed in fewer households were fortified cereal, beef and lamb.

Table 6.25 Vitamin B12 intake of children aged 5-14 years

Age group, years	Median Vitamin B12 intake, mg/p/d		RDA/AI		Percentage of children whose median intake is > 67% of RDA/AI	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
4-8	6.99	4.41	1.20	1.20	100	88.24
9-13	4.50	4.06	1.80	1.80	84.62	88.10
14	1.52	5.20	2.40	2.40	30	60

6.5.16 Vitamin C

Vitamin C has a wide range of functions which include promoting the functioning of immune system, healing of wounds and acting as an antioxidant (Naidu, 2003).

A minimum of 60% of all the children aged 4-8 years and female children aged 14 years had median intakes of vitamin C that were greater than 67% of RDA (Table 6.26). The rest of categories of children had poor median intakes, particularly male children aged 14 years whose median intakes was 15.74mg/p/d against the RDA of 76.4 mg/p/d. The results of low intake of vitamin C by some children can be explained. Firstly, vitamin C- rich citrus did not feature in the list of top 20 most consumed food items. Secondly, when administering a questionnaire on nutritional practices, only 39.5% of caregivers said their children ate citrus once per week, while many others said their children either occasionally ate it or never ate it (Table 5.34 of Chapter 5). On the other hand, moderate or high intake of vitamin C among other children may have been caused by the consumption of spinach and cabbage, which also contain a fair amount of this nutrient.

Table 6.26 Vitamin C intake of children aged 5-14 years

Age group, years	Median Vitamin C intake, mg/p/d		RDA/AI		Percentage of children whose median intake is > 67% of RDA/AI	
	Male	Female	Male	Female	Male	Female
4-8	75.40	19.58	25.00	25.00	90.53	66.67
9-13	20.05	16.34	45.00	45.00	23.08	34.52
14	15.74	76.44	75.00	65.00	0	60

6.5.17 Vitamin D

This vitamin assists in the formation and maintenance of bones. It is also required for the absorption and use of calcium, and for the regulation of the body's use of phosphorous (Jungert, Spinneker, Nagel & Neuhäuser-Berthold, 2014). Generally, there was low intake of vitamin D, especially among relatively older children (Table 6.27). Canned fish and milk appeared the main sources of vitamin D that have been consumed by the children. However, the consumption of these food items was in small quantities.

Table 6.27 Vitamin D intake of children aged 5-14 years

Age group, years	Median Vitamin D intake, µg/p/d		RDA/AI		Percentage of children whose median intake is > 67% of RDA/AI	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
4-8	3.35	2.10	5	5	40.00	11.8
9-13	2.41	2.20	5	5	11.8	11.9
14	0.36	1.60	5	5	0	0

6.5.18 Vitamin E

Vitamin E is used in the maintenance of healthy reproductive system and nerves, and in promoting a healthy skin. It also acts as an antioxidant that protects vitamins A and C, red blood cells and essential fatty acids from free radicals (Rizvi, Raza, Ahmed, Ahmad, Abbas & Mahdi, 2014).

At least 60% of children had median vitamin E intake that was above 67% of the RDA, except for female children aged 9-13 years and particularly male children aged 14 years (Table 6.28). The intake of vitamin E was attributed to the consumption of rich sources such as sunflower oil which was often used when preparing maize samp among other meals. Other contributing food items must have been spinach and butternut squash, and to a limited extent avocados and bananas, because not many children reportedly ate these fruits during the 24h dietary recall and qualitative FFQ.

Table 6.28 Vitamin E intake of children aged 5-14 years

Age group, years	Median Vitamin E intake, mg/p/d		RDA/AI		Percentage of children whose median intake is > 67% of RDA/AI	
	Male	Female	Male	Female	Male	Female
4-8	9.87	8.39	7.00	7.00	100	80.39
9-13	6.03	8.28	11.00	11.00	64.62	46.43
14	9.05	15.22	15.00	15.00	0	60

6.5.19 Vitamin K

This vitamin is used by the body for blood clotting and in the synthesis of bone and kidney tissues (DiNicolantonio, Bhutani & O'Keefe, 2015).

Median intake of less than 50% of male children aged 9-13 years and 14 years was less than two-thirds of the RDA for vitamin K, while the median intake of the rest of other categories of children was greater than the benchmarked RDA for this nutrient (Table 6.29). The moderate and high intake of vitamin K was presumably caused by the consumption of the top 20-ranked spinach and cabbage which provide a sizeable amount of this nutrient. On the other hand, limited or non-consumption of vitamin K-rich green vegetables such as turnip greens, cauliflower, and broccoli, and certain vegetables oils including soybean oil, canola oil and olive oil is reflected on restricted intake of this nutrient by the children understudy.

Table 6.29 Vitamin K intake of children aged 5-14 years

Age group, years	Median Vitamin K intake, μg/p/d		RDA/AI		Percentage of children whose median intake is > 67% of RDA/AI	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
4-8	76.23	63.94	55.00	55.00	93.68	54.91
9-13	37.66	75.17	60.00	60.00	27.69	67.86
14	38.29	91.30	75.55	75.00	30	60

6.5.20 Thiamine

Interchangeably, thiamine is called vitamin B3. It is necessary for the proper functioning of the nervous system, metabolism of fats and protein, and maintenance of healthy skin, hair, eyes and liver (Parks, Dawant & Riddle, 2002).

All the children aged 4-8 years and 14 years had median intake of thiamine that was greater than 67% of the RDA (Table 6.30). A few of other children (29.47%), aged 9-13 years had median intake of thiamine that fell below the benchmarked two-thirds of the RDA.

High median intake of thiamine is attributable mainly to intake of fortified bread and rice which featured fairly high in the list of top 20 most consumed food items. These food items provided adequate thiamine for the children despite the low or non-consumption of eggs, legumes, nuts and seeds which are also rich in this nutrient.

Table 6.30 Thiamine intake of children aged 5-14 years

Age group, years	Median thiamine intake, mg/p/d		RDA/AI		Percentage of children whose median intake is > 67% of RDA/AI	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
4-8	1.22	0.95	0.60	0.60	100	100
9-13	0.95	0.74	0.90	0.90	90.77	79.76
14	1.07	1.30	1.20	1.00	100	100

6.5.21 Riboflavin

Riboflavin is also called vitamin B2. The functions of this vitamin include maintaining mucous membranes that are located throughout the digestive tract; and assisting in the formation of red blood cells. It helps the body produce antibodies (Powers, 2003). The nutrient is of great importance for good skin, hair, fingers, toes and nails.

All the children aged 4-8 years and 14 years had median intake of riboflavin that was greater than 67% of the RDA for this nutrient (Table 6.31). Among those aged 9-13 years, 43.71% had intake of riboflavin that was lower than the benchmark – greater than 67% of the RDA.

The high intake of riboflavin by the children under study is ascribable to high consumption of fortified rice, fresh milk that is often drank with tea, sour milk (*amasi*) that is often mixed with riboflavin fortified crumbed maize meal (*umphokoqo*), and spinach. Low or non-consumption of other rich sources of riboflavin did not appear to have had an negative effect on the intake of this nutrient. These rich sources include lamb, yogurt and sundried tomatoes, among many.

Table 6.31 Riboflavin intake of children aged 5-14 years

Age group, years	Median Riboflavin intake, mg/p/d		RDA/AI		Percentage of children whose median intake is > 67% of RDA/AI	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
4-8	1.20	0.96	0.60	0.60	100	100
9-13	0.92	0.92	0.90	0.90	64.62	91.67
14	0.92	0.94	1.30	1.00	100	100

6.3.22 Niacin

Niacin, also called vitamin B3, promotes functioning of nervous systems, normal secretion of bile and stomach fluids, proper blood circulation and maintenance of a healthy skin. It assists in cell respiration and in the release of energy and metabolism of carbohydrates, fats, and proteins (Iikhani, Hosseini & Saedisomeolia, 2016). This nutrient is also used in the synthesis of sex hormones, treating schizophrenia and other mental illnesses.

All the children aged 4-8 years and 14 years had median niacin intake of greater than 67% of the RDA for this nutrient (Table 6.32). However, a small group of children (38.7%) aged 9-13 years had niacin intake that fell below the benchmark.

The generally high intake of niacin was attributable to high consumption chicken and sardines that were presented in canned fish. The high intake can also be linked to nutritional practices of the caregivers. That is, 46.8% of the reported that their children had consumed liver over the previous 24h under investigation. Liver is a rich source of niacin.

Table 6.32 Niacin intake of children aged 5-14 years

Age group, years	Median niacin intake, µg/p/d		RDA/AI		Percentage of children whose median intake is > 67% of RDA/AI	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
4-8	15.00	10.68	8.00	8.00	100	100
9-13	13.00	11.69	12.00	12.00	81.54	79.76
14	13.41	14.00	16.00	14.00	100	100

6.5.23 Folate

Folate, interchangeably called vitamin B9, is known for promoting formation of red blood cells, growth and division of cells. It also helps to prevent heart diseases (Sombolos, Fragia, Natse, Bartholomatos, Karagianni & Katsaris, 2002).

All male children aged 14 years had folate median intake that was greater than 67% of the RDA of 400µg (Table 6.33). The rest of other groups of children, particularly those aged 9-13 years had folate intake of less than 67% of the RDA. Spinach and dried beans were the main sources of folate in the absence or limited consumption of other sources such as broccoli, lentils and chickpeas.

Table 6.33 Folate intake of children aged 5-14 years

Age group, years	Median folate intake, µg/p/d		RDA/AI		Percentage of children whose median intake is > 67% of RDA/AI	
	Male	Female	Male	Female	Male	Female
4-8	153.44	120.27	200.00	200.00	84.21	49.02
9-13	142.00	105.26	300.00	300.00	30.77	26.19
14	141.15	310.00	400.00	400.00	100	60

6.5.24 Pantothenic acid

Pantothenic acid or vitamin B5 as it is also called is used in the synthesis of essential lipids, sterols, hormones, and neurotransmitters. With respect to metabolism, it is used in drugs and alcohol detoxification. It is also used in the metabolism of carbohydrates, fats and proteins (Qian, Li, Zhang, Cai, Tian & liu, 2015).

In all the categories of children under investigation, the intake of pantothenic acid ranged from moderate to high. No less than 50% of children in each category had pantothenic acid intake that was not greater than 67% of the RDA of this nutrient (Table 6.34). The high intake of pantothenic acid was ascribable to correspondingly high consumption of pantothenic acid-rich canned fish, chicken, liver, fresh milk, sour milk, maize meal and bread.

Table 6.34 Pantothenic acid intake of children aged 5-14 years

Age group, years	Median pantothenic acid intake, µg/p/d		RDA/AI		Percentage of children whose median intake is > 67% of RDA/AI	
	Male	Female	Male	Female	Male	Female
4-8	4.50	2.61	3.00	3.00	96.84	72.55
9-13	3.38	3.10	4.00	4.00	58.46	54.76
14	5.85	3.40	5.00	5.00	100	60

6.5.25 Biotin

Biotin is also called vitamin B7. Biotin assists the body in using blood sugar. It is also used in energy and amino acid metabolism, and in the synthesis and breakdown of fat (Fiume, 2002; Said, 2009).

Generally all children had high intake of biotin, particularly those aged 4-8 years and 14 years whose median biotin intake was greater than 67% of the RDA for this nutrient (Table 6.35). This high intake was linked to high consumption of biotin-rich sources such as onion, carrots, fresh milk, sour milk, livers and grain products.

Table 6.35 Biotin intake of children aged 5-14 years

Age group, years	Median biotin intake, µg/p/d		RDA/AI		Percentage of children whose median intake is > 67% of RDA/AI	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
4-8	44.33	17.72	12.00	12.00	100	86.27
9-13	21.12	14.88	20.00	20.00	80	66.67
14	21.12	53.67	25.00	25.00	100	60

6.6 THE CONTEXT OF FINDINGS OF NUTRIENT INTAKE

In this section, the results of the children's intake of the nutrients under investigation were consolidated and briefly discussed in the context of this study's research objectives.

6.6.1 Baseline nutrient intake

The first and foremost objective of this study was to establish a baseline intake of nutrients by children of agri-business families. Details of such intakes were presented in section 6.5 (Tables 6.12 – 6.35). Irrespective of age and gender, the average baseline intake per child per day for the nutrients under investigation is summarised in Table 6.36.

Table 6.36 Baseline intake of macro and micro nutrients by children aged 5-14 years

Nutrient	Nutrient intake, child /day
Carbohydrates, g	263.92
Protein, g	58.31
Total fibre, g	11.88
Calcium, mg	657.50
Iron, mg	11.31
Magnesium, mg	229.35
Phosphorus, mg	890.66
Zinc, mg	6.44
Chromium, mg	12.12
Selenium, µg	22.57
Iodine, µg	10.04
Vitamin A, µg	601.58
Vitamin B6, mg	0.67
Vitamin B12, mg	4.45
Vitamin C, mg	37.26
Vitamin D, µg	2.00
Vitamin E, mg	9.47
Vitamin K, µg	63.77
Thiamin, mg	1.04
Riboflavin, mg	0.89
Niacin, mg	12.96
Folate, µg	162.02
Pantothenic acid, µg	3.81
Biotin, µg	28.81

Baseline nutrient intake alone does not mean much if it is not viewed against dietary reference intakes (DRI). The following section relates the baseline nutrients' intake to their RDA / AI.

6.6.1.1 Baseline nutrient intake that is in excess of RDA / AI

The second objective of this study sought to establish the extent of nutrition security / nutritional status among children of agri-business families. Accordingly, the baseline intake of nutrients was benchmarked against each nutrient's RDA / AI (Tables 6.12 – 6.35). Summarised from these tables and presented below is the list of 11 nutrients whose baseline intake exceeded their RDA /AI. Also presented in the descending order alongside the names of these nutrients is the extent (%) to which the RDA / AI was exceeded (Table 6.37).

Table 6.37 The extent to which baseline nutrients intake exceeded the nutrients' RDA/AI among children aged 5-14 years

Rank	Nutrient	The extent to which baseline intake exceeded the nutrients' RDA/AI, %
1	Vitamin B12	59.55
2	Carbohydrates	50.74
3	Protein	35.67
4	Biotin	34.05
5	Thiamine	16.35
6	Riboflavin	10.20
7	Niacin	9.95
8	Iron	8.66
9	Phosphorus	4.56
10	Vitamin K	0.69
11	Vitamin A	0.26

Consumed food items that possibly resulted in the excessive intake of the 11 nutrients were discussed in section 6.5. In the context of those discussions, the origins and causes of excessive intake of the 11 nutrients were traced. For example, excessive intake of carbohydrates is directly linked to high FVS of 5.05 and 5.26 for 24h dietary recall and FFQ, respectively, within the `cereal, roots and tubers' food group, while that of vitamins and some minerals is linked to fortification of staple food items from this food group (see Table 6.1). Retail maize meal-based staple foods are fortified and / or have remarkable contents of vitamin A, vitamin B6, thiamine, riboflavin, niacin, folate, and iron. High consumption of vitamin A-rich vegetables (carrots, pumpkin / butternut, spinach), and protein-rich canned fish and chicken also had a contributing factor to excessive intake of nutrients.

Worthy to mention, the line of discussion presented above should be viewed with caution, because it is generalising among the studied children irrespective of their age and gender. Children of specific age and gender have specific nutrient requirements (see Tables 2.4 and 6.12 – 6.35).

Contrary to the excessive intake of the 11 nutrients referred to above, the baseline intake of the 13 nutrients listed below fell short in meeting their RDA / AI (Table 6.38). Again, in section 6.3 the levels of consumption of food items that are potential sources of these 13 nutrients were put to the fore.

Table 6.38 The extent to which baseline nutrients intake fell short in meeting the nutrients' RDA/AI among children aged 5-14 years

Rank	Nutrient	The extent to which baseline intake fell short in meeting the nutrient's RDA/AI, %
1	Iodine	91,63
2	Vitamin D	60.00
3	Selenium	53.30
4	Chromium	46.13
5	Folate	45.99
6	Fibre	43.29
7	Calcium	40.23
8	Vitamin B6	29.47
9	Vitamin C	20.16
10	Vitamin E	13.91
11	Zinc	12.14
12	Magnesium	8.87
13	Pantothenic acid	4.75

6.6.1.2 Proportion of children whose baseline nutrients intake exceeded 67% of the nutrients' RDA / AI

In real life, people's nutrient intake does not amount to 100% of every nutrient's RDA / AI every day. A person can live a healthy productive life by having nutrients intake that is not less than the threshold of two-thirds of the nutrients' RDA / AI (see Table 6.12 – 6.35). In summary of the contents of the abovementioned tables, presented below in a descending order is the proportion of the 327 studied children whose intake of the 24 nutrients exceeded 67% of their RDA / AI (Table 6.39). As expected, the children's intake of carbohydrates and some vitamins was boosted by the consumption of fortified food items from the `cereal, roots and tuber' food group, while the intake of iodine was the lowest in all 327 children understudy, irrespective of age and gender.

Table 6.39 The proportion of children aged 5-14 years whose baseline nutrients intake exceeded 67 percent of the nutrients' RDA/AI

Rank	Nutrient	The proportion of children whose baseline nutrients intake exceeded 67 percent of the nutrients' RDA/AI, %
1	Carbohydrates	100
2	Protein	97.84
3	Thiamine	95.09
4	Niacin,	93.55
5	Riboflavin	92.72
6	Iron	87.85
7	Biotin	82.16
8	Vitamin A	77.77
9	Vitamin B12	75.16
10	Pantothenic acid	73.77
11	Zinc	65.11
12	Magnesium	63.82
13	Phosphorus	62.35
14	Vitamin B6	58.62
15	Vitamin E	58.57
16	Folate	58.37
17	Vitamin K	55.69
18	Vitamin C	45.8
19	Calcium	42.83
20	Selenium	27.26
21	Fibre	22.58
22	Chromium	21.20
23	Vitamin D	12.58
24	Iodine	0

6.7 ANTHROPOMETRIC MEASUREMENTS

6.7.1 Introduction

This section presents results from anthropometric measurements that were discussed in subsection 2.6.2.1.2 of Chapter 2. The measurements were taken on the following parameters; weight-for-age (WAZ), height-for-age (HAZ) and BMI-for-age (BMIZ).

6.7.2 Anthropometric parameters

6.7.2.1 Weight-for-age

This measurement is carried out on children that are not more than 10 years old (Faber & Wenhold, 2007). In the current study, it was undertaken to 146 children who fell in the range of 5-8 years of age. Of these children, the majority (80.14%) had `normal WAZ', while the remaining minority (19.86%) were `underweight' (Table 6.41). None were `severely underweight'. Underweight was more prevalent in Umzumvubu Local Municipality than in Ntabankulu, particularly among male children (Table 6.40).

6.7.2.2 Height-for-age

Among the 327 children who were subjected to this measurement, the overwhelming majority (90.70%) had `normal HAZ', followed by those (9.30%) who were `stunting' (Table 6.41). No children were `severely stunting'. Again, the prevalence of stunting in Umzimvumbu Local Municipality was higher than in Ntabankulu (Table 6.40).

6.7.2.3 BMI-for-age

Over half (56.57%) of the children included in this study had `normal BMIZ' (Table 6.41). A very small proportion (0.92%) was `wasting', and none were `severely wasting'. Of concern was a creeping problem of over-nutrition. For example, 36.39% of children were at `risk of overweight', while 6% and 8% were `overweight' and `obese', respectively. Noticeably, female children were heavier than their male counterparts of the same age.

Table 6.40 Anthropometric characteristics of children from agri-business families of Ntabankulu and Umzimvubu Local Municipalities

Classification	Z-score	Ntabankulu			Umzimvubu		
		Male	Female	Total	Male	Female	Total
WAZ (n=146)							
Severely underweight	<-3SD	0	0	0	0	0	0
Underweight	≥-3SD<-2SD	8 (14.04%)	5 (15.15%)	13 (14.44%)	11 (37.93%)	5 (18.52%)	16 (28.57%)
Normal WAZ	<-2SD	49 (85.96%)	28 (84.85%)	77 (85.56%)	18 (62.07%)	22 (81.48%)	40 (71.43%)
HAZ (n=327)							
Severely stunting	<-3SD	0	0	0	0	0	0
Stunting	≥-2SD	5 (5.05%)	6 (10.53%)	11 (7.05%)	8 (7.84%)	11 (17.74%)	19 (11.11%)
Normal HAZ	<-1SD to +3SD	94 (94.95%)	51 (89.47%)	145 (92.95%)	94 (92.16%)	51 (82.26%)	152 (88.89%)
BMIZ (n=327)							
Severely wasting	<-3SD	0	0	0	0	0	0
Wasting	<-2SD to >-3SD	1(1.01%)	0	1 (0.64%)	0	2 (2.5%)	2 (1.17%)
Normal BMIZ	>-2SD to <+1SD	67 (67.28%)	19 (33.33%)	86 (55.13%)	51 (65.38%)	47 (50.54%)	98 (57.31%)
Risk of overweight	>+1SD to <+2SD	28 (28.28%)	33 (57.89%)	61 (39.10%)	24 (30.77%)	35 (37.63%)	59 (34.50%)
Overweight	>+2SD to <+3SD	0	2 (3.51%)	2 (1.28%)	2 (2.56%)	4 (4.30%)	6 (3.51%)
Obese	>+3DS	3 (3.03%)	3 (5.26%)	6 (3.85%)	1 (1.28%)	5 (5.38%)	6 (3.51%)

Table 6.41 Summary of anthropometric characteristics of the children understudy

Classification	Z-score	Gender		Total
		Male	Female	
WAZ (n=146)				
Severely underweight	<-3SD	0	0	0
Underweight	≥-3SD<-2SD	17 (17.71%)	12 (24.00%)	29 (19.86%)
Normal WAZ	<-2SD	79 (82.29%)	38 (76.00%)	117 (80.14%)
HAZ (n=327)				
Severely stunting	<-3SD	0	0	0
Stunting	≥-2SD	13 (7.34%)	17 (11.33%)	30 (9.30%)
Normal HAZ	<-1SD to +3SD	164 (92.66%)	133 (88.67%)	297 (90.7%)
BMIZ (n=327)				
Severely wasting	<-3SD	0	0	0
Wasting	<-2SD to >-3SD	2 (1.13%)	1 (0.67%)	3 (0.92%)
Normal BMIZ	>-2SD to <+1SD	117 (66.10%)	68 (45.33%)	185 (56.57%)
Risk of overweight	>+1SD to <+2SD	52 (29.38%)	67 (44.67%)	119 (36.39%)
Overweight	>+2SD to <+3SD	2 (1.13%)	6 (4.00%)	8 (2.45%)
Obese	>+3DS	4 (2.26%)	8 (5.33%)	12 (3.67%)

6.7.3 Key drivers of nutritional status

Further statistical analyses were carried out on key variables that were deemed influential in the children's nutritional status. These were the agri-business households' monthly non-farm income, monthly food expenditure, farm income, and the caregivers' level of education and ability to provide children with breakfast daily. To this end, non-parametric statistical analysis that has been referred to in section 6.5 was performed. A correlation analysis was used to establish a relationship between nutrient intake, and FVS and DDS from the 24h dietary recall method. Further correlation analysis was done between nutrient intake, and WAZ, HAZ and BMIZ.

6.7.3.1 Non-farm income

Regarding the caregivers' monthly non-farm income, the null and alternative hypotheses were as follows**:**

Null and alternative hypotheses No. 1	
H_0:	Higher caregiver's monthly non-farm income does not lead to his/her children' better nutritional status.
H_1:	Higher caregiver's monthly non-farm income leads to his/her children' better nutritional status.

The p-values for nutrient intake were statistically non-significant ($p \geq 0.05$) for total dietary fibre, and vitamins A and C, but either statistically significant ($p \leq 0.05$) or highly significant ($p \leq 0.01$) for the bulk of nutrients (Table 6.42). The p-values were highly significant ($p \leq 0.01$) for BMIZ, WAZ and HAZ.

The null hypothesis that `higher caregiver's monthly non-farm income does not lead to his/her children's better nutritional status' was rejected for many nutrients, except for total dietary fibre, and vitamin A and C. It was also rejected for BMIZ, WAZ and HAZ.

The alternative hypothesis was adopted.

6.7.3.2 Food expenditure

The null and alternative hypotheses on monthly food expenditure are stated as follows**:**

Null and alternative hypotheses No. 2	
H_0:	Higher caregiver's monthly food expenditure does not lead to his/her children' better nutritional status.
H_2:	Higher caregiver's monthly food expenditure leads to his/her children' better nutritional status.

The p-values for intake of nutrients, and BMIZ, WAZ and HAZ were statistically highly significant ($p \leq 0.01$) [Table 6.42]. Therefore, the null hypothesis that says `higher caregiver's monthly food expenditure does not lead to his/her children' better nutritional status' was rejected.

The alternative hypothesis was accepted.

6.7.3.3 *Farm income*

This variable's null and alternative hypotheses read as follows**:**

Null and alternative hypotheses No. 3	
H_0:	Higher agri-business family's farm income does not lead to its children' better nutritional status.
H_3:	Higher agri-business family's farm income leads to its children' better nutritional status.

The p-values for intake of all the nutrients, and the anthropometric dimensions - BMIZ, WAZ and HAZ - were statistically highly significant ($p \leq 0.01$) [Table 6.42]. To this end, the null hypothesis that reads `higher agri-business family's farm income does not lead to its children' better nutritional status' was rejected.

The alternative hypothesis was accepted.

6.7.3.4 *Educational qualifications of the caregivers*

The following null and alternative hypotheses were made on the educational qualifications of the caregivers**:**

Null and alternative hypotheses No. 4	
H_0:	Higher educational qualifications of a caregiver do not lead to his/her children' better nutritional status.
H_4:	Higher educational qualifications of a caregiver lead to his/her children' better nutritional status.

As shown in Table 6.43, the p-values for nutrient intake were either statistically significant ($p \leq 0.05$) or highly significant ($p \leq 0.01$) for all nutrients, except for calcium, phosphorus and vitamin D which had non-significant p-values ($p \geq 0.05$). The p-values for BMIZ, WAZ and HAZ were statistically significant ($p \leq 0.05$).

Therefore, the null hypothesis that `higher educational qualifications of a caregiver do not lead to his/her children's better nutritional status' was rejected. However, the same could not be said for calcium, phosphorus and vitamin D.

The alternative hypothesis was accepted.

Table 6.42 Summary of results of Kruskal-Wallis H test on the effect of caregivers' monthly non-farm income and farm income, and food expenditure on their children's nutritional status

	Statistical components								
Nutritional status – nutrient intake (p/d), and BMIZ, WAZ and HAZ	**Monthly non-farm income**			**Monthly farm income**			**Monthly food expenditure**		
	df	**Chi-square**	**Asymp. Sig.**	**df**	**Chi-square**	**Asymp. Sig.**	**df**	**Chi-square**	**Asymp. Sig.**
Energy, kJ	4	34.18	0.000**	9	37.45	0.000**	8	38.89	0.000**
Carbohydrates, g	4	27.62	0.000**	9	24.11	0.000**	8	60.07	0.000**
Protein, g	4	25.26	0.000**	9	23.89	0.000**	8	43.09	0.000**
Total fibre, g	4	8.38	0.079^{NS}	9	12.34	0.000**	8	65.44	0.000**
Calcium, mg	4	21.49	0.000**	9	15.87	0.000**	8	30.49	0.000**
Iron, mg	4	24.23	0.000**	9	19.76	0.000**	8	35.91	0.000**
Magnesium, mg	4	35.86	0.000**	9	32.19	0.000**	8	25.86	0.001**
Phosphorus, mg	4	30.14	0.000**	9	25.56	0.000**	8	38.30	0.000**
Zinc, mg	4	45.82	0.000**	9	40.47	0.000**	8	31.33	0.000**
Chromium, mg	4	24.91	0.000**	9	28.34	0.000**	8	55.18	0.000**
Selenium	4	11.56	0.021*	9	8.99	0.000**	8	27.12	0.001**
Iodine	4	17.89	0.001**	9	12.45	0.000**	8	50.60	0.000**
Vitamin A	4	4.05	0.399^{NS}	9	5.75	0.000**	8	39.06	0.000**
Vitamin B6	4	19.36	0.001**	9	17.54	0.000**	8	36.60	0.000**
Vitamin B12	4	45.92	0.000**	9	43.62	0.000**	8	33.97	0.000**
Vitamin C	4	9.46	0.050^{NS}	9	10.06	0.000**	8	46.46	0.000**
Vitamin D	4	39.25	0.000**	9	43.12	0.000**	8	25.11	0.000**
Vitamin E	4	18.85	0.001**	9	15.89	0.000**	8	57.79	0.000**
Vitamin K	4	16.10	0.003**	9	14.30	0.000**	8	78.59	0.000**
Thiamin	4	12.41	0.015*	9	13.94	0.000**	8	37.43	0.000**
Riboflavin	4	12.93	0.012*	9	10.11	0.000**	8	26.62	0.001**
Niacin	4	29.60	0.000**	9	26.13	0.000**	8	34.46	0.000**
Folate, µg	4	10.77	0.029*	9	7.33	0.000**	8	41.53	0.000**
Pantothenate, µg	4	16.28	0.003**	9	18.47	0.000**	8	45.92	0.000**
Biotin, µg	4	13.00	0.010**	9	11.79	0.000**	8	43.37	0.000**
MBIZ	4	42.82	0.000**	9	44.27	0.000**	8	46.08	0.000**
WAZ	4	44.23	0.000**	9	39.68	0.000**	8	40.12	0.000**
HAZ	4	43.18	0.000**	9	37.26	0.000**	8	43.91	0.000**

Table 6.43 Summary of results of Kruskal-Wallis H test on the effect of educational status of caregivers and their children's feeding patterns on nutritional status

Statistical components						
Nutritional status – nutrient intake (p/d), and BMIZ, WAZ and HAZ	**Level of education**			**Breakfast feeding patterns**		
	df	**Chi-square**	**Asymp. Sig.**	**df**	**Chi-square**	**Asymp. Sig.**
Energy, kJ	5	33.03	0.000**	1	20.37	0.001**
Carbohydrates, g	5	12.21	0.032*	1	2.61	0.106^{NS}
Protein, g	5	11.53	0.042*	1	8.40	0.004**
Total fibre, g	5	34.33	0.000**	1	3.17	0.075^{NS}
Calcium, mg	5	8.75	0.120^{NS}	1	6.00	0.010**
Iron, mg	5	12.68	0.027*	1	5.51	0.019*
Magnesium, mg	5	13.92	0.016*	1	18.27	0.000**
Phosphorus, mg	5	10.76	0.056^{NS}	1	11.72	0.001**
Zinc, mg	5	17.37	0.004**	1	11.07	0.001**
Chromium, mg	5	22.89	0.000**	1	0.27	0.605^{NS}
Selenium	5	13.64	0.018*	1	3.57	0.059^{NS}
Iodine	5	21.80	0.001**	1	1.21	0.272^{NS}
Vitamin A	5	32.89	0.000**	1	2.01	0.157NS
Vitamin B6	5	20.43	0.001**	1	4.37	0.037*
Vitamin B12	5	12.78	0.026*	1	0.06	0.808^{NS}
Vitamin C	5	23.80	0.000**	1	0.71	0.400^{NS}
Vitamin D	5	9.94	0.077^{NS}	1	2.88	0.090^{NS}
Vitamin E	5	35.53	0.000**	1	1.83	0.176^{NS}
Vitamin K	5	26.22	0.000**	1	1.14	0.286^{NS}
Thiamin	5	17.45	0.004**	1	1.65	0.200^{NS}
Riboflavin	5	13.71	0.018*	1	5.44	0.020*
Niacin	5	18.63	0.002**	1	21.44	0.000**
Folate, µg	5	29.81	0.000**	1	5.01	0.025*
Pantothenate, µg	5	21.80	0.001**	1	9.20	0.002**
Biotin, µg	5	27.21	0.000**	1	0.01	0.972^{NS}
BMIZ	5	12.18	0.021*	1	1.60	0.20^{NS}
WAZ	5	14.27	0.010*	1	1.93	0.32^{NS}
HAZ	5	13.42	0.015*	1	2.4	0.43^{NS}

6.7.3.5 Other drivers of nutritional status

Other key factors that could have an influence on the children's nutritional status were investigated in this study. These key factors are the households' breakfast patterns, FVS and DDS.

6.7.3.5.1 Children's breakfast patterns

In the previous chapter, breakfast eating patterns of the children were discussed. Table 5.19 of Chapter 5 which formed part of these discussions showed that the majority of children (80.2%) reportedly often had breakfast before they go to school or church, while the rest did not. Further investigations on this subject showed that, generally nutrient intake of those who had breakfast was higher than those who did not, except for chromium, vitamin A, vitamin B12, vitamin C and vitamin D. However, as shown in Table 6.43, the differences in nutrient intake were either significant ($p \leq 0.05$) or highly significant ($p \leq 0.01$) for 52% of the nutrients, and non-significant ($p \geq 0.05$) for the rest of the nutrients investigated in this study. The BMIZ, WAZ and HAZ of those who reportedly ate breakfast were slightly higher ($p \geq 0.05$) than that of those who did not.

In a nutshell, the nutritional status of children who ate breakfast before going to school or church was elevated in comparison to that of children who did not have breakfast.

6.7.3.5.2 FVS and DDS

Results on FVS and DDS were presented and briefly discussed earlier in this chapter. In the literature, these two components are widely regarded as indicators of dietary quality and nutritional status (Ruel & Menon, 2002; Ruel, 2002; Acham, Oldewage-Theron & Egal, 2012; Herrador, Perez-Formigo, Sordo, Gadisa, Moreno, Benito, Aseffa & Custodio, 2015; Thornston, 2016).

Subsequently to bivariate correlation analysis and in line with the above academic consensus, this study also found a positive association between nutrient intake, on one hand, and FVS and DDS, on the other hand. The extent of these associations varied with nutrients (Table 6.44). Further positive associations were identified between individual nutrient and BMIZ, WAZ and HAZ, with the exception of calcium and vitamin D which were negatively correlated to the above anthropometric standards (Table 6.45).

Table 6.44 **Summary of Pearson correlation analyses between nutrient intake, and FVS and DDS**

Nutrient	Statistical components			
	FVS		DDS	
	R	p-value	R	p-value
Energy, kJ	0.291	0.000**	0.182	0.003**
Carbohydrates, g	0.209	0.001**	0.212	0.001**
Protein, g	0.197	0.001**	0.215	0.000**
Total fibre, g	0.134	0.030*	0.082	0.184 NS
Calcium, mg	0.148	0.016*	0.178	0.004**
Iron, mg	0.229	0.000**	0.126	0.042*
Magnesium, mg	0.197	0.001**	0.169	0.006**
Phosphorus, mg	0.148	0.016*	0.171	0.005**
Zinc, mg	0.194	0.002**	0.171	0.005**
Chromium, mg	0.249	0.000**	0.158	0.010**
Selenium	0.152	0.013*	0.101	0.101NS
Iodine	0.218	0.000**	0.145	0.019*
Vitamin A	0.149	0.016*	0.129	0.036*
Vitamin B6	0.155	0.012*	0.102	0.099 NS
Vitamin B12	0.132	0.032*	0.124	0.045*
Vitamin C	0.214	0.000**	0.130	0.034*
Vitamin D	0.211	0.001**	0.193	0.002**
Vitamin E	0.486	0.000**	0.313	0.000**
Vitamin K	0.323	0.000**	0.036	0.566 NS
Thiamin	0.199	0.001**	0.194	0.002**
Riboflavin	0.125	0.043*	0.028	0.653 NS
Niacin	0.099	0.109 NS	0.030	0.633 NS
Folate, µg	0.155	0.012*	0.037	0.555 NS
Pantothenate, µg	0.023	0.023*	0.183	0.003**
Biotin, µg	0.099	0.107 NS	0.040	0.521 NS

Table 6.45 **Summary of Pearson correlation analyses between nutrient intake, and BMIZ, WAZ and HAZ**

Nutrient	Statistical components					
	BMIZ		WAZ		HAZ	
	R	p-value	R	p-value	R	p-value
Energy, kJ	0.072	0.211 NS	0.034	0.291 NS	0.084	0.241 NS
Carbohydrates, g	0.073	0.206 NS	0.018	0.346 NS	0.069	0.481 NS
Protein, g	0.158	0.006**	0.042	0.462 NS	0.098	0.591 NS
Total fibre, g	0.200	0.000**	0.074	0.570 NS	0.101	0.620 NS
Calcium, mg	-0.047	0.416 NS	0.105	0.600 NS	0.002	0.570 NS
Iron, mg	0.096	0.096 NS	0.231	0.002**	0.052	0.508 NS
Magnesium, mg	0.129	0.024*	0.183	0.350 NS	0.091	0.611 NS
Phosphorus, mg	0.089	0.124 NS	0.029	0.300 NS	0.067	0.521 NS
Zinc, mg	0.200	0.000**	0.074	0.410 NS	0.165	0.562 NS
Chromium, mg	0.103	0.073 NS	0.098	0.560 NS	0.172	0.530 NS
Selenium	0.079	0.171 NS	0.006	0.940 NS	0.058	0.670 NS
Iodine	0.009	0.874 NS	0.002	0.984 NS	0.014	0.364 NS
Vitamin A	0.220	0.000**	0.331	0.000**	0.020	0.330 NS
Vitamin B6	0.244	0.000**	0.100	0.610 NS	0.194	0.004**
Vitamin B12	0.102	0.074 NS	0.048	0.461 NS	0.183	0.290 NS
Vitamin C	0.306	0.000**	0.069	0.498 NS	0.284	0.300 NS
Vitamin D	-0.026	0.647 NS	0.000	0.990 NS	0.003	0.002**
Vitamin E	0.006	0.922 NS	0.008	0.892 NS	0.008	0.970 NS
Vitamin K	0.198	0.000**	0.009	0.880 NS	0.153	0.890 NS
Thiamin	0.153	0.008**	0.001	0.994 NS	0.091	0.710 NS
Riboflavin	0.042	0.466 NS	0.060	0.480 NS	0.030	0.523 NS
Niacin	0.172	0.002**	0.193	0.010**	0.124	0.541 NS
Folate, µg	0.122	0.033*	0.173	0.042*	0.070	0.734 NS
Pantothenate, µg	0.185	0.001**	0.210	0.000**	0.210	0.381 NS
Biotin, µg	0.146	0.010**	0.121	0.05*	0.177	0.004**

6.8 CHAPTER SUMMARY

Discussions made in this chapter centred on key factors that are indicative of the children's nutritional status, namely; FVS, DDS, nutrient intake, BMIZ, WAZ and HAZ. Results from the 24h dietary recall method showed that children were served rather small quantities of foods that made it difficult to meet their nutrient requirements. Children consumed a wide variety of food items from the `cereal, roots and tubers' food group, and very limited varieties from fruits and vegetables. As the result, the households had overall low mean FVS and conservatively high DDS on both 24h dietary recall and FFQ dietary assessment methods. Children from Ntabankulu had elevated nutrient intake than their counterparts from Umzimvubu. The children's intake of some nutrients met their RDA / AI (e.g. carbohydrates), while the intake of others fell below their RDA /AI (e.g. iodine). With respect to anthropometric indicators of nutritional status, the majority of children were found to have normal WAZ (80.14%), normal HAZ (90.70%) and normal BMIZ (56.57%). Of serious concern was the growing number of children who were at the risk of overweight (36.39%). Subsequent to hypothetical analysis, the following factors were found to have an effect on the children's nutritional status, namely; non-farm income, food expenditure, farm income, and the caregiver's level of education.

The following chapter discusses results presented in Chapters 5 and 6.

CHAPTER 7
DISCUSSION OF RESULTS

7.1 INTRODUCTION

In Chapter 5 a presentation was made of the results of the socio-economic status of households of the caregivers. In Chapter 6, a presentation was on the results of the caregivers' nutritional knowledge, attitudes and practices, and their children's eating patterns and related nutritional aspects, and anthropometric measurements.

This chapter seeks to make a discussion on the results of the aspects that have been outlined above, and their implications to the farming families under investigation.

7.2 KEY INDICATORS OF THE CHILDREN'S NUTRITIONAL STATUS

Parental nutritional knowledge, attitudes and practices may indirectly affect a child's nutritional status. Factors that are indicative of a child's nutritional status are namely; FVS, DDS, nutrient intake and anthropometric standards (BMIZ, WAZ and HAZ), all of which are discussed in the subsequent sections of this chapter.

7.2.1 Nutritional knowledge and attitudes

Generally, the caregivers were found to have good knowledge and attitudes towards various aspects of human nutrition such as the importance of eating breakfast, the ideal number of meals a child should have a day, the importance of food variety, dangers of excessive consumption of dietary salt, the importance of using clean water for drinking, and adherence to basic hygiene and sanitary measures. In part, this good nutritional knowledge and attitudes may be the function of nutritional advice that the caregivers get from DRDAR's agricultural extension officers, and personnel from other organisations. Nutritional advice does not shape nutritional knowledge and attitudes only, it also impact on one's feeding behaviour (Hard, Uno & Koch, 2015). In this study, the caregivers also appeared to advise each other on various nutritional and health matters. The telling themes and consistence of their answers to questions are supportive of this observation.

7.2.2 Nutritional practices

According to Shakkour (2007), good nutritional knowledge and attitudes do not automatically lead to good nutritional practices. In many instances good nutritional practices are hindered by socio-economic constraints such as employment, poverty, and many dependents (Naser, Jalil, Muda, Nik, Shariff & Abdullah, 2014). Indeed, in this study, the caregivers' feeding practices were not as good as their nutritional knowledge and attitudes. This observation was clear right from their provision of the first meal of the day – breakfast. Half of the caregivers could not provide their children with breakfast before they go to school or church. In view of various undesirable consequences that are associated with skipping breakfast, the affected children were exposed to:

- Reduced short memory (Hahoney, Taylor, Kanarek & Samuel, 2005);
- Reduced metabolism, and increased cholesterol and insulin levels (Min, No, Kang, Sim, Baik, Song, Yoong, Park & Joung, 2011).
- Depletion of energy (Holt, Delargy, Lawton & Blundell, 1999).; and
- Increased risk of type 2 diabetes (Mekary, Giovannucci, Cahill, Willett, van Dam and Hu, 2013).

This undesirable situation is possibly ameliorated by the school nutrition programme of the Department of Education which provides breakfast to school children. However, local schools provide breakfast rather late between 11h00 and 12h00, by which time a child who has not been provided with breakfast at home is already hungry.

Breakfast is one of many meals that are skipped by the caregivers' children understudy. Ideally, children aged 5-14 should have at least three meals a day and a snack in between (Macdiarmid, Loe, Craig, Masson, Holmes and McNeill, 2009). However, in this study, only 39.5% of the caregivers' households could afford the above prescribed number of meals. Equally of concern is the quality of consumed meals in the face of the revelation that over half of the caregivers' households find it difficult to provide a variety of meals. A wide variety of meals is likely to provide a wide range of nutrients that are necessary for a child's good nutritional status, health and performance at school. This view is widely held by many in the literature (Matla, 2008; Bezerra & Sichieri, 2011).

7.2.3 Variety of meals and implications on nutrient intake

The caregivers' inabilities in providing a variety of meals to their children is reflected on their households' low FVS. Most of the caregivers' households provided meals that are dominated by carbohydrates-rich maize products such as stiff pap, crumbed maize meal, samp and *amarhewu*, and wheat-based products such as steamed bread and baked bread. It was, therefore, not surprising that in this study the 'cereal, roots and tubers' food group had the highest FVS. On the other hand, it is commendable that most of the caregivers' households had a conservatively high DDS. This high DDS came as a result of consumption of few food items on a wide range of the nine food groups. This eating pattern is unlikely to lead to adequate nutrient intake and good nutritional status due to exclusion of critically important nutrients in the feeding menu. A wide range of fruit, which provide a good source of minerals and vitamins, was either rarely consumed or not consumed in many households. Apples and citrus were two most consumed fruits, but their consumption was limited to approximately half of the 263 households that were included in this study. Consumption of bananas was expected to be high by virtue of the proximity of the studied population and local retail shops to banana plantations of the province of KwaZulu-Natal. Banana consumption was reported in only 28.57% of the caregivers' households. It appears that physical availability of this food item was not a problem, but its financial accessibility (Burchi & De Muro, 2016).

It also appears that, the intake of minerals and vitamins that couldn't be realised from fruit consumption largely due to financial constraints, was realised from cheaper alternative sources of these nutrients - vegetables. For instance, carrots, pumpkin / squash fruit, and spinach which were consumed in many households provided an alternative cheaper supply of vitamin A which couldn't be accessed from a relatively expensive mango and apricot fruit /juice. A further intake of vitamin A appeared to have come from a moderate consumption of liver, a cheaper source of animal protein. Indeed, the intake of vitamin A exceeded two-thirds of this vitamin's RDA in between 60% and 100% of the children, depending on their age. Spinach and cabbage appeared to have provided either an alternative or a complementary source of vitamin C to citrus. This eating behaviour appeared effective in satisfying vitamin C requirements for most of the children aged 4-8 years, but not much for many of the older children.

7.2.3.1 Macro-nutrients and energy

The macro-nutrients that were investigated in this study were namely, carbohydrates, protein and dietary fibre. The intake of fat, also a macro-nutrient, was not part of the investigation.

7.2.3.1.1 Carbohydrates

As indicated earlier in this chapter, carbohydrates-rich food items from the `cereal, roots and tubers' food group had the highest FVS when compared to other eight food groups. Most of these food items featured high in the list of the top 20 most consumed food items. It, therefore, transpired expectedly that all 327 children included in this study had carbohydrates intake that exceeded 67% of the RDA for this nutrient. These results are characteristic of eating behaviour of poverty stricken households. Work done by some authors in other provinces of South Africa also yielded similar results. That is:

- Silangwe (2012) and Mchiza *et al*.,2015) in KwaZulu-Natal;
- Matla (2008) in Gauteng;
- Rossouw (2005) and Mchiza *et al.* (2015) in North-West;
- Mushaphi (2011) in Limpopo; and
- Mofokeng (2013) in Orange Free State.

Carbohydrates are vital in providing a source of energy (Laville & Nazare, 2009; Hardy *et al*., 2015). However, excessive intake of carbohydrates among children is known to lead to harmful conditions such as obesity, which in turn may lead to other conditions such as diabetes (Joubert, Norman, Bradshaw, Goedecke, Steyn & Puoane, 2007; van Dam & Seidell, 2007).

7.2.3.1.2 Protein

Regarding protein, its intake was also high, with between 92%-100% of the studied children having intake of this nutrient exceeding 67% of its RDA. Canned fish and chicken were the two most consumed sources of protein. Other studies found chicken to be the main source of protein (Matla, 2008; Silangwe, 2012; Rossouw, 2005, Govender, 2011; Mchiza *et al*., 2015). The consumption of dried beans, which are cheaper alternative sources of protein was not exploited. Other cheaper legumes such as soya and lentils were not consumed at all; apparently due to the entrenched eating habits in the study area. Such eating habits are common across the globe (Ganasegeran, Al-Dubai, Qureshi, Al-abed, AM & Aljunid, 2012; Coelho, Cándido, Machado-Coelho & de Freitas, 2012).

7.2.3.1.3 Dietary fibre

The intake of dietary fibre was not only low, but is concerning. This situation appears a function of food processing which often results in refined food that has either low fibre content or none. Even purchased maize-based staple food items that were consumed by the study population had little fibre content in it. Breakfast cereals which contain a considerable amount of dietary fibre were consumed in few households (11%), because they are not easily financially accessible. Vegetables could not have provided a good source of dietary fibre, because a few of such vegetables (cabbage and spinach) were consumed, and their consumption was in very small quantities as shown in Chapter 6.

Nevertheless, other similar studies conducted in South Africa which made similar observations with respect to low intake of dietary fibre were in North West (Rousouw, 2005; Mchiza *et al*., 2015), and Gauteng (Mchiza *et al*., 2015). In fact, low levels of dietary fibre intake is a concerning problem in many parts of the world including developed countries like the US (Garko, 2013), and many developing countries (Vitolo, Campagnolo & Gama, 2007). Low dietary fibre intake in children is associated with the following conditions:

- Colorectal cancer (Bijkerk, Muris, Knottnerus, Hoes & Wit, 2004; Murphy, Norat, Ferrari, Jenab, Bueno-de-Mesquita & Skeie, 2012; Garko, 2013);

- High incidence of obesity (Vitolo *et al*., 2007); and
- High incidence of cardiovascular diseases and diabetes (Marlett, McBurney & Slavin, 2002).

7.2.3.1.4 Energy

In concluding a discussion in this sub-section, it is worthy to mention that the food items from the ‘cereal, roots and tubers’ food group which led to high intake of carbohydrates did not yield energy that satisfied the requirements of the children under study. The amount of additional energy yielded from consumption of foods from the ‘flesh foods’ and ‘fats and oils’ food group also fell short in satisfying the children’s energy requirements. There are three possible and plausible reasons for the energy deficit:

- The consumed food quantities were low, owing to constraining socio-economic status of the caregivers which had been presented in Chapter 5. Silangwe (2012) made similar observations in KwaZulu-Natal.
- Food intake, particularly among older children was under-reported by the caregivers.
- Older children who had higher Physical Activity Level (PAL) factors were more active than the younger children due to long distances that they had to travel to school, and farming-related chores that they had to do at home. Some of them also participated in sporting activities at school and their places of residences.

In view of the above situation, and findings of similar studies that have been conducted locally, it appears that the majority of South African children have energy intake that is below their requirement for this nutrient. The worst affected happened to be children from a black population particularly in rural areas and informal urban areas (Mchiza *et al*., 2015).

7.2.3.2 Minerals and vitamins

The results of low intake of many minerals and vitamins that have been presented in Chapter 6 are a reflection of poor consumption of fruits and vegetables. Among the eight minerals that have been investigated in this study, only four had intake that ranged from moderate to high. These minerals were iron, magnesium, phosphorus and zinc. The intake of these minerals exceeded 67% of their RDA / AI in over half of the 327 children that were included in this study. However, the same could not be said for calcium, selenium, chromium and iodine, because less than half of the children exceeded the above threshold of 67% of the nutrients' RDA / AI. In vitamins, moderate to high intake were recorded in 11 out of 13 vitamins that were investigated. These were vitamins A, B6, B12, K and E, thiamin, riboflavin, niacin, folate, pantothenic acid, and biotin.

The rather satisfactory intake of the abovementioned minerals and vitamins is attributable to many factors. Firstly, the purchased bread / baking flour and maize meal had been fortified with selected minerals and vitamins in accordance with the South African Act No 54 of 1972 (Department of Health, 1972). Fortification of maize meal was evident among the local newly established maize milling companies that have been funded through food security programmes of the Department of Rural Development and Land Reforms (DRDLR) and DRDAR. These programmes are AgriParks and Rural Enterprise Development (REDHUBS). Fortified food items and their nutritive value appeared in the database of FoodFinder III. Secondly, high consumption of food items such as dried beans, chicken, canned fish, dairy products, carrots, pumpkin / squash fruit and spinach appeared to have led to moderate or high intake of the minerals and vitamins that have been referred to above. However, as indicated earlier, these food items were not consumed in inadequate quantities.

Other than the fortification of staple food items, farming families need to grow and consume a wide range of vegetables, including those that are cheaper alternatives to fruit. Daily consumption of vegetables is associated with improved gastro-intestinal health status and vision, reduced risks of heart disease, diabetes, stroke, cancer and improved general health (Prior & Cao, 2000; Hyson, 2002; Goldberg, 2003). Analysis from FoodFinder III showed that the consumption of spinach by the study population played a pivotal role in elevating the intake of minerals and vitamins that were under investigation. Spinach is a wonderful leafy vegetable that is rich in many minerals and vitamins that include calcium, iron, magnesium, zinc and phosphorus, as well as vitamins A, B6, C, E and K, and niacin, thiamin, riboflavin, and folate (Akubugwo, Obasi, Chinyere & Ugbogu, 2007). Indeed, the intake of most of these minerals and vitamins was either moderate or high, depending on the children's age and gender. Needless to say, in order to improve intake of all minerals and vitamins, and mitigate the outlined diseases (Dias, 2012), diversification vegetable production and consumption should be applied. Inclusion of a legumes other than dried beans in study population's diets is encouraged so as to improve the intake of nutrients that cannot be realised from rather expensive dairy products, for example, calcium. Alfred Nzo District has unexploited potential to produce legumes which include soya. In addition to entertaining diversified crop / horticultural production, nutrition education need to be taken seriously in view of those nutrients whose intake was below 67% of their RDA in many households. Amongst many, these included dietary fibre, chromium, and iodine. The latter's deficiency early in life is likely to impair children's intellectual and developmental abilities (Zimmermann & Boelaert, 2015). To this end, a typical nutritional education would be informative and would encourage caregivers to purchase and consume iodised salt which costs as much as the non-iodised product. Since 1995, the South African government instructed that all table salt for sale be iodised (Jooste & Zimmermann, 2016). However, the catch is that many caregivers included in this study reportedly used salt sparingly (Chapter 5), owing to health dangers of excessive consumption of this food item.

7.2.4 Anthropometric dimensions

The results of anthropometric measurements showed that most of the children under investigation had 'normal weight-to-age' (80.14), and 'normal height-to-age' (90.7%), and had fewer, but concerning cases of 'underweight' (19.86%) and 'stunting' (9.30%). With respect to BMIZ, the majority of children had 'normal BMIZ' (56.57%) and a fewer worrisome cases of 'risk of overweight' (36.39%), 'overweight' (2.45%), and 'obesity' (3.67%). Prevalence of 'wasting' was negligibly small (0.92%).

On one hand, the above results suggest that the majority of children from agri-business families have good nutritional status. On the other hand, and notwithstanding the children's good nutritional status, the above results are indicative of the fact that children from Alfred Nzo Municipality are 'sandwiched' between problems of malnutrition/hunger, on one extreme, and overweight /obesity, on the other extreme. Regarding the latter extreme, van Graan *et al*., (2013) cautioned that South African children are the most obese when compared to their sub-Saharan African counterparts. This situation is expected to remain, if not exaggerated partly because many black people in rural areas still associate overweight/ obesity with good health, while lean weight is associated with adversity. As presented in Chapter 5, most caregivers' (84.0%) appraised and categorised their children's BMI in the healthy weight range, contrary to the anthropometric measurements that have been presented above.

Nevertheless, both extreme problems of malnutrition / hunger and overweight / obesity among the children understudy can be addressed. In both problems, nutrition education and improved agricultural production levels are not only the key, but are the starting point going forward. A typical example on advancing nutrition education is that caregivers should be enlightened not to embrace overweight / obesity due to its harmful effects such as:

- Heart disease (Karnik & Kanekar, 2011; Raj, 2012);
- Type 2 diabetes (Pulgaron & Delamater, 2014);
- Hypertension (Raj, Sundaram, Paul, Deepa & Kumar, 2007); and
- Social discrimination (Goyal, Shah, Saboo, Phatak, Shah & Gohel, 2010).

Furthermore, nutrition education should be employed to drive the farming practices of agri-business households into producing and /or accessing a wide range of crops / vegetables and livestock / poultry so as to make improvements in their households' FVS, DDS, nutrient intake and feeding practices, in general. This recommendation is prompted by the influence that the abovementioned parameters has on anthropometric dimensions – WAZ, HAZ and BMIZ – (see section 6.5.3 on key drivers of nutritional status).

7.3 INTERPRETATION OF HYPOTHESES

This study had four hypotheses which were tested, and its outcomes presented in Chapter 6. The remaining sub-sections of the current chapter are devoted to interpreting these hypotheses.

7.3.1 Non-farm income

The first hypothesis of this study was that:

H_0: Higher caregiver's monthly non-farm income does not lead to his/her children' better nutritional status.

H_1: Higher caregiver's monthly non-farm income leads to his/her children' better nutritional status.

Having rejected the null hypothesis and the alternative became relevant. Indeed, the households' non-farm income was positively highly correlated ($r=0.55$) to household food expenditure ($p<0.01$). In turn food expenditure had a significant influence on FVS ($p<0.01$) and DDS ($p<0.05$). Notwithstanding that agri-business farmers are expected to produce food, and use farm proceeds to financially access that which they cannot produce, non-farm appeared to play a significant role in the farming families' nutritional status. These non-farm incomes included salaries / wages of employed family members, remittances, and government's child support grant and old age grant. There is extension literature on the role played by various sources of non-farm income in sustaining farming families food security (Stats SA, 2011). According to von Fintel and Piennaar (2016), non-farm income, especially government social grants create dependency on the fiscus among smallholder farmers of the former homelands.

7.3.2 Expenditure on food

The second hypothesis of this study states that:

H_0: Higher caregiver's monthly food expenditure does not lead to his/her children' better nutritional status.

H_2: Higher caregiver's monthly food expenditure leads to his/her children' better nutritional status.

The null hypothesis was rejected in favour of the alternative. As indicated in the previous section, expenditure on food had a strong influence on dietary diversity which happened to be the indicator of dietary quality and of nutritional status (Bezerra & Sichieri, 2011). Various similar studies also established that household expenditure on food has a great influence on food security or nutritional status (Thorne-Lyman, Valpiani, Sun, Semba, Klotz, Kraemer, Akhter, de Pee, Moench-Pfanner, Sari & Bloem, 2010; FAO, 1996; Hatloy, Hallund, Diarra & Oshaug, 2000; Melgar-Quinonez, Zubieta, MkNelly, Nteziyaremye, Gerardo & Dunford, 2006; Naser *et al*., 2014).

However, Rauber and Vitolo (2009) qualified the extent of influence of food expenditure on nutritional status by asserting that the two variables were related to each other only in as far as intakes of micronutrients is concerned. The consumption of energy-rich fats and carbohydrates were not part of the relationship under discussion. These findings further reinforce the need for the caregivers to top-up the children's meals that are based on staple foods with other food materials that are rich in minerals and vitamins which they can produce and / or purchase. The adoption of this nutritional practice among farming families is not expected to be easy. Agreeably, von Fintel and Pienaar (2016) found that smallholder farmers in the former homelands, of which Alfred Nzo District was part, are contend with feeding their families with what they produce than with what they purchase. Non-farming families purchase a wide variety of food items which make them food secure than their farming counterparts (von Fintel & Pienaar, 2016).

7.3.3 Farm income

Farm income refers to annual turnover generated from farming activities of agri-businesses. Accordingly, the third hypotheses were formulated as follows:

> H_0: Higher agri-business family's farm income does not lead to its children' better nutritional status.
>
> H_3: Higher agri-business family's farm income leads to its children' better nutritional status.

The null hypothesis was rejected in favour of the alternative. However, the FVS and DDS, and feeding practices of agri-business families that have been presented in Chapters 5 and 6 indicated that these families' farm income was not sufficient to allow them to financially access a wide range of food items. Their farm produce may not have been sufficient either, nor their farm income (see Table 5.16).

Low production and productivity has always been a problem with many previously disadvantaged farmers in the Eastern Cape. For instance, since their inception in 2003/4, Massive Food Production Programme (MFPP) and Siyakhula Programme (SP) which focussed mainly on grain production, like many of the agri-businesses understudy did, failed to meet their initial target of seven tons per hectare in the fifth year; the average yields were well below the target at 3.8 tons per hectare (Mtero 2012). These findings uphold those that were made by Bembridge (1984), some three decades ago wherein he found that crop production levels of smallholder farmers are below subsistence levels. Furthermore, between 2003/04 and 2007/08, the Eastern Cape invested R270 million in MFPP and SP. A loss of R20 million was suffered at the end of 2007/08 (Tregurtha 2012). Low yields on livestock production are also a food security concern. Ainslie (2005) indicated that contrary to what is often reported in the literature, the current livestock numbers in the rural areas of the Eastern Cape are similar to those reported in the 1930s.

Low food production levels in the Eastern Cape are caused by many factors. At a higher level, Jacobson and Myhr (2012) puts a blame on the neoliberal policies that promote unidirectional agricultural development through growth only. These agricultural policies promote commercialisation, whilst they overlook the imperative task of social conscientisation which is critically important in changing the mind-set of the previously disadvantaged smallholders, first and foremost. As a result of the omission of social conscientisation in favour of commercialisation, the private sector has made more gain than smallholder farmers (Mtero 2012).

7.3.4 Caregivers' level of education

The fourth hypothesis of this study goes as follows:

> H_0: Higher educational qualifications of a caregiver do not lead to his/her children' better nutritional status.
>
> H_4: Higher educational qualifications of a caregiver lead to his/her children' better nutritional status.

The null hypothesis was rejected in favour of the alternative. The caregivers' level of education influences his / her children's nutritional status in many ways. During the field visits, those with higher levels of education appeared assertive and knowledgeable about various aspects of nutrition which are important in raising a child. Some could access and interpret nutrition-related information on their own. Indeed, this was found commendable in a district that has literacy rate of 55% (ECSECC, 2014). This study's socio-economic results showed that caregivers with relatively higher level of education were able to seize employment opportunities, be it on either a permanent basis or temporary or fixed-term contracts (see Chapter 5). Non-farm income realised from these employment opportunities influenced the children's nutritional status as discussed in sub-section 7.3.1. In the literature, there is abundance of studies that are supportive of a relationship between parental level of education and children's nutritional status (Thorne-Lyman *et al*., 2010; Nase *et al*., 2004; Annim & Imai, 2014; Hooshmand & Udipi, 2014).

Notwithstanding the importance of formal education, the researcher asserts that nutritional education should be strengthened in order to change eating behaviour of among the farming families. In many parts of the world nutritional education is held in high regard (Hard, Uno & Koch, 2015).

CHAPTER 8
SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

8.1 INTRODUCTION

This chapter provides a brief summary of the work done during the course of this study, conclusions drawn, and recommendations made. It also elaborates on the contribution of the study and future research.

8.2 SUMMARY OF WORK DONE

The underlying purpose of this study is to investigate the current state of nutrition security / nutritional status among children from agri-business families, thereby making a contribution to further understanding of the parent concept of food and nutrition security; its application and implications to various role players and stakeholders. Indeed, in pursuit of this purpose, work was performed, and various activities unfolded. First and foremost, an extensive literature review was undertaken of the concept of food security in terms of its origin in the 1930s (section 2.3) and its evolution that has been advanced by various researchers, organisations, events and developments (section 2.4). This evolution saw the emerging of various definitions and dimensions of understanding of the concept of food security (section 2.2 and Table 2.1), and other forms and levels of food security which include the focal nutrition security (section 2.4.3). Also reviewed were the four components that constitute the concept of food security. Among these components, of particular importance to the purpose of this study is food utilisation (section 2.5.3). Accordingly, a review was done on selected aspects of human nutrition that relate to the purpose of this study and on scientifically proven methods of measuring nutritional status (section 2.6). This study's literature review was also extended to how the world and its many parts experience food (in)security (Chapter 3). Special emphasis on this review was placed on the application of this concept in South Africa, in general, but particularly in the Eastern Cape Province of South Africa.

The extensive literature review had many outcomes. Firstly, gaps in the literature of food security which culminated into a research problem were identified, discussed and summarised in Table 1.1 of Chapter 1. Against the research problem / gaps, research questions and hypotheses were formulated (section 1.7) along with corresponding research objectives (section 1.8).

In order to achieve the abovementioned research elements / outcomes, appropriate research methodology was followed (Chapter 4). That is, a study population of agri-business families who operate and reside in Umzimvubu and Ntabankulu Local Municipalities of Alfred Nzo District Municipality in the Eastern Cape Province was identified. Targeted were previously disadvantaged smallholder agri-business owners / managers whose individual or collective annual turnover is between R150 000 and R4 000 000. All owners / managers who met this criterion were purposefully selected from a farmer database that was made available by local agricultural extension officers. Subsequent to the exclusion of farming families who did not meet the lowest entry requirement, the whole remaining purposeful research sample of 263 agri-business owners / managers, and 327 children aged 5-14 years was included in this study. From each of the 263 farming households, questions that relate to nutritional knowledge, attitudes and feeding and general care of children were directed to caregivers who lived in these households. After data was collected through the use of scientifically sound research instruments for measuring nutritional status, data was subjected to statistical analyses which included parametric statistics and non-parametric statistics (Mann-Whitney U test and Kruskal-Wallis H test), subject to the violation of key statistical assumptions. The study's results were presented in Chapters 5 and 6, and discussed in Chapter 7.

Having summarised the worked done in this study, the following section contains conclusions drawn from the study.

8.3 CONCLUSIONS

This section outlines the actual conclusions of the study. This is done by revisiting the research questions and hypotheses, objectives and purpose, and demonstrate how they were achieved.

8.3.1 Linking findings to research questions and hypotheses

Mann-Whitney U test and Kruskal-Wallis H test were used to address the research questions and hypotheses. Conclusions drawn from these exercises were as follows (sections 6.5.3 and 7.3):

- Higher caregiver's monthly non-farm income leads to his/her children's nutritional status;
- Higher caregiver's monthly food expenditure leads to his/her children's better nutritional status;
- Higher agri-business family's farm income leads to its children' better nutritional status; and
- Higher educational qualifications of a caregiver lead to his/her children's better nutritional status.

8.3.2 Linking findings to research objectives

Nutrition security / nutritional status was central to the objectives of this study. The direct indicators of nutrition security / nutritional status were; FVS, DDS, nutrient intake and BMI.

8.3.2.1 Objective 1: Establish baseline data for nutritional security / nutritional status among children from agri-business families

The agri-business families had low aggregated FVS of 23.43 and 25.51 on the 24h dietary recall and FFQ scales, respectively (sections 6.2-6.3). These low FVS are indicative of low nutritional status among children from agri-business families.

However, they had 'high' DDS of 7.82 and 8.12 on the 24h dietary recall and FFQ scales, respectively (section 6.4). These scores depict a 'high' DDS, although fewer food items were consumed from a wide range of food groups. Consequently, the nutritional status of children from agri-business families was conservatively and debatably' high'.

Details of intake 25 nutrients by children of agri-business families are shown in section 6.3 (Tables 6.11 – 6.35) and consolidated in Chapter 7. The baseline intake of these nutrients varied from being low, moderate and high; so is the reflected children's baseline nutritional status.

Baseline data on anthropometric measurements was that most of the children from the agri-business families had WAZ and HAZ scores of <-2SD and <-1SD to +3SD, respectively. These Z-scores respectively translated to 'normal weight-for-age' (80.14% of children) and 'normal height-for-age' (90.70% of children). Furthermore, most of the children (56.7%) had 'normal BMIZ' (body mass for-age) of >-2SD to <+1SD, followed by 36.39% of the children that were at 'risk of overweight' (>+1SD to <+2SD). Further details of the baseline anthropometric measurements are contained in Tables 6.40–6.41.

In the nutshell, most of the children from agri-business families had good nutritional status as far as their baseline anthropometric measurements are concerned.

8.3.2.2 Objective 2: Establish the extent of nutritional security / nutritional status amongst children from agri-business families, using a variety of scientifically sound research methods

In terms of FVS from the 24h dietary recall method, most (81.7%) of the agri-business families had low FVS, while the rest (18.3%) had medium FVS (see Figure 6.3.1 in section 6.2.10). These findings are indicative of low nutritional status at a large scale among agri-business families. A similar conclusion was drawn when using FVS generated from FFQ. That is, most households (74.9%) were on low FVS, followed by those (25.1%) on medium FVS (see Figure 6.3.2 in section 6.2.10).

With respect to dietary diversity, on a 24h dietary recall method, most (70%) of the agri-business families had high DDS, followed by those (25.7%) with medium DDS, and low DDS (4.2%). Similar conclusions were echoed in FFQ method where 73.8%, 23.2% and 3% of households were found on high DDS, medium DDS and low DDS, respectively. As indicated earlier in the previous section, these DDS depict a largely medium and high nutritional status, while in reality, a limited number of food items were consumed from a wide range of food groups. The case in point is fewer food items picked and consumed from the vegetables, fruits, and legumes and nuts food groups (sections 6.2.4, 6.2.6, 6.2.7 and 6.2.8). Therefore, the large scale of medium DDS and high DDS should be viewed cautiously.

The baseline data on nutrient intake of the 25 investigated nutrients was outlined in Chapter 6-7. The RDA / AI for the 24 nutrients – excluding energy - are shown in Tables 6.12 – 6.35 alongside the children's intake for these nutrients. Irrespective of age and gender, the children's intake of the following nutrients was either higher or within their RDA / AI. These are namely; carbohydrates, protein, iron, phosphorus, vitamin A, vitamin B12, vitamin K, thiamine, riboflavin, niacin, and biotin. To the contrary, the children's intake of the following nutrients was lower than their RDA / AI. The nutrients in question are fibre, calcium, magnesium, zinc, chromium, selenium, iodine, vitamin B6, vitamin C, vitamin D, vitamin E, folate, and pantothenic acid.

In pursuit of fulfilling the current research objective, a calculation was made of the number of children whose nutrient intake for a particular nutrient exceeded at least 67% of the RDA / AI for that nutrient. The detailed outcomes of these calculations are outlined in Tables 6.12 - 6.35 and summarised in Tables 6.36-6.39. In summary and irrespective of age and gender, the following proportion of children had intake that exceeded 67% of the RDA / AI for these nutrients, namely; carbohydrates (100%), protein (97.84%), fibre (22.58%), calcium (42.83%), iron (87.85%), magnesium (63.82%), phosphorus (62.35%), zinc (65.11%), chromium (21.2%), selenium (27.26%), iodine (0%), vitamin A (77.77%), vitamin B6 (58.62%), vitamin B12 (75.16%), vitamin C (45.8%), vitamin D (12.58%), vitamin E (58.57%), vitamin K (55.69%), thiamine (95.09%), riboflavin (92.72%), niacin (93.55%), folate (58.37%), pantothenic acid (73.77%) and biotin (82.16%).

The extent of nutritional status of children from agri-business families in terms of their anthropometric dimensions has been covered in the previous sub-section. That is, most were found to have 'normal WAZ', 'normal HAZ' and 'normal BMIZ' (see Tables 6.40-6.41 for more details).

8.3.2.3 Objective 3: Identify and understand shortcomings to achieving nutritional security or good nutritional status amongst children from agri-business families

Key impediments to achieving the above objective are outlined below.

a) Low non-farm income and other constraining demographic factors

This study has shown that non-farm income strongly influences food expenditure and eventually nutritional status, through direct and indirect indicators such as feeding patterns of skipping breakfast, consumption of small quantities of food, narrow food variety and dietary, and poor nutrient intake (Chapter 5 and 6). The agri-business families were found to earn modest non-farm income that is fairly similar to the one earned by many poor non-farming families in the region, with only 19.8% families earning a monthly non-farm income of more than R2 500, while the majority (32.9%) earn in the range of R1 001- R1 500. Over 90% of this income is used to buy food, an expenditure that is symptomatic of poverty (ECSECC, 2014).

Various demographic factors that stretch the very limited non-farm income came to the fore during the course of this study. These are high unemployment rates amongst family members, a large number of dependants, and low levels of education; all of which are characteristic of poverty (Section 5.3.15 – 5.3.1.6).

b) Low farm income and limited agricultural production

The farm income of agri-business families does not appear sufficient to financially access nutritious foods that would elevate their nutritional status. This explains why their monthly expenditure on food is so modest; R701 – R900 being the expenditure of most families (section 5.3.1.8). Information from semi-structured interviews indicated that most of the consumed by the children on agri-business families is not produced their farming activities, but is financially accessed from grocery shops, and through the government school nutrition programme (sections 5.3.2.2 – 5.3.2.3). The large proportion of staple food consumed also appeared to have been acquired from the grocery shops, because their nutritive value showed that it had been fortified minerals and vitamins. Livestock production (Table 5.14) did not appeared to support neither sufficient nor large scale consumption of dairy products, eggs, red meat and pork (Chapter 6). A wide variety of vegetables and legumes which could do well in high potential soils and climate of Alfred Nzo District were not grown.

c) Nutritional knowledge and attitudes

Caregivers were found to have sufficient knowledge on various issues of nutrition. However, improvements need to be done through robust educational programmes, that are geared towards changing feeding attitudes and behaviour such as being content with growing and consuming a narrow band of vegetables and legumes. They also need to be equipped with skills to assess, monitor and interpret their children's BMI with better accuracy (Chapter 5.5.1.5 and 6.7.2).

Improved nutritional knowledge and attitudes should also be directed towards changing counter-nutritive feeding practices such as limited number of meals consumed per day (section 5.4.1.2) and lack of variety in meals (section 5.5.1.3).

Other impediments to achieving good nutritional status among the children of agri-business families which featured strongly during semi-structured interviews and direct observations were drought, high cost of food, and unavailability of some foodstuffs in the local grocery shops.

8.3.2.4 Objective 4: Draw recommendations based on the findings of the study

The recommendations which fulfilled this objective are contained in section 8.4 of this chapter.

8.3.3 Linking objectives to purpose

The purpose of this study is outlined in section 8.2. Conclusions drawn from the achieved objectives 1-4 showed that the nutritional status of children from agri-business families varied as determined and reflected on the indicative FVS, DDS, anthropometric dimensions and nutrient intake. On the scale of FVS and DDS, the nutritional status of children understudy is low and debatably high, respectively. On the scale of anthropometric dimensions, the majority of children had good nutritional status. Based on nutrient intake, the following nutrients appeared to support good nutritional status of the children under investigation; the potentially harmful and inhibiting effect of an overdose of some being a concern. These nutrients include carbohydrates, protein, iron, phosphorus, vitamin A, vitamin B12, vitamin K, thiamine, riboflavin, niacin, and biotin.

To the contrary, the intake of the following nutrients may not be sufficient to support good nutritional status of the children. That is fibre, calcium, magnesium, zinc, chromium, selenium, iodine, vitamin B6, vitamin C, vitamin D, vitamin E, folate, and pantothenic acid.

8.3.4 Contributions of the study

This study has made theoretical, methodological, and professional contributions in the body of knowledge of food and nutrition security, all of which are original in the agriculture sector, particularly among organised smallholder agricultural producers.

- This study has not only identified gaps in the body of knowledge of food and nutrition security through extensive literature review (Table 1.1), but it has charted a methodologically sound path to filling these gaps (Chapter 4). A further striking observation is that these gaps are more severe in developing countries like South Africa, than in developed counterparts (Chapter 3).
- The nutritional status of children of agri-business families from Alfred Nzo District, South Africa, has been measured and benchmarked against its international acclaimed indicators, in the name of FVS, DDS, anthropometric measurements and nutrient intake (Chapter 6).
- This study, being the first of its kind to be conducted among previously disadvantaged, but now organised smallholder agri-business families, provide a comparative database in this agricultural band in South Africa. Accordingly, the findings of this study dismiss the long-held myth that children of agri-business families are automatically nutrition secure and have elevated

nutritional status, by virtue of being dependants of food producers (Chapters 6 and 7).

- In line with the above findings, this study found that against the popular belief by many policy makers (Chapter 3), that food production, and food availability, thereof, are key to addressing individual food and nutrition insecurity; good nutritional knowledge, attitude and feeding practices presented themselves as effective alternative vehicles in this discourse. Case in point, large intake of micro-nutrients was sourced from fortified commercial staple foods, rather than from unfortified home grown (Chapter 6 and 7).
- As a result of the baseline data, this study contributes to the much-needed national data on nutritional status with a view to updating dietary references intake for children. It also provides a foundation for future research in the smallholder agri-business band of the agriculture sector.

Lastly, but not the least. Three research papers have so far been prepared for publication to various journals (see Annexure 8). In summary, these research papers and their status of publication are as follows:

Sonandi, A., Zwane, E.M. and Van Niekerk, J.A., 2017. Nutritional status of children from historically disadvantaged agri-business families, South Africa. *Paper has been accepted and revised for the Journal of Health, Population and Nutrition.*

Sonandi, A., Zwane, E.M. and Van Niekerk, J.A., 2017. Feeding practices, food variety and dietary diversity – indicators of nutritional status of children from historically disadvantaged agri-business families, South Africa. *Journal of Nutrition and Food Security, 2(4):308-317.*

Sonandi, A., Zwane, E.M. and Van Niekerk, J.A., 2018. Nutritional status, nutrient intake and anthropometric indices of children from agri-business families, South Africa. *Nutrition and Food Science International Journal, 6(2): 555682.DOI:10.19080/NFSIJ.2018.6.555682.*

8.4 RECOMMENDATIONS

This section of the chapter elaborates on recommendations to improve the state of nutrition security / nutritional status among agri-business families. Further recommendations are made on future research work to be undertaken.

8.4.1 Strategies to improve the state of food and nutrition security

In view of the findings, discussions and conclusions drawn on this study, the following recommendations for improving the state of nutrition security / nutritional status are made:

- Coordination and integration of provincial food security policies and programmes that have been outlined in Chapter 3.
- Coordination and integration of plans, implementation, monitoring and evaluation of the FNS policies and programmes.
- Extension officers of DRDAR should be charged with advancing nutrition education at schools and in communities. This responsibility should form part of their mandate in rural development. Education programmes should reflect on the deficiency of nutrients such as dietary fibre and iodine, among many. Other necessary elements of nutritional education are; namely, dietary diversity, feeding patterns, obesity, and diseases that are associated with poor nutrition.
- The Siyazondla Programme that was referred to in Chapter 3 should encourage production of a wide range of vegetables that are dense in micronutrients, while the Cropping Programme should accommodate production of protein-rich legumes.
- Necessary interventions should be made to increase production and productivity levels among smallholder agri-businesses. The operators of these enterprises are expected to feed the nation over and above their families.

In implementing the above recommendations, a reflection should be made on the participatory action research design that was used in this study. In line with the principles of this design, the study population should receive a feedback about the study from the researcher. The complexity of nutrition insecurity among families of smallholder agri-business owners / managers, warrants that this problem and the above recommendations are dealt with in an integrated and systematic approach. The researcher proposed a 6-step approach that is outlined in Figure 8.

Step 1: Formation of food and nutrition security forum

A provincial food and nutrition security forum need to be formed with the underlying mandate to coordinate planning, implementation, monitoring and evaluation of policies and programmes for this subject. The forum should be constituted by role players and stakeholders in the field of food and nutrition security. Terms of reference of the forum should be drawn and flow from its mandate.

Step 2: Stakeholder` and role player consultative workshop

Subsequent to the formation of the food and nutrition security forum, a consultative workshop for public and private stakeholders, and role players relevant to the subject should be held. This workshop should work towards a common understanding of the problem of food and nutrition insecurity in the province, a need for intervention, and a need to plan for such intervention.

Step 3: Identification and analysis of food and nutrition security policies and programmes

Having agreed on a 'plan to plan' in the previous step, the current step is meant to identify and analyse policies that regulate FNS in order to clarify them. Areas that inhibit successful implementation of the policies and programmes should be identified. At the end, this step should ensure that adopted policies and programmes are adhered to.

Step 4: Identification of strategic issues facing food and nutrition security

In this robust step, difficult but necessary questions should be raised on the current mandate of FNS, and type of clients that is being served under this mandate. Other pertinent questions are**:** who should serve the clients? Why should clients be served?

How should they be served? These questions together with their answers would be expected to yield strategic issues.

Step 5: Strategy development

In this step, strategies would be developed to deal with the strategic issues covered in the previous section. Basically, these strategies would include programmes, actions, decision-making and responsibilities, and resource allocations, among other things.

Step 6: Development of monitoring and evaluation mechanisms

Prior to the implementation of the strategy for food and nutrition security, monitoring and evaluation mechanisms should be put in place.

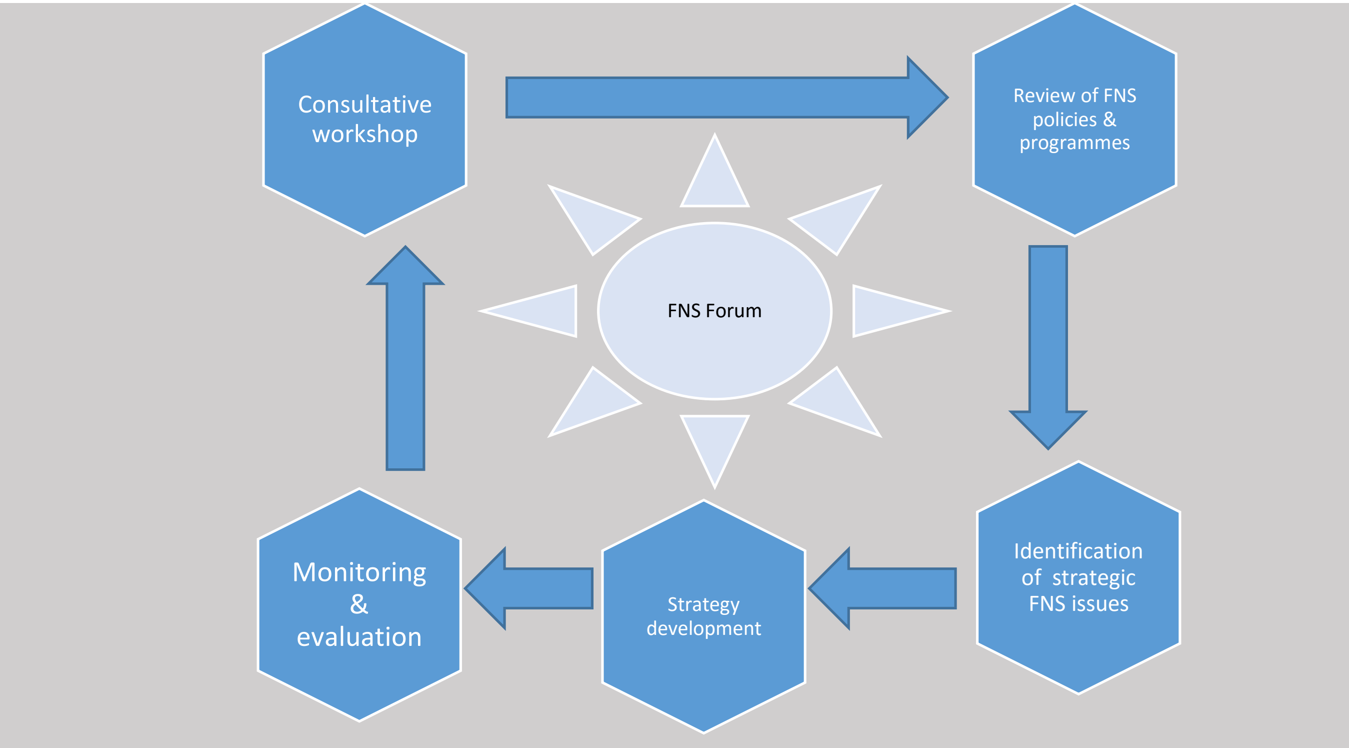


Figure 8 An integrated and systematic approach to addressing food and nutrition security

8.4.2 Future research work

In order to improve the chances of success of the abovementioned recommendations, there is a need to have supportive research initiatives. These initiatives should flow from the findings of the current study and its delimitations. Some of the research initiatives can yield results in the short period of time, while others are either medium-term or long-term based. Accordingly, the researcher proposed the following future research work:

- An investigation into the standard procedure(s) and method(s) to be used in assessing nutrition security / nutritional status is needed. Currently, many black smallholder farming families are declared food and nutrition insecure by virtue of being previously disadvantaged. The awarding of government production subsidies is based on this historical misfortune.
- As indicated in this study, FAO have targets on combating hunger. There is a need for such targets for nutrition security from municipality level to national level.
- In line with the above recommendation, there is a need to extend similar research to other provinces of South Africa and to SADC.
- There is also a need to establish the nutrition security / nutritional status of families of relatively bigger and well-established agri-business owners / managers.

BIBLIOGRAPHY

Abate, T., Shiferaw, B., Menkir, A., Wegary, D., Kebede, Y., Tesfaye, K., Kassie., M., Bogale, G., Tadessee, B & Keno, T., 2015. Factors that transformed maize productivity in Ethiopia. Food Security, 7: 965-981.

Abbaspour, N., Hurrell, R. & Kelishadi, R., 2014. Review on iron and its importance for human health. Journal of Research in Medical Sciences, 19(2): 164-174.

Abdu-Raheem, K.A. & Worth, S.H., 2011. Household food security in South Africa: evaluating extension's paradigms relative to the current food security and development goals. South African Journal of Agricultural Extension,39(2) 1-9.

Aborisade, B. & Bach, C. 2014. Assessing the pillars of sustainable food security. European International Journal of Science and Technology, 3(4):117-125.

Abrams, S.A., 2010. Calcium absorption in infants and small children: methods of determination and recent findings. Nutrients, 2(4): 474-80.

Acham, H., Oldewage-Theron, W.H. & Egal, A.A., 2012. Dietary diversity, micronutrient intake and their variation among black women in informal settlements in South Africa: a cross-sectional study. International Journal of Nutrition and Metabolism, 4(2):24-39.

Acquash, B. Kapunda, S., Legwegoh, A., Gwebu, T., Modie-Moroka, T., Gobotswang, K. & Mosha, A. 2013. *The state of food insecurity in Gaborone, Botswana.* University of Cape Town: African Food Security Urban Network (AFSUN).

Adekunle, O.O., 2013. The role of home gardens in household food security in the Eastern Cape: A case study of three villages in Nkonkobe Municipality. Journal of Agricultural Sciences, 5(10):67-76.

Ahad, F. & Ganie, S., 2010. Iodine, iodine metabolism and iodine deficiency disorders revisited. Indian Journal of Endocrinology and Metabolism, 14(1): 13-17.

African Studies Centre, 2011. *Food (in)security, famine and drought in Africa*. Available at: *www.ascleiden.nl/?q=content/webdossiers* [Accessed on 12 March 2013].

Ainslie, A., 2005. Farming cattle, cultivating relationships: cattle ownership and cultural politics in Peddie District, Eastern Cape. Social Dynamics, 31: 29-56.

Akubugwo, I.E., Obasi, N.A, Chinyere, G.C. & Ugbogu, A.E., 2007. Nutritional and chemical value of *Amaranthus hybridus L.* leaves from Afikpo, Nigeria. African Journal of Biotechnology, 6(24): 2833-2839.

Alfred Nzo District Municipality 2013. *Integrated Development Plan*. Bhisho, Eastern Cape: Government Printer.

Alfred Nzo District Municipality 2014. *Integrated Development Plan*. Bhisho, Eastern Cape: Government Printer.

Anderson, J.J., 2001. Calcium requirements during adolescence to maximise bone health. Journal of the American College of Nutrition, 20(2 Sppl): 186S-19S.

Andreou, E., Alexopoulos, E.C., Lionis, C., Varvogli, L., Gnardellis, C., Chrousos,

G.P. & Darviri, C. 2011. Perceived stress scale: reliability and validity study. International Journal of Environmental Research and Public Health, Vol. 8(8), pp. 3287-3298*.*

Annigan, J., 2015. *The effects of low protein intake*. http://healtheating.sfgete.com/ [Accessed 3 March 2015].

Appleby, M., 2014. *Three problems associated with low too much protein intake*. http://healtheating.sfgete.com/ [Accessed 18 December 2015].

Amend, A., Melkus, G. D., Chyun, D. A., Galasso, P., and Wylie-Rosett, J., 2007. Validation of dietary intake data in black women with type 2 diabetes. Journal of American Dietetics. Association, 107:112–117.

Andersen, L. F., Bere, E., Kolbjornsen, N., and Klepp, K. I., 2004. Validity and reproducibility of self-reported intake of fruit and vegetable among 6th graders. European Journal of Clinical Nutrition, 58: 771–777.

Annim, S.K. & Imai, K.S., 2014. *Nutritional status of children, food consumption diversity and ethnicity in Lao PDR*. Economics Discussion Paper Series EDP-1404. Manchester: University of Manchester.

Arumugam, V., Ooi, K. & Fong, T., 2008. TQM practices and quality management performances: an investigation of their relationship using data from ISO 9001:2000 firms in Malaysia. The TQM Magazine, 20(6): 636-650*.*

Arimond, M. & Ruel, M., 2002. *Summary indicators for infants and child feeding practices: an example from Ethiopia demographic and health survey 2000*. Food consumption and nutrition division discussion paper, Washington, D.C.: IFPRI

AUSAID, 2012. *Sustainable economic development.* Canberra, Australia: AUSAID. Available at: http://www.ausaid.gov.au [Accessed on 12 March 2013].

Babbie, E & Mouton, J, **2002.** *The practice of social research*. London: Oxford University Press.

Badari, S.A.Z., Arcot, J., Haron, S.A., Paim, L., Sulaiman, N. & Masud, J., 2012. Food variety and dietary diversity scores to understand the food intake pattern among selected Malaysian households. Journal of Ecology of Food and Nutrition, 51(4):265-299.

Barrett, C.B., 2010. Measuring food insecurity. Science, 327:825-828.

Bembridge, T.J., 1984*.* *A farming systems approach study of agricultural development problems in Transkei*. Doctoral thesis, Stellenbosch: University of Stellenbosch.

Bernard, R. H., 2006. *Research methods in anthropology: qualitative and quantitative approaches.* Walnut Creek: Altamira Press.

Beukman, T.L. 2005. *The effect of selected variables on leadership behaviour within the framework of a transformational organisation*. Doctoral thesis, Pretoria: University of Pretoria.

Bezerra, I.N. & Sichieri, R., 2011. Household food diversity and nutritional status among adults in Brazil. International Journal of Behavioral Nutrition and Physical Activity, 8(22):1-8.

Bhat, K.S. & Rajashekhar, J., 2009. An empirical study of barriers to TQM implementation in Indian industries. The TQM Magazine, 21(3): 261-272.

Bibler, S. & Lauterbach, C. 2012. *Gender, IFIs and Food Insecurity Case Study: Zambia*. Available at: www.genderaction.org. [Accessed on 12 November 2014].

Bickel, G., Nord, M., Price, C., Hamilton & Cook, J. 2000. *Measuring food security in the United States – guide to measuring household food security.* Washington DC: United States Department of Agriculture (USDA).

Bijkerk, C.J., Muris, J.W.M., Knottnerus, J.A., Hoes, A.W. & De Wit, N.J., 2004. Systematic review: the role of different types of fiber in the treatment of irritable bowel syndrome. Alimentary Pharmacology & Therapeutics, 19:245-251.

Borg, S. 2010. Doing good quality research. JACET Journal, 50: 9-13.

Broome, C.S., McArdle, F., Kyle, J.A.M., Andrews, F., Lowe, N.M., Hart, C.A., Arthur, J.R., & Jackson, M.J., 2004. An increase in Selenium intake improves immune function and poliovirus handling in adults with marginal selenium status1’2’3. The American Journal of Clinical Nutrition, 80(1): 154-162.

Bryman, A., 2004. *Quantity and quality in social research.* 1st Edition. London: Routledge.

Burchi, F. & De Muro, P., 2016. From food availability to nutritional capabilities: advancing food security analysis. Food Policy, 60: 10-19.

Burchi, F., Fanzo, J. & Frison, E. 2011. The role of food and nutrition system approaches in tackling hidden hunger. International Journal of Environmental Research and Public Health, 8: 358-373.

Burke, S.J., Lass, E., Thistle, P., Katumba, L., Tetha, A., Swarz, D., Bolotin, S., Barker, R.D., Simor, A. & Silverman, M. 2014. Increased incidence of tuberculosis in Zimbabwe, in association with food insecurity, and economic collapse: an ecological analysis. Pub Med, 9(2): e83387.

Burns, N & Grove, SK. 1999. *Understanding research*. 2nd edition Philadelphia: Saunders.

Buyene, F. & Muche, M., 2010. Determinants of food security among rural households of Central Ethiopia: an empirical analysis. Quarterly Journal of International Agriculture, 49(4):299-318

Calasanti, T. & King, N., 2015. Beware of the estrogen assault: ideals of old manhood in anti-ageing studies. *Journal of Ageing Studies*. 21(4): 357-368.

Capone, R., El Bilali, H., Debs, P., Cardone, G. & Driouech, N., 2014. Journal of Food Security, 2(1): 13-22.

Caracciolo, F., Depalo, D. & Macias, J.B., 2014. Food price changes and poverty in Zambia: an empirical assessment using household micro data. Journal of International Development, 26(4): 492-507.

Carlson, M.D.A. & Morrison, R.S., 2009. Study design, precision and validity in observation studies. Journal of Palliative Medicine, 12(1):77-82.

Castillo, J.J., 2009. Research population - experiment Resources. Available at: http://www.experiment-resources.com/research-population.html [Accessed on 24 November 2012].

Chapman, J. & Lown, C., 2010. Practical ways to promote and support collaborative data analysis projects. Code Journal {4} lib, 12: 1-11.

City of Toronto, 2000. *Toronto's food charter*. Available at: http://www.foodsecuritynews.com/presentations [Accessed on 24 November 2012].

Coelho, L.G., Cândido, A.P.C., Machado-Coelho, G.L.L. & de Freitas, S.N., 2012. Association between nutritional status, food habits and physical activity level in school children. Jornal de Pediatria, 88(5): 1-6.

Committee on World Food Security (CFS), 2012. *Coming to terms with terminology: food security, nutrition security, food security and nutrition, and food and nutrition security*. Rome: FAO.

Crush, J., Hovorka, A. & Tevera, D., 2011. Food security in Southern African cities: the place of urban agriculture. Progress in Development Studies, 11(4):285-305.

Darrouzet-Nardi, A.F., Masters, W.A., 2015. Urbanization, market development and malnutrition in farm households: evidence from the demographic and health surveys, 1986-2011. Journal of Food Security, 7: 521-533.

Davies, F. 2015. *Reconceptualising urban food security: an analysis of the everyday negotiations of food access in Lusaka, Zambia.* Master's degree thesis. Stellenbosch: University of Stellenbosch.

Demetre, L., Mchiza, Z.J., 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 of the World Health Organisation, 89:891-899.

Department of Agriculture (DOA), 2002a. *Agricultural education and training strategy for agriculture and rural development in South Africa*. Pretoria: Government Printer.

Department of Agriculture, 2002b*.* *Integrated Food Security Strategy for South Africa (IFSS) 2002*. Pretoria: Government Printer.

Department of Agriculture, Forestry and Fisheries (DAFF, 2014a). *Agricultural Policy Action Plan.* Pretoria: Government Printer.

Department of Agriculture, Forestry and Fisheries, 2014b*.* *Fetsa Tlala food production initiative.* Pretoria: Government Printer.

Department of Economic Development, Environmental Affairs and Tourism (DEDEAT), 2013. *The Eastern Cape socio-economic review and outlook*. Pretoria: University of Pretoria.

Department of Health (DOH), 1972. Foodstuffs, cosmetics and disinfectants Act No. 54 of 1972. Pretoria: Government Printer.

Department of Health, 2007. *South African guidelines on nutrition for people living with HIV /AIDS. TB and other chronic debilitating conditions*. Pretoria: Government Printer.

Department of Social Development and Special Projects (DOSDSP), 2012. *Eastern Cape anti-poverty and food security strategy*. Bhisho: Government Printer.

Department of Trade and Industry, 1996. *National Small Business Act No. 62 of 199*6. Pretoria: Government Printer.

De Cock, N., Haese, M.D., Vink, N., van Rooyen, C.J., Staelens, L., Schönfeldt, Haese, L.D., 2013. Food security in rural areas of Limpopo province, South Africa. Food Security, 5:269-282.

Dias, J.S., 2012. Nutritional quality and health benefits of vegetables: a review. Food and Nutrition Sciences, 3:1354-1374.

DINIcolantonio, J., Bhutani, J. & Keefe, J.H., 2015. *The health benefits of vitamin K. Open Heart, British Cardiovascular Society*. https://www.ncbl.nlh.nih.gov/pubmed/26468402

Dirwayi, T.P. 2010. *Application of the sustainable livelihoods framework to the analysis of the provincial growth and development plan of the Eastern Cape: A case study of the Massive Food Production Programme in Nkonkobe Municipality and Buffalo City Municipality*. Master's thesis. Alice: University of Fort Hare.

Drimie, S., Arntzen, J., Dube, P., Ingram, J.S.I., Mano, R.T., Mataya, C., Muchero, M.T., Vhurumuku, E. & Ziervogel, G. 2011. Global environmental change and food systems in Southern Africa: the dynamic challenges facing regional policy. Journal of Geography and Regional Planning, 4(4):169-182.

Dunnion, M., 2012. *Is qualitative research still considered the poor relation?* Available at: http://jebs.efpsa.org [Accessed on November 2012].

Dwyer, J. T., Krall, E. A., & Coleman, K. A., 1987. The problem of memory in nutritional epidemiology research. Journal of American Dietetics Association, 87: 1509–1512.

Eastern Cape Department of Agriculture, 2010. *Policy speech, 2010/11*. Bhisho, Eastern Cape: Government Printer.

Eastern Cape Department of Social Development and Special Projects (DOSDSP), 2012. *Eastern Cape Anti-poverty and Food Security Strategy (ECAFSS)*. Bhisho, Eastern Cape: Government Printer.

Eastern Cape Socio-Economic Consultative Council (ECSECC), 2014. *Alfred NzoDistrict Municipality socio-economic profile.* East London: ECSECC.

Ecker, O. & Breisinger, C., 2012. The food security system – a new conceptual framework. Washington DC: International Food Policy Research Institute. Available at: http://www.ifpri.org/sites/default/files/publications [Accessed on 12 April 2013].

Egbe, E.M. 2015. Food insecurity and poverty in Sub-Sahara African immigrant population in Tarragona Province, Spain. Journal of Food Security, 3(5): 115-124.

El-Kafafi, S. 2006. TQM models and their effectiveness in New Zealand water utilities services. The TQM Magazine, 18(5): 440-454.

Enarson, D.A., Kennedy, S.M. & Miller, D.L. 2004. Choosing a research study design and selecting a population to study. International Journal of Tuberc Disaster, 8(9): 1151-1167.

Etzioni, A. 1997. The new golden rule: community and morality in a democratic society. Science, 300 (5620): 758-762.

Eruvbetine, D., 2003. *Canine Nutrition and Health*. A paper presented at the seminar organized by Kensington Pharmaceuticals Nig. Ltd., Lagos on August 21, 2003.

Evans, S.T., 1991. Good surveys guide. British Medical Journal, 332(6772):302-3.

Eygelaar, S.J.D. 2004. *The implication of the excellence model to enhance military health service delivery and performance excellence*. Doctoral thesis, Johannesburg: Rand Afrikaans University.

Faber, M. & Wenhold, F., 2007. Nutrition in contemporary South Africa. Water SA, 33(3):393-400

Food and Nutrition Technical Assistance (FANTA), 2006. *Household dietary diversity score (HDDS) for measurement of household food access: indicator guide – version 2.* Washington DC: FANTA.

Fielding-Miller, R., Mnisi, Z., Adams, D., Barol, S. & Kennedy, C., 2014. 'There is hunger in my community': a qualitative study of food security as a cyclical force in sex work in Swaziland. Pub Med., 14:1-10.

Fincham, J.E. 2008. Response rates and responsiveness for surveys, standards and the journal. American Journal of Pharmaceutical Education, 72(2): 43-47.

Fischer, A.H., 2018. Gender differences in emotion perception and self-reported emotional intelligence: a test of the emotion sensitivity hypothesis. PLOS ONE, 13(1):1-19.

Fisher, M. & Lewin, P.A. 2013. Household, community and policy determinants of food security in rural Malawi. Development Southern Africa, 30(4-5): 451-467.

Fiume, M.Z., 2002. Cosmetic ingredient: Final report on the safety assessment of biotin. International Journal of Toxicology, 20: 1-12.

Food and Agriculture Organisation of the UN., 1945. *Report of the first Conference of FAO held at Quebec City, October 16 – November 1*. Ottawa: Dominion Department of Agriculture.

Food and Agriculture Organisation of the UN., 1996. *World food summit: Rome declaration on world food security and world food summit plan of action*. Rome: FAO.

Food and Agriculture Organisation of the UN., 2001. *Food balance sheet – a handbook*. Rome: FAO.

2014].

Food and Agriculture Organisation of the UN., 2003. *The state of food insecurity in the world.* Rome: FAO. Available at: http://www.fao.org.docrep/ [Accessed on 22 March 2013].

Food and Agriculture Organisation of the UN., 2006. *'Food Security'. Policy Brief*. Available at: ftp://ftp.fao.org/es/ESA/policybriefs/pb02.pdf [Accessed on 05 March 2013].

Food and Agriculture Organisation of the UN., 2008. *The state of food and agriculture 2008*. Rome: FAO.

Food and Agriculture Organisation of the UN., 2009. *Declaration of the World Summit on Food Security*. Rome: FAO Available at: http://www.fao.org.docrep/ [Accessed on 12 December 2012].

Food and Agriculture Organisation of the UN., 2009. *Global agriculture towards 2050.* Rome: FAO Available at: http://www.fao.org/fileadmin/template. [Accessed on 10 November 2011].

Food and Agriculture Organisation of the UN., 2010. *The state of food insecurity in the world – addressing food insecurity in protracted crises*. Rome: FAO Available at: http://www.fao.org.docrep/013/i683e.pdf [Accessed on 10 November 2011].

Food and Agriculture Organisation of the UN., 2011. *The state of food and agriculture 2010 - 2011*. Rome: FAO. Available at: http://www.fao.org/docrep/013/i205e/i2050eoo.htm [Accessed on 12 October 2014].

Food and Agriculture Organisation of the UN., 2012a. *The state of food insecurity in the world. Economic growth is necessary but not sufficient to accelerate reduction of hunger and malnutrition.* Rome: FAO. Available at: http://www.fao.org.docrep/ [Accessed on 24 February 2013].

Food and Agriculture Organisation of the UN. 2012b. *Background to the voluntary guidelines*. Rome: FAO. Available at: http://www.fao.org.docrep/ [Accessed on 11 September 2014].

Food and Agriculture Organisation of the UN., 2013. *The state of food and agriculture 2013*. Rome: FAO. Available at: http://www.fao.org/publications.sofa/2013/en/?amp= [Accessed on 15 March 2014].

Food and Agriculture Organisation of the UN., 2014. *The state of food insecurity in the world.* Rome: FAO. Available at: http://www.fao.org.docrep/ [Accessed on 12 June 2015].

Food and Agriculture Organisation of the UN., 2015. *The state of food insecurity in the world.* Rome: FAO Available at: http://www.fao.org/3/a-i4646e.pdf (accessed 18 December 2016).

Food and Agriculture Organisation of the UN., 2016. *The state of food and agriculture: climate change, agriculture and food security*. Rome: FAO. Available at: http://www.fao.org.docrep/ [Accessed on 3 March 2017].

Frankenberger, T. R., 1992. *Indicators and data collection methods for assessing*

household food security. In: S. Maxwell & T, Frankenberger, eds. Household food security: concepts, indicators, and measurements: a technical review. New York, NY, USA and Rome, UNICEF and IFAD.

Frankenberger, T.R., Oshaug, A. & Smith, L.C., 1997. *A definition of nutrition security*. Care Mimeo

Frayne, B., Pendleton, W., Crush, J., Acquah, B., Battersby, J., Bras, E., Chiweza, A., Fincham, R., Kroll, F., Leduka, C., Mosha, A., Mulenga, C., Mvula, P., Pomuti, A., Raimundo, I., Rudolph, M., Ruysenna, S., Tevera, D., Tsoka, M. & Tawodzera, G. 2010. *The State of Urban Food Insecurity in Southern Africa*. CapeTown:AFSUN.

Gaberson, K.B., 1997. *Measurement reliability and validity*. Available at: *http://findarticles.com/p/articles/mi_m0FSL/is_n6_v66/ai_20157980/* [Accessed on 24 November 2010].

Ganasegeran, K., Al-Dubai, S.A.R., Qureshi, A.M., Al-abed, A.A.A., Rizal, A.M. & Aljunid, S. M., 2012. Social and psychological factors affecting eating habits among university students in a Malaysian medical school: a cross-section study. Nutrition Journal, 11(48): 183S-188S.

Garko, M., 2013. *Part 1: The inadequate intake of dietary fiber in the United States – trends and recommendations.* Health and Wellness Monthly. http://www.letstalknutrition.com

Gibson, J.L., 2007. Truth and reconciliation as social indicators. Social Indicators Research. International and Interdisciplinary Journal for Quality of Life Measurement, 81(2): 257-281*.*

Gillespie, S., van den Bold, M., Hodge, J. & Herforth, A. 2015. Leveraging agriculture for nutrition in South Asia and East Africa: examining the enabling environment through stakeholder perceptions. Food Security, 7: 463-477.

Global Forum for Food and Agriculture (GFFA), 2016. *GFFA 2016 Highlights Agriculture and Food Security for SDGs, Climate.* http://sdg.iisd.org/news/gffa-2016-highlights-agriculture-and-food-security-for-sdgs-climate/ (Accessed 18 December 2016).

Godfray, H., Charles, J., Beddington, J.R., Crute, I.R., Haddad, L., Muir, D. & Toulmin, C., 2010. Food security: the challenge of feeding 9 billion people. Science, 327(5967):812-818.

Goldberg, G., 2003. *Plants: diets and health.* In: G.Golberg, Ed., The report of a British Nutrition Foundation Task Force. Oxford:.Blackwell Science.

Govender, T., 2011. *Analysis of the nutritional status and dietary intake data of a group of elderly at a day and frail care centre in Verulam*. Master's thesis. Durban: Durban University of Technology.

Goyal, R.K., Shah, V.N., Saboon, B.D., Phatak, S.R., Shah, N.N. & Gohel, M.C., 2010. Prevalence of overweight and obesity in Indian adolescent school going children its relationship with socio-economic status and associated lifestyle factors. Journal of Association of Physicians, India, 17:151-8.

Green, H., 2015. Dietary carbohydrates: a food processing perspective. Nutrition Bulletin, 40(2): 77-82.

Gross, S.M., Bronner, Y., Welch, C., Dewbery-Moor, N. & Paige, D.M., 2004. Breakfast and lunch meal skipping patterns among fourth-grade children for selected public schools in urban, suburban, and rural Maryland. Journal of American Dietetics Association, 104(3):12-21.

Gupta, S.K. 2012. The relevance of confidence interval and P-value in inferential statistics. Indian Journal of Pharmacol, 44(1):143-144.

Ha, S.K., 2014. Dietary salt intake and hypertension. Electrolyte, 12(1):7-18.

Hahoney, C.R., Taylor, H.A., Kanarek, R.B. & Samuel, P., 2005. Effect of breakfast composition on cognitive processes in elementary school children. Physiology and Behavior. 85(5): 635-645.

Hall, D.O., 1998. *Food Security: what have sciences to offer? A study for International Council for Science Union (ICSU).* Paris: ICSU. Available at: http://www.icsu.org/publications/reports-and-reviews/food-security,pdf [accessed on 12 December 2014].

Hall, S. & Vance, E.A., 2010. Improving self-efficacy in statistics: Role of self-explanation and feedback. Journal of Statistical Education, 18(3): 1-22.

Hamm, M.W. & Bellows, A.C., 2003. Community food security and nutrition educators. Journal of Nutrition Education and Behaviour, 35(1):37-43

Hard, A., Uno, C. & Koch, P.A., 2015. *The importance of nutrition education in the 2015 child nutrition reauthorisation*. http://www.tc.colombia.edu/media-library

Hardy, K., Brand-Miller, J., Brown, K.D., Thomas, M.G. and Copeland, L., 2015. The importance of dietary carbohydrate in human evolution. The Quarterly Review of Biology, 90(3): 251-268.

Harris, J., Meerman, J. & Aberman, N., 2015. *Introduction to conceptual issues related to agriculture, food security and nutrition. In: Mapping the linkages between agriculture, food security and nutrition in Malawi*. Edited by Aberman, N., J., Meerman & T. Benson. Lilongwe:IFPRI. Available at: http://massp.ifpri.info/files [accessed on 5 January 2016].

Hasan, M., Ahmed, S. & Chowdhury, A.H., 2013. Food insecurity and child under-nutrition: evidence from HDHS 2011. Journal of Food Security, 1(2): 52-57.

Hatloy, A., Hallund, J., Diarra, M.M. & Oshaug, A., 2000. Food variety, socio-economic status and nutritional status in urban and rural areas in Koutiala (Mali). Public Health Nutrition, 3:57-65.

Haupt, T.C. & Whiteman, D.E., 2004. Inhibiting factors of implementing total quality management on construction sites. The TQM Magazine, 16(3): 166-173.

Hay, R.W. & Rukuni, M., 1988. SADC strategies: evolution and role. World development, 16(9):1013-1024.

Health and Welfare Canada, 1986. *Definitions of food security*. Available at: http://www.toronto.ca/health/children/pdf/fsbp [Accessed on 24 November 2012].

Hels, O., Hassan, N., Tetens, I. & Thilsted, S.H., 2003. Food consumption, energy and nutrient intake nutritional status in rural Bangladesh: changes from 1981 – 1982 to 1995 – 1996. European Journal of Clinical Nutrition, 57(1): 586-594.

Herforth, A. & Ahmed, S., 2015. The food environment, its effects on dietary consumption, and potential for measurement within agriculture-nutrition interventions. Food Security, 7: 505-520.

Herrador, Z., Perez-Formigo, J., Sordo, L., Gadisa, E., Moreno, J., Benito, A., Aseffa, A. Custodio, E., 2015. Low dietary diversity and intake of animal source foods among school aged children in Libo Kemkem and Fogera Districts, Ethiopia. PLOS One, 10(7):7-21.

Hjartaker, A., Anderson, L.F. and Lund, E., 2007. Comparison of diet measures from a food frequency questionnaire with measures from repeated 24-hour dietary recalls. The Norwegian Women and cancer study. Public Health Nutrition, 10:1-12.

Holben, D.H., 2002. An overview of food security and its measurement. Nutrition Today, 37(4): 156-162.

Holt, S.H.A., Delargy, H.J., Lawton, C.L. & Blundell, J.E., 1999. The effects of high-carbohydrates vs high-fat breakfasts on feelings of fullness and alertness, and subsequent food intake. International Journal of Food Sciences and Nutrition, 50:13-28.

Holt, M.M. & Scariano, S.M., 2009. Mean, median and mode from a decision perspective. Journal of Statistics Education, 17(3): 1-16.

Hooshmand, S. & Udipi, S.A., 2014. Effect of parental education on nutritional status of urban school going children from Iran and India. Asian Academic Research Journal of Multidisciplinary, 1(19(: 632-644.

Houston, M., 2011. The role of magnesium in hypertension and cardiovascular disease. The Journal of Clinical Hypertension, 13(11): 843-847.

Human Sciences Research Council (HSRC), 2013. *The South African National Health and Nutrition Examination Survey (SANHANES – 1)*. Pretoria: Human Sciences Research Council.

Hyson, D., 2002. *The health benefits of fruits and vegetables: a scientific overview for health professionals*. Produce for Better Health Foundation, Wilmington DE

Iikhani, F., Hosseini, B. & Saedisomeolia, A., 2016. Niacin and oxidative stress: a mini review. Journal of Nutritional Medicine and Diet Care, 2(1):2-14.

Information Centre of University of Stellenbosch (NICUS), 2003. *Dietary reference intakes.* Available at: www.http://sun025.sun.ac.za/portal/page/portal/HealthSciences/English/Centres%20and%20Institutions/Nicus/Micronutrients/Vitamins/Biotin [Accessed 18 May 2015].

Institute of Food Research, 2015. *The importance of nutrition in food security*. Available at: www.ifr.ac.uk/news/latest-news/2015/01/importance-nutrition-food-security/ [Accessed on 22 December 2015].

Institute of Medicine (IoM), 1998. *Dietary reference intakes: a risk assessment model for establishing upper levels for nutrients*. Washington D.C.: National Academy Press

Institute of Medicine, 2000. *Dietary reference intakes*. Applications in dietary assessment. Washington, D.C.: National Academy Press.

Institute of Medicine, 2003. *Dietary reference intake*. Washington, D.C.: National Academy Press.

International Food Policy Research Institute (IFPRI), 2004. *Assuring food and nutrition security in Africa by 2020: Priortizing actions, strengthening actors, and facilitating partnerships.* Proceedings of an All-Africa Conference. Kampala, Uganda. Washington, DC: IFPRI.

International Food Policy Research Institute, 2013. *2013 global hunger index: the challenge of hidden hunger*. Available at: http://www.ifpri/publication/2013-global –hunger-index [Accessed on 22 December 2015].

International Food Policy Research Institute, 2014. *2014 global hunger index: the challenge of hidden hunger.* Available at: http://www.ifpri/publication/2014-global –hunger-index [Accessed on 22 December 2015].

Jacobson, K. & Myhr, A.I., 2012. GM crops and smallholders-biosafety and local practice. Journal of Environment and Development, 22(1):104-124.

Jongwe, A., 2014. Synergies between urban agriculture urban household food security in Gweru City, Zimbabwe. Journal of Development & Agricultural Economics, 6(2): 59-66.

Jooste, P.I. & Zimmermann, M.B., 2008. Progress towards eliminating iodine deficiency in South Africa. South African Journal of Clinical Nutrition, 21(1): 8-14.

Joubert. J., Norman, R., Bradshaw, D., Goedecke, J.H., Steyn, N.P. & Puoane, P., 2007. South African comparative risk assessment collaborating group estimating the burden of disease attributable to excess body weight on South Africa in 2000. South African Journal of Clinical Nutrition, 97:683-690.

Jungert, A., Spinneker, A., Nagel, A. & Neuhäuser-Berthold, M., 2014. Dietary intake and main food sources of vitamin D as a function of age, sex, vitamin D status, body composition, and income in an elderly German cohort. Food and Nutrition Research, 58: 2-9.

Kahsay, S. & Mulugeta, M., 2014. Determinants of rural household food security in Laelay Maichew Woreda Tigray, Ethiopia. African Journal of Agriculture and Food Security, 2(1): 106-112.

Karnik, S. & Kanekar, A., 2012. Childhood obesity: a global public health crisis. International Journal of Preventative Medicine, 3(1):1-7.

Kazerooni, E.A., 2011. Population and sample. American Journal of Roentgenology, 177(1): 993-999.

Kennedy, G., Ballard, T. & Dop, M., 2011. *Guidelines for measuring household and individual dietary diversity: Revised version*. Rome, Italy: FAO.

Koch, J., 2011. *The food security policy context in South Africa*. Brazil: International Policy Centre for Inclusive Growth.

Kotler, P. & Keller, K.L. 2006. Marketing management. 12th Edition. New Jersey: Pearson Prentice Hall, Upper Saddle River.

Kristjansdottir, A. G., Andersen, L. F., Haraldsdottir, J., de Almeida, M. D. & Thorsdottir, I., 2006. Validity of a questionnaire to assess fruit and vegetable intake in adults. European Journal Clinical Nutrition, 60, 408–415.

Kristjanso, P., Neufeldt, H., Gassner, A., Mango, J., Kyazze, F.B., Desta, S., Labadarios, D., Steyn, N.P. & Nel, J., 2011. How diverse is the diet of adult South Africans? Nutrition Journal, 10(33):1-5.

Labadarios D, Steyn NP & Nel J. 2011. How diverse is the diet of adult South Africans? Nutrition Journal. 10(33**)**: 1-5.

Lassale, C., Guilbert, C., Keogh, J., Lange, K. & Cox, D.N., 2009. Estimating food intakes in Australia: validation of the Commonwealth Scientific and Industrial Research Organisation (CSIRO) food frequency questionnaire against weighed dietary intakes. Journal of Human Nutrition and Dietetics, 22(6): 6-19.

Laville, M. & Nazare, J.A., 2009. Diabetes, insulin resistance and sugars. Obesity Review, 10(Suppl.1): 24-33.

Leduka, R., Crush, J., Frayne, B., McCordic, C., Matobo, T., Makoe., T.E., Mphale, M., Phaila, M. & Letsie, M., 2015. *The state of poverty and food insecurity in Maseru, Lesotho.* Cape Town: AFSUN.

Lee, D., Redfern, O. & Orengo, C., 2007. Predicting protein function from sequence and structure. Nature Reviews Molecular Cell Biology, 8: 995-1005.

Lee, R.D. & Nieman, D.C., 1996. *Nutritional assessment*. 3rd ed. New York: McGraw-Hill.

Lee, S., Brown, E.R., Grant, D., Belin, T.R. & Brick, J.M., 2009. Exploring non-response bias in a health survey using neighbourhood characteristics. American Journal of Public Health, 99(10): 1811-1817.

Lee, Y. & Taung, F., 2013. More caregiving, less working caregiving roles and gender difference. Journal of Comparative Social Welfare. 72(2):123-131.

Lentz-Marino, E., 2014. *Hunger in Lesotho*. Borgen Magazine. Available at: http://www.borgenmagazine.com/hunger-lesotho/ [Accessed on 12 June 2015].

Life Sciences Research Office, 1990. **Federation of American Societies for Experimental Biology.** Journal of Nutrition, 120S:1559-600.

Lin, W., Hang, C., Yang, H. & Hung, M., 2011. 2005-2008 nutrition and health survey in Taiwan: the nutrition knowledge, attitude and behaviour of 19-64 years old adults. Asia Pacific Journal of clinical Nutrition, 20(2):309-318.

Lin, W., Yang, H., Hang, C. & Pan, W., 2007. Nutrition knowledge, attitude, and behaviour of Taiwanese elementary school children. Asia Pacific Journal of Clinical Nutrition, 16(S2):534-456.

Longfield, K., 2004. *In-depth interviews*. Available at: http://www.aidsmark.org/ipc_en/pdf/manual/14_Research-Toolkit-Ch6-In-Depth-interviews.pdf [Accessed on 13 June 2011].

Look, J.O., Schiffman, E.L., Truelove, E.L. & Ahmad, M., 2010. Reliability and validity of axis of the research diagnostic criteria for temporomandibular disorder (RDC/TMD) with proposed revisions. Journal of Oral Rehabilitation, 37(10): 744-759

Louw, S., Wilson, J.R.U., Janion, C., Veldtman, R., Davies, S.J. & Addison, M., 2014. The unknown underworld: understanding soil health in South Africa. South African Journal of Science, 110(56): 1-4.

Lukaski, H.C., 2000. Magnesium, zinc, and chromium nutritive and physical activity1'2'3. The American Journal of Clinical Nutrition, 72(2): 585s-593s

Lutz, A.E., Swisher, M.E. & Brennan, M.A., 2013. *Defining Community food security*. University of Florida: Florida. Available at: *http://edis.ifas.ufl.edu* [Accessed 17 December 2014].

Macdiarmid, J., Loe, J., Craig, L.C.A., Masson, L.F., Holmes, B. & McNeill, 2009. Meal and snacking patterns of school-aged children in Scotland. European Journal of Clinical Nutrition, 63:1297-1304.

Machete, C. L., 2004. *Agriculture and poverty in South Africa: Can agriculture reduce poverty*? Paper presented at the conference, Overcoming Underdevelopment, October 28-29, 2004, Pretoria, South Africa.

Madziakapita, A., 2008. *An evaluation of the impact of food aid on food security: the case of Ngabu area in Malawi.* Master's thesis. Pretoria: University of South Africa.

Makenete, A., Ortmann, G. & Darroch, M., 1998. Food aid dependency in Lesotho: issues and policy implication. Development Southern Africa, 15(2):251-266.

Mann, J.I., 2006. Nutrition recommendations for the treatment of type 2 diebetes and the metabolic syndrome: an advanced based review. Nutrition Review, 64:422-427.

Marlett, J.A., McBurney, M.I. & Slavin, J.L., 2002. Position of the American Dietetic Association: health implications of dietary fiber. Journal of American Dietetics Association, 102: 993-1000.

Matla, M.T.H., 2008. *The contribution of food access strategies to dietary diversity of farm worker households on Orange farm in the Fouriesburg District (RSA).* Master's degree thesis, Pretoria: University of Pretoria.

Maxwell, S., 1996. Food security: a post-modern perspective. *Food Policy.* 21 (2): 155-170.

Maxwell, S. & Smith, M., 1992. *Household food security; a conceptual review. In* S. Maxwell & T.R. Frankenberger, eds. *Household Food Security: Concepts, Indicators, Measurements: A Technical Review.* New York and Rome: UNICEF and IFAD.

Mchiza, Z.J., Steyn, N.P., Hill, J., Kruger, A., Schönfeldt, H., Nel, J. & Wentzel-Viljoen, E., 2016. A review of dietary surveys in the adult South African population from 2000 to 2015. Nutrients, 2015(7): 8227-8250.

Mekary, R.A., Giovannucci, E., Cahill, L., Willett, W.C., van Dam, R.M. & Hu, F.B., 2013. Eating patterns and type 2 diabetes risk in older women: breakfast consumption and eating frequency. American Journal of Clinical Nutrition. 98(2): 436-443.

Melgar-Quinonez, H.R., Zubieta, A.C., MkNelly, B., Nteziyaremye, A., Gerardo, M.F. & Dunford, C., 2006. Household food security and food expenditure in Bolivia, Burkina Faso, the Phlippines. Journal of Nutrition, 136: S143-7.

Mellenbergh, G.J., 2008. Surveys. In *Advising on research methods: a consultant's companion* edited by H.J. Adèr & G.J, Mellenbergh. Huizen, The Netherlands: Johannes van Kessel. (pp. 183–209).

Meunier, N., O'Connor, J.M., Maiani, G., Cashman, K.D., Secker, D.L., Ferry, M., Roussel, A.M. & Coudray, C., 2005. Importance of zinc in the elderly: The Zenith study. European Journal of Clinical Nutrition, 59(Suppl. 2): S1-S4.

Min, C., Noh, H., Kang, Y.S., Sim, H.J., Baik, H.W., Song, W.O., Yoong, J., Park, Y.H. & Joung, H., 2011. Skipping breakfast is associated with diet quality and metabolic syndrome risk factors of adults. Food Science and Human Nutrition. 5(5):455-463.

Mofokeng, M.J., 2013. *Nutritional status and dietary intake patterns of children aged 7-13 years in Qwaqwa*. Master's thesis. Vanderbijlpark: Vaal University of Technology

Monde, N., 2003. *Household food security in rural areas of central Eastern Cape: The case of Guquka in Victoria East and Koloni in Middledrift districts*. Doctoral thesis. Alice: University of Fort Hare.

Mouratidou, T., Ford, F. & Fraser, R.B., 2006. Validation of a food frequency questionnaire for use in pregnancy. Public Health Nutrition, 9(4):8-15.

Mtero, O.F., 2012. *Commercialisation, de-agrarianisation and the accumulation / reproduction dynamics: massive maize production schemes in the Eastern Cape, South Africa.* Paper presented at the International Conference on Global Land Grabbing, October 17-19, 2012, Department of Sociology at Cornell University, Ithaca, NY

Mulenga, C., 2013. *The state of food insecurity in Lusaka, Zambia*. Cape Town AFSUN.

Müller, O. & Krawinkel, M., 2005. Malnutrition and health in developing countries. Canadian Medical Association Journal, 173(3):279-86

Murphy, N., Norat, T., Ferrari, P., Jenab, M., Bueno-de-Mesquita, B. & Skele, G., 2012. Dietary fibre intake and risks of cancers of the colon and rectum in the European Prospective Investigation into Cancer and Nutrition (EPIC). Plos ONE, 7(6):1-8.

Murphy, S.P. & Barr, S.I., 2006. Recommended dietary allowances should be used to set daily values for nutrition labelling. American Journal of Clinical Nutrition, 83(5): 12235-12275.

Murray, R.K., Granner, D.K., Mayes, P.A. & Rodwell, V.W., 2000. *Harper's Biochemistry. 25th ed.* McGraw-Hill, Health Profession Division, USA.

Mushaphi, L.F., 2011. *Impact of a nutrition education programme on the nutritional status of children aged 3 to 5 years, and the nutritional practices and knowledge of their caregivers in rural Limpopo Province, South Africa*. Doctoral thesis. Bloemfontein: University of the Free State.

Mvula, P. & Chiweza, A., 2013. *The state of food insecurity in Blantyre City, Malawi*. Cape Town: AFSUN.

Naidu, K.A., 2003. Vitamin C in human health and disease is still a mystery? An overview. Nutrition Journal, 2(7):1-12.

Nalty, C.C., Sharkey, J.R. & Dean, W.R., 2013. School-based nutrition programs are associated with reduced child food insecurity over time among Mexican-origin mother-child dyads in Texas Border Colonia. Journal of Nutrition, 143(5): 708-713.

Nandan, B., Sharma, B.C. & Kumar, A., 2013. Mitigating food security options through climate resilient mustard-maize based intercropping sequences for North-west Himalayas. Journal of Food Security, 1(2):58-64.

Naser, I.A., Jalil, R., Muda, W.M.W., Nik, W.S.W., Shariff, Z.M. Abdullah, M.R., 2014. Association between household food insecurity and nutritional outcomes among children in Northeastern of Peninsular Malaysia. Nutrition, Research and Practice, 8(3): 304-311.

Ndhleve, S., Musemwa, L. & Zhou, L., 2013. Housing food security in a coastal rural community of South Africa: status, causes and coping strategies. African Journal of Agriculture and Food Security, 1(1): 15-20.

Nelson, M. & Bingham, S.A., 1992. Assessment of food consumption and nutrient intake. European Journal of Clinical Nutrition, 44(1):1-2.

Ndiku, M., Jaceldo-Siegl, J., Singh, P. & Sabaté, J., 2011. Gender inequality in food intake and nutritional status of children under 5 years old in rural Eastern Kenya. European Journal of Clinical Nutrition. 65:26-31.

Nguema, I.E. & Ella, G.A., 2014. Trade liberalisation and food security for a new green revolution in Africa. Journal of Food Security, 2(2): 42-50.

Nordstokke, D.W., Zumbo, B.D., Cairns, S. & Saklofske, D.H., 2011. The operating characteristics of the non-parametric Levene test for equal variances with assessment and evaluation data. Practical Assessment, Research and Evaluation, 16(5): 1-8.

Obamiro, E.O. Dopper, W. & Kormawa, P.M., 2003. Pillars of food security in rural areas of Nigeria. Paper accepted for the Food Security Theme. Food Africa, Internet Forum. 31 March – 11 Apr 2003. Available at: www.foodafrica.nri.org/security/internetpapers [Accessed on 14 March 2013].

O'Brien, R., 2001. *An overview of the methodological approach of action research*. Faculty of Information Studies, University of Toronto. Available at: http://www.web.ca/~robrien/papers/arfinal.html [Accessed 17 December 2012].

Olaoye, A.O., 2014. Potentials of the agro-industry towards food security in Nigeria and other sub-Saharan countries. Journal of Food Security, 2:3-41.

Olaoye, O.A. & Onilude, A.A., 2010. Investigating on potential use of biological agent in the extension of fresh beef in Nigeria. World Journal Microbiology and Biotechnology, 26:1445-1454

Olaoye, O.A., Idown, O.A. & Lawrence, I.G., 2014. Certain roles of the food scientist in ameliorating food insecurity in developing countries, particularly Nigeria. ISABB Journal of Food and Agriculture Science, 4(1): 13-19.

Oldewage-Theron, W.H. & Kruger, R., 2008. Food variety and dietary diversity as indicators of the dietary adequacy and health status of an elderly population in Sharpeville, South Africa. Journal of Nutrition for the Elderly, 27(1-2):101-133.

Ongosi, A.N., Gericke, G., Mbuthia, E. & Oelofse, A., 2014. Food variety, dietary diversity and perceived hunger among lactating women (0-6 months post-partum) in low socio-economic area in Nairobi, Kenya. African Journal of Food, Agriculture, Nutrition and Development, 14(2):8663-8675.

Oni, S.A., Maliwichi, L.L. & Obadire, O.S., 2013. Socio-economic factors affecting smallholder farming and household food security: a case of Thulamela local municipality in Vhembe district of Limpopo province, South Africa. African Journal of Agriculture and Food Security, 1(5): 93-99.

Ontario Public Health Association (OPHA). 2002. *A systemic approach to community food security: a role for public health*. Available at: http://opha.onca/OPHA/media/Resources%20Documents/2002-01_pp.pdf [Accessed 17 December 2012].

Palese, A., Colognese, S., Pellicciari, C. & Mecugni, D. 2012. Implementation strategies of measurement instruments and their validity as adopted in Italian hospital nursing practice: an Italian cross-section study. International Journal of Nursing Knowledge, Vol. 10(11): 1-3.

Pangaribowo, E.H., Gerber, N. & Torero, M., 2013. *Food and nutrition security indicators: a review.* Food secure working paper 05, February 2013.

Parks, M.H., Dawant, B.M. & Riddle, W.R., 2002. Longitudinal brain metabolic characterisation of chronic alcoholics with proton magnetic resonance spectroscopy. Alcoholism: Clinical and Experimental Research, 26(9):1368-1380.

Pathak, A. & Intratat, C., 2012. Use of semi-structured interviews to investigate teacher perceptions of student collaboration. Malaysian Journal of ELT Research, 8(1):1-10.

Peat, J., Mellis, C., Williams, K. & Xuan W., 2002. *Health Science Research: A Handbook of Quantitative Methods*. London: Sage Publications.

Pendleton, W., Crush, J. & Nickano, N., 2014. *Migrant Windhoek: rural-urban migration and food security in Namibia*. Urban Forum, 25:191-205.

Pendleton, W., Nickanor, N. & Pomuti, A., 2012. *The state of food insecurity in Windhoek, Namibia*. Cape Town: AFSUN.

Phillips, T. & Taylor, D., 1991. *Background paper on food security: draft final.* University of Guelph, Ontario: Centre for Food Security.

Pillai, V.K. & Ortiz-Rodriguez, J., 2015. Child malnutrition and gender preference in India: the role of culture. Health Science Journal, 9(6/8): 1-6.

Pingali, P., Terri, R. & Wiebe, K. 2008. Biofuels and food security: missing the point. Review of Agricultural Economics, 30(3): 506-516.

Pingali, P., 2015. Agricultural policy and nutrition outcomes – getting beyond the preoccupation with staple grains. Food Security, 7:583-591.

Polonsky, M.J. & Waller, D.S., 2010. *Designing and managing a research project.* A business student's guide. London: Sage Publications

Posner, B.M., Martin-Munley, S.S., Smigelski, C., Cupples, L.A., Cobb, J.L., Schaefer, E., Miller, D.R. & D'Agostino, R.B., 1992. Comparison of techniques for estimating nutrient intake: the Framingham Study. Epidemology, 3(2):171-177.

Pothukuchi, K., 2004. Community food assessment: a first step in planning for community food security. Journal of Planning Education and Research, 23(1):356-377.

Powell, B., Thilsted, S.H., Ickowitz, A., Termote, C., Sunderland, T. & Herforth, A. 2015. Improving diets with wild and cultivated biodiversity from across the landscape. Food Security, 7(3): 535-554.

Powers, H.J., 2003. Riboflavin (vitamin B2) and health. American Journal of Clinical Nutrition, 77(6): 1352-1360.

Prior, R.L. & Cao, G., 2000. Antioxidant phytochemical in fruit and vegetables, diet and health implications. HortScience, 35(4):588-592.

Public Health Association of British Colombia, 2004. Toward better health care in Britsh Colombia. Available at: https://www.health.gov.bc.ac [Accessed 17 December 2016].

Pulgaron, E.R. & Delamater, A.M., 2014. Obesity and type 2 diabetes in children: epidemiology and treatment. Current Diabetes Reports, 14(8): 508-524.

Qian, Y., Li, X., Zhang, D., Cai, D., Tian, H & Liu, W., 2015. Effects of dietary pantothenic acid on growth, intestinal function, anti-oxidative status and fatty acids synthesis of juvenile blunt snout bream *Megalobrama amblycephala*. PLoS One, 10(3): e0119518.

Rahim, S., Saeed, D., Rasool, G.A. & Saeed, G., 2011. Factors influencing household food security status. Food and Nutrition Sciences, 2(1): 31-34.

Raimundo, I., Crush, J., Pendleton. W., 2014. *The State of food insecurity in Maputo, Mozambique*. Cape Town:AFSUN.

Raj, M., 2012. Obesity and cardiovascular risk in children and adolescents. Indian Journal of Endocrinology and Metabolism, 16(1); 13-19.

Raj, M., Sundaram, K.R., Paul, M., Deepa, A.S. & Kumar, R.K., 2007. Obesity in Indian children: time trends and relationship with hypertension. National Medical Journal of India, 20: 288-93

Ramchander, P., 2004. *Towards the responsible management of the socio-cultural impact of township tourism*. Doctoral thesis. Pretoria: University of Pretoria, Pretoria.

Rankin, D., 2008. *The validity and reproducibility of the 24-hour recall dietary assessment method among adolescents in North West Province, South Africa*. Doctoral thesis. Potchefstroom: North West University.

Rauber, F & Vitolo, M.R., 2009. Nutritional quality and food expenditure in preschool children. Jornal de Pediatria, 85(6):1-5.

Riboli, E. & Norat, T., 2003. Epidemiologic evidence on the protective effects of fruits and vegetables on cancer risks. American Journal of Nutrition, 78:559S-569S.

Riely, F., Mock, N., Cogill, B., Bailey, L. & Kenefick, E., 1999. *Food security indicators and framework for use in the monitoring and evaluation of food aid programs.* Washington DC: Food and Nutrition Technical Assistance (FANTA).

Rivellese, A., De Natale, C. & Lilli, S., 2002. Type of dietary fat and insulin resistance. Analysis of the New York Academy of Science, New York: John Wiley & Sons.

Available at: http://onlinelibrary.wiley.com/doi/10.1111/j:1749-6632.2002 [Accessed 17 December 2016].

Rizvi, S., Raza, S.T., Ahmed, F., Ahmad, A., Abbas, S. & Mahdi, F., 2014. The role of vitamin E in human health and some diseases. Sultan Qaboos University Medical Journal, 14(2): e157-e165.

Rossouw, C.R., 2005. *Eating habits and nutrient intakes of 10-15 year old children in the North West Province*. Master's thesis. Potchefstroom: North-West University

Ruane, J. & Sonnino, A. 2011. Agricultural biotechnologies in developing countries and their possible contribution to food security. Journal of Biotechnology, 156:356-363.

Rubin, H.J. & Rubin, I.S., 2001. *Community organizing and development*. 3rd ed. Needham Heights: A Pearson Education Company.

Ruel, M.T., 2002. *Is dietary diversity an indicator of food security or dietary quality? A review of measurement issues and research needs?* Washington, D.C.: IFPRI.

Ruel, M.T. & Menon, P., 2002. Child feeding practices are associated with child nutritional status in Latin America: innovative uses of the demographic and health surveys. Journal of Nutrition, 132: 1180-1187.

Ruel, M.T., 2006. *Operationalising dietary diversity: a review of measurement issues and research priorities*. Washington, D.C.: IFPRI

Ryan-Harshman, M. & Aldoori, W., 2008. Vitamin B12 and health. College of Family of Physicians of Canada, 54(4):536-541. https://www.ncbi.nlm.gov/pmc/articles/PMC2294088/ [Accessed 7 November 2016].

Sachs, J. 1998. The real causes of famine. Time Magazine, 26 October 1998.

Said, H.M., 2009. Cell and molecular aspects of human intestinal biotin absorption. The Journal of Nutrition, 139(1):158-162.

Sarason, S.B. 1974. *The psychological sense of community: prospects for a community psychology*. San Francisco: Jossey-Bass.

Sasson, A., 2012. Food security for Africa: an urgent global challenge. Agriculture and Food Security, 1(2):1-16.

Savy, M., Martin-Prével, Y., Traissac, P., Eymard-Duvernay, S. & Delpeuch, F. 2006. Dietary diversity scores and nutritional status of women change during the seasonal food shortage in rural Burkina Faso. The Journal of Nutrition, 136(1): 2625-2632.

Schatz, E. 2012. Rationale and procedures for nesting semi-structured interviews in survey or censuses. Population Studies, 66(2): 183- 95.

Scheinberg, P. & Chen, J., 2013. Aplastic anemia: What have we learned from animal models and from the clinic. Semil Hematol, 50: 156-64.

Scheinfeld, N.S., 2013. Protein-Energy malnutrition. http://emdedicine.medscape.com/article/1104623-overview [Accessed 18 December 2015].

Schensul, S., Schensul, J. J. & Le Compte, M. D., 1999. *Essential ethnographic research methods: observations, interviews and questionnaires*. Walnut Creek, CA: Altamira Press.

Schneeman, B.O., 1999. Building scientific consequences: the importance of dietary fiber. The American Journal of Clinical Nutrition, 69(1):30-42.

Schuna, C., 2015. The effects of not enough protein in the diet. http://www.livestrong.com/article/2560074 [Accessed 2 December 2016].

Seligman, H. K., Laraia, B.A. & Krushel, M.B. 2010. Food insecurity is associated with chronic disease among low income NHANES participants. Journal of Nutrition, 140(2):304-310.

Sen, A., 1981. Ingredients of famine analysis: Availability and entitlements. The quarterly Journal of Economics, 93:433-464.

Shakkour, E., 2007. *The relationship between nutritional knowledge and application.* Honors thesis, Lynchburg: Liberty University.

Shaaban, S.Y., Nassar, M.F., Shatla, R.H., Deifallah, S.M., Marzouk, D. & Abogabal, W., 2014. Nutrition knowledge, attitude, and practice of predominantly female preschool teachers: effect of education intervention. British Journal of Medicine and Medical Research, 4(8):1739-1749.

Sharma, K.D., Lal, H. & Gupta, M., 2006. Status of food and nutritional security in Himachal Pradesh – empirical assessment. Indian Journal of Agricultural Economics, 61(3):436-440.

Shaw, D.J. 2007. World food security: a history since 1945. New York: Macmillan.

Shepherd, C.D. & Helms, M.M., 1995. *TQM measures: Reliability and validity issues*. Available at: http:www.highbeam.com/doc/1G1-17586492.html [Accessed 24 November 2011].

Siegle. D., 2002. P*rinciples and methods in educational research*. Available at: http://www.gifted.uconn.edu/siegle/research/Qualitative/qualitativeInstructorNotes.html [Accessed on 10 May 2012].

Simon, G., 2012. *Food security: definition, four dimensions, history*. Paper presented to students from IPAD Master, SupAgro, Montpellier attending a joint training programme. Rome: University of Roma Tre. 19-24 March 2012.

Silangwe, B.N., 2012. *Nutritional status and dietary intake of adolescents in Mandlenkosi High School – Lindelani*. Masters' thesis. Durban: Durban University of Technology.

Smith, M., Pointing, J. & Maxwell, S. 1995. *Household food security: concepts and definitions*. New York: United Nations Children's Fund & International Fund for Agricultural Development.

Smyth, P.A., 2003. Role of iodine in antioxidant defense in thyroid and breast disease. Biofactors, 19:121-130.

Sombolos, K., Fragia, T., Natse, T., Bartholomatos, G., Karagianni, A. & Katsaris, G., 2002. The effect of long-term intravenous high dose B-complex vitamins with or without folic acid on serum homocysteine in hemodialysis patients. Journal of Nephrology, 15:671-5.

Soetan, K.O., Olaiya, C.O. & Oyewole, O.E., 2010. The importance of mineral elements: a review. African Journal of Food Science, 4(5):200-222.

South African Institute of Race Relations, 2016. *South Africa Survey 2016*. http://irr.org.za/reports-and-publications [Accessed 18 February 2017].

Sri-Tarino, P.W., Sun, Q., Hu, Q. & Krauss, R.M., 2010. Saturated fat, carbohydrate and cardiovascular disease. American Journal of Clinical Nutrition, 91(3): 502-509.

Statistical Package for Social Sciences, Version 20. Available at: http:SPSS-64bits.jaleco.com [Accessed 17 October 2015].

Stats SA. 2009. *General household survey – Statistics South Africa*. Pretoria: Stats SA.

Stats SA. 2011. *2011 Census*. Pretoria: Stats SA.

Stephen, A., Alles, M., de Graaf, C., Hadjilucas, E., Isaacs, E., Maffeis, C., Zeinstra, G., Matthys, C. & Gill, A., 2012. The role and requirements of digestible dietary carbohydrates in infants and toddlers. European Journal of Clinical Nutrition, 66(7): 765-779

Steyn, N.P., Nel, J.H., Nantel, G., Kennedy, G. & Labadarios, D. 2006. Food variety and dietary diversity scores in children: are they good indicators of dietary adequacy? Public Health Nutrition, 9(5):644-650.

Sukandar, D., Khomsan, A., Anwar, F., Riyadi, H. & Mudjajanto, E., 2015. Nutrition knowledge, attitude and practice of mothers and children: nutritional status improved after five months nutrition education intervention. International Journal of Sciences: Basic and Applied Research, 23(2):424-442.

Swaminathan, M.S., 1998. Population and food security. Journal of Indian Society of Agricultural Statistics, 51(2&3): 99-112.

Swaminathan, M.S., 2008. *Achieving sustainable nutrition security for al and forever*. International Union of Food Science and Technology (IUFOST) Congress, 2008. Available at: http://www.iufost.org/worldcongress/documents/IUF.Food.Security.Swami.2.pdf [Accessed on 12 October 2014].

Takeda, E., Yamamoto, H., Yamanaka-Okumura, H. & Taketani, Y., 2014. Increasing dietary phosphorus intake from food additives: potential for negative impact on bone health. Advances in Nutrition: An International Review Journal, 5: 92-97.

Takachi, R., Ishihara, J., Iwasaki, M., Hosoi, S., Ishii, Y., Sasazuki, S., Shimazu, T., Inoue, M. & Tsugane, S., 2011. Validity of a self-administered food frequency questionnaire for middle-aged urban cancer: comparison with 4-day weighed dietary receords. Journal of Epidemiology, 21(6):447-458.

Tang, G., **Qin, J., Dolnikowski, G., Russel, R.M. & Grusak, M.A., 2009.** Golden rice is an effective source of Vitamin A. The American Journal of Clinical Nutrition, 89(6):1776-1783.

Tawodzera, G., Riley, L. & Crush, J., 2016. *The return of food: poverty and urban food security in Zimbabwe after the crisis*. Cape Town: African Food Security Urban Network (AFSUN).

Taren, D., de Tobar, M., Ritenbaugh, C., Graver, E., Whitacre, R., & Aiken, M., 2000. Evaluation of the Southwest Food Frequency Questionnaire. Journal of Ecology, Food and Nutrition, 38: 515–547.

Tembwe, G., 2010. *Diet diversity coping strategies and food access of unemployed young single mothers with children under 9 years of age in Botswana.* Master's degree thesis. Pretoria: University of South Africa.

Tevera, D., Simelane, N., Peter, G. & Salam, A. 2012. *The state of food I nsecurity in Manzini, Swaziland*. Cape Town: AFSUN.

Thedford, K., Archer, S., Shayka, J., Gernhofer, N., Peters, E., Gowan, A., Johnson, K. & Vanttorn, L., 1999. Comparison of a food frequency questionnaire to 3-24 hour recalls in young women. Journal of the American Dietetic Association, 99(9):A92.

The Economists, 2014. The third great wave. Special Report, The World Economy, October 4th 2014.

The M & E Harmonization Group of Food Security Partners, 2013. *The food security learning framework.* Available at: www.ifad.org/hfs/tools/hfs/fs_frameworkpub/foodsecurity.pdf [Accessed on 12 June 2014].

Theodoratou, E., Farrington, S.M., Tenesa, A., McNeill, G., Cetnarsky, R. & Getnarsky, N., 2008. Dietary vitamin B6 intake and risk of colorectal cancer. Cancer Epidemiol. Biomaker Prev., 17:171-182.

Thorne-Lyman, A., Valpiani, N., Sun, K., Semba, R., Klotz, C., Kraemer, K., Akhter, N., de Pee, S., Moench-Pfanner, R., Sari, M. & Bloem, M., 2010. Household dietary diversity and food expenditures are closely linked in rural Bangladesh, increasing the risk of malnutrition due to the financial crisis. The Journal of Nutrition (Suppl.), 140(1):182S-188S.

Thornston, A.J., 2016. *Dietary diversity and food security in South Africa: an application using NIDS Wave 1.* Master's degree thesis, Cape Town: University of Cape Town.

Tregurtha, N., 2012. *Inequality and economic marginalisation: review of the Eastern Cape's Siyakhula / Massive maize project*. Pretoria: Trade & Industrial Policy Strategies (TIPS).

Trochim, W.M.K., 2006. *The research methods knowledge base*. Available at: *http://www.socialresearch methods.net/kb/stat.php* [Accessed on 11 May 2013].

UN HABITAT, 2008. *State of the world's cities 2008 / 2009 – harmonious cities*. Available at: *http://mirror.unhabitat.org/pmss/* [Accessed 11 May 2013].

UNICEF, 2008. *Food prices increases / nutrition security: action for children*. Available at: http://www.unicef.org/eapro/Food_Prices_Technical_Note_july-4th.pdf [Accessed on 11 May 2013].

United States Department of Agriculture (USDA), 2000. *Guide to measuring household food security (Revised 2000)*. Washington DC: USDA. Available at: http://www.fns.usda.gov/guide_measuring-household-food-security-revised-2000 [Accessed on 2 October 2014].

United States Department of Agriculture, 2005. *Chapter 10: Protein and amino acids. Retrieved from dietary reference intakes for energy, carbohydrates, fiber, fat, fatty acids, cholesterol, protein and amino acids (macronutrients).* http://www.nal.usda.gov/fnic/DRI//DRI-Energy/589-768.pdf [Accessed 18 December 2015].

Van Dam, R.M. & Seidell, J.C., 2007. Carbohydrates intake and obesity. European Journal of Clinical Nutrition, 61(Suppl. 1): S75-S99.

Van Epp, A.S. 2012. Librarians and statistics: thoughts on a tentative relationship. The International Journal of the SLA Academic Division, 2(1): 1-12.

Van Graan, A.E., Bopape, M., Phooko, D., Bourne, L. & Wright, H.H., 2013. "Drink lots of clean, safe water": a food-based dietary guideline for South Africa. South African Journal of Clinical Nutrition, 26 (Supplement): S77-S86.

Vardanjani, A.E., Reisi, M., Javadzade, H., Pour, Z.G. & Tavassoli, E., 2015. The effect of nutrition education on knowledge, attitude and performance about junk food consumption among students of female primary school. Journal of Education and Health Promotion, 4(53):3-12.

Vitolo, M.R., Campagnolo, P.D.B & Gama, C.M., 2007. Factors associated with risk of low dietary fiber intake in adolescents. Journal de Pediatria, 83(1):47-52.

Von Fintel, D. & Pienaar, L., 2016. *Small-scale farming and food security: the enabling role of cash transfers in South Africa's former homelands*. Stellenbosch: University of Stellenbosch https://ideas.repec.org/p/iza/izadps/dp10377.html [Accessed 5 November 2015].

Vorvick, L.J., 2012. *Carbohydrates*. Retrieved from Medicine Plus: http://www.nlm.nih.gov/melineplus/ency/article/002469.htm [Accessed 13 November 2015].

Waghmare, M.N. & Tilekar, S.N., 2012. Dietary pattern, nutritional status and food security of farm households in Maharashtra. Indian Journal of Agricultural Economics, 67(3):45-67.

Walsh, C.M., Dannhauser, A. & Joubert, G., 2002. The impact of a nutrition education programme on the anthropometric nutritional status of low-income children in South Africa. Public Health Nutrition, 5(1):3-9.

Webb, p., Coates, J., Frongillo, E., Rogers, B., Swindale, A. & Bilinsky, P., 2006. Measuring household food insecurity: why it's so important and yet so difficult to do. The Journal of Nutrition (Suppl.), 136(5):1404S-1408S.

Webb, P., Luo, H. & Gentilini, U., 2015. Measuring multiple facets of malnutrition simultaneously: the missing link in setting nutrition targets and policymaking. Food Security, 7: 479-492.

Weingàrtner, L., 2004. The concept of food and nutrition security. Available at: http://www.oda.alc.org/documents/1341934899.pdf [Accessed on 3 October 2013].

Wellman, N.S. & Kamp, B.J., 2008*.* *Nutrition and ageing*. In: L.K. Mahan and E.S. Krauer's Food, Nutrition and Diet Therapy, 12th ed. Philadelphia, Pennsylvania: WB Saunders Company.

Williams, J.B.W. & Kobak, K.A., 2012. Development and reliability of a structured interview guide for the Montgomery - Åsberg Depression Rating Scale (SIGMA). The British Journal of Psychiatry, 192: 52-58.

World Bank, 1986. *Poverty and hunger.* Washington D.C.: World Bank.

World Bank. 2014. *Food price volatility, food security and trade policy conference*. Washington DC: World Bank. Available at:

http://www.worldbank.org/en/events/2014/07/21/ [Accessed 21 December 2015].

World Food Programme (WFP). 2009. Emergency food security assessment– handbook, 2nd ed. Rome: WFP. Available at: http://www.wfp.org/stellent/groups/public/documents/manual_guide_proceed/wfp203244.pdf. [Accessed 6 May 2014].

World Food Programe, 2013. *2013 – HIV, AIDS, TB and nutrition*. Available at: https://www.wfp.org/content/hiv-aidis-t6-and-nutrition [Accessed 28 May 2015].

World Food Security (WFS.), 1996. *Rome Declaration on World Food Security*. Rome: FAO.

World Health Organisation (WHO), 2000. *Obesity: preventing and managing the global epidemic*. Report of a WHO Consultation. Geneva: WHO

World Health Organisation, 2016. *Dietary recommendations / nutritional requirements: Establishing human nutrient requirements for worldwide application*. http://www.who.int/nutrition/topics/nutrecmm/en/

World Summit on Food Security (WFS), 2009. *Declaration of the World Summit on Food Security.* Rome: FAO. Available at: http://www.mofa.go.jp/policy/economy/fishery/wfs0911-2.pdf [Accessed 17 October 2014].

Wrieden, W., Peace, H., Armstrong, J. & Barton, K., 2003. *A short review of dietary assessment methods used in National and Scottish Research Studies. Briefing Paper Prepared for: Working Group on Monitoring Scottish Dietary Targets Workshop., September 2013*

Yeldah, B. 2011. *The three pillars of food insecurity: getting to the guts of utilisation*. Society for the Anthropology of Food and Nutrition, SNAC 4. Available at: http://foodanthro.com [Accessed on 15 April 2013].

Zimmermann, M.B. & Boelaert, K., 2015. Iodine deficiency and thyroid disorders. The Lancet, Diabetes & Endocrinology, 3(4): 286-295. http://www.afesis.org.za/sustainable-settlement/sustanable-article/369-

addresing-food-security-through-household-food-security-programme.html [Accessed 17 December 2016].http://encore.seals.ac.za [Accessed 12 March 2017] http://www.fao.org/docrep/103 http://www.mmegi.bw/index

Zunyou, W. & Wang, Y., 2010. Introduction: China meets new AIDS challenges. JAIDS Journal of Acquired Immune Deficiency Syndrome, 53: S1-S3.

Zurayk, R., 2013. Global views of local food systems: reflections on the growing worldwide food systems, and community development, 3(2): 7-9.

ANNEXURE 1

A LETTER OF CONSENT TO PARTICIPATE IN THE FOOD AND NUTRITION SECURITY RESEARCH

Centre for Sustainable Agriculture and Rural Development and Extension, University of the Free State

I, the undersigned…………………………………………………………… (Full names in print) have read the details of the project, or have listened to the oral explanation thereof, and declare that I understand it. I have had the opportunity to discuss relevant aspects with the researcher and declare that I voluntarily participate in the project. I hereby give consent to participate in the project.

Name: ……………………………………………………………….

Signature ……………………………………………………………

Witness

Name ……………………………………………………………..…

Signature ……………………………...……………………….

Signed at (place) …………………………………………………………………

On (date) ………………………………………………………………………..

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA
UFS UV

ANNEXURE 2

SOCIO-ECONOMIC QUESTIONNAIRE

Geographical Characteristics

Name of the enumerator:……………………………………………………………….
Name of the respondent:……………………………………………………………..
Name of the village:……………………………………………………………………
Name of the municipality:…………………………………………………………..
Questionnaire reference number:……………………………………………………

Section A of Annexure 2
Personal Information

Code	Questions / statements	Response	Coding (official use only)
A1	Gender male=1; female=2	☐	
A2	What is your role in the family? father=1; mother=2; grandfather=3; grandmother=4; other (specify)=5………………………………………..	☐	
A3a	When where you born? Year:….……month:………….day:………		
A3b	What is your age group? ≤30=1; 31-35=2; 36-40=3; 41-45=4; 46-50=5; 51-55=6; 56-60=7; 61-65=8; 66-70=9; ≥70=10	☐	
A4	Marital status. Never married=1; married=2;widowed=3; other(specify)……………………..	☐	
A5	What is your highest education qualification? No education at all=1; adult basic education and training (ABET)=2; Grade one to seven=3; Grade eight to eleven=4; N1-N2=5; Grade 12 / N3=6; Bachelor's degree / Diploma=7; Honour's degree=8; Master's degree=9; Doctorate=10.	☐	
A6a	How many people permanently live in your household? 1-3=1; 4-6=2; 7-9=3; ≥10=4	☐	
A6b	Of those who permanently live in your household how many are working, excluding yourself?	☐	
A6c	Are you currently employed? yes=1; no=2	☐	
A6d	If "yes" how is your current job? Permanent position=1; temporary position=2; fixed term contract=3; other (specify)=4:…………………………………………………..	☐	
A7a	What is the total monthly non-farm income in your household? None=1; R500-R1 000=2; R1 001-R1500=3; R1 501-R2 000=4; R2 001-R2 500=5; > R2 500=6	☐	
A7b	What is your monthly household expenditure on food? ≤R500=1; R501-700=2; R701-R900=3; R901-R1 100=4; R1 101-R1 200=5; R1 201-R1 400=6; R1 401-R1 600=7; R1 601-R1 800=8; R1 801-R2 000=9; ≥R2 000=10	☐	

Section B of Annexure 2
Farming Operations

Code	Questions / statements	Response	Coding (official use only)
B1	What is the name of your farm / project? ………………………………………………………………………………..		
B2	What is the area size of your farm / project? ……………………….ha		
B3	Who owns the farm / project? (tick one box only). Individual=1; family=2; co-operative=3; community project=4; close corporation=5; trust=6; other (specify)=7…………………………………………………..		
B4 (1..9)	Please indicate the type of farming practised (tick box or boxes) Cattle=1; Sheep=2; Goats=3; Pigs=4; Poultry=5; Vegetables=6; Grain=7; Fruit=8; Other=9 (specify).....................................		
B5	How many livestock units do you currently have? Cattle= ; Sheep= Goats= ; Pigs= Poultry= Other (Specify) ……………………………………………………..		
B6	At the end of a season, how many tons of the following crops to your harvest? Vegetables= ; Gr ruits= ; Other cify) ………………………………………………………..		
B7	What is the total annual turnover of the farm? R150 000-R200 000=1; R201 000-R250 000=2; R251 000-R300 000=3; R301 000-R350 000=4; R351 000-R400 000=5; R401 000-R450 000=6; R451 000-R500 000=7; R501 000-R1 million =8; R1 million-R1.5 million=9; R1.5 million-R2 million=10; > R2 million=11		

ANNEXURE 3

QUESTIONNAIRE ON NUTRITIONAL PRACTICES

Code	**Questions / statements**	**Response**	**Coding (official use only)**
C1a	Do your children aged 5 to14 years usually have breakfast? Yes=1; no=2; don't know=3		
C1b	If "yes" how many times did you have breakfast last week (i.e. in the past 7 days)? Every day (the 7 previous days)=1; four to six times per week=2; one to three times per week=3; never=4.		
C2a	Yesterday, during the day and night, did your children aged 5 to14 years consume any of the following fruits? Ripe mango or mango juice =1; Apricot or apricot juice =2; Both fruits =3 Yes-4; no=5; don't know=6		
C2b	In the past week, did your children aged 5 to 14 years eat any of the following vegetables? Pumpkin fruit=1; Carrot=2; Squash=3 Yes=4; no=5, don't know=6		
C3a	Do your children aged 5 to 14 years usually eat fresh citrus fruits such as orange, naartjies, grapefruit or lemon? Yes=1; no=2 don't know=3		
C3b	If your response is "Yes", how often do you eat these fruits? Every day=1; thrice a week=2; twice a week=3; once a week=4; never=5; don't know=6		

ANNEXURE 3

QUESTIONNAIRE ON NUTRITIONAL PRACTICES (continued)

C4a	Yesterday during the day or night, did your children aged 5 to 14 years eat any of the following foods (read the list of these foods and tick either "yes" or "no"). Yes=1; no=2 (a) ORGAN MEAT Liver=3; Kidney=4; Heart=5		
C4b	(b) FLESH MEAT Yes=1; no=2 Beef=3; Mutton=4; Pork=5; Chicken=6		
C4c	(c) FISH Yes=1; no=2 Fresh fish=3; Canned fish=4; Prawns=5; Mussels=6; Crayfish=7; Crabs=8; Oyster=9		
C4d	How much do your children aged 5 to 14 years like the taste of the above protein-rich foods? Like=1; dislike=2; you are not sure=3		
C5a	What is your household's source of water? Tap water=1; rain water=2; water from a dam=3; water from a river=4; Other (specify)=5………………………………….		
C5b	Do you treat your water in any way to make it safe to drink? Yes=1; no=2		
C5c	If "yes", what do you usually do to the water to make it safer? Boil it=1; add bleach=2; strain through a cloth=3; let it stand and settle=4; don't know=5; other(specify)=6……………………………		
5d	There are key moments when you need to wash your hands to prevent germs from reaching your food. What are these key moments? After going to the toilet=1; After cleaning a baby's bottom / changing nappies=2; Before preparing / handing food=3; Before feeding a child=4; Before eating=5; After handling raw food=6; After handling garbage=7; Don't know=8; Other=9 (specify)………………………………………………..		

ANNEXURE 4

QUESTIONNAIRE ON NUTRITIONAL KNOWLEDGE, ATTITUDES AND PERCEPTIONS

Code	Questions / statements	Response	Coding (official use only)
D1a	How good do you think it is for children aged 5 to 14 years to have breakfast before going to school? Good=1; not good=2; don't know=3		
D1b	Please give reasons for your answer…………………………………………………………………………………… …………………………………………………………………………………………… ………………………………………………………………		
D2a	How difficult is it for children aged 5 to 14 years to have breakfast before going to school? Difficult=1; not difficult=2 or don't know=3		
D2b	If your answer is "difficult", please give reasons:…………………………………………………………………………………… ……………………………………………………………………………		
D3a	How often should children aged 5 to 14 years be fed a day? Once=1; twice=2; three times=3; more than three times=4; do not know=5		
D3b	How good do you think it is for children aged 5 to 14 years to have three meals a day and snacks in between? Good=1; not good=2; don't know=3		
D3c	Please give reasons for your answer on the above question. ..:………………………………………………………………………………… …………………………………………………………….		
D3d	Can you afford to provide 3 meals a day and snacks in between for your children aged 5 to 14 years? Yes=1; no=2		
D3e	Do you think it is difficult for you to feed your children aged 5 to 14 years three meals a day and snacks in between? Not difficult=1; difficult=2; don't know=3		

ANNEXURE 4

QUESTIONNAIRE FOR NUTRITIONAL KNOWLEDGE, ATTITUDES AND PERCEPTIONS (continued)

D3f	If your response is “difficult”, please give reasons. ……………………………………………………………………………………… ……………………………………………………………………………………… …………………………………………………………....		
E1a	How good do you think it is for your children aged 5 to 14 years to have different types of foods at meals? Good=1; not good=2; don’t know=3	☐	
E1b	Please give reasons for your answer ……………………………………………………………………………………… ………………………………………………………………………………………		
E1c	Do you think it is difficult for your children aged 5 to 14 years to have different types of foods at meals? Not difficult=1; difficult=2; don’t know=3	☐	
E1d	If your response is “difficult”, please give reasons why. ……………………………………………………………………………………… ………………………………………………………………………………………		
F1a	How good do you think it is to prepare meals for your children aged 5 to 14 years with iodized salt? Good=1; not good=2; you don’t know=3	☐	
F1b	If your response is “not good”, do you do anything to decrease your salt consumption? Yes=1; no=2; don’t know=3	☐	
F1c	If your response is “yes”, what exactly do you do? I cook with less salt=1; I add less salt to my food=2; I keep the salt-shaker far from the kitchen table=3; I do not know=4; other (specify)=5…………………………………………………………………	☐	
G1a	Do you think you have any of your children aged 5 to 14 years either very lean or lean or overweight or obese? Overweight=1; obese=2; don’t know=3; none of the above=4	☐	
G1b	Please give reasons for your answers :…………………………………………………………………………………… ……………………………………………………………………………………… ………………………………………………………………		

ANNEXURE 4

QUESTIONNAIRE FOR NUTRITIONAL KNOWLEDGE, ATTITUDES AND PERCEPTIONS (continued)

G1c	Can you tell me the reason(s) why children aged 5 to 14 years are either overweight or obese? Excessive intake of energy-dense foods that are high in fat and / or sugar=1; Lack of or decreased physical activity=2; Other (specify:………………………………………………………………………………… ………………………………………………….. ………………… …………………………………………………………. …………………	☐	
G1d	How can people prevent overweight and obesity? Reduced energy in take=1; Eat vegetables and fruits=2; Eat legumes and whole-grain products more often=3; Increase physical activity=4; Don't know=5; Other (specify)=6 ………………………………………………………………………………………… …………………………………………………………………… …………………………………………………………. …………………	☐	
H1a	Do you get nutrition advice from extension officers? Yes=1; no=2	☐	
H1b	If your answer is "yes", what kind of advice to you get? ………………………………………………………………………………………… ………………………………………………………………………………………… ………………………………………………………………………………………… ………………………….............................		
H1c	Are there any organisations that provide you with nutrition advice? Yes=1; no=1	☐	
H1d	If your answer is "yes", please give the name of these organisations ………………………………………………………………………………………… ………………………………………………………………………………………… ………………………………………………		

ANNEXURE 5.1

24-hour Dietary Recall – first /second week day

				Office use only	
Approximate time	**Place (e.g. home, work**	**How was the food prepared ? / what was added in it?**	**Amount in spoon or cup?**	**Amount in *g* or *ml***	**Code**
From the time your children aged 5 to 14 years woke up to do the day's activities or going to school					

ANNEXURE 5.1

24-hour Dietary Recall – first / second week day (continued)

				Office use only	
Approximate time	**Place (e.g. home, work**	**How was the food prepared ? / what was added in it?**	**Amount in spoon or cup?**	**Amount in *g* or *ml***	**Code**
During the morning at school or home or elsewhere					
During the middle of the day (lunch time)					

ANNEXURE 5.1

24-hour Dietary Recall – first / second week day (continued)

During the afternoon					
During the night (diner time)					
After dinner and before going to bed					

Code	**Questions / statements**	**Response**	**Coding (official use only)**
X1a	Was this a typical day of the week day? Yes=1; No=2	☐	
X1b	If not, what was different? …………………………………………………………………………………… …………………………………………………………………………………… …………………………………………………………………………………… …………………………………………………………………………………… ………..		

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA
UFS
UV

ANNEXURE 5.2

24-hour Dietary Recall – first /second weekend day

				Office use only	
Approximate time	**Place (e.g. home, work**	**How was the food prepared ? / what was added in it?**	**Amount in spoon or cup?**	**Amount in *g* or *ml***	**Code**
From the time your children aged 5 to 14 years woke up to do the day's activities or going to church					

ANNEXURE 5.2

24-hour Dietary Recall – first / second weekend day (continued)

				Office use only	
Approximate time	**Place (e.g. home, work**	**How was the food prepared ? / what was added in it?**	**Amount in spoon or cup?**	**Amount in *g* or *ml***	**Code**
During the morning in church or home or elsewhere					
During the middle of the day (lunch time)					

ANNEXURE 5.2

24-hour Dietary Recall – first / second weekend day (continued)

During the afternoon					
During the night (diner time)					
After dinner and before going to bed					

Code	**Questions / statements**	**Response**	**Coding (official use only)**
X1a	Was this a typical day of the weekend day? Yes=1; No=2	☐	
X1b	If not, what was different? ……………………………………………………………………………… ……………………………………………………………………………… ……………………………………………………………………………… ……………………………………………………		

ANNEXURE 6

Qualitative Food Frequency Questionnaire

Please indicate with an (X) the food or drink that you eat or drink over a period of either a day or week or month

Name of Respondent:………………………………………………..

Local Municipal Area:………………………………………………….

Date of interview:………………………………………….

ANNEXURE 6

Qualitative Food Frequency Questionnaire

Code	Food Group	Number of times (only one option)			Office use only / Coding details
	Group 1:Cereal, roots and tubers	**Per day**	**Per week**	**Per month**	
A1	Maize (mealie meal, mealie rice, pap, porridge, sweet corn, corn on the cob)				
A2	All tubers / roots (potatoes, sweet potatoes, amadumbe)				
A3	All bread (white, brown or whole wheat)				
A4	Dumpling, steamed bread, fat koek				
A5	Scones, biscuits				
A6	Amarhewu				
A7	Breakfast cereals (corn flakes, oats weet bix, matabela)				
	Group 2:Flesh Foods (Meat, poultry fish)	**Number of times (only one option)**			
		Per day	**Per week**	**Per month**	
B1	Beef				
B2	Mutton, lamb				
B3	Pork				
B4	Minced meat				
B5	Dried meat (biltong)				
B6	Offal/tribe/heads/feet				
B7	Fresh fish				
B8	Seafood (Calamari, prawns, mussels, crab, shrimp, crayfish)				
B9	Canned fish (sardines, pilchards, tuna)				
B10	Processed meat (Russians, boerewors sausage, polony, viennas)				

ANNEXURE 6

Quantitative Food Frequency Questionnaire (continued)

	Group 3: Dairy products	**Number of times (only one option)**			**Office use only/ Coding details**
		Per day	**Per week**	**Per month**	
C1	Fresh milk				
C2	Amasi / Maas				
C3	Powdered milk (unsweetened)				
C4	Condensed milk				
C5	Cheese				
C6	Ice cream				
C7	Custard				
	Group 4: Legumes and nuts	**Number of times (only one option)**			
		Per day	**Per week**	**Per month**	
D1	Whole dried beans				
D2	Dried peas				
D3	Lentils				
D4	Soya				
D5	Peanuts and nuts				
	Group 5: Eggs				
		Number of times (only one option)			
		Per day	**Per week**	**Per month**	
E1	Eggs				
	Group 6: Vitamin A-rich vegetables and fruits	**Number of times (only one option)**			
		Per day	**Per week**	**Per month**	
F1	Carrots				
F2	Pumpkin				
F3	Butternut				
F4	Spinach				
F5	Wild leafy vegetables, fresh and dried				
F6	Apricot				
F7	Peach (yellow cling)				
F8	Mango				

ANNEXURE 6

Qualitative Food Frequency Questionnaire (continued)

	Group 7: Other fruits and juices	**Number of times (only one option)**			**Office use only / Coding details**
	Deciduous fruit	**Per day**	**Per week**	**Per month**	
G1	Apples				
G2	Pear				
G3	Peaches				
G4	Grapes (red / green)				
G5	Plum				
	Sub-tropical fruit	**Number of times (only one option)**			
		Per day	**Per week**	**Per month**	
G6	Orange				
G7	Lemon				
G8	Naartjie				
G9	Banana				
G10	Pineapple				
G11	Avocado				
G12	Kiwi fruit				
G13	Watermelon				
G14	Guava				
G15	Pap-paw				
	Juices	**Number of times (only one option)**			
		Per day	**Per week**	**Per month**	
G16	Juice (100% juice; e.g. liquifruit, ceres)				

ANNEXURE 6

Qualitative Food Frequency Questionnaire (continued)

	Group 8: Other vegetables	**Number of times (only one option)**			**Office use only**
		Per day	**Per week**	**Per month**	**Coding details**
H1	Cabbage				
H2	Cauliflower				
H3	Brocholi				
H4	Onions				
H5	Beetroot				
H6	Tomatoes				
H7	Fresh green beans				
H8	Fresh peas				
H9	Lettuce				
H10	Chilli (red / green)				
H11	Green / yellow / red pepper				
H12	Frozen vegetables (mixed)				
H13	Ginger and garlic (fresh)				

ANNEXURE 6

Qualitative Food Frequency Questionnaire (continued)

	Group 9: Oils and fats	**Number of times (only one option)**			**Office use only**
		Per day	**Per week**	**Per month**	**Coding details**
I1	Butter				
I2	Margarine				
I3	Sunflower oil				
I4	Lard				
I5	Salad dressing / oil				
I6	Potato crisps				
I7	Coffee creamer (e.g. Cremora, Eliis Brown)				

ANNEXURE 7

Anthropometric Measurements of a Child

Code	Questions / statements	Response	Coding (official use only)
	Child's name:		
	Child's date of birth: day…………month…………………..year………………		
I1	Gender male=1; female=2		
12	Child's weight (kg)		
I3	Child's height (cm)		

ANNEXURE 8

Research papers from the thesis

PAPER NO.1

Paper No.1

Nutritional status of children from historically disadvantaged agri-business families, South Africa

Paper has been accepted, revised and sent to the Journal of Health, Population and Nutrition

JOHP-D-17-00050R1

Nutritional status of children from historically disadvantaged agri-business families, South Africa Awonke Sonandi, DBL; Elliot Frank Zwane, PhD; Johan Adam Van Niekerk, PhD Journal of Health, Population and Nutrition

Dear Dr Sonandi,

Thank you for the revised version of your manuscript 'Nutritional status of children from historically disadvantaged agri-business families, South Africa' submitted to Journal of Health, Population and Nutrition.

You may check the status of your manuscript at any time by accessing the following website:

http://johp.edmgr.com/

Your username is: sonandi

Your password is: available at this link http://johp.edmgr.com/Default.aspx?pg=accountFinder.aspx&firstname=Awonke&lastname=Sonandi&email_address=awonke.sonandi@drdar.gov.za

We will inform you of the Editor's decision as soon as possible.

Best wishes,

Editorial Office

Journal of Health, Population and Nutrition https://jhpn.biomedcentral.com/

Nutritional status of children from historically disadvantaged agri-business families, South Africa

Awonke Sonandi[1,*], Elliot Frank Zwane[1], Johan Adam Van Niekerk[1]

ABSTRACT

Background: In the South African context, little is known of the nutritional status of children of historically disadvantaged agri-business smallholders. Instead, they are presumed having elevated nutritional status by virtue of being dependants of food producers. This study sought to evaluate the nutritional status of children from historically disadvantaged agri-business families.

Methods: The study's purposeful sample comprised of 263 agri-business households that generated an annual turnover of $11 811 - $39 370, and 327 children aged 5-14 years. A 3-day 24h dietary recall method was administered, and questionnaires were used to assess the households' socio-economic status, and the caregivers' nutritional knowledge, and practices. Food models and Foodfinder III nutritional software were used to improve the accuracy of recorded food quantities. Statistical Package for Social Sciences, Version 20, was used to perform descriptive, inferential and non-parametric statistical analyses. **Results:** Generally, the caregivers had good nutritional knowledge, but their households' feeding practices were modest. The majority of their households had a monthly non-farm income of $78.82 - $118.11 (32.9%), and monthly food expenditure of $55.20 - $70.87 (23.2%). The average annual farm income payable to each agri-business smallholder was $2 903. The mean food variety score (FVS) was low at 23.431±7.89, while the mean dietary diversity score (DDS) was debatably high at 7.82±4.53. The households' non-farm income was positively highly correlated to food expenditure ($p<0.01$). In turn, food expenditure had a significant influence on FVS ($p<0.01$) and DDS ($p<0.05$). The majority of children had normal weight-to-age (80.14%), normal height-to-age (90.7%) and normal body mass index-for-age Z-scores (56.57%). However, the risk of overweight, the actual overweight and obesity were a concern as they were evident among 36.39%, 6% and 8% of the children, respectively.

Conclusion: Notwithstanding their good nutritional knowledge, the agri-business families consumed meals that were predominantly carbohydrates-based, and had low FVS and debatably high DDS. The majority of children had normal anthropometric dimensions that were indicative of good nutritional status. However, overweight / obesity appeared a creeping problem than is stunting and wasting.

Keywords: *Nutritional Knowledge, FVS, DDS, Anthropometric parameters, Nutritional Status, Children*.

[*]Correspondence : awonke.sonandi@drdar.gov.za, [1]zwanefrank@gmail.com; [1]vNiekerkJA@ufs.ac.za

[1]Centre for Sustainable Agriculture, Rural Development and Extension; University of the Free State, Bloemfontein, 9301, South Africa

1. Background

Since the dawn of the democratic South Africa in 1994, the subject of food security has received serious attention in many civil society, academic and government circles. This attention which led to the formulation of South Africa's Integrated Food Security Strategy (IFSS) [1] was prompted by the dire need to address food insecurity concerns of many previously disadvantaged families, particularly those who reside in poverty-stricken rural areas of South Africa.

Subsequent to the inception of the IFSS, the country introduced a number of food security-based agricultural programmes that sought to benefit mainly the previously disadvantaged smallholder agri-business families. A number of local food security studies were conducted on these smallholder families. However, many of them tended to put either little emphasis or none on the nutrition facet of food security [2, 3, 4, 5, 6]. Instead, children of smallholder farmers are presumed having an elevated nutritional status by virtue of being dependants of food producers. One's food security status is no guarantee to achieving good nutritional status. Nevertheless, in other parts of the world, the nutrition dimension of food security receive due attention [7] Research in the nutrition facet covers indicators of nutritional status such as food variety and dietary diversity [8, 9], and anthropometric parameters [10, 11]. These indicators formed part of the investigation in the current study.

In the light of the above gaps, this study sought to make an investigation into, namely; the nutritional status of children from historically disadvantaged agri-business families, and key socio-economic attributes that influence the children's nutritional status.

2. Methods

2.1 Study population and sampling

The study population was agri-business families who operate and reside in Umzimvubu and Ntabankulu Local Municipalities of Alfred Nzo District Municipality in the Eastern Cape Province, South Africa. Specifically, it targeted previously disadvantaged smallholder agri-business families whose individual or collective annual turnover is between $11 811 and $39 370. All families who met this criterion were purposefully selected from a farmer database that was made available by local agricultural extension officers. Subsequent to the exclusion of survivalist farming families (annual turnover less than $11 811) this study included the whole remaining purposeful research sample of 263 agri-business families, and 327 children aged 5-14 years. From each of the 263 farming households, questions that relate to nutritional knowledge, attitudes and feeding and general care of children were directed to caregivers who lived in these households.

2.2 Research methods

2.2.1 Socio-economic and nutrition questionnaires

Questionnaires were used to assess the caregivers' socio-economic status, and feeding practices. A 24h dietary recall questionnaire was administered twice in weekdays and once in weekends. Food models and the internationally acclaimed Foodfinder III nutritional software of the Medical Research Council of South Africa were used to improve the accuracy of recorded food quantities.

2.2.2 Anthropometric measurements

The researcher and fieldworkers received training from public health workers on measurement of weight and height of the caregivers' children in order to determine anthropometric measurements. Accordingly, a calibrated electronic scale was used to measure weight. All the children were weighed with their shoes and socks being removed, and with their light clothes put on. Two weight readings were taken within the nearest 0.1kg, and the average of the two readings was recorded if the two readings were different. Height was measured with a stadiometer, with vertical scale of metres and a sliding headpiece, to the nearest 0.1cm. Children had to put their legs and knees straight together with arms aside, and feet and heels touching together. As with weight, two measurements were taken, and the average recorded if the two measurements were different. .

Weight and height recordings were captured on Excel, and the following anthropometric measurements determined on WHO Anthro V3.2.2 and AnthroPlus V1.0.4 softwares, namely; weight-for-age Z-scores (WAZ), height-for-age Z-scores (HAZ) and body mass index-for-age Z-scores (BMIZ). WAZ, which is measured in children that are younger than nine years11 was confined to 146 children aged 5-8 years in this study. MBIZ was calculated as, weight/height^2. The classification of the children's Z-scores of WAZ, HAZ and BMIZ was done in accordance with WHO [12].

2.3 Data analysis

Data was cleaned and statistically analysed using Statistical Package for Social Sciences (SPSS), Version 20. Descriptive statistics was performed to establish central tendencies. Non-parametric Kruskal-Wallis H test was conducted in order to elucidate the outcomes of the parametric tests, and a bivariate correlation analysis was conducted to describe relationships between variables.

2.4 Ethical considerations

The researcher obtained consent from the caregivers to conduct the study. Their right to anonymity, confidentiality and fair treatment was respected. This study also upheld scientific integrity.

3. Results

3.1 Socio-economic information

3.1.1 Demographic characteristics

Most of the caregivers who participated in this study were women (n=250, 94.95%), the majority of which were aged 36-40 years (n=54, 20.5%), followed by those aged 46-50 years (n=36, 13.7%). Their children were aged 5-14 years, the majority of which were male (n=177, 45.13%). The caregivers' level of education was low; the majority having acquired Grade 8-11 (n=66, 25.1%), while some never had any formal education (n=41, 15.6. Most caregivers permanently lived with 4-6 persons (n=109, 41.4%), while the majority (n=143, 55.4%) had no employed family members among those that they permanently live with.

3.1.2 Economic characteristics

The main sources of non-farm income of households were wages / salaries of employed family members, government social grants and remittances. The households had a modest monthly non-farm income; the majority earning \$78.82 - \$118.11 (n=85, 32.9%). A minimum monthly non-farm income of \$39.37 - \$78.74 was earned by 21.3% of the households, while a maximum of more than \$196.85 (19.8%) was earned by 19.8%. Monthly non-farm income was positively strongly correlated to food expenditure ($r=0.55$, $p<0.01$).

The farming activities of the agri-business smallholders were not intense, often characterized by low yields and productivity due to use of out dated farming methods and poor infrastructure base. The majority of the smallholders (n=236, 89.73%) co-owned and / or co-managed their agri-business units in groups; the average size of a group being four people. The average annual farm income payable to each agri-business smallholder was \$2 903. However, in their homesteads the agri-business smallholders kept some livestock and grew crops which were used for home consumption, mainly.

3.2 Nutritional knowledge

In the current study, the caregivers' nutritional knowledge was assessed on areas of namely; breakfast patterns, frequency and variety of meals consumed per day, and ability to judge their children's basic anthropometric conditions.

3.2.1 Breakfast eating patterns

In this study, caregivers were asked some opinion seeking questions on breakfast eating patterns, the responses of which are captured in Table 1. When asked for an opinion on whether it is a good nutritional practice to provide breakfast to their children before they go to school or church, the majority of the caregivers responded in the `affirmative' (n=227, 86.3%), while a few (n=8, 3.%) said such practice was not good.

Subsequently, the caregivers were asked if it is economically difficult to provide breakfast to their children before they go to school or church. Most caregivers acknowledged such economic difficulty (n=153, 58.2%), while 106 (40.3%) said it was not difficult. Commonly mentioned sources of economic difficulties in providing breakfast included; expensive electricity, and expensive food materials that make a nutritious breakfast.

With respect to the frequency of providing breakfast to their children, about half of the caregivers (n=132, 50.2%) said the provision of breakfast is made every day of the week, followed by those who reportedly provided breakfast four to six times a week (n=82, 31.2%).

Table 1 Caregivers' opinion in providing children with breakfast

Characteristics	Frequency (n=263)	Percentage (%)
IS PROVISION OF BREAKFAST A GOOD PRACTICE?		
Good	227	86.3
Not good	8	3.0
Do not know	28	10.6
IS IT DIFFICULT TO PROVIDE BREAKFAST?		
Difficult	153	58.2
Not difficult	106	40.3
Do not know	4	1.5
FREQUENCY OF PROVISION OF BREAKFAST		
Every day	132	50.2
4-6 times per week	82	31.2
1-3 times per week	26	9.9
Never	23	8.7

3.2.2 Frequency and diversity of meals

A similar line of questions were posed to the caregivers regarding their opinion on the practice of providing their children with three meals a day and a snack in between. To this end, many said this was a good practice (n=222, 84.4%), while the rest reported either `not good' (n=10, 3.8%) or `do not know' (n=31, 11.8%). Those who responded in the affirmative felt that this nutritional practice would make their children; grow fast, and perform well at school. In reality, a smaller number of caregivers (n=104, 39%) said they are affording to provide their children with three meals a day and snacks in between, while the rest (n=159, 60.5%) indicated that they are not affording.

This study also sought to make a brief assessment of nutritional knowledge and attitudes of the caregivers on the importance of providing their children with different types of meals. When asked to share their opinion on this nutritional practice, the overwhelming majority said this practice was good (n=244, 92.8%), followed by those who said they `do not know' (n=10, 3.8%) [Table 2]. The commonly cited reasons given for providing different types of meals were; children do get tired of eating the same food all the time, and different meals provide a wide range of nutrients that are needed by the body Notwithstanding the above responses on the diversity of meals, more than half of the caregivers (n=139, 52.9%) said in reality it was difficult to provide their children with different types of foods (Table 2). Cited causes of this difficulty were; expensive prices of food, and unavailability of some foodstuffs in the local shops.

Table 2 **Caregivers' opinion on the practice of providing children with three meals per day, and a snack in betweeen**

Characteristics	**Frequency (n=263)**	**Percentage (%)**
	IS IT A GOOD PRACTICE?	
Good	222	84.4
Not good	10	3.8
Do not know	31	11.8
	IS IT A DIFFICULT PRACTICE?	
Difficult	138	52.5
Not difficult	125	47.5
	IS PROVISION OF VARIETY IN MEALS A GOOD PRACTICE?	
Good	244	92.8
Not good	10	3.8
Do not know	9	3.4
IS PROVISION OF VARIETY IN MEALS A DIFFICULT PRACTICE?		
Difficult	139	52.9
Not difficult	124	47.1
Do not know	0	0

3.3 Food intake, food variety and dietary diversity

3.3.1 Food intake

Table 3 presents a summary of top 20 most consumed food items by the caregivers' children during the 3-day 24h dietary recall. Noticeably, the carbohydrates-rich food items from the `cereal, roots and tubers' group dominated the top 10 most consumed foods. From the `flesh' and `dairy products' groups, only canned fish and chickens, and fresh milk and sour milk, respectively, appeared in the list of top 20 most consumed foods items. Only carrots and spinach from the `vitamin A-rich vegetables and fruits' group, and cabbage and onion from the `other vegetables' group appeared in the list presented in Table 3, while sunflower oil represented the `fats and oils' group. Food groups whose food items did not feature in the list in question were `eggs', `legumes and nuts', and `other fruits and juices' groups.

This study also found that consumed quantities of food items varied widely within and between households, largely due to the varying socio-economic profiles of the caregivers' households. Consumed quantities of food items from other food groups were rather low (e.g. dairy products, vegetables, and flesh foods). Again, this appeared a function of socio-economic properties of the caregivers' households, which have been discussed earlier in this paper.

Table 3 Top 20 most consumed food items

Rank	Food item	Mean food intake (g/person/day)
1	Maize meal soft porridge	99.23±74.56
2	Instant tea	182.14±131.38
3	White sugar	19.99±7.05
4	Maize meal stiff *pap*	123.49±72.79
5	Brown bread/rolls	27.58±30.81
6	Amarhewu	176.78±174.66
7	Crumbed maize meal (*uphuthu*)	107.67±105.07
8	Fresh milk	21.85±26.34
9	Potatoes	21.38±14.34
10	Samp	156.63±139.91
11	Rice	64.86±36.03
12	Sour milk	128.57±118.77
13	Carrot	14.28±10.94
14	Baked bread, homemade	49.16±50.43
15	Cabbage	10.64±12.47
16	Spinach	10.17±14.89
17	Onion	8.78±11.74
18	Sunflower oil	23.85±32.99
19	Canned fish	13.66±17.56
20	Chicken	33.81±39.95

3.3.2 Food variety and dietary diversity

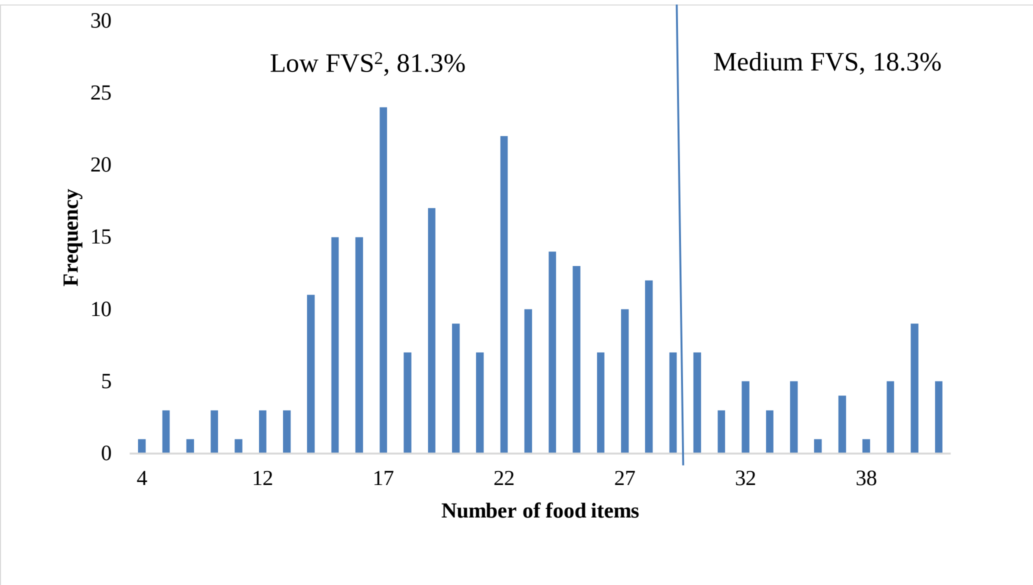
The average FVS for the 263 investigated households was low at 23.43 (see Table 4). Most of the caregivers' households (n = 215; 81.7%) had a low FVS, followed by those with a medium FVS (n = 48; 18.3%). None of the households had a high FVS category (see Fig. 1).

Regarding dietary diversity, most of the caregivers' households (n = 88; 33.5%) consumed foods from eight food groups, followed by those (n = 71; 27.0%) who consumed foods from all nine foods groups. Three food groups was the lowest number consumed (n = 5; 1.9%). The mean dietary diversity score (DDS) was 7.82, which is indicative of a high DDS. The majority of the caregivers' households (n = 184; 70%) had high DDS (see Fig. 2), followed by those with medium DDS (37.2%) and low DDS (8.2%).

Table 4 Food variety scores within food groups

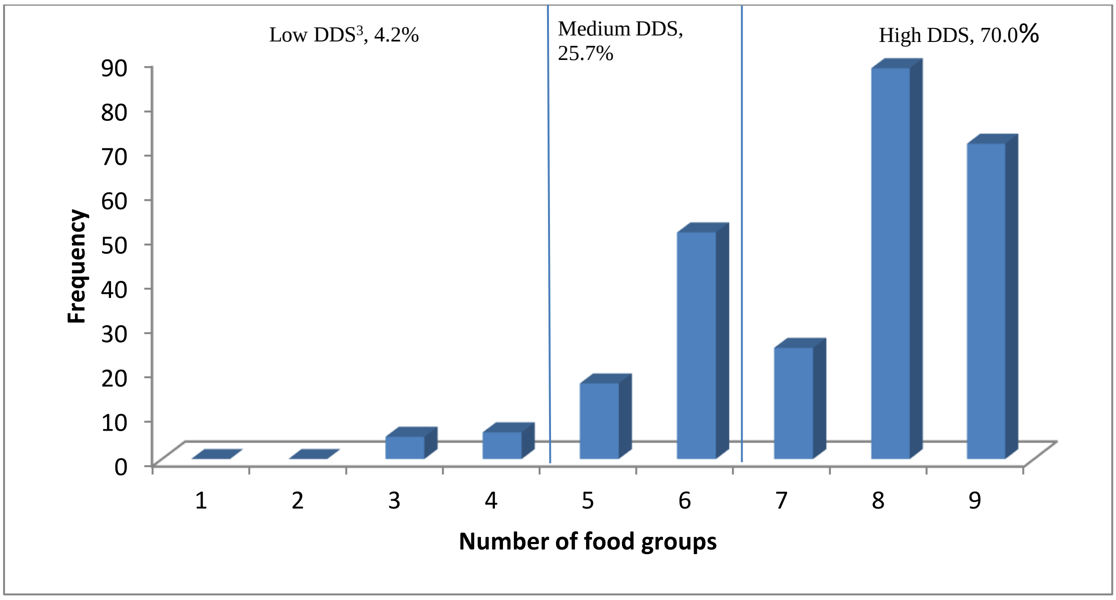
Food Group	**Mean**	**SD[1]**	**Range**
Cereal, roots and tubers	5.05	0.89	3-7
Fleshy foods	3.22	1.08	1-5
Dairy products	1.97	1.14	0-6
Legumes and nuts	1.00	0.58	0-3
Eggs	0.38	0.49	0-1
Vitamin A-rich vegetables and fruits	3.06	1.20	0-5
Other fruits and juices	2.85	1.93	0-8
Other vegetables	4.03	2.48	0-11
Fats and oils	1.86	0.86	0-4
Total Food Items	**23.43**		

[1] SD: Standard Deviation



2

Fig. 1 **Distribution of food variety scores from the caregivers' households**



3

Fig. 2 **Distribution of dietary diversity scores from the caregivers' households**

[2] FVS: Food Variety Score

[3] DDS: Dietary Diversity Score

3.4 Anthropometric parameters

3.4.1 WAZ, HAZ and BMIZ

As indicated earlier, the measurement of WAZ was limited only to 146 children of 5-8 years of age. Of these children, the majority (80.14%) had normal WAZ (<-1SD to <0SD), while the remaining minority (19.86%) were underweight (≥-3SD to <-2SD) [Table 5]. The prevalence of underweight was higher among male children than in their female counterparts (p≤0.05).

Of the 327 children who were subjected to the HAZ measurement, the overwhelming majority (90.70%) had normal HAZ (>-1SD to +3SD). The rest who were stunting (<-2SD), particularly female children (p≥0.05).

The measurement of BMIZ was also extended to all 327 children. Over half (56.57%) of the children included in this study had normal BMIZ (>-2SD to <+1SD), and a very small proportion (0.92%) was wasting (<-2SD to >-3SD). Of concern was a creeping problem of over-nutrition. To this end, 36.39% of children were at risk of overweight (>+1SD to <+2SD), while 6% and 8% were overweight (>+2SD to <+3SD) and obese (>+3SD), respectively. Noticeably, female children were heavier than their male counterparts of the same age (p≥0.05).

The caregivers were given an opportunity to visually appraise the body condition of their children in a scale of underweight, normal weight, overweight and obese. In their responses, most of the caregivers rated the weight of their children as normal (n=221, 84%), followed by those who rated them underweight (n=29, 11%), overweight (n=1, 0.4%) and obese (n=12, 4.6%).

Table 5 Summary of anthropometric characteristics of the children understudy

Classification	Z-score	Gender		Total
		Male	**Female**	
		WAZ[4] (n=146)		
Severely underweight	<-3SD	0	0	0
Underweight	≥-3SD to <-2SD	17 (17.71%)	12 (24.00%)	29 (19.86%)
Normal WAZ	<-1SD to <0SD	79 (82.29%)	38 (76.00%)	117 (80.14%)
		HAZ[5] (n=327)		
Severely stunting	<-3SD	0	0	0
Stunting	<-2SD	13 (7.34%)	17 (11.33%)	30 (9.30%)
Normal HAZ	<-1SD to +3SD	164 (92.66%)	133 (88.67%)	297 (90.7%)
		BMIZ[6] (n=327)		
Severely wasting	<-3SD	0	0	0
Wasting	<-2SD to >-3SD	2 (1.13%)	1 (0.67%)	3 (0.92%)
Normal BMIZ	>-2SD to <+1SD	117 (66.10%)	68 (45.33%)	185 (56.57%)
Risk of overweight	>+1SD to <+2SD	52 (29.38%)	67 (44.67%)	119 (36.39%)
Overweight	>+2SD to <+3SD	2 (1.13%)	6 (4.00%)	8 (2.45%)
Obese	>+3SD	4 (2.26%)	8 (5.33%)	12 (3.67%)

[4] WAZ: Weight-for-age

[5] HAZ: Height-for-age

[6] BMIZ: Body mass index-for-age Z score

Table 6 Summary of results of Kruskal-Wallis H tests on the effect of various factors on anthropometric parameters

Nutritional status – WAZ, HAZ and BMIZ	Monthly non-farm income			Monthly food expenditure		
	df	Chi-square	Asymp. Sig.	df	Chi-square	Asymp. Sig.
WAZ	4	44.23	0.000**	8	40.12	0.000**
HAZ	4	43.18	0.000**	8	43.91	0.000**
BMIZ	4	42.82	0.000**	8	46.08	0.000**

	Monthly farm income			Level of education		
	df	Chi-square	Asymp. Sig.	df	Chi-square	Asymp. Sig.
WAZ	7	74.83	0.027*	5	14.27	0.010*
HAZ	7	71.21	0.038*	5	13.42	0.015*
BMIZ	7	69.82	0.045*	5	12.18	0.021*

	Breakfast feeding patterns		
	df	Chi-square	Asymp. Sig.
WAZ	1	1.93	0.32
HAZ	1	2.4	0.43
BMIZ	1	1.60	0.20

3.4.2 Factors affecting nutritional status

Hypothetical tests were conducted on key factors that were deemed influential in the children's anthropometric parameters, namely; WAZ, HAZ and BMIZ. These key factors were monthly non-farm income, monthly food expenditure, farm income, and the caregivers' level of education and breakfast patterns. As shown in Table 6, all these key factors, with the exception of breakfast patterns, had an influence ($p \leq 0.01$) on the children's WAZ, HAZ and BMIZ. The influence of breakfast patterns on the children's anthropometric parameters was rather non-significant ($p \geq 0.05$).

4. Discussion

The size of the caregivers' households was investigated, because of its potential effect on the nutritional status of habitants of the households. It was found comparable with the average size of households of 3.7 and 3.9 at Alfred Nzo District and Eastern Cape Province, respectively. Also comparable was the unemployment rate among adult habitants of the studied households. Nutritional knowledge can play a pivotal role in determining one's feeding behaviour and nutritional status[13]. Generally, the caregivers were found to have good knowledge and attitudes towards various aspects of human nutrition such as the importance of eating breakfast, the ideal number of meals a child should have a day, and the importance of food variety. However, Shakkour [14] cautioned that good nutritional knowledge and attitudes do not automatically lead to good nutritional practices. In many instances good nutritional practices are hindered by socio-economic constraints such as employment, poverty, and a large number of dependents [15]. Indeed, in this study, the caregivers' feeding practices were not as good as their nutritional knowledge and attitudes. This observation was clear right from their provision of the first meal of the day – breakfast. Half of the caregivers could not provide their children with breakfast before they go to school or church. Skipping breakfast is not a good nutritional practice, because of its association with poor performance of children at school and numerous health risks [16, 17, 18].

Consumption of breakfast makes an important contribution to a day's nutrient intake, yet skipping breakfast is a common practice among adolescents [19]. Parents have an important role to play in influencing their children's breakfast eating patterns [20]. Breakfast is one of many meals that were skipped by the caregivers' children understudy. Ideally, children aged 5-14 should have at least three meals a day and a snack in between [21]. However, in this study, only 39.5% of the caregivers' households could afford the above prescribed number of meals. Equally of concern is the quality of consumed meals in the face of the revelation that over half of the caregivers' households found it difficult to provide a variety of meals to their children. A wide variety of meals is likely to provide a wide range of nutrients that are necessary for a child's good nutritional status, health and performance at school. This view is widely held by many in the literature [22, 23, 24].

The caregivers' inabilities in providing a variety of meals to their children is reflected on their households' low FVS. Most the caregivers' households provided meals that were dominated by carbohydrates-rich maize products such as stiff *pap*, crumbed maize meal, samp and *amarhewu*, and wheat-based products such as steamed bread and baked bread. It was, therefore, not surprising that in this study the `cereal, roots and tubers' food group had the highest FVS. On the other hand, it is commendable that most of the caregivers' households had a conservatively high DDS. This high DDS came as a result of consumption of few food items on a wide range of the nine food groups. This eating pattern is unlikely to lead to adequate nutrient intake and good nutritional status due to exclusion of critically important nutrients in the feeding menu. A wide range of fruit, which provide a good source of minerals and vitamins, was either rarely consumed or not consumed in many households. Apples and citrus were two most consumed fruits, but their consumption was limited to approximately half of the 263 households that were included in this study. Consumption of bananas was expected to be high by virtue of the proximity of the studied population and local retail shops to banana plantations of the province of KwaZulu-Natal. Banana consumption was reported in only 28.57% of the caregivers' households. It appears that physical availability of this food item was not a problem, but its financial accessibility [25].

FVS and DDS which are indicative of the farming households' nutritional status, were influenced by a number of socio-economic factors. First and foremost, the caregivers' level of education had a significant influence on FVS ($p \leq 0.05$) than on DDS ($p \geq 0.05$). Probably, higher level of education of caregivers played a critical role in exposing them to good nutritional and caring practices for their children. Similar observations were also made by some authors [26, 27], while others could not find a relationship between parents' level of education and their children's nutritional status [28]. Further analysis of results showed that the caregivers' level of education had a significant effect ($p \leq 0.05$) on their households' monthly non-farm income and expenditure on food. The monthly non-farm income was positively strongly correlated to food expenditure ($r=0.55$, $p<0.01$). In turn, food expenditure had a significant influence on FVS ($r=0.672$; $p<0.01$) and DDS ($r=0.322$; $p<0.01$). These economic variables also had a significant influence on the anthropometric parameters of WAZ, HAZ and BMIZ which are also indicative of nutritional status. These findings on the economic variables (income and food expenditure) are similar to those reported in a survey that was conducted by ECSECC at Alfred Nzo District [29]. The survey found that most of the monthly expenditure is used to acquire non-durable goods like food, while very little is used to buy either durable or semi-durable goods. For example, in 2013 from a total household income of $811 million, $724 million was used in household expenditure. ECSECC concluded that this elevated household expenditure is symptomatic of poverty in the district, as high expenditure on non-durable goods does very little contribution to wealth creation.

With respect to anthropometric nutritional status, South African communities are reportedly sandwiched between malnutrition, and overweight / obesity [30]. In the current study, majority of children had good nutritional status, because they had normal WAZ, HAZ and BMIZ. Very few had low nutritional status through being wasted and stunted. However, among children aged 5-8 years, the prevalence of underweight was 20%, which is indicative of low nutritional status. In terms of the prevalence of various anthropometric conditions, this study found risk of overweight / overweight / obesity a more threatening problem than malnutrition is. Possibly, the high prevalence of these anthropometric conditions was caused by high consumption of carbohydrates-rich food items from the `cereal, roots and tubers' food group and lack of physical activity.

5. CONCLUSION

Whilst the caregivers were found to have good nutritional knowledge, in reality they followed modest feeding practices for their children. Their feeding practices were characterised by high consumption of carbohydrates-rich food items, low FVS and debatably high DDS which are indicative of low to moderate nutritional status. On the anthropometric scale, the majority of children had normal body weight which translated to a good nutritional status. Staple food production-based food security programmes need to be reviewed in favour of the nutrition dimension.

This study recommends diversification of food production and nutrition education as means to improving nutrition security / nutritional status of children from agri-business families. Furthermore, standard procedures and methods into assessing nutrition security / nutritional status should be used. Currently, many previously disadvantaged agri-business families are presumed food and nutrition insecure, and the awarding of government food production subsidies is based solely on this historical misfortunes. There is also a need to evaluate nutrition security / nutritional status of families of relatively bigger and well-established agri-business owners / managers.

In recognition of this study's limitations, it is advisable that caution be exercised when generalising its findings to children from previously disadvantaged agri-business families outside the Eastern Cape Province as agricultural performance of agri-business units in other provinces may differ. Eating behaviour is also expected to vary, subject to socio-economic conditions.

Abbreviations

BMIZ: Body mass index-for-age Z score; **ECSECC**: Eastern Cape Socio-Economic Consultative Council; **FVS**: Food variety score; **DDS**: Dietary diversity score; **HAZ**: Height-for-age; **IFSS:** Integrated food security strategy; SD: Standard deviation; SPSS: Statistical package for social sciences; **WAZ**: Weight-for-age; **WHO**: World Health Organisation.

Acknowledgements

The authors are grateful for the support received from the agricultural extension officers and health workers of the Department of Rural Development and Agrarian Reform, and the Department of Health, respectively.

Author's contributions

AS played a primary role in this article through conceiving and designing the study. He also collected and analysed data, and wrote the article. JAV provided material support. Both JAV and EFZ read, critiqued and approved the article.

Competing interests

There are no competing interests

Consent for publication

Not applicable

Ethics approval and consent to participate

Prior to the start of the study protocol was followed with the Regional Director of the Department of Rural Development and Agrarian Reform who is based at Alfred Nzo District where this study was undertaken. Consent to participate in the study was received from owners / managers of agri-businesses and the children's guardians.

References

[1] Integrated Food Security Strategy for South Africa. *Pretoria*: Government Printer; 2002.

[2] Dirwayi TP. *Application of the sustainable livelihoods framework to the analysis of the provincial growth and development plan of the Eastern Cape: a case study of the Massive Food Production Programme in Nkonkobe Municipality and Buffalo City Municipality*. Masters' degree thesis. Alice: University of Fort Hare; 2010.

[3] Tregurtha N. *Inequality and economic marginalisation: review of the Eastern Cape's Siyakhula / Massive Maize Project*. Pretoria: Trade and Industrial Policy Strategies; 2012.

[4] Ndhleve S, Musemva L, Zhou L. *Household food security in a coastal rural community of South Africa: status, causes and coping strategies*. African Journal of Agricultural and Food Security. 2013; 1(1): 15-20.

[5] Oni SA, Maliwichi LL, Obadira OS. *Assessing the contribution of smallholder irrigation to household food security in comparison to dryland farming in Vhembe District of Limpopo Province, South Africa.* African Journal of Agricultural Research. 2010; 6(10):2188-2197.

[6] Kahsay S, Mulugeta M. *Determinants of rural household food security in Laelay Maichew Woreda Tigray, Ethiopia.* African Journal of Agriculture and Food Security. 2014; 2(1): 106-112.

[7] Pingali P. *Agricultural policy and nutrition outcomes – getting beyond the pre-occupation with staple grains.* Food Security. 2015; 7(3):583-591.

[8] Oldewage-Theron WH, Kruger R. *Food variety and dietary diversity as indicators of the dietary adequacy and health status of an elderly population in Sharpeville, South Africa*. Journal Nutrition for the Elderly. 2008; 27(1-2):101-133.

[9] Labadarios D, Steyn NP, Nel J. *How diverse is the diet of adult South Africans?* Nutrition Journal. 2011; 10(33): 1-5.

[10] Wellman N S, Kamp B J. *Nutrition and ageing. In: Mahan LK , Escot SSK (ed), Food, nutrition and diet therapy*. 12th ed. Philadelphia, Pennsylvania: W B. Saunders Company, 2008.

[11] Wenhold F, Faber M. *Nutritional status of South African and strategies to address malnutrition. In: Oelofse A, Van Averbeke W (ed), Nutritional value and water use of African leafy vegetables for improved livelihoods*. Report to the Water Research Commission & Department of Agriculture, Forestry & Fisheries. WRC Report No TT 535/12, Pretoria; 2012.

[12] World Health Organisation. Physical status: the use and interpretation of anthropometry. technical report series No. 854. WHO: Geneva, 1995.

[13] Yabanci N, Kisaç Î, Karakus SS. *Procedia – Social and Behavioral Sciences*. 2014; 116(2014):4477-4481.

[14] Shakkour E. *The relationship between nutritional knowledge and application. Honors thesis, Lynchburg*: Liberty University; 2007.

[15] Naser AI, Jalil R, Muda WM, Nik WS, Shariff M, Abdullah MR. *Association between household food insecurity and nutritional outcomes among children in Northeastern of Peninsular Malaysia*. Nutrition Research Practice. 2014; 8(3):304–11.

[16] Hahoney CR, Taylor HA, Kanarek RB, Samuel P. *Effect of breakfast composition on cognitive processes in elementary school children*. Physiology and Behavior. 2005; 85(5): 635-645.

[17] Min C, Noh H, Kang YS, Sim HJ, Baik HW, Song WO, Yoon J, Park YH, Joung H. *Skipping breakfast is associated with diet quality and metabolic syndrome risk factors of adults*. Food Science and Human Nutrition. 2011; 5(5):455-463.

[18] Mekary RA, Giovannucci E, Cahill L, Willett WC, van Dam RM, Hu FB. *Eating patterns and type 2 diabetes risk in older women: breakfast consumption and eating frequency*. American Journal of Clinical Nutrition. 2013; 98(2): 436-443.

[19] Gross SM, Bronner Y, Welch C, Dewberry-Moore MS, Paige DM. *Breakfast and lunch meal skipping patterns among fourth-grade children from selected public*

schools in urban, suburban and rural Maryland. Journal of the American Dietetic Association. 2014; 104(3):420-423.

[20] Salvy SJ, Elmo A, Nitecki L, Kluczynski MA, Roemmich JN. *Influence of parents and friends on children's and adolescents' food intake and food selection*. American Journal of Clinical Nutrition. 2011; *93(1):87-92.*

[21] Macdiamid J, Loe J, Craig LC, Masson LF, Holmes B, McNeill G. *Meal and snacking patterns of school aged children in Scotland*. European Journal of Clinical Nutrition. 2009; 63(11):1297-304 doi:10.1038/ejcn.2009.87.

[22] Ruel M. *Is dietary diversity an indicator of food security or dietary quality? A review of measurement issues and research needs. Food Consumption and Nutrition Division Discussion Paper No. 140*. International Food Policy Research Institute. Washington, United States of America; 2002.

[23] Bezerra IN, Sichieri R. Household food diversity and nutritional status among adults in Brazil. International Journal of Behavioral Nutrition and Physical Activity. 2011; 8(22):1-7.

[24] Thornston AJ. Dietary diversity and food security in South Africa: an application using NIDS Wave 1. Masters degree thesis, Cape Town: University of Cape Town; 2016.

[25] Buyene F, Muche M. Determinants of food security among rural households of Central Ethiopia: an empirical analysis. Quarterly Journal of International Agriculture. 2010; 49(4):299-318.

[26] Kunwar R, Pillai PB. Impact of education of parents on nutritional status of primary school children. Medical Journal Armed Forces India. 2002; 58(1):38-43.

[27] Abuya BA, Ciera J, Kimani-Murage E. Effect of mother's education on child's nutritional status in the slums of Nairobi. BMC Pediatrics. 2012; 12(80):2-10.

[28] Alalaq H, Katuli S, Beeson L, Ormsby G, Cordero-MacItyre Z. *Parents education and children nutritional status aged 2 to 5 in Zambia.* The FASEB Journal. 2012; 28(1):1-12

[29] Eastern Cape Socio-Economic Consultative Council. *Alfred Nzo District Municipality Socio-Economic Profile*, East London: Eastern Cape Socio-Economic Consultative Council; 2013.

[30] Van Graan AE, Bopape M, Phooko D, Bourne L, Wright HH. *Drink lots of clean, safe water: a food-based dietary guideline for South Africa*. South African Journal of Clinical Nutrition. 2013; 26(3):S77-S86.

PAPER NO.2

Paper No.2

Feeding Practices, Food Variety and Dietary Diversity – Indicators of Nutritional Status of Children from Historically Disadvantaged Agri-business Families, South Africa

Paper has been published in the Journal of Nutrition, and Food Security, 2017:2(4): 308-317

Feeding Practices, Food Variety and Dietary Diversity – Indicators of Nutritional Status Among Historically Disadvantaged Agri-business Families, South Africa

Awonke Sonandi; DBL[1,*], Elliot Frank Zwane; PhD[1], Johan Adam Van Niekerk; PhD[1]

[1]Centre for Sustainable Agriculture, Rural Development and Extension, University of the Free State, South Africa

**Corresponding author*:

No. 15 Wooden House Street, King William's Town, 5600, South Africa

awonke.sonandi@drdar.gov.za

Tel: +27(0)724142742

ABSTRACT

Background*:* In the South African context, little is known of the nutritional status of dependents of historically disadvantaged smallholder food producers. Food variety scores (FVS) and dietary diversity scores (DDS) are some of the indicators of nutritional status. This study sought to evaluate the nutritional status of children of previously disadvantaged agri-business smallholders at Alfred Nzo District. **Methods**: The study's purposeful sample comprised of 263 agri-business households that generated annual turnover of $11 811 - $39 370, and 327 children aged 5-14 years. A 3-day 24h dietary recall method was administered, and questionnaires were used to assess the households' socio-economic status, and the caregivers' nutritional practices. Descriptive, correlation and non-parametric statistical analyses were performed. **Result***:* The majority of caregivers' households had a monthly non-farm income of $78.82 - $118.11 (32.3%), and food expenditure of $55.20 - $70.87 (23.2%). The households' nutritional practices appeared modest. Half (50.2%) of the caregivers' households could not afford to provide breakfast to their children every day before they go to school or church. The mean FVS was low at 23.43±7.89, while the mean DDS was debatably high at 7.82±4.53. The households' non-farm income was positively highly correlated ($r=0.55$) to food expenditure ($p<0.01$). In turn food expenditure had a significant influence on FVS ($p<0.01$) and DDS ($p<0.05$). **Conclusion**: Households of previously disadvantaged agri-business smallholders had rather modest nutritional status. Staple food production-based food security programmes need to strongly accommodate the facet of nutrition.

Keywords: *Feeding Practices, FVS, DDS, Nutritional Status*.

Introduction

Food security exists when all people at all times have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life, Food and Agriculture Organisation (FAO) [1]. This internationally accepted definition of food security was the cornerstone in the formulation of South Africa's post-apartheid Integrated Food Security Strategy (IFSS) [2]. Subsequently, the country has had numerous food security programmes, many of which sought to empower and make the previously disadvantaged black smallholder farmers self-sufficient through massive production of mainly staple food, maize. However, in view of the FAO's definition of food security, self-sufficiency in staple food production does not necessarily renders one food secure [3]. Indeed, many studies conducted in the subject of food security and many government interventions tend to either disregard or put little emphasis on the nutrition dimension of the concept of food security [4,5, 6].

However, in other parts of the world, nutrition-sensitive interventions are applauded in the contemporary literature of food security [3,7,8]. Among other things, nutrition-sensitive research covers food security indicators such as food variety, dietary diversity and nutrient intake [9, 10]. Other studies go a step further to include food absorption which gives a more accurate measure of food utilisation and state of food insecurity [11].

Studies on the food security and nutritional status of families of previously disadvantaged smallholder agri-business farmers are lacking in South Africa. It is presumed that by virtue of being food producers, they are food secure and have elevated nutritional status. However, adequate food availability or food production does not automatically lead to one's food security, nor does it result in one's higher nutritional status. Furthermore, food (in)security does not only affect the poor, as it is commonly perceived. It also affects well-off families whose nutritional knowledge and attitudes, and feeding practices may be key determinants of what food items to produce or economically access, and eventually what food security and nutritional status to acquire.

Against the above background, this study sought to evaluate the nutritional status of families of previously disadvantaged smallholder agri-business farmers of Alfred Nzo

District of South Africa through their food variety, dietary diversity and feeding practices. Each family respondent is referred to as a caregiver in this study, because of his/her role in influencing a family's feeding practices and nutritional status.

Research Methodology

Participatory action research was used to gain in-depth understanding of the determinants of nutritional status, which are feeding practices, food variety and dietary diversity.

Study population

This study targeted previously disadvantaged smallholder agri-business owners / managers of Alfred Nzo District of South Africa whose individual or collective annual turnover is between $11 811 and $39 370 All owners / managers who met this criterion were purposefully selected from a farmer database that was made available by local agricultural extension officers. The selection process led to a purposeful sample of 263 smallholder farmers. Each of the 263 representative respondents from the 263 agri-business households is referred to as a caregiver in the study, because of his / her influence in the children's feeding behaviour.

Research instruments

Questionnaires were used to assess the caregivers' socio-economic status, feeding practices, food variety and dietary diversity. A 24h dietary recall questionnaire was administered twice in weekdays and once in weekends. Food models and the internationally acclaimed Foodfinder III nutritional software of the Medical Research Council of South Africa were used to improve the accuracy of recorded food quantities. Data from the 24h dietary recall questionnaire was used to calculate FVS and DDS. The former was calculated as the sum of the number of food items consumed by a child over a period of time, while the latter was calculated as the sum of different food groups consumed by a child over a period of time. The following nine food groups were under investigation in this study, namely; cereal, roots and tubers; fleshy foods; dairy foods; legumes and nuts; eggs; vitamin-A rich vegetables and fruits; other fruits and juices; other vegetables; and fats and oils

Regarding feeding practices, investigation into the consumption patterns of vitamin A-rich fruits was limited to ripe mango/mango juice, and apricot/apricot juice. Similar investigation on animal protein sources was confined to organ meat (liver, kidney and heart); flesh meat (beef, mutton, pork and chicken); and fish (fresh fish, canned fish, prawns, mussels, crayfish, crabs and oysters). Feeding practices were assessed on the basis of responses that caregivers gave to questions that are pertaining, among other issues, to breakfast, number and diversity of meals, consumption of vitamin A and C-rich foods, and of protein sources. Further information on their feeding practices was obtained through a 3-day 24h dietary recall method.

Various measures were put in place to promote validity and reliability of data. These included extensive literature review, use of legitimate and a multiple of research instruments, and a selection of a research sample that is representative of a population to which this study's results are be generalised.

Data analysis

Data was captured on Excel, cleaned and statistically analysed using Statistical Package for Social Sciences (SPSS), Version 20. Descriptive statistics was performed to establish central tendencies, and tests for statistical significance were carried out using analysis of variance (ANOVA). Non-parametric Mann-Whitney U tests and Kruskal-Wallis H tests were conducted in order to elucidate the outcomes of the parametric tests. A bivariate correlation analysis was conducted to describe relationships between variables.

Ethical considerations

The researcher obtained consent from the caregivers to conduct the study. Their right to anonymity, confidentiality and fair treatment was respected. This study also upheld scientific integrity.

Results

Demographic information

The overwhelming majority of the caregivers (n=250, 94.95%) who were included in this study were women (see Table 1). Their marital status was such that most were `married' (n=125, 47.5%), followed by those who were `never married' (n=82, 31.2%) and `widowed' (n=56, 21.3%).

Most of the caregivers (n=54, 20.5%) fell in the age group of 36–40 years, followed by those whose age group fell within 46–50 years (n=36, 13.7%). The number of those who were eligible for government's old age social grants by virtue of having reached 60 years of age was estimated at 55 (20.8%).

With respect to education, the majority of caregivers had Grade 8-11 academic qualifications (n=66, 25.1%). Forty-one (15.6%) had no formal education, while a Bachelor's degree / Diploma was the highest level of education acquired (n=25, 9.5%).

When asked to indicate the number of people who permanently reside in their respective households, most caregivers registered a size of 4-6 persons (n=109, 41.4%), followed by 7-9 persons (n=68, 25.9%). Only 59 (22.4%) and 27 (10.3%) households accommodated 1-3 persons and more than 10 persons, respectively.

Table 1 Demographic characteristics

Characteristics	Frequency (n=263)	Percentage (%)
CAREGIVERS' GENDER		
Male	13	5.05
Female	250	94.95
CAREGIVERS' ROLE IN A FAMILY		
Father	4	1.6
Mother	141	53.8
Grand father	12	4.5
Grand mother	97	36.7
Other	9	3.4
CAREGIVERS' EDUCATIONAL QUALIFICATIONS		
No education	41	15.6
Adult basic education and training (ABET)	60	22.8
Grade 1-7	31	11.8
Grade 8-11	66	25.1
Grade 12 / N3	40	15.2
Bachelor's degree / Diploma	25	9.5

Income

Some of the caregivers' households had multiple sources of income. For example, a few caregivers included in this study were employed elsewhere outside their family agri-businesses (n=34, 12.9%). Of these employed caregivers, most were employed on permanent basis (n=14, 41.2%), while 32.4% and 26.5% were employed on temporary basis and fixed-term contract, respectively. The majority (n=143, 55.4%) said they have no employed family members that they permanently live with. The rest (n=115, 44.6%) reported employed family members, ranging from one to three persons per caregiver's household.

The non-farm income of households originated from those employed caregivers and their family members with whom they permanently live. Most of the caregivers' households (n=85, 32.3%) earned between $78.82 and $118.11, followed by those who earned between $39.37 and $78.74 (n=55, 21.9%). Some 51 (19.8%) caregivers' households earned more than $196.85 per month (Table 2).

Farming activities of the agri-business smallholders were not intense, often characterized by low yields and productivity due to use of out dated farming methods and poor infrastructure base. The majority of the smallholders (n=236, 89.7%) co-owned and / or co-managed their agri-business units in groups; the average size of a group being four people. The average annual farm income payable to each agri-business smallholder was $2 903. However, in their homesteads the agri-business smallholders kept some livestock and grew crops which were used for home consumption, mainly.

With respect to the households' monthly expenditure on food, most spent between $55.20 and $70.87 (n=61, 23.2%). Nineteen (7.2%) of the caregivers' households spent $39.45 or less a month, while 13 (4.9%) reportedly spent $157.48 or more (Table 2).

Table 2 Economic characteristics

Characteristics	Frequency (n=263)	Percentage (%)
HOUSEHOLDS’ MONTHLY NON-FARM INCOME		
\$39.37-\$78.74	55	20.9
\$78.82-\$118.11	85	32.3
\$118.19-\$157.48	26	9.9
\$157.56-\$196.85	41	15.6
>\$196.85	51	19.4
No response	5	1.9
HOUSEHOLDS’ MONTHLY FOOD EXPENDITURE		
≤\$39.45	19	7.2
\$39.49-\$55.12	38	14.4
\$55.20-\$70.87	61	23.2
\$70.94-\$86.61	39	14.8
\$86.69-\$94.49	17	6.5
\$94.57-\$110.24	32	12.2
\$110.31-\$125.98	11	4.2
\$141.82-\$157.48	33	12.5
≥\$157.48	13	4.9

Breakfast eating patterns

The caregivers were asked to quantify frequencies of providing breakfast to their children. To this end, about half of the caregivers (n=132, 50.2%) said the provision of breakfast is made `every day of the week'. This group of caregivers was followed by those who reportedly provided breakfast `four to six times a week' (n=82, 31.2%), while 23 (8.7%) indicated that they 'never' provided breakfast to their children before they go to school (Table 3). The results from the 24h dietary recall method showed that the government's school nutrition programme of the Department of Education provides `late' breakfast between 11h00 and 12h00 for all school children. This nutrition programme appeared helpful, particularly to children from households (n=131; 49.8%) who could not provide breakfast on a daily basis.

Meals

When asked if they `can afford' providing their children with `three meals a day and a snack in between', most caregivers (n=159; 60.5%) conceded that they `cannot afford' (Table 3). In line with this response, most caregivers admitted that the provision of such number of meals a day is `difficult' (n=138, 52.5%), while the rest (n=125, 47.5%) said it is `not difficult' (Table 3). The most cited sources of `difficulties' in providing children with `three meals a day and a snack in between' were high cost of food and drought.

More than half of the caregivers (n=139, 52.9%) said it was `difficult' to provide their children with different types of foods (Table 3), largely due to high food costs and unavailability of some foodstuffs in the local shops.

Table 3 Households' general feeding patterns

Characteristics	Frequency (n=263)	Percentage (%)
FREQUENCY OF PROVISION OF BREAKFAST		
Every day	132	50.2
Four to six times per week	82	31.2
One to three times per week	26	9.9
Never	23	8.7
AFFORDABILITY OF PROVIDING THREE MEALS A DAY, AND A SNACK IN BETWEEN		
Can afford	104	39.5
Cannot afford	159	60.5
IS IT DIFFICULT TO PROVIDE DIFFERENT MEALS A DAY?		
Difficult	139	52.9
Not difficult	124	47.1

Consumption of Vitamin A and C-rich foods

The caregivers were asked if over the previous 24h period their children had consumed any of the above fruits. To this end, the majority of caregivers reported that their children had not consumed any of the abovementioned fruits (n=203, 77.2%), while only 29 (11.0%) and 26 (9.9%) indicated that their children had consumed ripe mango/mango juice and apricot fruit/juice, respectively. The rest of the caregivers (n=5, 1.9%) did not respond to the question.

With respect to consumption patterns on vitamin A-rich vegetables (carrots and pumpkin/squash fruit), the caregivers were asked to indicate whether over the previous 24h period their children had consumed any of the abovementioned vegetables. In their responses, most caregivers indicated that their children had consumed carrots (n=169, 64.3%), followed by pumpkin / squash fruit (n=51, 19.4%), while the rest (n=43, 16.3%) said their children had consumed none of the abovementioned vegetables.

On the frequency of consumption of vitamin C-rich citrus, only a small number of caregivers said their children consume citrus ‘everyday’ (n=9, 3.4%). Most caregivers said the consumption is `once per week’ (n=96, 36.5%), while 42 (16.0%) said it is `twice per week’. Noticeably, responses of a sizeable number of caregivers to this question were `never’ (n=45, 17.1%), while a remarkable number responded ‘thrice per week’ (n=29, 11.0%). The rest either responded ‘do not know’ (n=22, 8.4%) or ‘did not respond’ (n=20, 7.6%).

Consumption of protein-rich foods

The caregivers were asked if their children had consumed any of the following protein-rich foods presented to them over the past 24h, namely; organ meat, flesh meat and fish. With respect to consumption of ‘organ meat’, most of the caregivers responded that their children had consumed liver (n=123, 46.8%), followed by those who mentioned heart (n=12, 4.5%) and kidney (n=6, 2.3%). The rest said their children had consumed none of the abovementioned ‘organ meat’ (n=122, 46.4%).

On `flesh meat', the majority of caregivers reported that their children had consumed `chicken' (n=160, 60.8%), while the consumption of 'mutton' (n=11, 4.2%), 'pork' (n= 5, 1.9%) and 'beef' (n=4, 1.5%) was restricted to very few households. A sizeable number (n=83, 31.6%) said their children had consumed `none of the flesh meat' listed above. Regarding `fish', only the consumption of `canned fish' (n=161, 61.2%) and `fresh fish' (n=13, 4.9%) were registered by the caregivers. The rest (n=89, 33.8%) said their children had not consumed any 'fish' over the past 24h.

Food variety and dietary diversity

Having discussed the caregivers' feeding practices, further investigations were extended to food variety and dietary diversity using a 3-day 24h dietary recall method. The average FVS for the 263 investigated households was low at 23.43 (see Table 4) [12]. Most of the caregivers' households (n = 215; 81.7%) had a low FVS, followed by those with a medium FVS (n = 48; 18.3%). None of the households had a high FVS category.

Regarding dietary diversity, most of the caregivers' households (n = 88; 33.5%) consumed foods from eight food groups, followed by those (n = 71; 27.0%) who consumed foods from all nine foods groups. Three food groups was the lowest number consumed (n = 5; 1.9%). The mean dietary diversity score (DDS) was 7.82, which is indicative of a high DDS. The majority of the caregivers' households (n = 184; 70%) had high DDS, followed by those with medium DDS (37.2%) and low DDS (8.2%).

Table 5 presents a summary of top 20 most consumed food items by the caregivers' children during the 3-day 24h dietary recall. Noticeably, the carbohydrates-rich food items from the `cereal, roots and tubers' group dominated the top 10 most consumed foods. From the `flesh' and `dairy products' groups, only canned fish and chickens, and fresh milk and sour milk, respectively, appeared in the list of top 20 most consumed foods items. Only carrots and spinach from the `vitamin A-rich vegetables and fruits' group, and cabbage and onion from the `other vegetables' group appeared in the list presented in Table 5, while sunflower oil represented the `fats and oils' group. Food groups whose food items did not feature in the list in question were `eggs’, `legumes and nuts’, and `other fruits and juices’ groups.

This study also found that consumed quantities of food items varied widely within and between households, largely due to the varying socio-economic profiles of the caregivers’ households. Consumed quantities of food items from other food groups were rather low (e.g. dairy products, vegetables, and flesh foods). Again, this appeared a function of socio-economic properties of the caregivers’ households, which have been discussed earlier in this paper.

Table 4 Food variety scores within food groups

Food Group	**Mean**	**SD**	**Range**
Cereal, roots and tubers	5.05	0.89	3-7
Fleshy foods	3.22	1.08	1-5
Dairy products	1.97	1.14	0-6
Legumes and nuts	1.00	0.58	0-3
Eggs	0.38	0.49	0-1
Vitamin A-rich vegetables and fruits	3.06	1.20	0-5
Other fruits and juices	2.85	1.93	0-8
Other vegetables	4.03	2.48	0-11
Fats and oils	1.86	0.86	0-4
Total food items	**23.43**		

Table 5 Top 20 most consumed food

Rank	Food item	Mean food intake (g/person/day)
1	Maize meal soft porridge	99.23±74.56
2	Instant tea	182.14±131.38
3	White sugar	19.99±7.05
4	Maize meal stiff pap	123.49±72.79
5	Brown bread/rolls	27.58±30.81
6	Amarhewu	176.78±174.66
7	Crumbed maize meal (uphuthu)	107.67±105.07
8	Fresh milk	21.85±26.34
9	Potatoes	21.38±14.34
10	Samp	156.63±139.91
11	Rice	64.86±36.03
12	Amasi	128.57±118.77
13	Carrot	14.28±10.94
14	Baked bread, homemade	49.16±50.43
15	Cabbage	10.64±12.47
16	Spinash	10.17±14.89
17	Onion	8.78±11.74
18	Sunflower oil	23.85±32.99
19	Canned fish	13.66±17.56
20	Chicken	33.81±39.95

Discussion

In a normal society, men and women are at a young age raised and groomed to play specific roles at home and in a society at large. Generally, men are meant or conditioned to be problem solvers who ought to be manly and show less emotions in their behaviour. On the other hand, women have inherent emotional coping strategies which are necessary for taking care of children and the sick [13,14]. In accordance with the above gender norm, it was therefore not surprising that the majority of caregivers in this study were women who played roles of being mothers and grandmothers. The age of the caregivers did not seem to have had an effect on their households' feeding practices, FVS and DDS. This suggests that the monthly government old age grant of $118.11 which is payable to those who are over 60 years of age had no significant effect on the households' nutritional status. However, the same could not be said for caregivers' level of education which had a significant influence on FVS ($p \leq 0.05$) than on DDS ($p \geq 0.05$). Further analysis of results showed that the caregivers' level of education had significant effect ($p \leq 0.05$) on their households' monthly non-farm income and expenditure on food. The monthly non-farm income was positively strongly correlated to food expenditure ($r=0.55$, $p<0.01$). In turn, food expenditure had a significant influence on FVS ($r=0.672$; $p<0.01$) and DDS ($r=0.322$; $p<0.01$).

The study population's expenditure patterns on food are similar to those reported in a survey that was conducted at Alfred Nzo District [15]. The survey found that most of the monthly expenditure is used to acquire non-durable goods like food, while very little is used to buy either durable or semi-durable goods. For example, in 2013 from a total household income of $810 million, $720 million was used in household expenditure. The survey concluded that this elevated household expenditure is symptomatic of poverty in the district, as high expenditure on non-durable goods does very little contribution to wealth creation.

The caregivers' actual nutritional practices appeared suppressed largely due to socio-economic factors. As a result, the quality of meals consumed by the caregivers' children was not reflective of their food producing status, but that of ordinary low income people. Their meals, especially breakfast were dominated by carbohydrate-rich food items, many of which were based on homegrown and purchased maize (products). These maize-based food items were soft porridge, stiff pap, crumbed maize meal, maize samp, and *amarhewu*. Basically, the caregivers' families ate various carbohydrate-rich food items that were more of the same.

The eating behavior and the number of meals that a child can have a day are largely determined by their parents [16]. In this study, the reported late or non-provision of breakfast to children before they go to school was found not to be a good feeding practice, because it is associated with reduction of short memory [17]; reduction of metabolism, and increased cholesterol and insulin levels[18]; depletion of energy[19]; and increased risk of type 2 diabetes [20].

With respect to the `fleshy food' group, canned fish was consumed the most, followed by chicken, while mutton, beef and pork were consumed in very few caregivers' households. It appeared that this feeding pattern was primarily driven by food costs. In the area where this study was undertaken, the average retail price of a 400g canned fish is $1.18, while frozen chicken costs $2.91/ kg. Mutton, beef and pork cost $5.64/kg, $5.40/kg and $4.90/kg, respectively.

Cheaper alternative protein sources such as dried beans and peas were consumed in fewer households as they did not feature in the list of top 20 most consumed food items. Soya and lentils were not consumed. This situation presents itself as an area for nutrition awareness and nutrition education. The agricultural extension practitioners are best placed to perform this function.

Vitamins are organic substances that are required in small quantities for overall health, normal cell function, growth and development [21]. Vitamin A, in particular, is for maintenance of healthy teeth, bones and soft tissues [22], while vitamin C promotes the functioning of immune system, healing of wounds and acting as an antioxidant [23]. The low consumption of vitamin C-rich citrus was remarkable (Table 4). Part of this sparingly low consumption may have been due to limited availability and the commensurately higher price of citrus, which in turn may have been caused by the citrus post-harvest period (September) at which data collection for this study was started. To the contrary, the widespread consumption of vitamin A-rich vegetables (carrot and pump/ squash fruit) was commendable. By virtue of being a dark leafy vegetable, the high consumption of spinach and liver might have resulted in a good intake of vitamin A.

In view of the above outlined discussions, it appears that home-grown and /or purchased staple food, a few vegetables and other food items provided daily meals for the caregivers' families. The poor quality of consumed meals is traceable from modest feeding practices, low FVS and the debatably high DDS. These results are indicative of a low nutritional status of the caregivers' families. In order to ameliorate this sub-standard situation, smallholder farmers should grow a wide variety of crops that are not necessarily staple foods. Alternatively or in addition to the above, a portion of proceeds from their farming activities should be used to purchase those affordable food items that they are otherwise unable to produce. This proposal is in line with assertion by Simon (2012) [24] who stated that food can be accessed through the three following means; physical, financial and socio-cultural. Against the popular and largely held political view, reliance on the first element did not yield desirable results in this study. There is a need to increase the households' ability to access food by strengthening markets and market access, among other factors, Australian Agency for International Development [25]. Such approach would best represent the ideals of South Afirca's IFSS (2002) and FAO's (2002) definition of the concept of food security, in the first place.

Conclusion

The quantities and variety of food produced and / or purchased, and subsequently consumed by families of smallholder farmers is indicative of their families' low nutritional status. Some families' inability to provide their children with breakfast and sufficient number of meals per day, and low FVS and DDS diffuse the perception that families of food producers are automatically food secure, and enjoy a higher nutritional status than non-farming families.

Acknowledgements

The authors are grateful for the support received from the agricultural extension officers and health workers of the Department of Rural Development and Agrarian Reform, and the Department of Health, respectively.

Authors' contributions

Both Zwane EF and Van Niekerk JA participated in the conceptualisation of the study. They further presided over the literature review, designing of the study, analysis and writing of the article. The latter author also organised financial and institutional support for the study.

Conflicts of interest

The authors of this paper have no conflicts of interest.

References

[1] **Food &** Agriculture **Organisation (FAO).** 2012. The state of food insecurity in the world. Economic growth is necessary but not sufficient to accelerate reduction of hunger and maladministration. Available from: http://www.fao.org.docrep/ [Accessed 24 February 2012].

[2] **Integrated Food Security Strategy for South Africa (IFSS**). 2015. Pretoria: Government Printer.

[3] **Pingali P.** 2015. Agricultural policy and nutrition outcomes – getting beyond the pre-occupation with staple grains. *Food Security*. **7(3):**583-591.

[4] **Dirwayi TP.** 2010. Application of the sustainable livelihoods framework to the analysis of the provincial growth and development plan of the Eastern Cape: a case study of the Massive Food Production Programme in Nkonkobe Municipality and Buffalo City Municipality. *Masters' degree thesis*. Alice: University of Fort Hare.

[5] **Tregurtha N.** 2012. Inequality and economic marginalisation: review of the Eastern Cape's Siyakhula / Massive Maize Project. Pretoria: Trade and Industrial Policy Strategies.

[6] **Ndhleve S, Musemva L & Zhou L.** 2013. Household food security in a coastal rural community of South Africa: status, causes and coping strategies. *African Journal of Agricultural and Food Secuirity*: **1(1)**: 15-20.

[7] **Herforth A & Ahmed S.** 2015. The food environment, its effects on dietary consumption, and potential for measurement within agriculture-nutrition interventions. *Food Security.* **7(3):**505-520.

[8] **Institute of Food Research.** 2015. The importance of nutrition in food security. Available from: www.ifr.ac.uk/news/latest-news/2015/01/importance-nutrition-food-security/ [Accessed 22 December 2015].

[9] **Oldewage-Theron WH & Kruger R.** 2008. Food variety and dietary diversity as indicators of the dietary adequacy and health status of an elderly population in Sharpeville, South Africa. *Journal Nutrition for the Elderly*. **27(1-2):**101-133.

[10] **Labadarios D, Steyn NP & Nel J.** 2011. How diverse is the diet of adult South Africans? *Nutrition Journal*. **10(33)**: 1-5.

[11] **Yeldah B.** 2011. The three pillars of food insecurity: getting to the guts of utilisation. Society for the Anthropology of Food and Nutrition, SNAC 4. Available from: http://foodanthro.com [Accessed 15 March 2013].

[12] **Matla MTH.** 2008. The contribution of food access strategies to dietary diversity of farm worker households on Orange farm in the Fouriesburg District (RSA). *Master's degree thesis*, Pretoria: University of Pretoria.

[13] **Lee Y & Taung F.** 2013. More caregiving, less working caregiving roles and gender difference. *Journal of Comparative Social Welfare*. **72(2)**:123-131.

[14] **Calasanti T & King N.** 2015. Beware of the estrogen assault: ideals of old manhood in anti-ageing studies. *Journal of Ageing Studies*. **21(4)**: 357-368.

[15] **Eastern Cape Socio-Economic Consultative Council (ECSECC).** 2014. Alfred NzoDistrict Municipality socio-economic profile. East London: ECSECC.

[16] **Scaglioni S, Arrizaa C, Vacchi F, Tedeschi S.** 2011. Determination of children's eating behavior. *American Journal of Clinical Nutrition*. **94(6Suppl)**:2006S-2011S.

[17] **Hahoney CR, Taylor HA, Kanarek RB & Samuel P.** 2005. Effect of breakfast composition on cognitive processes in elementary school children. *Physiology and Behavior*. **85(5)**: 635-645.

[18] **Min C, Noh H, Kang YS, Sim HJ, Baik HW, Song WO, Yoon J, Park YH & Joung H.** 2011. Skipping breakfast is associated with diet quality and metabolic syndrome risk factors of adults. *Food Science and Human Nutrition*. **5(5)**:455-463.

[19] **Veasey, RC, Haskell-Ramsay, CF, Kennedy, DO, Tiplady, B & Stevenson, EJ.** 2015. The effect of breakfast prior to morning exercise on cognitive performance, mood and appetite later in the day in habitually active women. *Nutrients*. **7(7)**: 5712-5732.

[20] **Mekary RA, Giovannucci E, Cahill L, Willett WC, van Dam RM & Hu FB.** 2013. Eating patterns and type 2 diabetes risk in older women: breakfast consumption and eating frequency. *American Journal of Clinical Nutrition*. **98(2)**: 436-443.

[21] **Gupta C & Gupta UC.** 2015. Role of vitamins in human health and nutrition sources and morbidity. *Current Nutrition and Food Science*. **11(2)**:105-1115.

[22] **Zhou XE, Suino-Powell KM, Chan CW, Tanabe O, Kruse SW, Reynolds R, Engel JD & Xu HE.** 2011. The orphan nuclear receptor TR4 is a vitamin A-activated nuclear receptor. *Journal of Biological Chemistry*. **28(4)**:2877-2885.

[23] **Naidu KA.** 2003. Vitamin C in human health and disease is still a mystry? An overview. *Nutrition Journal.* **2(7)**:1-10.

[24] **Simon G.** 2012. Food security: definition, four dimensions, history. Paper presented to students from IPAD Master, SupAgro, Montpellier attending a joint training programme. Rome: University of Rome Tre, 19-124 March 2012.

[25] **Australian Agency for International Development (AUSAID).** 2012. Sustainable economic development, 2012; Canberra, Australia: AUSAID. Available from: http://www.ausaid.gov.au [Accessed 12 March 2013].

PAPER NO. 3

Paper No. 3

Nutritional Status, Nutrient Intake and Anthropometric Indices of Children from Agri-business Families, South Africa

Paper has been published in the Nutrition and Food Science International Journal, 2018, 6(2):555682. DOI:10.19080/NFSIJ.2018.6.555682.

Dear Dr. Awonke Sonandi,

Hope you doing well.

We have received review comments for your manuscript. We request you to go through the attachment and send the revised manuscript.

Please acknowledge this email within 24hours.

Await your reply.

Regards,

Laura Wager

Nutrition & Food Science International Journal (NFSIJ)

Nutritional Status, Nutrient Intake and Anthropometric Indices of Children from Agri-business Families, South Africa

Awonke Sonandi*, Elliot F. Zwane, Johan A. Van Niekerk

***Corresponding author:** Centre for Sustainable Agriculture, Rural Development and Extension, University of the Free State, Bloemfontein, 9301 South Africa, Tel: +27(0)43 605 4200 or +27(0) 724142742; Email: Awonke.Sonandi@drdar.gov.za

Abstract

Food producing families are presumed nutrition secure. This study sought to evaluate the nutritional status of children from historically disadvantaged agri-business families. A purposeful sample comprised of 263 agri-business households, and 302 children aged 5-13 years. A 24h recall and food frequency questionnaires were administered along with other questionnaires on the households' socio-economic status and feeding practices, and the caregivers' nutritional knowledge. Food models and Foodfinder III nutritional software were used to calculate nutrient intake. Statistical Package for Social Sciences, Version 20, was used to perform descriptive, correlation and non-parametric statistical analyses. The households had low food variety and debatably high dietary diversity scores. Generally, nutrient intake varied ($p \leq 0.05$) with children's age and gender. Most children had normal weight-to-age (80.14%), normal height-to-age (90.7%) and normal body mass index-for-age Z-scores (56.57%). The children's nutritional status was found to be the function of low farm and non-farm income, low expenditure on food, and low educational status of caregivers. The children did not necessarily have elevated feeding patterns, and nutrient intake. The majority had normal anthropometric indices, although obesity appeared a creeping problem. Nutrition education, diversification and intensification of agri-business practices were highly recommended.

Keywords: Nutritional status; nutrient intake, FVS, DDS, anthropometric indices, children

Abbreviations: BMIZ: Body Mass Index-for-age Z score; HAZ: Height-for-age; WAZ: Weight-for-age; ECSECC: Eastern Cape Socio-Economic Consultative Council; FVS: Food Variety Score; DDS: Dietary Diversity Score; FFQ: Food Frequency Questionnaire; RDA: Recommended Dietary Allowance; ANOVA: Analysis of Variance; IFSS: Integrated food security strategy; SD: Standard deviation; SPSS: Statistical package for social sciences; WHO: World Health Organisation

1. Introduction

The Eastern Cape Province of South Africa is home to 495 042 farming households which are involved in the production of livestock, poultry, grain and food crops, industrial crops, fruit and other commodities [1]. About 95 percent of these farming households, constitute those which were disadvantaged by the previous apartheid regime. Since the democratisation of South Africa in 1994, the new South African government has introduced numerous food security programmes which sought to improve food security status among previously disadvantaged farming households. According to Food and Agriculture Organisation [2], people are food secure when at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. This official definition of food security carries four components of this concept, namely; food availability, food accessibility, food utilisation and stability [3].

The province's food security programmes have in the past sparked a lot of research interest which tended to focus on low income and survivalist rural farming households and on food availability which is the supply end of the concept of food security [4, 5, 6, 7, 8, 9, 10]. Similar local studies on the food utilisation pillar of food security which targeted children from previously disadvantaged agri-business households are rare. Instead, children of such households are often presumed nutrition secure or having elevated nutritional status by virtue of being dependants of food producers. One's food security status is no guarantee to achieving good nutritional status.

Nevertheless, in other parts of the world, the nutrition dimension of food security continues to receives due attention [11]. Research in the nutrition facet covers indicators of nutritional status such as food variety, dietary diversity and nutrient intake [12], and anthropometric parameters [13]. These indicators formed part of the investigation in the current study.

Against the above background, this study sought to evaluate the nutritional status, nutrient intake and anthropometric dimensions of children from agri-business families using a multiple of scientifically proven research methods. It also sought to identify and understand short-comings to achieving good nutritional status, nutrient intake and anthropometric dimensions among the abovementioned children.

2. Materials and Methods

2.1 Study Population and Sampling

The study population was agri-business families who operate and reside in Umzimvubu and Ntabankulu Local Municipalities of Alfred Nzo District Municipality in the Eastern Cape Province, South Africa. Specifically, it targeted previously disadvantaged smallholder agri-business families whose individual or collective annual turnover was between $11 811 and $157 480. All families who met this criterion were purposefully selected from a farmer database that was made available by local agricultural extension officers. Subsequent to the exclusion of survivalist farming families (annual turnover less than $11 811) this study included the whole remaining purposeful research sample of 263 agri-business families, and 302 children aged 5-13 years. From each of the 263 farming households, questions that relate to nutritional knowledge, attitudes and feeding and general care of children were directed to caregivers who lived in these households.

2.2 Research Tools

2.2.1 Socio-economic and Nutrition Questionnaires

Upon visiting agri-business households, questionnaires were used to assess the caregivers' socio-economic status, and feeding practices. A 24h dietary recall questionnaire was administered twice in weekdays and once in weekends, while a qualitative food frequency questionnaire (FFQ) was administered over a seven-day period. Food models and the internationally acclaimed Foodfinder III nutritional software of the Medical Research Council of South Africa were used to improve the accuracy of recorded food quantities.

Data from the 24h dietary recall questionnaire and qualitative FFQ was used to calculate food variety scores (FVS) and dietary diversity scores (DDS). The former was calculated as the sum of the number of food items consumed by the child over a period of time, while the latter was calculated as the sum of different food groups consumed by the child over a period of time. The following nine food groups were under investigation in this study, namely; cereal, roots and tubers; fleshy foods; dairy foods; legumes and nuts; eggs; vitamin-A rich vegetables and fruits; other fruits and juices; other vegetables; and fats and oils.

Quantitative food intakes from the 24h dietary recall questionnaire and Foodfinder III were used to calculate the children's intake of selected macronutrients, minerals and vitamins. Children's nutrient intake was compared with their recommended dietary allowances (RDA) in order to establish whether their nutrient requirements are met in accordance with the Institute of Medicine [14]. The proportion of children whose nutrients intake exceeded two-thirds of the nutrients' RDA was tabulated.

2.2.2 Anthropometric Measurements

The researcher and fieldworkers received training from public health workers on measurement of weight and height of the caregivers' children in order to determine anthropometric measurements. Accordingly, a calibrated electronic scale was used to measure weight. All the children were weighed with their shoes and socks being removed, and with their light clothes put on. Two weight readings were taken within the nearest 0.1kg, and the average of the two readings was recorded if the two readings were different. Height was measured with a stadiometer, with vertical scale of metres and a sliding headpiece, to the nearest 0.1cm. Children had to put their legs and knees straight together with arms aside, and feet and heels touching together. As with weight, two measurements were taken, and the average recorded if the two measurements were different.

Weight and height recordings were captured on Excel, and the following anthropometric measurements determined on WHO Anthro V3.2.2 and AnthroPlus V1.0.4 softwares, namely; weight-for-age Z-scores (WAZ), height-for-age Z-scores (HAZ) and body mass index-for-age Z-scores (BMIZ). WAZ, which is measured in children that are younger than nine years [15] was confined to 146 children aged 5-8 years in this study. MBIZ was calculated as child's weight divide by height squared (kg/m^2). The classification of the children's Z-scores of WAZ, HAZ and BMIZ was done in accordance with World Health Organisation [16].

2.3 Data Analysis

Data was cleaned and statistically analysed using Statistical Package for Social Sciences (SPSS), Version 20. Descriptive statistics was performed to establish central tendencies, and tests for statistical significance were carried out using analysis of variance (ANOVA). Non-parametric Kruskal-Wallis H tests were used in variables where the assumption of normality was violated, and to elucidate the outcomes of the parametric tests [17, 18]. Bivariate correlation analysis was conducted to describe relationships between variables. P-values that were less than 0.05 confidence interval were considered non-significant, while those that were greater than 0.05 and 0.01 confidence intervals were regarded as significant and non-significant, respectively.

Various measures were put in place to promote validity and reliability of data. These included extensive literature review, use of legitimate and a multiple of research instruments, and a selection of a research sample that is representative of a population to which this study's results are be generalised

2.4 Ethical Considerations

The researcher obtained consent from the caregivers to conduct the study. Their right to anonymity, confidentiality and fair treatment was respected. This study also upheld scientific integrity.

3. Results

3.1 Socio-economic Characteristics

This sub-section presents the respondents' social characteristics (age, gender, marital status etc.) and economic characteristics (farm and non-farm income, farming activities etc.).

3.1.1 Social Characteristics

The overwhelming majority of the caregivers (N=250, 94.95%) who were included in this study were women (Table 1). Their marital status was such that most were `married' (N=125, 47.5%), followed by those who were `never married' (N=82, 31.2%) and `widowed' (N=56, 21.3%). Most of the caregivers (N=54, 20.5%) fell in the age group of 36–40 years, followed by those whose age group fell within 46–50 years (N=36, 13.7%). The number of those who were eligible for government's old age social grants by virtue of having reached 60 years of age was estimated at 55 (20.8%). With respect to education, the majority of caregivers had Grade 8-11 academic qualifications (N=66, 25.1%) [Table 1]. Forty-one (15.6%) had no formal education, while a bachelor's degree / diploma was the highest level of education acquired (N=25, 9.5%).

When asked to indicate the number of people who permanently reside in their respective households, most caregivers registered a size of 4-6 persons (N=109, 41.4%), followed by 7-9 persons (N=68, 25.9%). Only 59 (22.4%) and 27 (10.3%) households accommodated 1-3 persons and more than 10 persons, respectively. The average size of households in the Eastern Cape Province is 3.9 persons, while that of Alfred Nzo District where this study was undertaken is 3.7 persons [19].

Table 1: Demographic Characteristics

Characteristics	Frequency (N=263)	Percentage (%)
CAREGIVERS' GENDER		
Male	13	5.05
Female	250	94.95
CAREGIVERS' ROLE IN A FAMILY		
Father	4	1.6
Mother	141	53.8
Grand mother	12	4.5
Other	97	36.8
CAREGIVERS' EDUCATIONAL QUALIFICATIONS		
No education	41	15.6
Adult basic education and training (ABET)	60	22.8
Grade 1-7	31	11.8
Grade 8-11	66	25.1
Grade 12 / N3	40	15.2
Bachelor's degree / diploma	25	9.5

3.1.2 Economic Characteristics

Economic characteristics of the agri-business households were described in terms of their non-farm and farm income. With respect to non-farm income, a few caregivers included in this study were employed elsewhere outside their family agri-businesses (N=34, 12.9%). Of these employed caregivers, most were employed on permanent basis (N=14, 41.2%), while 32.4% and 26.5% were employed on temporary basis and fixed-term contract, respectively. The majority (N=143, 55.4%) said they have no employed family members that they permanently lived with. The rest (N=115, 44.6%) reported employed family members, ranging from one to three persons per caregiver's household. Non-farm income of households originated from those employed caregivers and their family members with whom they permanently live. Most of the caregivers' households (N=85, 32.9%) earned a monthly non-farm income of between $78.82 and $118.11, followed by those who earned between $39.37 and $78.74 (N=55, 21.3%). Some 51 (19.8%) caregivers' households earned more than $196.85 per month (Table 2).

With respect to the households' monthly expenditure on food, most spent between $55.20 and $70.87 (n=61, 23.2%). Nineteen (7.2%) of the caregivers' households spent $39.37 or less a month, while 13 (4.9%) reportedly spent $157.48 or more (Table 2). Monthly non-farm income was positively strongly correlated to food expenditure ($r=0.55$, ≤ 0.01).

Table 2: Economic Characteristics

Characteristics	Frequency (N=263)	Percentage (%)
HOUSEHOLDS' MONTHLY NON-FARM INCOME		
$39.37-$78.74	55	21.3
$78.82-$118.11	85	32.9
$118.19-$157.48	26	10.1
$157.56-$196.85	41	15.9
>$196.85	51	19.8
HOUSEHOLDS' MONTHLY FOOD EXPENDITURE		
≤$39.45	19	7.2
$39.49-$55.12	38	14.4
$55.20-$70.87	61	23.2
$70.94-$86.61	39	14.8
$86.69-$94.49	17	6.5
$94.57-$110.24	32	12.2
$110.31-$125.98	11	4.2
$141.82-$157.48	33	12.5
≥$157.48	13	4.9

The farming activities of the agri-business smallholders were not intense, often characterized by low yields and productivity due to use of out dated farming methods, poor infrastructure base and lack of farming skills. The majority of 263 agri-business units were registered co-operatives (N=46; 37.10%), followed by those classified as community projects (N=41; 33.06%). A few of the agri-business units were classified as individually (N=15; 12.10) or family owned (N=17; 13.71). On average, family-owned / group-owned agri-business units had 2.6 owners / managers; range being between two and nine owners / managers.

As shown Table 3, the core business of the agri-business units understudy was predominantly crop production (grain, vegetables and fruits) [N=94; 75.80%] followed by poultry and pig production (N=21; 16.94%). Although some agri-business units kept cattle, sheep and goats; none of these livestock species formed part of their core business or flagship commodities. 'Other' flagship commodities included bee farming

Having excluded micro agri-businesses from this study (those generating annual turnover of less than \$11 811, most of the 124 agri-business units whose flagship commodities are outlined in Table 3 were classified in accordance with the South African National Small Business Act No. 102 of 1996 [20], as 'very small' (N=109; 87.89%), followed by the 'small' ones (N=15; 12.1%). None of the enterprises were classified as 'medium' sized (Table 4). The contents of this Act, which are relevant to this study are attached below Table 4. They classify agri-businesses as either very small or small or medium-sized.

Interestingly, while the family or group-owned agri-businesses had a large membership of owners / managers that ranged between two and nine, many did not appear to generate sufficient income that would adequately support the livelihoods of families of the owners / managers. For example, the majority of agri-businesses generated annual gross income of between \$11 811 and \$15 748 (N=41; 33.06%), followed by those who made between \$15 827 and \$19 685 (N=24; 19.35%). Only a few made income of between \$78 740 and \$157 480 (N=2; 1.62%). Like non-farm income, the farm income was positively strongly correlated to food expenditure ($r=0.48$, $p \leq 0.01$).

Table 3: Flagship Commodities of the Agri-business Units

Flagship commodities	Frequency (N=263)	Percentage (%)
Grain	58	46.77
Vegetables	34	27.42
Fruits	2	1.61
Pigs	9	7.26
Poultry	12	9.68
Other	9	7.26
Cattle	0	0
Sheep	0	0
Goats	0	0
Total	124	100

Table 4: Total Annual Turnover of the Agri-business Units

Annual turnover	Frequency (N=124)	Percentage (%)	Classification[7]
$11 811-$15 748	41	33.06	Very small
$15 827-$19 685	24	19.35	Very small
$19 764-$23 622	20	16.13	Very small
$23 701-$27 559	13	10.48	Very small
$27 638-$31 496	11	8.87	Very small
$31 575-$35 433	8	6.45	Small
$35 512-$39 370	2	1.61	Small
$39 449-$78 740	3	2.42	Small
$78 740-$118 110	1	0.81	Small
$118 110-$157 480	1	0.81	Small
> $157 480	0	0	Medium

NB:

Annual turnover of: < $31 496 = very small agri-businesses;

< $157 480 = small agri-businesses; and

< $314 961 = medium agri-businesses

3.2 Feeding Practices

In this sub-section, the results of the agri-business households' feeding practices were presented in terms of breakfast eating patterns, number of meals consumed per day, consumption of vitamin A and C-rich foods, consumption of protein-rich foods, food variety, dietary diversity, food intake and nutrient intake.

3.2.1 Breakfast Eating Patterns

When requested to quantify frequencies of providing breakfast to their children, about half of the caregivers (N=132, 50.2%) said the provision of breakfast is made `every day of the week'. This group of caregivers was followed by those who reportedly provided breakfast `four to six times a week' (N=82, 31.2%), while 23 (8.7%) indicated that they 'never' provided breakfast to their children before they go to school (Table 5). The results from the 24h dietary recall method showed that the government's school nutrition programme of the Department of Education provided `late' breakfast between 11h00 and 12h00 for all school children. This nutrition programme appeared helpful, particularly to children from households (N=131; 49.8%) who could not provide breakfast on a daily basis.

3.2.2 Number of Meals Consumed per Day

The eating behaviour and the number of meals that a child can have a day are largely determined by their parents. Indeed, when asked if they `can afford' providing their children with `three meals a day and a snack in between', most caregivers (N=159; 60.5%) conceded that they `cannot afford' (Table 5). In line with this response, most caregivers admitted that the provision of such number of meals a day was `difficult' (N=138, 52.5%), while the rest (N=125, 47.5%) said it was `not difficult' (Table 3). The most cited sources of `difficulties' in providing children with `three meals a day and a snack in between' were high cost of food and drought.

In raising children, the number of meals provided is important as the quality of such meals. High variety of food is linked to high quality of such food. More than half of the caregivers (n=139, 52.9%) said it was `difficult’ to provide their children with different types of foods (Table 5), largely due to high food costs and unavailability of some foodstuffs in the local shops.

Table 5: Households’ General Feeding Patterns

Characteristics	Frequency (N=263)	Percentage (%)
FREQUENCY OF PROVISION OF BREAKFAST		
Every day	132	50.2
Four to six times per week	82	31.2
One to three times per week	26	9.9
Never	23	8.7
AFFORDABILITY OF PROVIDING THREE MEALS A DAY, AND A SNACK IN BETWEEN		
Can afford	104	39.5
Cannot afford	159	60.5
Is it difficult to provide different meals a day?		
Difficult	139	52.9
Not difficult	124	47.1

Table 6: Households' Consumption of Vitamins A and C-rich Foods

Characteristics	Frequency (N=263)	Percentage (%)
CONSUMPTION OF VITAMIN A-RICH FRUITS		
Ripe mango / mango juice	29	11.0
Apricot fruit / juice	26	9.9
Both fruit	21	8.0
None of the above fruits	203	77.2
CONSUMPTION OF VITAMIN A-RICH VEGETABLES		
Carrot	169	64.3
Pumpkin / squash fruit	51	19.4
None of the above vegetables	43	16.3
CONSUMPTION OF CITRUS		
Every day	9	3.7
Thrice per week	29	11.9
Twice per week	42	17.3
Once per week	96	39.5
Never	45	18.6
Do not know	22	9.1

Table 7: Households' consumption of protein-rich foods

Characteristics	Frequency (N=263)	Percentage (%)
ORGAN MEAT CONSUMED		
Liver	123	46.8
Kidney	6	2.3
Heart	12	4.6
None of the above	122	46.4
FLESH MEAT CONSUMED		
Mutton	11	4.2
Beef	4	1.5
Pork	5	1.9
Chicken	160	60.8
None of the above	83	31.6
FISH CONSUMED		
Fresh fish	13	4.9
Canned fish	161	61.2
Sea food	0	0
No fish consumed	89	33.8

3.2.3 *Consumption of Vitamin A and C-rich Foods*

Investigation into the consumption patterns of vitamin A-rich fruits was limited to ripe mango/mango juice, and apricot/apricot juice. Specifically, the caregivers were asked if over the previous 24h period, their children had consumed any of the above fruits. To this end, the majority of caregivers reported that their children had not consumed any of the abovementioned fruits (N=203, 77.2%), while only 29 (11.0%) and 26 (9.9%) indicated that their children had consumed ripe mango/mango juice and apricot fruit/juice, respectively (Table 6).

With respect to consumption patterns on vitamin A-rich vegetables (carrots and pumpkin/squash fruit), the caregivers were asked to indicate whether over the previous 24h period, their children had consumed any of the abovementioned vegetables. In their responses, most caregivers indicated that their children had consumed carrots (N=169, 64.3%), followed by pumpkin / squash fruit (N=51, 19.4%). On the frequency of consumption of vitamin C-rich citrus, most caregivers said the consumption was `once per week' (N=96, 39.5%), while 42 (17.3%) said it was `twice per week' (Table 6). Noticeably, responses of a sizeable number of caregivers to this question were `never' (N=45, 18.6%), while a remarkable number responded `do not know' (N=22, 9.1%).

3.2.4 *Consumption of Protein-rich Foods*

Feeding patterns on the following animal protein sources were investigated; organ meat (liver, kidney and heart); flesh meat (beef, mutton, pork and chicken); and fish (fresh fish, canned fish, prawns, mussels, crayfish, crabs and oysters). The caregivers were asked if their children had consumed any of the abovementioned protein-rich foods over the past 24h. With respect to `organ meat', a fairly equal number of caregivers responded that their children had consumed `organ meat' (N=123, 46.8%), while others said they had consumed `none of the organ meat' (N=122, 46.4%). Noticeably, liver was the most popular `organ meat', followed by kidney and heart.

On `flesh meat’, the majority of caregivers reported that their children had consumed `chicken’ (N=160, 60.8%), while a sizeable number (N=83, 31.6%) said their children had consumed `none of the flesh meat’ (Table 7). `Beef’ (N=4, 1.5%) and ‘pork’ (N= 5, 1.9%) consumption was restricted to very few households. Regarding `fish’, only the consumption of `canned fish’ (N=161, 61.2%) and `fresh fish’ (N=13, 4.9) were registered by the caregivers. No consumption of seafood (prawns, mussels, crayfish, crabs, oysters) was reported.

3.2.5 Food Variety and Dietary Diversity

Recording of the agri-business households’ feeding practices led to generation of FVS and DDS using the 24h dietary recall method and qualitative FFQ. The average FVS from the 24h dietary recall method for the 263 investigated households was low at 23.43±10.65 (Table 6). Most of the caregivers’ households (N = 215; 81.7%) had a low FVS, followed by those with a medium FVS (N = 48; 18.3%). None of the households had a high FVS category (Figures 1-2). These results were echoed by those from the qualitative FFQ where households’ FVS was also low at 25.51±8.32.

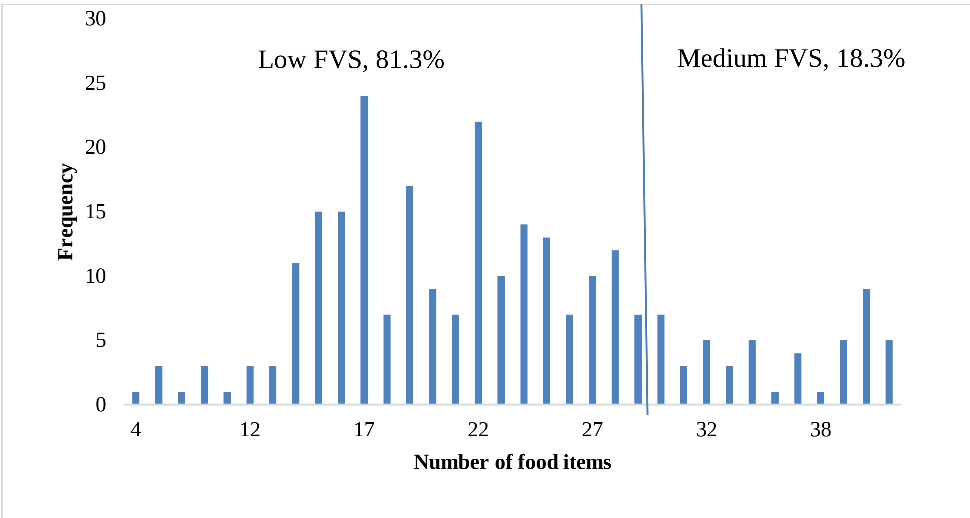
Regarding dietary diversity, the mean DDS from the 24h dietary recall method and qualitative FFQ were 7.82±3.20 and 8.12±3.54, respectively. These results were indicative of high DDS [21]. From the 24h dietary recall method, most the caregivers’ households (N = 88; 33.5%) consumed foods from eight food groups, followed by those (N = 71; 27.0%) who consumed foods from all nine foods groups. Three food groups was the lowest number consumed (N = 5; 1.9%). The majority of the caregivers’ households (N = 184; 70%) had high DDS (Figure 3), followed by those with medium DDS (37.2%) and low DDS (8.2%). Results from the qualitative FFQ also followed a similar trend as shown in Figure 3.

Table 9 presents a summary of top 20 most consumed food items by the caregivers’ children during the 3-day 24h dietary recall method and the seven-day qualitative FFQ. Noticeably, the carbohydrates-rich food items from the `cereal, roots and tubers’ group dominated the top 10 most consumed foods. From the `flesh’ and `dairy products’ groups, only canned fish and chickens, and fresh milk and sour milk, respectively, appeared in the list of top 20 most consumed foods items. Only carrots and spinach from the `vitamin A-rich vegetables and fruits' group, and cabbage and onion from the `other vegetables' group appeared in the list presented in Table 9, while sunflower oil represented the `fats and oils' group. Food groups whose food items did not feature in the list in question were `eggs', `legumes and nuts', and `other fruits and juices' groups.

This study also found that consumed quantities of food items varied widely within and between households, largely due to the varying socio-economic profiles of the caregivers' households. Consumed quantities of food items from other food groups were rather low (e.g. dairy products, vegetables, and flesh foods). Again, this appeared a function of socio-economic characteristics of the caregivers' households, which have been discussed earlier in this paper.

Table 8: Food variety scores within food groups

Food Group	24h dietary recall method		Qualitative FFQ	
	Mean	**SD**	**Mean**	**SD**
Cereal, roots and tubers	5.05	0.89	5.26	1.01
Fleshy foods	3.22	1.08	3.34	0.92
Dairy products	1.97	1.14	2.30	0.84
Legumes and nuts	1.00	0.58	1.08	0.63
Eggs	0.38	0.49	0.31	0.21
Vitamin A-rich vegetables and fruits	3.06	1.20	3.80	0.97
Other fruits and juices	2.85	1.93	2.80	1.02
Other vegetables	4.03	2.48	4.59	1.98
Fats and oils	1.86	0.86	2.03	0.74
Total Food Items	**23.43**		**25.51**	



8

Figure 1: Distribution of food variety scores from the caregivers' households using a 24h dietary recall method

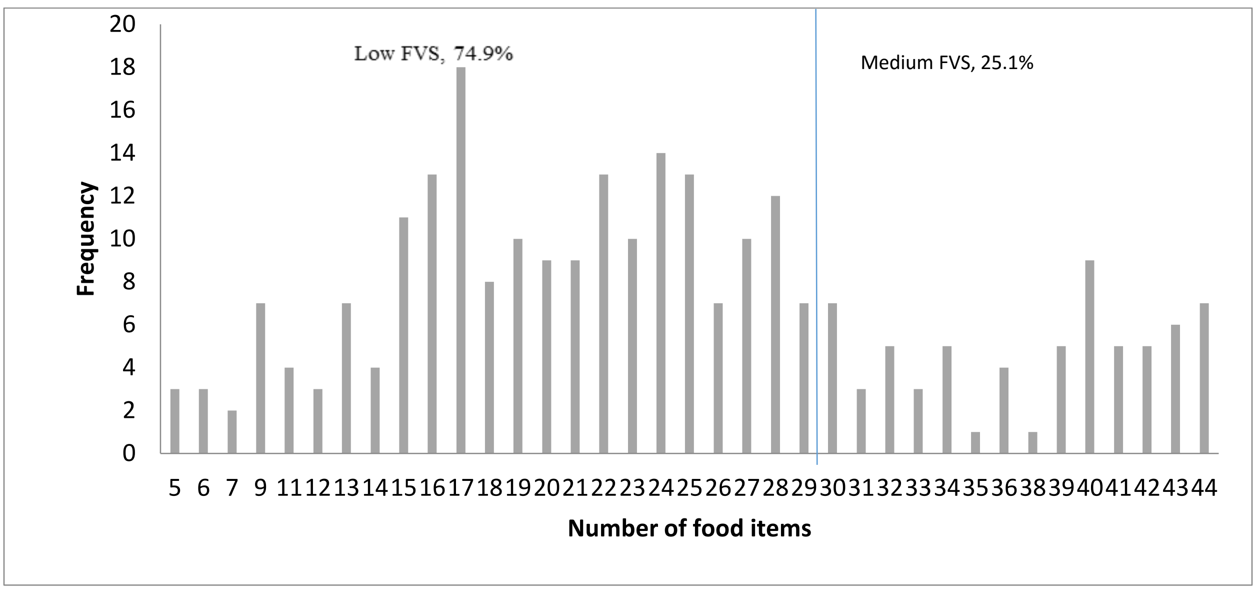


Figure 2: Distribution of food variety scores from the caregivers' households using a qualitative FFQ

Abbreviations:
FVS- Food Variety Source
FFQ- Food Frequency Questionnaire

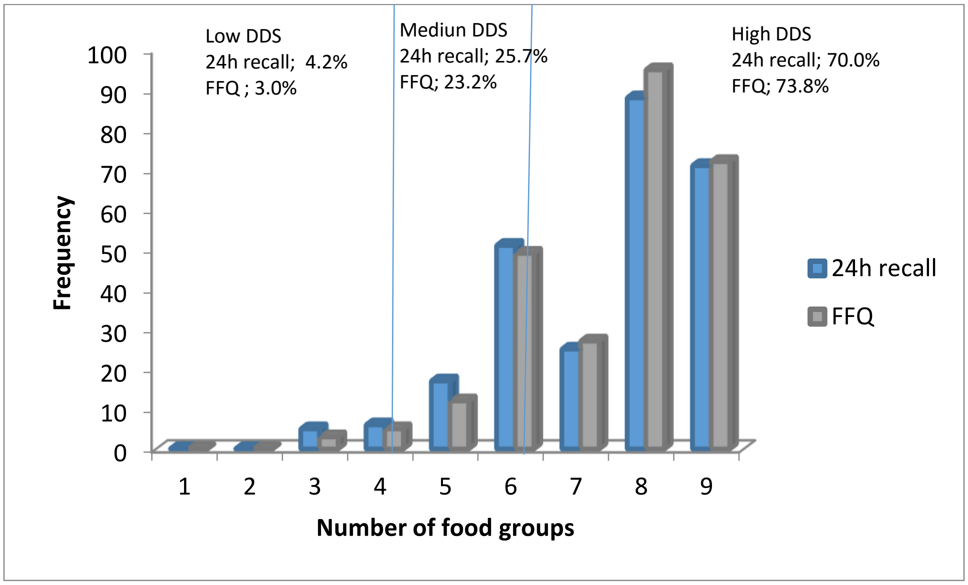


Figure 3: **Distribution of dietary diversity scores from the caregivers' households using both the 24h dietary recall method and qualitative FFQ**

Table 9: The top 20 most consumed food items measured by the 24h dietary recall and qualitative FFQ

	24h dietary recall method		Qualitative FFQ	
Rank	**Food item**	**Mean food intake, g/person/day**	**Rank**	**Food item**
1	Maize meal soft porridge	99.23±74.56	1	White sugar
2	Instant tea	182.14±131.38	2	Maize meal stiff porridge
3	White sugar	19.99±7.05	3	Sweetened cold drink
4	Maize meal stiff porridge	123.49±72.79	4	Brown bread/rolls
5	Brown bread/rolls	27.58±30.81	5	Maize meal soft porridge
6	*Amarhewu*	176.78±174.66	6	Instant tea
7	Crumbed maize meal	107.67±105.07	7	A*marhewu*
8	Fresh milk	21.85±26.34	8	Coffee creamer
9	Potatoes	21.38±14.34	9	Crumbed maize meal
10	Maize samp	156.63±139.91	10	Fresh milk
11	Rice	64.86±36.03	11	Rice
12	Sour milk	128.57±118.77	12	Potatoes
13	Carrot	14.28±10.94	13	Maize samp
14	Baked bread, homemade	49.16±50.43	14	Sunflower oil
15	Cabbage	10.64±12.47	15	Sour milk
16	Spinash	10.17±14.89	16	Carrot
17	Onion	8.78±11.74	17	Baked bread, homemade
18	Sunflower oil	23.85±32.99	18	Cabbage
19	Canned fish	13.66±17.56	19	Canned fish
20	Chicken	33.81±39.95	20	Spinach

3.2.5 Nutrient Intake

Food consumption patterns, FVS and DDS that have been discussed in the previous sections of this paper are directly linked to nutrient intake which is under discussion in the current section [22, 23]. The proportion of children whose median nutrients intake exceeded 67% of the nutrients' RDA was presented in Table 10. Also indicated in Table 10 are those nutrients whose intake by less than 50% of children exceeded the 67% cut-off point of the nutrients' RDA. The intake of such nutrients was regarded as low, but moderate / high for those nutrients whose intake by more than 50% of children exceeded this 67% cut-off point.

Differences in nutrient intake between male and female children were highly significant ($p \leq 0.01$) in nutrients with the exception in calcium where these differences were significant ($p \leq 0.05$). To this end, less than half (50%) of male and female children had nutrients intake that were above the 67% threshold in nine and fourteen nutrients, respectively (Table 10). There were also highly significant ($p \leq 0.01$) differences in nutrient intake among children aged 5-8 years and 9-13 years, with the exception in vitamin K where these differences were non-significant ($p \geq 0.05$). That is, less than half (50%) of younger (5-8 years) and older children (9-13 years) had nutrients intake that were above the 67% cut-off point in five and eighteen nutrients, respectively (Table 10).

Among macro-nutrients, the intake of protein and carbohydrates, in particular, exceeded 67% of the nutrients' RDAs among the overwhelming majority of children. The moderate / high intake of protein appeared to have been supported by consumption of the two main protein sources, namely; canned fish and chicken (Table 9), while a similar intake of carbohydrates was due to high FVS within the 'cereal, roots and tubers' food group (Table 8). To the contrary, the intake of dietary fibre was low as it exceeded 67% of this nutrient's RDA in less than half of female children aged 5-8 years and children aged 9-13 years. Low dietary fibre intake was in part caused by low consumption of fibre-rich fruit and vegetables, and virtually no consumption of cereals.

The intake of minerals was moderate / high on four out of six minerals that were under investigation in this study. These minerals were iron, zinc, magnesium and phosphorus.

Their intake exceeded 67% of RDA in over half of the 302 children who were included in this study, irrespective of their age or gender. However, the same could not be said for calcium and selenium, because less than half of the children exceeded the threshold of 67% of these nutrients' RDA.

Among vitamins, moderate / high intake was recorded on eleven out of twelve vitamins that were investigated. These vitamins were, namely; vitamin A, vitamin B6, vitamin B12, vitamin C, vitamin E, vitamin K, thiamine, riboflavin, niacin, pantothenic acid and biotin. The intake of these vitamins exceeded 67% of their RDA in more than 50% of the 302 children understudy, irrespective of age or gender. The contrary held for folate where its intake was in excess of 67% of its RDA in less than 50% of the studied 302 children.

Table 10: Proportion of children aged 5-13 years whose baseline nutrients intake exceeded 67% of the nutrients' RDA

Nutrient	**Gender and age group**			
	No. of children aged 5-8 years, N(%)		**No. of children aged 9-13 years, N(%)**	
	Male	Female	Male	Female
Carbohydrates	95(100)	51(100)	51(100)	84(100)
Protein	95(100)	51(100)	51(95.4)	77(91.7)
Total fibre	65(68.4)	15(29.4)$^{<50\%}$	15(13.9)$^{<50\%}$	20(23.8)$^{<50\%}$
Calcium	86(90.5)	25(49.0)$^{<50\%}$	25(30.8)$^{<50\%}$	14(16.7)$^{<50\%}$
Iron	95(100)	45(88.2)	45(90.8)	74(88.1)
Magnesium	95(100)	51(100)	51(70.8)	69(82.1)
Phosphorus	95(100)	51(100)	51(53.9)	17(20.2)$^{<50\%}$
Zinc	95(100)	51(100)	51(66.2)	29(34.5)$^{<50\%}$
Selenium	71(74.7)	28(54.9)	28(18.5)$^{<50\%}$	13(15.5)$^{<50\%}$
Vitamin A	95(100)	38(74.5)	38(63.1)	58(69.1)
Vitamin B6	95(100)	44(86.3)	44(49.2)$^{<50\%}$	22(26.2)$^{<50\%}$
Vitamin B12	95(100)	45(88.2)	45(84.6)	74(88.1)
Vitamin C	86(90.5)	34(66.7)	34(23.1)$^{<50\%}$	29(34.5)$^{<50\%}$
Vitamin E	95(100)	41(80.4)	41(64.6)	39(46.4)$^{<50\%}$
Vitamin K	(93.68)	28(54.9)	28(27.7)$^{<50\%}$	57(67.9)
Thiamin	95(100)	51(100)	51(90.8)	67(79.8)
Riboflavin	95(100)	51(100)	51(64.62	77(91.7)
Niacin	95(100)	51(100)	51(81.5)	67(79.7)
Folate	80(84.2)	25(49)$^{<50\%}$	25(30.8)$^{<50\%}$	22(26.2)$^{<50\%}$
Pantothenic acid	92(96.8)	37(72.6)	37(58.5)	46(54.8)
Biotin	95(100)	44(86.3)	44(80)	56(66.7)^{9}

< 50% - less than half of the gender or age group of children had nutrients intake that exceeded 67% of nutrients' RDA

3.4 Anthropometric parameters

The investigated anthropometric parameters which are under discussion in this sub-section where namely; weight-for-age (WAZ), height-for-age (HAZ) and body mass index-for age (BMIZ).

3.4.1 WAZ, HAZ and BMIZ

As indicated earlier, the measurement of WAZ was limited only to 146 children of 5-8 years of age. Of these children, the majority (80.14%) had normal WAZ (<-1SD to <0SD), while the remaining minority (19.86%) were underweight (≥-3SD to <-2SD) [Table 11]. The prevalence of underweight was higher among male children than in their female counterparts ($p \leq 0.05$).

Of the 302 children who were subjected to HAZ measurement, the overwhelming majority (90.70%) had normal HAZ (>-1SD to +3SD). The rest were stunting (≤-2SD), particularly female children ($p \geq 0.05$).

The measurement of BMIZ was also extended to all 302 children. Over half (56.57%) of children included in this study had normal BMIZ (>-2SD to <+1SD), and a very small proportion (0.92%) was wasting (<-2SD to >-3SD). Of concern was a creeping problem of over-nutrition. To this end, 36.39% of children were at risk of overweight (>+1SD to <+2SD), while 6% and 8% were overweight (>+2SD to <+3SD) and obese (>+3SD), respectively. Noticeably, female children were heavier than their male counterparts of the same age ($p \geq 0.05$).

The caregivers were given an opportunity to visually appraise the body condition of their children in a scale of underweight, normal weight, overweight and obese. In their responses, most of the caregivers rated the weight of their children as normal (N=221, 84%), followed by those who rated them underweight (N=29, 11%), overweight (N=1, 0.4%) and obese (N=12, 4.6%).

3.4.2 Factors Affecting Anthropometric Parameters

Hypothetical tests were conducted on key factors that were deemed influential in the children's anthropometric parameters, namely; WAZ, HAZ and BMIZ. These key factors were farm and non-farm income, food expenditure, the caregivers' level of education and breakfast eating patterns. As shown in Table 12, all these key factors, with the exception of breakfast eating patterns, had an influence ($p \leq 0.01$) on the children's WAZ, HAZ and BMIZ. The influence of breakfast patterns on the children's anthropometric parameters was rather non-significant ($p \geq 0.05$).

Table 11: Summary of anthropometric characteristics of the children aged 5-13 years

Classification[10]	Z-score	Gender		Total
		Male, N (%)	**Female, N (%)**	
WAZ (N=146)				
Severely underweight	<-3SD	0	0	0
Underweight	≥-3SD to <-2SD	17 (17.71%)	12 (24.00%)	29 (19.86%)
Normal WAZ	<-1SD to <0SD	79 (82.29%)	38 (76.00%)	117 (80.14%)
HAZ (N=302)				
Severely stunting	<-3SD	0	0	0
Stunting	≤-2SD	13 (7.34%)	17 (11.33%)	30 (9.30%)
Normal HAZ	<-1SD to +3SD	164 (92.66%)	133 (88.67%)	297 (90.7%)
BMIZ (N=302)				
Severely wasting	<-3SD	0	0	0
Wasting	<-2SD to >-3SD	2 (1.13%)	1 (0.67%)	3 (0.92%)
Normal BMIZ	>-2SD to <+1SD	117 (66.10%)	68 (45.33%)	185 (56.57%)
Risk of overweight	>+1SD to <+2SD	52 (29.38%)	67 (44.67%)	119 (36.39%)
Overweight	>+2SD to <+3SD	2 (1.13%)	6 (4.00%)	8 (2.45%)
Obese	>+3DS	4 (2.26%)	8 (5.33%)	12 (3.67%)

WAZ - Weight for age
HAZ - Height for Age
BMIZ - Body Mass Index for age- Z score
SD - Standard Deviation

Table 12: Summary of results of Kruskal-Wallis H tests on the effect of farm and non-farm income, food expenditure, caregivers' level of education, and breakfast eating patterns on anthropometric parameters

Anthropometric parameters	Monthly non-farm income			Monthly food expenditure		
	df	Chi-square	Asymp. Sig.	df	Chi-square	Asymp. Sig.
WAZ	4	44.23	0.000**	8	40.12	0.000**
HAZ	4	43.18	0.000**	8	`43.91	0.000**
BMIZ	4	42.82	0.000**	8	46.08	0.000**
	Monthly farm income			**Level of education**		
	df	Chi-square	Asymp. Sig.	df	Chi-square	Asymp. Sig.
WAZ	7	74.83	0.027*	5	14.27	0.010*
HAZ	7	71.21	0.038*	5	13.42	0.015*
BMIZ	7	69.82	0.045*	5	12.18	0.021*
	Breakfast eating patterns					
	df	Chi-square	Asymp. Sig.			
WAZ	1	1.93	0.32			
HAZ	1	2.4	0.43			
BMIZ	1	1.60	0.20			

4. Discussion

The results from this study showed that the agri-business families under investigated had rather modest feeding practices that were characterised with skipping of meals and provision of a limited variety of meals. This observation was clear right from their provision of the first meal of the day – breakfast. Half of the caregivers could not provide their children with breakfast before they go to school or church. Skipping breakfast is not a good feeding practice, because of its association with poor performance of children at school and numerous health risks such as reduction of short memory [24], reduction of metabolism and increased cholesterol and insulin levels [25] depletion of energy and increased risk of type 2 diabetes [26].

Breakfast is one of many meals that were skipped by the caregivers' children understudy. Ideally, children aged 5-13 should have at least three meals a day and a snack in between [27]. However, in this study, only 39.5% of the caregivers' households could afford the above prescribed number of meals. Equally of concern is the quality of consumed meals in the face of the revelation that over half of the caregivers' households found it difficult to provide a variety of meals to their children. A wide variety of meals is likely to provide a wide range of nutrients that are necessary for a child's good nutritional status, health and performance at school. This view is widely held by many in the literature [28].

The caregivers' inabilities in providing a variety of meals to their children is reflected on their households' low FVS. Most the caregivers' households provided meals that were dominated by carbohydrates-rich maize products such as stiff porridge, crumbed maize meal, samp and *amarhewu*, and wheat-based products such as steamed bread and baked bread. It was, therefore, not surprising that in this study the `cereal, roots and tubers' food group had the highest FVS. On the other hand, it is commendable that most of the caregivers' households had a conservatively high DDS. This high DDS came as a result of consumption of few food items on a wide range of the nine food groups. This eating pattern is unlikely to lead to adequate nutrient intake and good nutritional status due to exclusion of critically important nutrients in the feeding menu.

The low consumption of vitamin C-rich citrus was remarkable (Table 6). Part of this sparingly low consumption may have been due to limited availability and the commensurately higher price of citrus, which in turn may have been caused by the citrus post-harvest period (September) at which data collection for this study was started. To the contrary, the widespread consumption of vitamin A-rich vegetables (carrot and pump/ squash fruit) was commendable. By virtue of being a dark leafy vegetable, the high consumption of spinach and liver (Table 7) might have resulted in a good intake of vitamin A.

Noticeably, the `fleshy food' group had a wider variety of food items (n=10), than the `cereal, roots and tubers' group (N=7), yet fewer affordable food items from this group were consumed. The low FVSs of 3.22 and 3.34 from the 24h dietary recall method and qualitative FFQ, respectively, bears testimony to this claim. Canned fish was consumed the most, followed by chicken, while mutton, beef and pork were consumed in very few caregivers' households. It appeared that this feeding pattern was primarily driven by food costs. In the area where this study was undertaken, the average retail price of a 400g canned fish was $1.18, while frozen chicken costs $2.91/kg. Mutton, beef and pork cost $5.64/kg, $5.40/kg and $4.89/kg, respectively.

When faced with high costs of `fleshy foods', the feeding behaviour of the population understudy did not seem to favourably accommodate alternative cheaper protein sources such as legumes. The FVSs for the 'legumes and nuts' food group were 0.96 and 1.08 from the 24h dietary recall method and qualitative FFQ, respectively. Dried beans which are often prepared with maize samp were not in the top 20 most consumed food items, while dried peas were consumed in very few households (N=9; 3.57%). Soya and lentils were not consumed. This situation presented itself as an area for nutrition awareness and nutrition education. The agricultural extension personnel are best placed to perform this function.

A wide range of fruit, which could have provided a good source of minerals and vitamins, was either rarely consumed or not consumed in many households. Apples and citrus were two most consumed fruits, but their consumption was limited to approximately half of the 263 households that were included in this study. Consumption of bananas was expected to be high by virtue of the proximity of the studied population and local retail shops to banana plantations of the province of KwaZulu-Natal. Banana consumption was reported in only 28.57% of the caregivers' households. It appeared that physical availability of this food item was not a problem, but its financial accessibility [29].

FVS and DDS which are indicative of the farming households' nutritional status, were influenced by a number of socio-economic factors. First and foremost, the caregivers' level of education had a significant influence on FVS ($p \leq 0.05$) than on DDS ($p \geq 0.05$). Probably, higher level of education of caregivers played a critical role in exposing them to good nutritional and caring practices for their children. Similar observations were also made by some authors [30, 31], while others could not find a relationship between parents' level of education and their children's nutritional status [32]. Further analysis of results showed that the caregivers' level of education had a significant effect ($p \leq 0.05$) on their households' monthly non-farm income and expenditure on food. The monthly non-farm income was positively strongly correlated to food expenditure ($r=0.55$, $p<0.01$). In turn, food expenditure had a significant influence on FVS ($r=0.672$; $p<0.01$) and DDS ($r=0.322$; $p<0.01$).

These findings on the economic variables (income and food expenditure) are similar to those reported in a survey that was conducted by ECSECC [19] at Alfred Nzo District. The survey found that most of the monthly expenditure was used to acquire non-durable goods like food, while very little was used to buy either durable or semi-durable goods. For example, in 2013 from a total household income of $811 million, $724 million was used in household expenditure. ECSECC [19] concluded that this elevated household expenditure was symptomatic of poverty in the district, as high expenditure on non-durable goods does very little contribution to wealth creation.

With respect to farming activities of the agri-businesses, the results from this study showed that income from these activities was not sufficient to allow easy financial access to a wide range of food items. Their farm produce may not have been sufficient either as evidenced in the low FVS and debatably high DDS. These findings echoed those made earlier by other authors whose work included the same geographical area of Alfred Nzo District Municipality [33]. They found that non-farming families were more food secure than their farming counterparts, because instead of relying on food production, they purchase a wide variety of food items.

Generally, the nutrient intake of children from agri-business families was reflective of a rather modest feeding behaviour. This was evidenced in the moderate/high intake of carbohydrates, which in turn was linked to the fact that carbohydrates-rich food items from the `cereal, roots and tubers' food group had the highest FVS when compared to other eight food groups. Carbohydrates-rich food items featured high in the list of top 20 most consumed food items. These findings are characteristic of a eating behaviour of poverty stricken households. Work done by some authors in other provinces of South Africa also yielded similar results. That is, in KwaZulu-Natal Province [34, 35], Gauteng Province [21], North-West Province [35, 36] , Limpopo Province [37], and Orange Free State Province [38].

Regarding protein, its intake was also moderate/high, with between 91.7% and 100% of the studied children having intake of this nutrient exceeding 67% of its RDA (Table 10). Canned fish and chicken were the two most consumed sources of protein. Other studies conducted in other South African provinces other than the Eastern Cape Province also found chicken to be the main source of protein [21, 34-36, 39]. The consumption of dried beans, which are cheaper alternative sources of protein was not exploited. Other cheaper legumes such as soya and lentils were not consumed at all; apparently due to the entrenched eating habits in the study area. Such eating habits are common across the globe [40, 41].

The intake of dietary fibre was not only low, but was concerning. This situation appeared a function of food processing which often resulted in refined food that has either low fibre content or none. Breakfast cereals which contained a considerable amount of dietary fibre were consumed in few households (11%), because they were not easily financially accessible. Vegetables could not have provided a good source of dietary fibre, because a few of such vegetables (cabbage and spinach) were consumed, and their consumption was in very small quantities as shown in Table 9. Nevertheless, low intake of dietary fibre is a concerning problem in many parts of the country [35, 36] and in many developed and developing countries like South Africa [42].

The results of low intake of many minerals and vitamins that have been presented in the previous section of this paper are a reflection of poor consumption of fruits and vegetables, dairy products, eggs, legumes and various fleshy foods. On the other hand, the rather moderate to high intake of other minerals and vitamins is attributable to many factors. Firstly, bread / baking flour and maize meal had been fortified with selected minerals and vitamins in accordance with the South African Act No 54 of 1972 [43]. Fortification of maize meal was evident among the local newly established maize milling companies that have been funded through food security programmes of the Eastern Cape government. Fortified food items and their nutritive value appeared in the database of FoodFinder III. Secondly, the wide spread households' consumption of food items such as dried beans, chicken, canned fish, dairy products, carrots, pumpkin / squash fruit and spinach appeared to have led to moderate to high intake of the minerals and vitamins that have been referred to above. However, as indicated earlier, these food items were not consumed in inadequate quantities (Table 9). Other than the fortification of staple food items, agri-business families need to grow and consume a wide range of vegetables, including those that are cheaper alternatives to fruit. Needless to say, in order to improve intake of all minerals and vitamins, diversification vegetable production and consumption should be applied. Inclusion of a legumes other than dried beans in study population's diets is encouraged so as to improve the intake of nutrients that cannot be realised from rather expensive dairy products (e.g calcium). Alfred Nzo District has unexploited potential to produce legumes which include soya. In addition to entertaining diversified crop / horticultural production, nutrition education need to be taken seriously in view of those nutrients whose intake was below 67% of their RDA in many households.

Regarding anthropometric nutritional status, South African communities are reportedly sandwiched between malnutrition, and overweight / obesity [44]. In the current study, majority of children had good nutritional status, because they had normal WAZ, HAZ and BMIZ. Very few had low nutritional status through being wasted and stunted. However, among children aged 5-8 years, the prevalence of underweight was 20%, which is indicative of low nutritional status. In terms of the prevalence of various anthropometric conditions, this study found risk of overweight / overweight / obesity a more threatening problem than malnutrition was. Possibly, the high prevalence of these anthropometric conditions was caused by high consumption of carbohydrates-rich food items from the `cereal, roots and tubers' food group and lack of physical activity.

5. CONCLUSION

This study showed that children from previously disadvantaged agri-business families enjoyed rather modest nutritional practices that were often characterised with consumption of low quantities of foods, deprivation of breakfast and some meals, high consumption of carbohydrates-rich foods, and low consumption of fruits and vegetables. Food variety and dietary diversity scores which are indicative of nutritional status were low and conservatively high, respectively. The above indicators and feeding patterns, in general, had an effect on the intake of various nutrients under investigation. When compared with their RDA, the intake of these nutrients various, dietary fibre and carbohydrates intake being remarkably low to moderate/high, respectively. Most of the children had good nutritional status, in as far as their anthropometric dimensions are concerned. However, the creeping problem of overweight / obesity was concerning, while stunting and wasting were at low levels.

Nutritional status was found to be a function of farm and non-farm income, expenditure on food, and educational status of caregivers. In order to improve the children's nutritional status, this study recommended nutritional education among the caregivers, and diversification and intensification of farming practices in agri-busineses.

Conflict of Interests

There is no conflict of interests to be declared by the authors.

Acknowledgements

The authors are grateful for the support received from the agricultural extension officers and health workers of the Department of Rural Development and Agrarian Reform, and the Department of Health, respectively.

References

[1] Stats SA (2016) Community survey, Stats SA, Pretoria, South Africa.

[2] Food and Agriculture Organisation of the United Nations (1996), World food summit: Rome declaration on world food security and world food summit plan of action, FAO, Rome, Italy.

[3] Ecker O, Breisinger C (2012) The food security system – a new conceptual framework, IFPRI, Washington DC, USA.

[4] Monde N (2003) Household food security in rural areas of central Eastern Cape: The case of Guquka in Victoria East and Koloni in Middledrift districts, University of Fort Hare, Alice.

[5] Dirwayi TP (2010) Application of the sustainable livelihoods framework to the analysis of the provincial growth and development plan of the Eastern Cape: a case study of the Massive Food Production Programme in Nkonkobe Municipality and Buffalo City Municipality, University of Fort Hare.

[6] Tregurtha N (2012) Inequality and economic marginalisation: review of the Eastern Cape's Siyakhula / Massive Maize Project. Trade and Industrial Policy Strategies, Pretoria, South Africa.

[7] Ndhleve S, Musemva L, Zhou L (2013) Household food security in a coastal rural community of South Africa: status, causes and coping strategies, African Journal of Agricultural and Food Security, 1(1): 15-20.

[8] Oni SA, Maliwichi LL, Obadira OS (2010) Assessing the contribution of smallholder irrigation to household food security in comparison to dryland farming in Vhembe District of Limpopo Province, South Africa, African Journal of Agricultural Research, 6(10): 2188-2197.

[9] Kahsay S, Mulugeta, M (2014) Determinants of rural household food security in Laelay Maichew Woreda Tigray, Ethiopia, African Journal of Agriculture and Food Security, 2(1): 106-112.

[10] Abate T, Shiferaw B, Menkir A, Wegary, D, Kebede, Y et al. (2015) Factors that transformed maize productivity in Ethiopia, Food Security, 7: 965-981.

[11] Pingali P (2015) Agricultural policy and nutrition outcomes – getting beyond the pre-occupation with staple grains, Food Security, 7(3): 583-591.

[12] Oldewage-Theron WH, Kruger R (2008) Food variety and dietary diversity as indicators of the dietary adequacy and health status of an elderly population in Sharpeville, South Africa. Journal Nutrition for the Elderly, 27(1-2): 101-133.

[13] Wellman NS, Kamped BJ (2008) Nutrition and ageing, In: Mahan LH, Krauer ESS, Food, nutrition and diet therapy. 12th edition, W B. Saunders Company, Philadelphia, Pennsylvania, USA.

[14] Institute of Medicine (2003) Dietary reference intake, National Academy Press, Washington, D.C, USA.

[15] Wenhold F, Faber M (2012) Nutritional status of South African and strategies to address malnutrition, In: Oelofse A, Van Averbeke W, Nutritional value and water use of African leafy vegetables for improved livelihoods, Government Printer, Department of Agriculture, Forestry and Fisheries, Pretoria, South Africa.

[16] World Health Organisation (1995) Physical status: the use and interpretation of anthropometry, technical report series No. 854. WHO: Geneva.

[17] Beukman TL (2005) The effect of selected variables on leadership behaviour within the framework of a transformational organisation, University of Pretoria, Pretoria, South Africa.

[18] Nordstokke DW, Zumbo BD, Cairns S, Saklofske DH (2011) The operating characteristics of the non-parametric Levene test for equal variances with

assessment and evaluation data, Practical Assessment, Research and Evaluation, 16(5):1-8. 2011.

[19] Eastern Cape Socio-economic Consultative Council (2014) Alfred Nzo District Municipality socio-economic profile, Eastern Cape Socio-economic Consultative Council, East London, South Africa.

[20] Department of Trade and Industry (1996) National Small Business Act. No. 92 of 1996, Government Printer, Pretoria, South Africa.

[21] Matla MTH (2008) The contribution of food access strategies to dietary diversity of farm worker households on Orange farm in the Fouriesburg District (RSA), University of Pretoria, Pretoria, South Africa.

[22] Badari SAZ, Arcot J, Haron SA, Paim L, Sulaiman N et al. (2012) Food variety and dietary diversity scores to understand the food intake pattern among selected Malaysian households, Journal of Ecology of Food and Nutrition, 51(4): 265-299.

[23] Ongosi AN, Gericke G, Mbuthia E, Oelofse A (2014) Food variety, dietary diversity and perceived hunger among lactating women (0-6 months post-partum) in low socio-economic area in Nairobi, Kenya, African Journal of Food, Agriculture, Nutrition and Development, 14(2): 8663-8675.

[24] Hahoney CR, Taylor HA, Kanarek RB , Samuel P (2005) Effect of breakfast composition on cognitive processes in elementary school children, Physiology and Behavior, 85(5): 635-645.

[25] Min C, Noh H, Kang KS, Sim HJ, Baik HW et al. (2011) Skipping breakfast is associated with diet quality and metabolic syndrome risk factors of adults, Food Science and Human Nutrition, 5(5): 455-463.

[26] Mekary RA, Giovannucci E, Cahill L, Willett WC, van Dam RM et al. (2013) Eating patterns and type 2 diabetes risk in older women: breakfast consumption and eating frequency, American Journal of Clinical Nutrition , 98(2):436-443.

[27] Macdiamid J, Loe J, Craig LC, Masson LF, Holmes B et al (2009) Meal and snacking patterns of school aged children in Scotland, European Journal of Clinical Nutrition, 63(1):1297-1304.

[28] Ruel M (2002) Is dietary diversity an indicator of food security or dietary quality? A review of measurement issues and research needs. Food Consumption and Nutrition Division Discussion Paper No. 140. International Food Policy Research Institute, Washington, D.C., USA.

[29] Burchi F, De Muro P (2016) From food availability to nutritional capabilities: advancing food security analysis, Food Policy, 60:10-19.

[30] Kunwar R, Pillai PB (2002) Impact of education of parents on nutritional status of primary school children, Medical Journal Armed Forces India, 58(1): 38-432.

[31] Abuya BA, Ciera J, Kimani-Murage E (2012) Effect of mother's education on child's nutritional status in the slums of Nairobi, BMC Pediatrics, 12(8): 2-10.

[32] Alalaq H, Katuli S, Beeson L, Ormsby G, Cordero-MacItyre Z(2014) Parents education and children nutritional status aged 2 to 5 in Zambia, The FASEB Journal, 28(1):1-12.

[33] Von Fintel D, Pienaar L (2016) Small-scale farming and food security: the enabling role of cash transfers in South Africa's former homelands, University of Stellenbosch, Stellenbosch, South Africa.

[34] Silangwe BN (2012), Nutritional status and dietary intake of adolescents in Mandlenkosi high school – Lindelani, Durban University of Technology, Durban, South Africa.

[35] Mchiza ZJ, Steyn NP, Hill J, Kruger A, Schönfeldt et al. (2015) A review of dietary surveys in the adult South African population from 2000 to 2015, Nutrients, 2015(7): 8227-8250.

[36] Rossouw CR (2005) Eating habits and nutrient intakes of 10-15 year old children in the North West Province, North-West University, Potchefstroom, South Africa.

[37] Mushaphi LF (2011) Impact of a nutrition education programme on the nutritional status of children aged 3 to 5 years, and the nutritional practices and knowledge of their caregivers in rural Limpopo Province, South Africa, University of the Free State, Bloemfontein, South Africa

[38] Mofokeng MJ (2013) Nutritional status and dietary intake patterns of children aged 7-13 years in Qwaqwa, Vaal University of Technology, Vanderbijlpark, South Africa.

[39] Govender T (2011) Analysis of the nutritional status and dietary intake data of a group of elderly at a day and frail care centre in Verulam, Durban University of Technology, Durban, South Africa.

[40] Ganasegeran K, Al-Dubai SAR, Qureshi AM, Al-abed AAA, Rizal AM et al (2012) Social and psychological factors affecting eating habits among university students in a Malaysian medical school: a cross-section study, Nutrition Journal, 11(48):183S-188S.

[41] Coelho LG, Cândido APC, Machado-Coelho GLL, de Freitas SN (2012) Association between nutritional status, food habits and physical activity level in school children, Jornal de Pediatria, 88(5):1-6.

[42] Vitolo MR, Campagnolo PDB, Gama CM (2007) Factors associated with risk of low dietary fiber intake in adolescents, Journal de Pediatria, 83(1): 47-52.

[43] Department of Health (1972), Foodstuffs, cosmetics and disinfectants, Act No. 54 of 1972, Government Printer, Pretoria, South Africa.

[44] Van Graan AE, Bopape M, Phooko D, Bourne DL, Wright HH (2013) Drink lots of clean, safe water: a food-based dietary guideline for South Africa, South African Journal of Clinical Nutrition, 26 (Supplement): S77-S86.