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Development and implementation of nutrition strategies to improve the application of a food-based dietary guideline for use by crèche caregivers in Thulamela, Limpopo Province, South Africa

PFANANI CHARLOTTE KWINDA

June 2010

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DEVELOPMENT AND IMPLEMENTATION OF NUTRITION STRATEGIES TO IMPROVE THE APPLICATION OF A FOOD- BASED DIETARY GUIDELINE FOR USE BY CRÈCHE CAREGIVERS IN THULAMELA, LIMPOPO PROVINCE, SOUTH AFRICA

by

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Dissertation submitted in partial fulfilment of the requirements for the degree

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Supervisor: Mrs HH Van der Spuy
Co-Supervisor: Dr AT Viljoen

June 2010

This study is dedicated to my beloved family, my husband Fulufhelo Sydney, my daughters Vele and Phuluso, my son Ramudzuli, my brother Dakalo as well as my entire extended family for their love and support throughout, not forgetting my late mother Matodzi Thifhelimbilu Grace and sister Eunice who regretfully did not live to see the accomplishment of this work which in no small way resulted from their gift of inspiration and many years of love shown to me.

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DECLARATION

I, **Pfanani Charlotte Kwinda** hereby declare that the dissertation for a **Master of Consumer Science** degree at the University of Pretoria hereby submitted by me has not previously been submitted for a degree at this university or any other university and that it is my own work in design and execution and that all reference material contained herein has been acknowledged.

PFANANI CHARLOTTE KWINDA

15 June 2010

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ABSTRACT

DEVELOPMENT AND IMPLEMENTATION OF NUTRITION STRATEGIES TO IMPROVE THE APPLICATION OF A FOOD-BASED DIETARY GUIDELINE FOR USE BY CRÈCHE CAREGIVERS IN THULAMELA, LIMPOPO PROVINCE, SOUTH AFRICA

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Degree: Masters in Consumer Science

Many of the world's children, particularly those living in developing countries, subsist on diets that seldom vary and often do not allow for an adequate intake of the complete range of nutrients required for healthy living. Of concern is the absence of regular consumption of fresh vegetables and fruit that provide vitamin A which, if deficient, impairs children's growth and development. In South Africa about 21% of children under the age of six years attend crèche facilities on a daily basis. The nutritional state of meals provided to children at many crèches tends to lack micronutrients, particularly vitamin A. Vitamin A deficiency is the main nutritional problem facing crèche children in South Africa today. Underlying causes are unsatisfactory diets restricted in variety and minimal knowledge of optimal dietary practices, a situation exacerbated by a high incidence of food insecurity. Limpopo is a province seriously affected by vitamin A deficiency.

A South African study, based on a quantitative research paradigm, was undertaken (April-September 2007) in Thulamela municipality with the aim of developing and implementing nutrition strategies to improve crèche children's consumption of vitamin A-rich vegetables and fruit, as advocated by an officially recognised food-based dietary guideline. Through convenience sampling, 100 caregivers from 20 crèches in the study area responded to questionnaires and participated in a game. Ongoing observation continued. Information about the participants, their nutrition knowledge and the meals provided was collected following the triple-A cycle approach (assessment, analysis and action). The research process was structured in three phases.

Phase one involved a situational assessment and analysis that provided baseline information. Limitations contributing to the problem under investigation were identified and data showed that the children's intake of vitamin A from vegetables and fruit at crèches was low. This was found to be due to a lack of knowledge and information about vitamin A, coupled with the unavailability and inaccessibility of food primarily due to non-production and affordability. Food preparation, storage and preservation also posed challenges to caregivers.

Using evidence from documented studies and the findings from phase one, nutrition strategies were developed and implemented in phase two. Caregivers were shown how to increase the availability and use of foods rich in vitamin A and were encouraged to grow, and use, both cultivated and non-cultivated vitamin A-rich vegetables and fruit. Furthermore, the concept of the food-based dietary guideline *"eat plenty of vegetables and fruits everyday*" was introduced to the caregivers and became part of the developed nutrition strategies.

Follow-up data collected in phase three showed substantial advancement in caregivers' knowledge and skills. Access, availability and utilisation of vitamin A-rich vegetables and fruit had improved markedly. Flourishing vegetable gardens, planned menus and well prepared meals were concrete evidence, and vegetables and fruit were more frequently served to children. Implementation of the developed nutrition strategies epitomised the envisaged outcome of this study. Based on the research results, important recommendations are made to enhance the appropriate consumption of vegetables and fruit rich in vitamin A, leading to a reduction in disease and death caused by vitamin A deficiency among children.

KEYWORDS: nutrition strategies, food-based dietary guideline, vitamin A (beta carotene), nutrition knowledge, food production from gardening, dietary diversity and menu planning.

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CHAPTER 1

BACKGROUND AND JUSTIFICATION OF THE STUDY

1.1 INTRODUCTION AND BACKGROUND

This chapter presents the background and justification of the study. It introduces the research problem as well as the important concepts that are used throughout the study.

Nutritional status, especially of children aged five years and younger, is generally accepted as a sound indicator of the overall development and distribution of available resources within a society. Micronutrient deficiencies have been identified as a major health issue in this five year old and younger age group (Palafox, Gamble, Dancheck, Ricks, Briand & Semba, 2003:405; Department of Health, 2002:1; Pietersen, Charlton, Du Toit & Sebeko, 2002:16). It is during this period of rapid growth that deficiency symptoms are most prevalent. Therefore micronutrient intake must increase during this period or else growth failure or deficiency diseases might develop (Mannar, 2000). Vitamin A is one of the most vital micronutrients needed by children in this age group (Hayes & Laudan, 2009:1067). Young children up to the age of five years old depend amongst others on vitamin A to help them grow, develop normally and to stay healthy (Williams, 2002:241; Faber, Venter & Benade 2001:1).

Vitamin A is a major public health concern around the world because it affects the human body's immunity and entire physiology. It has been found to be one of the nutrients that people are most likely to lack in many countries of the world (Faber *et al.*, 2001:1). According to Hayes and Laudan (2009:1067) vitamin A is known to be widely deficient in most of the developing countries. Faber *et al.* (2001:1) further aver that vitamin A deficiency persistently constitutes a severe health problem in developing countries, with a total of 250 million children worldwide being affected by it. The World Health Organization (WHO) has estimated that over three million children manifest the clinical signs of vitamin A deficiency, with the serious risk of blindness and early death (Louw, 2001:3; Department of Health, 2002:1). In the light of these observations there is no doubt that a high prevalence of vitamin A deficiency among children in developing countries poses a serious public health threat (Vorster, Love & Brown, 2001; Department of Health, 2000:3).

Although micronutrient rich foods may be both available and consumed, they are often not eaten in sufficient quantities to prevent deficiencies (FAO, 1997a:55). Balanced diets are not accessible for a large proportion of the world's children, particularly those living in developing countries and subsisting on diets that often lack diversity. These children are, to some degree, affected by vitamin A deficiency (VAD), which in turn impairs their growth and development (Maunder & Meaker, 2007:403; Ruel, 2003:3911s; Kennedy, Nantel & Shetty 2003:8).

The nutritional situation in South Africa is complex as a range of micronutrient deficiencies, particularly vitamin A deficiency, exists. Vitamin A deficiency, which is primarily caused by inadequate diets, lack of access to a variety of foods, lack of knowledge of optimal dietary practices and a high incidence of household food insecurity, is the main nutritional problem facing preschool children in South Africa, especially blacks and coloureds living in rural areas in informal housing and whose mothers are not well educated (ACC/SCN, 2002:4; Faber *et al.,* 2001; Vorster *et al.,* 2001; Ruel & Levin, 2000). The symptoms of vitamin A deficiency, including night blindness, bitot spots, corneal xerosis and keratomalacia (Louw, 2001:4) are found among many South African children.

The National Food Consumption Survey (NFCS) of 1999 which was conducted among one to nine year-old children found that approximately half the children consumed less than 50% of the required amount of vitamin A (Faber, Laurie & Venter, 2006:13). These findings complement the results of the 1994 study completed by the South African Vitamin A Consultative Group (SAVACG) (Labadarios & Van Middelkoop, 1995), in which it was found that one out of three children was deficient or had marginal vitamin A status.

The national prevalence of vitamin A deficiency and vitamin A marginal status was 33% among children from six months to almost six years old, with prevalence highest in Limpopo with 43%. This translates into approximately 600 000 pre-school children being identifiably malnourished and 1-5 million being stunted as a consequence of malnutrition and long-term vitamin A deficiency, a situation particularly typical of South Africa's rural areas (Faber *et al.,* 2006:13; Pietersen *et al.*, 2002:5). The national Department of Health (2002:1), aver that vitamin A deficiency is suspected to be responsible for one in every four child deaths in South Africa. Even though progress has been made in ameliorating this problem, vitamin A deficiency remains a serious public health issue in South Africa. This is substantiated by the 2005 National Food Consumption Survey which found that approximately two in every three children had poor vitamin A status (Labadarios, Steyn, Maunder, MacIntryre, Gericke, Swart, Huskisson, Dannhauser, Vorster, Nesamvuni & Nel, 2005).

Young children are often the key target group for micronutrient programmes. Therefore preschools have been identified by the Department of Health as a means to reach a nutritionally vulnerable group through targeted state-funded nutrition interventions. About 21% of all South African children under the age of six years attend preschool, crèche or day care facilities (Pietersen *et al.*, 2002:16). The younger they are the more dependent they are on adults to give them an adequate micronutrient-rich diet. If children attend facilities that do not provide adequate meals and snacks during the time spent there, their nutritional status may deteriorate over a period of time (Pietersen *et al.*, 2002:16). Therefore the high prevalence of growth faltering and underweight as a result of poor nutrition including vitamin A deficiency, due to inadequate dietary intake in crèche children, and the lack of nutritional knowledge, menu-planning skills and meal preparation practices of crèche caregivers is of great concern (Pietersen *et al.,* 2002:5 &16).

Children's growth may begin to falter when they are about six months old, if they are not given adequate complementary foods. Many children cannot compensate for poor feeding in their early years but are more likely to thrive if given a micronutrient-rich diet from this age (Administrative Committee on Co-ordination/ Standing Committee on Nutrition (ACC/SCN), 1997; ACC/SCN, 1995:45). There is growing awareness that good nutrition is a major determinant of growth, development and long-term health in the healthy and the sick child (Pietersen *et al.*, 2002:6). Therefore a poor diet in early childhood leads to growth failure, delayed motor and mental development, impaired immune-competence and increased risk of complications and death from infections. Good nutrition is thus the cornerstone of primary health care and is considered one of the key developmental priorities in South Africa (Pietersen *et al.*, 2002:15).

The goal for combating vitamin A deficiency is improvement in dietary intake through the modification of eating practices or changing the supply of foods available for consumption (Beaton, Martorell, Aronson, Edmonston, McCabe, Ross & Harvey, 1993:30). The assumption here is that food-based dietary guidelines can be effective in promoting appropriate diets for preschool children. Food-based dietary guidelines will provide practical advice for choosing optimal diets and specify dietary modifications to address vitamin A deficiency among children (Vorster *et al.*, 2001). Maunder and Meaker (2007:401) state that the South African Food-Based Dietary Guidelines promote the consumption of vegetables and fruit in order to counteract the low intake of vegetables and fruit by all South Africans. Therefore giving and encouraging children to eat vegetables and fruit daily is the best overall advice because vegetables and fruit are truly protective against disease.

When planning strategies to overcome barriers in achieving optimal fruit and vegetable intake by children, increasing the eating of fruit and vegetable and maximizing nutrients from vegetables and fruit would be a top priority (Vorster *et al.,* 2001). Dietary guidelines for increased fruit and vegetable consumption would therefore be supported in this study as has been the case in previous studies, such as the work of Love and Sayed (2001). Thus the development and implementation of strategies that will improve the availability, access and utilisation of vitamin A-rich vegetables and fruit will lead to an increase in the consumption of vitamin A-rich foods and play a major role in the lives of children, as it is bound to contribute to a reduction of diseases and deaths that result from vitamin A deficiency (Department of Health, 2004:7).

Louw (2001:4) draws attention to the fact that, although there is an abundance of plant sources rich in pro-vitamin A that are available to most households, children in developing countries still suffer from vitamin A deficiency. The ongoing prevalence of vitamin A deficiency amongst young children, may be caused by a lack of knowledge and apparent inadequate, usually low, intake of vitamin A-rich foods (Faber & Wenhold, 2007:395; Faber *et al.*, 2006:28; Engelberger, Darnton-Hill, Coyne & Fitzgerald, 2003:303; Louw, 2001:4), Therefore there is a genuine need to increase the intake of vitamin A-rich foods by children aged six years and under. Tompson and Manore (2005:596) are of the opinion that children can meet their recommended dietary allowance of vitamin A by consuming five servings of vegetables and fruit each day.

This study therefore aims to develop and recommend the implementation of nutrition strategies that would improve the application of the Food-Based Dietary Guideline (FBDG) *"eat plenty of vegetables and fruits everyday"* by crèche caregivers in order to enhance the consumption of vitamin A-rich vegetables and fruit by pre-school children in the Thulamela municipal area of the Vhembe district in the Limpopo province of South Africa.

1.2 JUSTIFICATION

Children have the right to get the best possible start in life. Yet it has been found that the greater majority of children consume a diet which is deficient in most micronutrients, with specific reference to the required amount of vitamin A (Faber *et al.,* 2001). Since children are the group most strongly affected by malnutrition and food insecurity that further leads to vitamin A deficiency, it was considered important to conduct this research in an area deeply affected by the problem. The prevalence of vitamin A deficiency is high in children younger

than five years and it is one of the major problems experienced in over 75 countries worldwide. Moreover it is thought to contribute to over one million childhood deaths a year and cause blindness in about half a million children (Faber & Wenhold, 2007:395; International Vitamin A Consultative Group (IVACG), 1999; Solomons, 1999:354; Sommer & West, 1996).

Along with other African countries, South Africa is particularly adversely and continually affected by vitamin A deficiency (Faber, Van Jaarsveld & Laubscher 2007:407) and its symptoms are apparent among many South African children (Louw, 2001:4). Vitamin A has a marked effect on the productivity within a country in that children growing up with this problematic start seldom mature as healthy adults. The high rates of vitamin A deficiency, identified at 43% for Limpopo (Faber *et al.,* 2007:407, Faber *et al.,* 2006:13; Pietersen, *et al.,* 2002:5) as the highest in the country, present an enormous challenge to parents and caregivers. It is the prevalence of vitamin A deficiency among children that is prominent all over the country that compelled and inspired the researcher to undertake this study.

Given the national and worldwide situation of vitamin A deficiency, it is considered necessary that adequate consumption of vitamin A-rich foods be provided to children under the age of six years. The essential role of vitamin A in vision and eye health has been recognized as a critical factor in child health and survival. It is also vitally important for supporting the rapid growth and development that occurs during childhood (Faber *et al.,* 2001:11). According to the National Department of Health (2004:27), there is accumulating evidence to support an increased daily intake of vegetables and fruit as a means of protection against vitamin A deficiency. Therefore regular consumption of vitamin A-rich foods such as orange and yellow vegetables and fruit and dark green edible leaves could prevent vitamin A deficiency.

Pietersen *et al.* (2002:23) maintain that the nutritional content of meals given to children at crèches is often inadequate, particularly in terms of micronutrients. As a result these children suffer from micronutrient deficiencies. Children in crèches generally spend eight to nine hours a day there, and this presents an ideal opportunity for ensuring that children receive nutritious food. This is particularly important in view of the fact that many children arrive at crèche without having eaten breakfast, or having consumed an inadequate breakfast. Thus, dietary intake, food security and the nutritional adequacy of meals provided at crèches, as well as the nutritional knowledge and feeding practices of the children's caregivers, need to improve to ensure enhanced consumption of vitamin A-rich foods (Pietersen *et al.,* 2002:5).

Providing information to caregivers on the nutritional value of foods, the components of an adequate diet, making appropriate food choices and purchases from available resources, proper food preparation and handling of food, storage, processing and preservation of food, through designed nutrition plans is one of all the broad strategies that have been identified to improve the nutritional status of everyone (Department of Health, 2002:4). This could be enhanced through application of a food-based dietary guideline *"eat plenty of vegetables and fruits everyday"*.

There are various ways of addressing this problem, such as supplementation and food-based approaches. However, this study uses a food-based approach (through the application of a food-based dietary guideline) as a solution to access, availability and utilisation of vitamin A-rich vegetables and fruit. Food-based strategies are sustainable approaches and they can be used to empower caregivers to ultimately take responsibility for the quality of children's diets through their own production and offering of vitamin A-rich foods after engaging in informed consumption choices (Faber *et al.*, 2006:12).

1.3 RESEARCH PROBLEM

Based on the background information, it is clear that a large percentage of South African children have a lower intake of vitamin A-rich foods, especially from vegetables and fruit, than is desirable, confirming that vitamin A deficiency is one of the main nutritional problems the country still faces (Labadarios *et al.,* 2005; Louw, 2001:4; Moodley & Jacobs, 2000:21). Many young children attend crèches where nutritional aspects are most generally neglected (Pietersen *et al.,* 2002:23). Therefore, it is important to address these associated aspects: nutrition knowledge of caregivers, food accessibility and availability, dietary diversity, food utilisation and appropriate menu planning, through employing the food-based approach by training the caregivers.

1.4 THE OUTLINE OF THE STUDY

This dissertation comprises five chapters as outlined below. Each chapter introduces, expands on and finally recapitulates the salient points made in the chapter.

CHAPTER 2 - LITERATURE REVIEW

This chapter provides a review of the literature related to the topic, theoretical models and other studies that have been conducted to support the aim and objectives of this study. The chapter presents an outline of the research procedure, the theoretical background as well as the conceptual frameworks. The intended area of investigation is identified and the main concepts are introduced.

CHAPTER 3 - RESEARCH METHODOLOGY

In this chapter the research approach and the techniques used to measure the concepts of this study, as well as the sampling process, data collection procedures and methods of analysis used in this study, are addressed. It describes the research design, the operationalisation process in terms of the aim and objectives of the study. The important concepts used are also contextualised.

CHAPTER 4 - PRESENTATION AND DISCUSSION OF THE RESULTS

This chapter presents the results obtained from questionnaires, participation in a game and observation in three phases. The main findings of the study are described and their implications are discussed.

CHAPTER 5 - CONCLUSIONS AND RECOMMENDATIONS

The last chapter presents the conclusion of the research by summarising the main findings of the study. Recommendations for future research are made in this chapter. The study is evaluated in terms of reliability and validity, data collection methods and their usefulness, and the achievement of the objectives. The success of the study and its limitations are dealt with and the benefits the findings bring to the caregivers and the children are appraised.

1.5 SUMMARY

The introductory chapter has outlined the background and justification of this study as well as the research problem and presented the layout of the study as a whole. It is clear from points made in this chapter that vitamin A is important in the lives of children. It has shown that South African children have a low intake of vitamin A-rich foods (particularly vegetables and

fruit) which explains that a vitamin A deficiency is one of the main nutritional problems faced by South African children. In view of this, the chapter indicates that the study will focus on the development and implementation of nutrition strategies which address the main causes of vitamin A deficiency, namely, an inadequate intake of vitamin A precursors, food low in vitamin A precursors and its poor availability, inadequate feeding and inappropriate food preparation, lack of access to a variety of foods, inadequate knowledge of vitamin A deficiency or vitamin A-rich diets and a lack of knowledge of optimal dietary practices.

The problem identified could be addressed through the application of a food-based dietary guideline by crèche caregivers. The significance of this study to both the caregivers and the crèche children and its contribution to the reduction of high rates of vitamin A deficiency within the Limpopo province has been spelt out in this chapter. Additionally the findings of this study should help to improve the dietary intake of preschool children, subsequently optimising their growth and development. This study will proceed by reviewing information as found in the literature and translating research findings on the strategies that can be developed and implemented for the application of a food-based dietary guideline to improve the consumption of vitamin A-rich vegetables and fruit by crèche children. The next chapter presents the literature review on which the conceptual framework of this study is based.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

In this chapter a review of the available literature, various models and other studies that have been conducted to support the application of the food-based dietary guideline *"eat plenty of vegetables and fruits everyday"*, are discussed to provide a general idea of the research focus and area of knowledge that the study intends to explore. Subsequently the theoretical background that facilitated the formulation of a conceptual framework and approach to this study is presented. The main concepts used throughout the study are introduced to direct the thoughts and reasoning on which the research is based. Moreover strategies to enhance nutrition knowledge, dietary diversity as well as access, availability, utilisation and ultimately the consumption of vitamin A-rich vegetables and fruit by 2-5 year old children are advanced.

An adaptation of UNICEF's model portraying vitamin A status (Figure 2.1) is used as a theoretical framework to guide this study. This model focuses more explicitly on children's nutrition and it shows the different causal factors influencing vitamin A deficiency in children. The highlighted parts of the model are highly considered as they relate more specifically to this study.

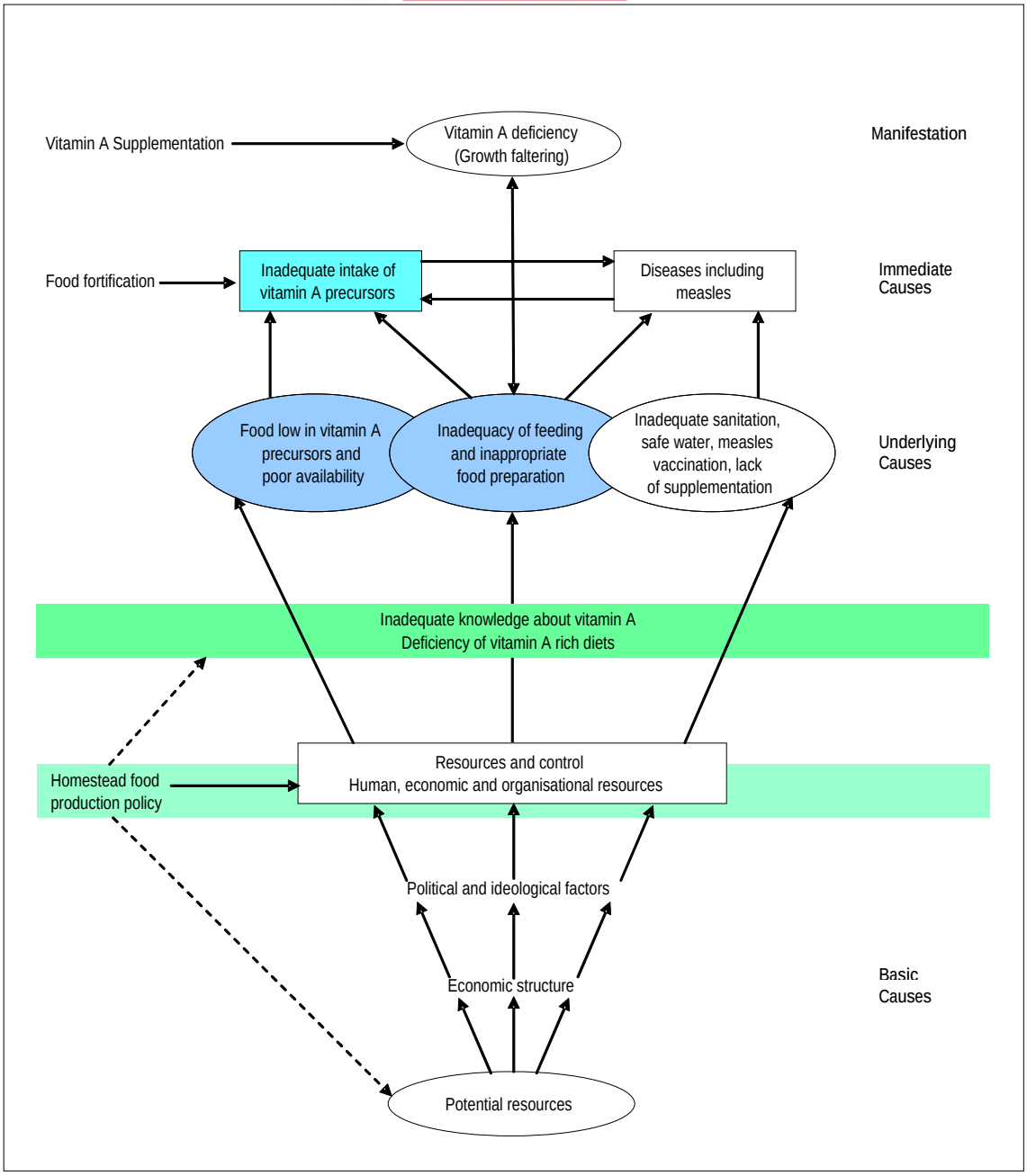


FIGURE 2.1: APPLIED UNICEF MODEL OF CAUSES OF VITAMIN A DEFICIENCY (Van Lieshout, Chopra & Sanders, 2004: 6)

Applying the UNICEF model suggests that adequate dietary intake and security of foods rich in vitamin A precursors, together with appropriate food preparation, year round access and availability as well as adequate knowledge and information about vitamin A-rich diets, will lead to improved consumption of vitamin A-rich foods (and vitamin A status), which in turn will bring about children's good health, sound growth and development.

2.2 VITAMIN A – A NUTRIENT ESSENTIAL FOR HUMAN HEALTH

Vitamins are chemical substances that the body needs in small amounts to help it function properly. Vitamin A is one of the vitamins that the body needs most. It is a fat soluble vitamin and an essential micronutrient for humans because the body cannot produce it (Whitney & Rolfes, 2010: 356; Tompson & Manore, 2005:279). Vitamin A is present in the diet in two forms, namely (i) preformed vitamin A (retinols), which is colourless and found only in foods of animal origin, and (ii) pro-vitamin A carotenoids (mostly beta-carotene), which are yellow and found in foods of plant origin, particularly vegetables and fruit. Carotenoids are the precursors of vitamin A (pro-vitamins) (Hands, 2000).

Although plant foods do not contain vitamin A as such, they do contain precursors or pro-vitamin A, beta-carotene and other carotenoids that the human body can covert to retinol, an active vitamin A form (Faber *et al.*, 2006:28; Louw, 2001). There are approximately 50 known active pro-vitamin A carotenoids, of which beta-carotene makes the largest contribution to vitamin A activity in plant foods (McLaren & Frigg 1997). The six carotenoids that are found most commonly in human blood are: beta-carotene, cryptoxanthin, lutein, lycopene, alpha-carotene and zeaxanthin. Beta-carotene which is an anti-oxidant is the most active one and it is capable of protecting the body against diseases (Faber *et al.*, 2006:28; Rolfes, Pinna, Whitney & Wadsworth, 2006:370; Tompson & Manore, 2005:279; Department of Health, 2002).

The main sources of pro-vitamin A are yellow and orange-fleshed vegetables and fruit, orange roots, dark green leafy vegetables and palm oil (Faber *et al.*, 2006:28; Rolfes *et al.,* 2006:373; Louw, 2001; McLaren & Frigg, 1997). Beta-carotene, as an active precursor, is responsible for the rich yellow/orange pigment of vegetables and fruit such as ripe paw-paw, ripe mango, ripe yellow-peach, butternut, pumpkin, carrot, yellow/orange sweet potato. Carotenoids are plentiful in dark green vegetables such as spinach, broccoli, African nightshade, amaranth, cowpeas, green beans, squash, Chinese cabbage, pumpkin leaves, and sweet potato leaves to mention but a few, are not as visible because the chlorophyll masks the orange colour (Maunder & Meaker, 2007:403; Faber *et al.*, 2006:28; Louw, 2001; McLaren & Frigg, 1997).

Indigenous green leafy vegetables, referred to as *imifino/morogo* or *miroho* in different indigenous South African languages, are also good sources of pro-vitamin A. However, *imifino* is actually a collective term for various dark green leaves that are eaten irrespective of whether the leaves grow wild or come from vegetables such as pumpkin or sweet potato leaves (Jansen Van Rensburg, Van Averbeke, Slabbert, Faber, Van Jaarsveld, Van

Heerden, Wenhold & Oelofse, 2007:317; Maunder & Meaker, 2007: 403). Yelow-fleshed sweet potatoes and carrots are regarded as excellent sources of carotene. The darker the green colour or the more intense the yellow/orange colour of the fruit or vegetable the higher the vitamin A content of that food (Louw, 2001; McLaren & Frigg, 1997).

People get vitamin A from the food they eat. Their body's needs for vitamin A can be met by dietary intake of preformed retinoids or by the consumption of carotenoids (McLaren & Frigg, 1997). In developing countries, most of the vitamin A is ingested from vegetables and fruit. Vegetables and fruit are of the few affordable source of vitamin A in the diet of poor households and it provides 70-90% of total vitamin A intake because of their high content of pro-vitamin A carotenoids (Faber *et al.*, 2006:28; Helen Keller International, 2003a).

The World Health Organization (WHO) (1995), estimates suggest that 80% of the dietary intake of vitamin A in Africa and South East Asia is from pro-vitamin A carotenoids. If people eat more vitamin A than they need, the excess vitamin A is stored in the liver for use later on. Thus poor growth in children is not only the result of energy and protein deficiency, but it is also due to inadequate dietary intake of minerals and vitamins, particularly vitamin A (Steyn & Temple, 2008:379 & 407). As suggested by De Pee, West, Permaesih, Martuti, Muhilal-Karyadi and Hautvast (1998:1058), in populations where vitamin A deficiency is a problem, consumption of vegetables and fruit is recommended because of their content of pro-vitamin A carotenoids. However, De Pee *et al.* (1998:1058) additionally state that yellow/orange vegetables and fruit are more effective than dark green vegetables because they are high in vitamin A precursors. This is further confirmed by Faber *et al.* (2006:120), who illustrate the vitamin A content of vitamin A-rich vegetables in the following table (see Table 2.1).

TABLE 2.1: VITAMIN A CONTENT OF A 100g EDIBLE PORTION OF COOKED VITAMIN A-RICH VEGETABLES (Faber *et al.,* 2006:120)

VEGETABLE	AMOUNT / 100G EDIBLE PORTION VITAMIN A µG RE
Butternut	332
Carrot	2880
Orange-fleshed sweet potatoes	2182
Pumpkin	401
Spinach	342

Thus the study focused on vitamin A that exists as carotene (pro-vitamin A/vitamin A precursor/ beta-carotene) and related pigments, which are found in vegetables and fruit such as carrots, orange-fleshed sweet potatoes, spinach, green beans, mango, peaches, paw-paw, amaranth, jute mallow, cow pea (Beaton *et al*, 1993:11).

2.2.1 Vitamin A – Essential for children

Vitamin A is essential for the health and well-being of an individual particularly the child and it plays many essential roles in the human body. Young children need adequate vitamin A to help them grow and develop normally. It helps to keep the inner and outer surface of the body healthy, so that it is difficult for micro-organisms to enter the body, and it also plays a most important overall function in the body's immune system (Faber *et al.*, 2006:27). Vitamin A's crucial significance in the functioning of the body's immune system as well as for vision and eye health has been recognized as a critical factor in children's health and survival (Rolfes *et al.,* 2006:371; Faber *et al.*, 2001:11). The eyes need vitamin A to function properly, to maintain eye health and it help to see in dim light. Vitamin A plays a major role in destroying free radicals and thus prevents tissue damage during infections. Its deficiency has been found to enhance susceptibility to chemical carcinogenesis and various infections (Faber *et al.*, 2006:27; Rolfes *et al.,* 2006:371).

Vitamin A deficiency occurs when the body's stores of vitamin A have been depleted. However, the major cause of vitamin A deficiency in children under the age of five years is an inadequate dietary intake and lack of pre-formed vitamin A (carotene) in the diet (Faber & Wenhold, 2007:395; Faber *et al.*, 2006:28; Engelberger *et al.*, 2003: 303). Factors such as the size of portions, dietary fat and food preparation methods influence preferences, accessibility and the availability of vitamin A carotenoids in the diet of children, all contribute to vitamin A deficiency (Steyn & Temple, 2008:407; Faber & Wenhold, 2007:395; Bere & Klepp, 2005).

Most children eat less vegetables and fruit than the amount recommended. Therefore promoting the year round availability and adequate consumption of vitamin A/carotene-rich food is fundamental to eradicating the deficiency (Slingerland, Koning, Merx & Nout, 2003:4). The International Conference on Nutrition, the World Summit for Children and the World Health Assembly has prioritised the eradication of vitamin A deficiency since it is now identified as a major public health problem (Cervinskas & Lotfi, 1996; Gillespie & Mason, 1994:4).

2.2.2 The prevalence of vitamin A deficiency in South Africa and other countries

As outlined in chapter 1, the prevalence of vitamin A deficiency is high in children younger than five years and it is one of the major problems in many countries of the world, in fact, in more than 75 countries (Faber & Wenhold, 2007:395). According to Faber *et al.* (2001) and WHO, (1995), millions of children worldwide suffer from vitamin A deficiency and the clinical signs of vitamin A deficiency are a serious risk of blindness and early childhood death. Faber *et al.* (2001) and WHO (1995), further maintain that vitamin A deficiency continues to be a major health problem in developing countries and in many parts of Africa. It is estimated that every year between 250 000 and 500 000 preschool age children go blind as a result of vitamin A deficiency (Department of Health, 2002:1).

As stated by Van Lieshout *et al.* (2004) and Integrated Nutrition Programme (2003), low vitamin A status in children is a problem facing many African countries despite the fact that many families have resources to give their children a balanced diet. Studies done in South Africa on the nutritional status of primary and preschool children (ACC/SCN, 2002) found that 40% of the children were suffering from vitamin A deficiency and between 23.7% and 46% of children were marginally vitamin A deficient. In 2000, the National Food Consumption Survey reported that 21% of children between one and nine years of age were stunted (Department of Health, 2000:3).

South Africa has a major public health problem of vitamin A deficiency, and the provinces most affected are Limpopo, Kwa-Zulu Natal, Mpumalanga, North West and Eastern Cape (Internet: Nicus: 1999:1; Labadarios, Steyn, Maunder, MacIntryre, Gericke, Swart, Huskisson, Dannhauser, Vorster, Nesamvuni & Nel, 1999:936). Rural areas in South Africa are found to be nutritionally more vulnerable and more severely affected than urban areas (Faber *et al.,* 2007:407; Faber *et al.,* 2006:13; Pietersen *et al.*, 2002:16). The SAVACG also found that vitamin A deficiency was present in three per cent of children between six and seventy one months of age, ranging from one per cent in Gauteng to eight per cent in Limpopo (Labadarios & Van Middelkoop, 1995). Figure 2.2, taken from Faber *et al.* (2006:13) illustrates the prevalence of vitamin A deficiency in 6-71 month old children in the various provinces of South Africa. On the basis of these findings the country is identified as having a serious problem regarding vitamin A deficiency, and it is indeed a cause of great concern.

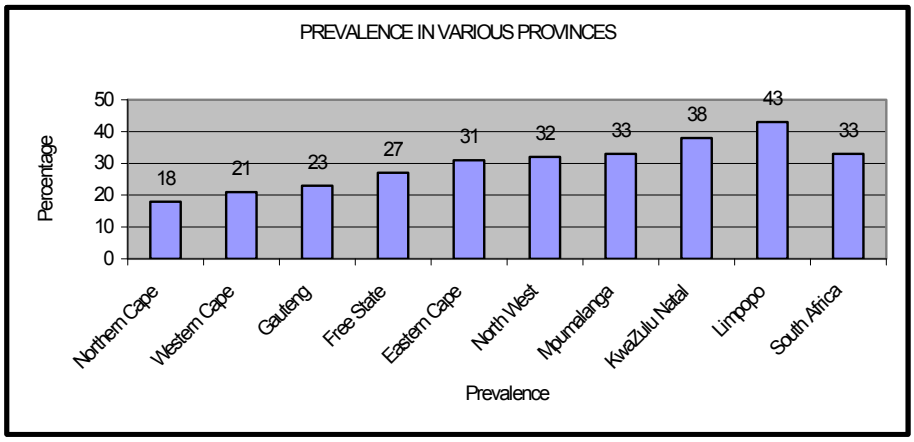


FIGURE 2.2: PREVALENCE OF VITAMIN A DEFICIENCY IN SOUTH AFRICAN 6-71 MONTH OLD CHILDREN [Labadarios *et al.,* 1995 as in Faber *et al.,* (2006:13)]

Limpopo (43%) and KwaZulu Natal (38%) are the provinces most adversely affected by vitamin A deficiency. These provinces are characterised by being more rural than urban. It could therefore be assumed that serious public health problems are more prevalent in rural areas where people depend mostly on locally produced foodstuffs and starchy foods such as maize meal porridges with only a small amount of fruit, vegetables and animal foods rich in vitamin A as part of their eating routine. In the light of this observation, the diet of rural people appears to lack variety and predisposes the children to low micronutrient intakes, particularly vitamin A (Faber *et al.*, 2001).

Vitamin A deficiency is very common amongst young children because they grow quickly and more often than not suffer from infections more readily so their needs are greater (Faber *et al.*, 2006:28). Vitamin A deficiency, as a global health problem, is considered a priority since it has far-reaching consequences on the health and development of children (Faber *et al.*, 2001). The National Food Consumption Survey (NFCS) of 2005 indicated that the prevalence of a poor vitamin A status in children in the country appears to have increased when compared with previous national information (Labadarios *et al.,* 2005).

2.2.3 Causes and consequences of vitamin A deficiency

2.2.3.1 Causes

An inadequate diet is the primary cause of vitamin A deficiency (Van Lieshout *et al.*, 2004:12; Integrated Nutrition Programme, 2003; Louw, 2001: 8). The consumption of animal foods such as meat, milk and eggs that are good sources of vitamin A is low in developing countries because of their high cost and limited availability. Therefore the majority of people rely on plant sources but their consumption is low due to lack of knowledge and seasonal availability (Steyn & Temple, 2008:407).

Sufficient vitamin A-rich foods are simply just not obtainable in some communities, particularly at certain times of the year. Sometimes these foods are difficult to store and preserve and are relatively expensive for many people. For example, mangoes and *miroho* are highly seasonal and not available for consumption unless they are preserved in one way or the other. This results in the usual intake of vitamin A being less than the required amount, as estimated, for young children (Engelberger *et al.*, 2003: 305).

Dark green vegetables are often associated with poverty and hence are often considered low status foods or even foods for animals and may not be eaten regularly. This perception makes the promotion of these foods difficult. For some people there are major obstacles to growing dark green vegetables including lack of water and limited land (Maunder & Meaker, 2007: 403-405; Engelberger *et al.*, 2003: 305) and an excessive amount of time may have to be spent gathering green leafy vegetables from the wild.

The use of a conceptual framework that shows the causes of vitamin A deficiency and how they relate to each other is important in this study for the analysis of the research problem within the process of the triple A cycle, a model suggested by Tontisirin and Gillespie (1999:47) that incorporates the three basic principles of situational assessment, analysis of the problem and action using available resources. The applied UNICEF model (Figure 2.1) explains growth faltering and vitamin A deficiency as the outcome of an interrelated complex of basic, underlying and immediate causes:

- **The basic causes** that lead to vitamin A deficiency include inadequate knowledge about vitamin A-rich diets, potential resources, economic structure, political and ideological factors, resources and control, human, economic and organisational resources (Van Lieshout *et al.*, 2004:12; Integrated Nutrition Programme, 2003).

Likewise these were among the factors identified by Krige and Senekal (1997:17-22) in their study of preschool children of farm workers in the Stellenbosch district as possible contributing factors to the development of micronutrient deficiency diseases.

- **The underlying causes** relate to factors such as the consumption of food low in vitamin A precursors and poor availability, inadequacy of feeding and inappropriate food preparation, inadequate sanitation, unsafe water, limited vaccination, a lack of dietary supplements and diseases such as measles. These causes are influenced by a lack of education and information about vitamin A-rich diets as well as absence of home food production and food policies (Van Lieshout *et al.*, 2004:12).

- **The immediate cause** of vitamin A deficiency is due to insufficient intake and absorption of vitamin A precursors, increased requirements for vitamin A during infections like diarrhoea, measles, respiratory infections and chicken pox which is influenced by inappropriate food preparation, inadequate feeding, food low in vitamin A precursors and poor availability (Van Lieshout *et al.*, 2004:12; Louw, 2001: 8; Integrated Nutrition Programme, 2003). Furthermore, Palafox *et al.* (2003) also maintain that poor growth in children is the result of inadequate dietary intake of vitamins.

2.2.3.2 Consequences

The consequences of vitamin A deficiency in children are poor growth and development, increased risk of infections, increased morbidity and mortality and eye-related problems (Faber *et al.*, 2006:27-28; Faber & Wenhold, 2007:395). It reduces the child's ability to fight infections thereby increasing the number and severity of common childhood infections like measles and diarrhoea, which closely relate to increased mortality among children particularly in developing countries (Allen & Gillespie, 2001). Vitamin A deficiency is also associated with gastrointestinal and respiratory infections and a loss of appetite in children. Their body's resistance and its immunity to infections are decreased (Faber & Wenhold, 2007:395; Faber *et al.*, 2006:11; Engelberger *et al.,* 2003:303; Allen & Gillespie, 2001).

The most widely known vitamin A problems concern the eyes, collectively referred to as xerophthalmia which ranges from the mildest form of night blindness through reversible signs in the eye to ulceration and destruction of the cornea, bitot spots and, in severe cases, keratomalacia. This may eventually result in impaired vision or irreversible blindness (Faber

& Wenhold, 2007:396; Faber *et al.*, 2006:11-13; Engelberger, *et al.*, 2003:303; Mannar, 2000).

A decreased growth rate can be regarded as a reliable marker of vitamin A deficiency and is found most commonly in children under the age of five years (Cervinskas & Lotfi, 1996). Children therefore need adequate vitamin A-rich foods in their diet in order to stay healthy because severe vitamin A deficiency can eventually mar natural growth, weaken resistance to infections, lead to blindness and even increased mortality of children (Engelberger *et al.*, 2003: 303).

2.2.4 Urgency to address vitamin A deficiency

The value of vitamin A in preventing night-blindness, promoting growth and a healthy skin, helping the body to fight against infections and a reduction in child mortality, will be supported in this study. Evidence from the literature (Internet: Rubaihayo; Faber *et al.*, 2001:11) endorses this view as well as noting that it is important to address the causes of vitamin A deficiency through appropriate actions. Mannar (2000), in particular, draws attention to the fact that vitamin A deficiency is the most preventable cause of blindness worldwide. A secure vitamin A-rich food supply is necessary but it does not by itself mean that children would be well-nourished; it also requires a basic knowledge of what constitutes a nutritious diet and how caregivers could best meet the vitamin A needs from available resources.

Knowledge regarding appropriate food preparation practices is important to ensure that food is handled and cooked in a manner that would prevent nutrient losses (Krige & Senekal, 1997:22). Caregivers need sufficient knowledge and skills to grow or purchase, prepare, and feed children a variety of foods in the right quantities and combinations (Department of Health, 2004:4; Krige & Senekal, 1997:22).

A solution to vitamin A deficiency is dependent on food availability, access to food and appropriate utilisation of vitamin A-rich food (Faber *et al.,* 2006:17). It is necessary for strategies to improve access, availability and consumption of vitamin A-rich foods to be developed and implemented by the children's caregivers. Both Maunder and Meaker (2007: 402) and Howsen, Kennedy and Horwitz (1998:21) suggest that food-based strategies are ideal long-term goals which caregivers should apply for the provision and assurance of access to a nutritionally adequate diet that would be achieved through the availability of a wide range of food products, wise food selection, proper preparation and adequate

consumption. Furthermore, to Faber *et al.* (2006:18), food-based strategies are appealing because they can address multiple nutrients simultaneously, they are also flexible and allow for modifications to be made where needed through the process of assessment, analysis and action, commonly known as the triple A cycle (Steyn & Temple, 2008:838; Department of Health, 2004:1;) illustrated in Figure 2.3.

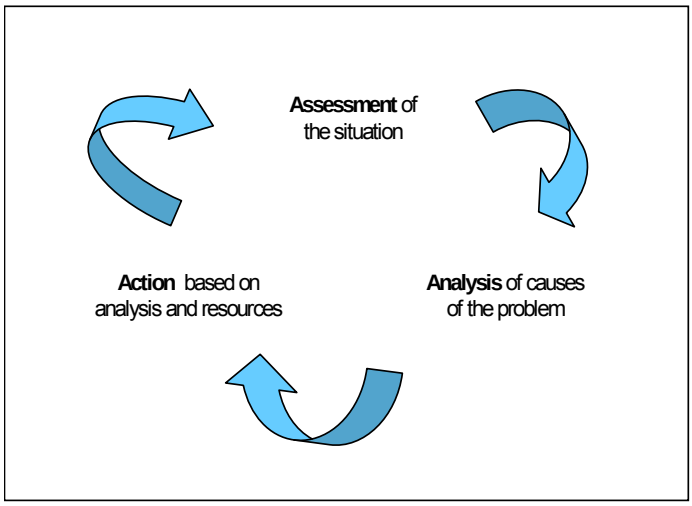


FIGURE 2.3: THE TRIPLE A CYCLE (Department of Health, 2004:1; Tontisirin & Gillespie 1999:47)

The triple A cycle can be applied in assessing and analysing the causes of vitamin A deficiency amongst children as well as in developing and implementing the nutrition strategies aimed to improve the situation. It is a process that consists of three consecutive steps in a problem-solving cycle of assessing the problem, analysing the causes and initiating action to eradicate the problem. The triple A cycle is an interactive, reiterative process that repeats the cycle of reassessment, reanalysis and reaction leading to expected modifications and improvements in the approach used (Steyn & Temple, 2008:838). This method works best when people themselves are involved and engaged from the start and they assist in identifying the problem, discuss and select their own solutions. The primary role of the agent (the researcher) is to facilitate and guide the process (Steyn & Temple, 2008:838). The triple A cycle provides guidance in strengthening or facilitating the problem-solving process (Tontisirin & Gillespie, 1999:47).

Faber *et al.* (2006:26) recommend that assessment of the situation should be done before and after the intervention in order to measure the change that might have taken place in the life of the target population.

It is important to take into consideration the availability of resources such as irrigation water, land, seeds, plant materials, skills and knowledge, as well as to understand the constraints under which the proposal was implemented, in order to adapt the nutrition strategies appropriately (Faber *et al.*, 2006:15, 16 & 26). The developed nutrition strategies should build on what already exists. This would help to enhance sustainability and cost effectiveness (ibid.).

In order to accomplish these goals, Stadler and Teaster (2002) feel it is important for caregivers to make wise food choices for the children and to give them at least one vitamin A-rich food daily. This can be done by applying the South African Food-based Dietary Guidelines, particularly *"eat plenty of vegetables and fruits everyday"* as it expresses dietary goals in terms of foods rather than nutrients.

2.3 FOOD-BASED DIETARY GUIDELINES

The massive global burden of diet-related diseases and the growing perception that nutrient-based dietary guidelines are not effective in promoting appropriate diets and healthy lifestyles (Maunder & Meaker, 2007:401; Department of Health, 2004:7; Vorster *et al.,* 2001:2) have motivated a number of countries and regions to develop food-based dietary guidelines. The national Department of Health has adopted the official food-based dietary guidelines for healthy South Africans which are based on the consumption of existing locally available foods and aims to address identified nutrition related public health problems (Department of Health, 2004:7).

Food-based dietary guidelines also aim to address the nutritional transition resulting from acculturation experienced by many South Africans. As a result of migration and urbanisation people abandon indigenous vegetables and rely on cultivated vegetables, the consequences of which has been a double burden of over- and under-nutrition occurring within households. South African food-based dietary guidelines are used as consistent communication tools as they represent expert agreement on how diet-related issues should be addressed by dietary recommendations to consumers. They can also be used as the basis for the planning, implementation and evaluation of public health nutrition strategies (Vorster *et al.,* 2001:2). However, the guidelines should be positive, practical, affordable, sustainable and culturally sensitive to help South Africans choose an adequate diet.

These guidelines can be used as an effective nutrition education tool for promoting the importance of nutrition, to combat diseases as well as nutritional disorders associated with poverty and under-nutrition. Food-based dietary guidelines form the core of nutrition education messages with a view to promoting a healthy lifestyle among all South Africans. These messages should be communicated to caregivers so that they make informed dietary choices regarding children's meals (Department of Health, 2004:7).

The food-based dietary guidelines cannot be used as stand-alone statements; they require an educational programme in order to achieve their aims. It is therefore recommended that the guidelines could and should be used in integrated nutrition programmes as the basis of nutrition education in South Africa. These should be based on locally consumed foods and should address existing nutrient deficiency and the resulting nutrient-related health problems (Maunder & Meaker, 2007:401; Vorster *et al.*, 2001:2). Application of these guidelines will have a major impact on the prevention of diseases and lower the death rate among children that results from malnutrition (Vorster *et al.*, 2001:2). Nutrition education would therefore focus on food rather than on nutrients (Maunder & Meaker, 2007:401). In total, eleven guidelines were formulated (Vorster *et al.*, 2001:2) for South Africans as follows:

1. ENJOY A VARIETY OF FOODS
2. BE ACTIVE (REGULAR EXERCISE)
3. MAKE STARCHY FOODS THE BASIS OF MOST MEALS
4. EAT PLENTY OF VEGETABLES AND FRUITS EVERYDAY
5. EAT DRY BEANS, PEAS, LENTILS, AND SOYA OFTEN
6. PROTEIN FOODS SUCH AS MEAT, FISH, EGGS, MILK, OR CHICKEN CAN BE EATEN DAILY.
7. EAT FATS SPARINGLY.
8. USE SALT SPARINGLY
9. EAT LESS SUGAR AND SWEET FOODS
10. DRINK LOTS OF CLEAN SAFE WATER
11. IF YOU DRINK ALCOHOL, DRINK SENSIBLY

The dietary guideline of particular interest in this study is *"eat plenty of vegetables and fruits everyday*". The scientific rationale for this guideline includes the importance of an adequate micronutrient intake and the observed inverse relationship which has been shown to exist between high dietary variety and vegetable and fruit consumption and mortality (Maunder & Meaker, 2007:401). The guideline *"eat plenty of vegetables and fruits everyday*" would therefore be encouraged and supported in this study, a proposal confirmed in the work of Vorster *et al.* (2001:2).

2.3.1 A food-based dietary guideline for increased fruit and vegetable consumption

The food-based dietary guideline *"eat plenty of vegetables and fruits everyday*" means that individuals should eat at least five portions of vegetables and fruit every day and this would apply to children too (Vorster *et al.,* 2001:2). The consequence of such a habit should increase their intake of vitamin A-rich foods. Considering that eating patterns tend to continue into adulthood, it is important to aim vegetables and fruit promotion interventions at children through their social environment, specifically through their parents or caregivers (Reinaerts, De Nooijer, Candel and De Vries, 2007:248). To provide more vegetables and fruit in the diet of children, caregivers could double the normal servings of vegetables by adding extra vegetables to salads, soups, stir-fries, stews and curries or by adding vegetables to other dishes such as eggs, fish, meat and chicken (Faber & Van Jaarsveld, 2007).

Love and Sayed (2001) state that the dietary guideline for increased vegetables and fruit consumption should be promoted because vegetables and fruit consumption can meet the vitamin A requirements of children as well as other dietary guidelines. According to Bere and Klepp (2005), most children eat fewer vegetables and fruit than is recommended. In their studies Reinaerts *et al.* (2007:248) revealed that it is recommended that children should eat at least 150 g of vegetables and two portions of fruit everyday but unfortunately they only eat an average of 71 g of vegetables and less than even one portion of fruit a day.

Vegetables and fruit are foods that must be eaten on a daily basis because they contain nutrients that are good for health. They play a role in health promotion and disease prevention. Unfortunately most South Africans do not eat enough vegetables and fruit and therefore do not get all the vitamins and minerals they need (Vorster *et al.,* 2001:2). There is accumulating evidence to support the increased daily consumption of vegetables and fruit as a means of protection against diseases. Therefore promoting an increased intake is still the best overall advice (Maunder & Meaker, 2007:401; Department of Health, 2004:27).

Caregivers should guide children to the habit of eating fruit when they are hungry between meals in order to promote vitamin A consumption (Department of Health, 2004:27). However, it is important to note that accessibility, availability and preferences were shown to strongly correlate favourably with fruit and vegetable intake in two cross-sectional studies (Reinaerts *et al.*, 2007:248-249; Bere & Klepp, 2005). To increase fruit and vegetable intake and to maximise their nutrient retention and absorption should be a high priority when planning strategies to overcome the barriers of achieving optimal nutrient intake (Vorster *et al.,* 2001:2).

Furthermore, interventions that aim to increase fruit and vegetable consumption should include strategies that make these foods more preferred, available and accessible to children and to ensure that children are exposed to them (Reinaerts *et al.*, 2007:248-249). This could include proper storage and preservation of vegetables and fruit when in abundance, for use in times of scarcity.

Even though application of this guideline is a necessity, the difficulty comes in when trying to achieve consumer behaviour change. It is easy to recommend plenty of vegetables and fruit everyday but the challenge lies in showing the caregivers how this can be realistically achieved given their specific constraints (Love & Sayed, 2001). South Africans should be encouraged to explore and enjoy the variety of vegetables and fruit that is available in this country. However, even though there is a plentiful supply of vegetables and fruit, the majority of South Africans do not get the recommended daily intake of five portions (400 g) of vegetables and fruit (Maunder & Meaker, 2007:401; Love & Sayed, 2001). Such a low intake further exacerbates the inadequacy of existing dietary patterns of most South Africans. This can sometimes be due to barriers such as unavailability due to seasonal fluctuation, taste preferences and affordability.

Maunder and Meaker (2007:402), suggest that indigenous vegetables should be promoted, particularly as a culturally appropriate and affordable alternative to fruit. They further maintain that exclusive promotion of exotic vegetables and fruit should be guarded against as it could result in indigenous plants and their produce being regarded as inferior, although many are nutritionally superior. An important contribution to *"eat plenty of vegetables and fruits everyday*'' could be made by constant use of edible plants including indigenous crops in the diet. Promoting and increasing the consumption of indigenous vegetables could contribute to more people being able to meet this dietary guideline (Maunder & Meaker, 2007:405).

Lack of access to a variety of foods, lack of knowledge of optimal dietary practices and the high incidence of household food insecurity can lead to micronutrient deficiencies particularly vitamin A deficiency (Labadarios *et al.*, 1999; Dannhauser, Joubert & Nel, 1996:14). In such circumstances intervention programmes should either increase the availability of vitamin A-rich foods or consumption of currently available and appropriate foods (Ruel & Levin, 2000; Cervinskas & Lotfi, 1996; Gillespie & Mason, 1994).

2.4 STRATEGIES TO IMPROVE THE APPLICATION OF A FOOD-BASED DIETARY GUIDELINE

Improving the consumption of vitamin A-rich foods, assumes that such foods are accessible and available or could be available but are not being consumed in adequate amounts by vulnerable groups (Cervinskas & Lotfi, 1996). This entails the need for effective nutritional strategies. To capitalise on vitamin A's benefits for protecting children against blindness and other related diseases, its ability to strengthen resistance to infection and reduce the rate of child mortality, nutrition strategies that would improve *access* to and *availability* of vitamin A-rich foods could be very effective, if applied in a comprehensive way (Gillespie & Mason, 1994:21).

In order to combat vitamin A deficiency, a combination of strategies is needed to improve the application of a food-based dietary guideline to enhance the consumption of vitamin A-rich foods (Cervinskas & Lotfi, 1996). These include: access and availability; dietary diversity; utilisation of vitamin A-rich foods; and nutrition education. Strategies should aim to persuade children to eat these foods more frequently by adding fruit and vegetable dishes to their meals and by giving them pro-vitamin A-rich snacks every day (Cervinskas & Lotfi, 1996; Internet: FAO, 1997a).

2.4.1 Food rich in vitamin A access and availability

Eating foods low in vitamin A precursors and their poor availability are the main causes of vitamin A deficiency (Van Lieshout *et al.*, 2004; Integrated Nutrition Programme, 2003; Louw, 2001:8). Food availability is based on the availability at national level as determined by local food production, exports and imports. This is a national indicator, while local conditions and seasonal variations must be taken into account (FAO, 1990). To Faber *et al.* (2006:17), for food to be accessible it should be available.

Nutritional well-being requires access to food to meet dietary needs throughout the year. To ensure access and availability of vitamin A-rich foods, food-based strategies, also referred to as dietary modifications, should aim at increasing:

- the production, availability of and access to these foods;
- the consumption of food rich in this micronutrient; or

- the broad availability of vitamin A in the diet through dietary diversity, proper food storage and preservation (IVACG, 1999; Huffman & Martin 1994:138; Beaton *et al.*, 1993:20).

To deal with access, poor availability and inappropriate utilisation of vegetables and fruit rich in vitamin A, many direct and indirect strategies can be implemented, such as fortification, supplementation, nutrition education, gardening and gathering (IVACG, 1999). Of these, nutrition education and gardening seem to improve the vitamin A situation best by increasing the broad availability of vitamin A in the diet (IVACG, 1999; Huffman & Martin, 1994:138; Beaton *et al.*, 1993:20).

It should be emphasised in food-based strategies that promoting year round availability and adequate consumption of vitamin A/carotene-rich food is fundamental to eradicating vitamin A deficiency. Most commonly this could be achieved through home gardening, food gathering, food preservation, nutrition education (teaching and training) and appropriate utilisation of these foods (Cervinskas & Lotfi, 1996; ACC/SCN, 1995:4). According to Faber and Wenhold (2007:297), food availability can be increased through mixed cropping and crops diversification, the introduction of new crops, the promotion of unexploited traditional food crops and home gardens. Therefore strategies that aim to increase access and availability and the consumption of currently available vitamin A-rich foods would be encouraged in this study.

2.4.1.1 Homestead food production (gardening)

Fundamental strategies to address micronutrient deficiency in resource-poor communities focus on improving the availability of, access to, and ultimately consumption of foods that are rich sources of micronutrients. Potentially this could be achieved through food production at household level. Home gardening has proven to be the most popular food-based strategy for the control of vitamin A deficiency (Ruel & Levin, 2000). Faber *et al.* (2006:14) posit that local production of vegetables and fruit may potentially provide households with direct access to foods that are rich in pro- vitamin A carotenoids.

Food production includes home gardening which proved to be an effective approach to ensuring household food security in terms of quantity and dietary quality in that the production of vegetables and fruit in the garden contributes significantly to increased consumption of those types of foods throughout the year, especially during lean seasons (Helen Keller International, 2003a; Ruel & Levin, 2000). Ruel and Levin (2000) note that

strategies to increase the cultivation of vitamin A-rich vegetables and fruit should involve an agricultural programme to promote the production of vegetables and fruit and emphasise that homestead food production is a long-term food-based strategy for combating micronutrient deficiencies, particularly vitamin A deficiency.

In developing countries, home gardens are usually established to increase household production of vegetables and fruit to supplement the cereal-based diet of rural households. They usually focus on crops that are rich in vitamin A because such crops have the potential to alleviate vitamin A deficiency and have been shown to improve vitamin A status (Faber & Wenhold, 2007:297). In many countries, vegetable gardens and various food preservation and preparation methods to enhance the vitamin content of diets have been advocated as a means of improving vitamin A consumption (Cervinskas & Lotfi, 1996). What is encouraging is that the findings of an investigation into the potential of plant sources to control vitamin A deficiency estimated that only a small plot is needed to cultivate and grow enough vegetables to meet the daily requirements (Engelberger *et al.*, 2003:311).

In contrast to other interventions such as food parcels and feeding schemes, home gardening as an intervention strategy with a strong education and communication component, showed a higher consumption of dark green leafy vegetables by infants and very young children (Smitasiri & Dhanamitta, 1999; English & Badcock, 1998). Studies conducted in various countries such as Kenya, Bangladesh, Uganda, Zimbabwe, Tanzania and Ethiopia indicated that home gardening, coupled with nutrition education, increased the overall consumption of vitamin A-rich food as well as knowledge of vitamin A, child feeding practices and the prevention of night blindness (Internet: Rubaihayo; Smitasiri & Dhanamitta, 1999; English & Badcock, 1998). Several home gardening intervention studies, with a strong nutrition education and behaviour change component, have reported an increase in the consumption of fruit and vegetable by those who participated in such projects (Faber *et al.,* 2006:15; Smitasiri & Dhanamitta, 1999).

Home gardens are positively associated with a decreased risk of vitamin A deficiency, better growth for preschool children and a reduction in the severity of acute respiratory infections (Faber *et al.,* 2006:15; Smitasiri & Dhanamitta, 1999; English & Badcock, 1998; Gillespie & Mason, 1994). This form of activity increases dietary diversity and is specifically important in overcoming seasonal scarcity of certain foodstuffs (Helen Keller International, 2003a). Evidence from these studies clearly indicates that home gardening is both an effective and feasible means for increasing pro-vitamin A intake.

Sufficient vitamin A foods are simply not available particularly at certain times of the year (Cervinskas & Lotfi, 1996). In these situations caregivers should rely on increasing availability through gardening. Production of yellow and dark green leafy vegetables at crèches may provide direct access and increased year round availability of pro-vitamin A-rich foods. If linked to nutrition education it could lead to significant improvement in the vitamin A status of young children (Faber *et al.,* 2006:24-26; Faber *et al.,* 2001; Smitasiri & Dhanamitta, 1999; English & Badcock, 1998).

It is posited that crèche-based gardening projects could reduce malnutrition through teaching caregivers how to establish and maintain gardens and introducing them to food preparation and storage techniques, together with providing nutrition information and encouraging the adoption of more healthy dietary habits (Faber *et al.*, 2006:24-26; Faber *et al.,* 2001).

Faber *et al.* (2007:407) offer the suggestion that crop production should also aim to increase the use of under-exploited natural resources such as indigenous food crops. Promoting the production of indigenous vegetables in home gardens to increase availability in local markets would be advantageous as often these vegetables are relatively drought tolerant and could even be produced in soils of limited fertility (Faber *et al.*, 2007:411). Production and use of these vegetables is therefore encouraged because they are harvested mainly in early spring when conventional crops are less abundant, and this can alleviate nutritional deficiencies during the off-season periods (Maunder & Meaker, 2007:403).

Thus an important contribution to *"eat plenty of vegetables and fruits everyday"* could be made by including indigenous crops in the diet (Maunder & Meaker, 2007:405) and more people would be able to meet this dietary guideline. The gathering of indigenous vegetables is therefore an aspect that will be considered in this study.

2.4.1.2 Food gathering giving access to indigenous vegetables

Throughout history, indigenous vegetables (also referred to as traditional or edible wild plants) have sustained human populations (Nebel, Pieroni & Heinrich, 2006:333; Grivetti & Ogle, 2000:41). Local food, as part of local traditions, is prepared from ingredients that are gathered, grown, or produced locally and the prepared dishes are often presented as local specialties. Vegetables and salads comprising wild greens are often important local dishes (Nebel *et al.,* 2006:333). Indigenous vegetables were widely consumed in the past and several scholars are of the opinion that, in these times, there appeared to have been fewer nutritional deficiencies than is currently the case, implying that these vegetables provide essential nutrients (Maunder & Meaker, 2007:404; Grivetti & Ogle, 2000:41).

In view of the current increase in problem diseases such as vitamin A deficiency, a situation worsened by the harsh economic environment, it is imperative that the conservation as well as promotion of these nutritionally valuable vegetables be awarded top priority status (Grivetti & Ogle, 2000:41; Nebel *et al.,* 2006:340; Chweya & Eyzaquirre, 1999).

A fair generalisation is that the consumption of indigenous vegetables is much higher among poor households. Most traditional poor rural societies rely heavily on indigenous plants to provide them with important micronutrients to fulfil their daily requirements throughout the year, especially vitamin A and iron (Grivetti & Ogle, 2000:31-32, 39-41; Weinberger & Swai, 2006:87). Indigenous vegetables make an important contribution to the diet of such people when there is appropriate food shortage. These vegetables have been credited as a major source of various micronutrients in the diet of the rural poor where cultivated vegetables are not accessible. Consequently there is a growing appreciation of indigenous vegetables partly because of the increasing awareness of their nutritive value (Internet: Rubaihayo).

(i) Indigenous vegetables

Traditional or African indigenous vegetables are those categories of plants whose leaves, fruits, stems or roots are acceptable and used habitually as vegetables by rural and urban communities through custom (Jansen Van Rensburg *et al.,* 2007:317). In South Africa more than a hundred different species of plants were and are still used as leafy vegetables. African people refer to these plants species collectively, using the term *morogo* (Sotho, Sepedi), *imifino* (isiXhosa, isiZulu) or *miroho* (Tshivenda) which means leafy vegetables. What exactly constitutes *miroho* is subject to spatial and temporal variability. The plant species that are included depend on the local ecology and culinary traditions (Jansen Van Rensburg *et al.,* 2007:317).

Indigenous leafy vegetables may be either genuinely native to a particular region or introduced to that region through the natural process of farming (Jansen Van Rensburg *et al.,* 2007:317). Therefore a leafy vegetable species is called indigenous in a particular region when it was externally derived but has since been incorporated into the local food culture. Traditional vegetables in South Africa include amaranth, jute mallow, cowpeas, black jack, okra, African nightshade, water dropwort, sweet potato leaves, pumpkin leaves, bitter berries, to mention but a few. Their role in food security and in the alleviation of malnutrition cannot be overemphasised (Internet: Machakaire, Turner & Chivenge; Internet: Chweya). African people obtain leafy vegetables in different ways. They may be harvested from the wild or from fallow and cultivated fields or they may be cultivated plant species that are used as leafy vegetables (Jansen Van Rensburg *et al.,* 2007:318).

(ii) Gathering indigenous vegetables

Food gathering involves the utilisation of the resources from the environment just as they exist, without any attempt to improve or increase the available supply. It also includes the use of readily available (traditional/wild) vegetables and fruit that grow naturally in certain areas (Maunder & Meaker, 2007; McIntosh 1995:17). In South Africa the use of leafy vegetables is as old as modern human history. The Bantu-speaking tribes in South Africa gathered leafy vegetables from the wild. Collecting and cultivating green leafy vegetables continues to be widespread among African people in South Africa, even though Western influences have considerably modified their food consumption patterns (Jansen Van Rensburg *et al.,* 2007:317). Most of these vegetables are gathered while in season or are grown in home gardens and consumed regularly by millions of people. They are abundant in the rainy seasons but scarce during the dry periods except for a few grown mainly for selling in traditional centres and urban markets. (Internet: Rubaihayo; Faber *et al.,* 2007:407; Grivetti & Ogle, 2000:39).

The habit of collecting and cooking non-cultivated indigenous plants is still practised among the older generation. However, it seems only a question of time before this traditional knowledge is lost forever (Nebel *et al.*, 2006:341). To Grivetti and Ogle (2000:31), globally there is a decline in the knowledge of indigenous plants. Traditional knowledge regarding food use is no longer actively accepted by the younger generation and is subject to many outside influences and changes such as familiarity, exposure and acceptability. The fact that indigenous foods are especially appreciated among the elderly people can be ascribed to many factors such as the perceived health value, taste appreciation as well as sense of local/cultural identity (Nebel *et al.,* 2006:341). Reliance on such indigenous species is critical, especially during months preceding the harvesting of domesticated field crops (Grivetti & Ogle, 2000:41). Although the majority of indigenous plants occur naturally in an area, some of these vegetables are domesticated while others still grow wild and are harvested as wild or semi-wild plants.

(iii) Domestication of indigenous vegetables

Domesticated indigenous plants are grown in small plots adjacent to human settlements, an age-old survival strategy. These vegetables demand minimal attention in their production (Internet: Machakaire, Turner & Chivenge; Internet: Chweya; Faber & Wenhold, 2007:397). African leafy vegetables are easy to cultivate, they are relatively tolerant to harsh environments and generally require simpler technologies and inputs to grow (Maunder & Meaker, 2007:403). They grow quickly, provide good groundcover and they can be

harvested within a short period of time. These plants are often cultivated without fertilizers or pesticides and they can grow on soils of limited fertility (Maunder & Meaker, 2007:403). These wild species might continue to provide important micronutrient needs during droughts or regular dry seasons. It is therefore important that people have the appropriate knowledge of the use of indigenous plants (Grivetti & Ogle, 2000:31-32). Deliberate cultivation and consumption of these vegetables should be encouraged. Efforts should therefore be made to encourage the general population to cultivate and consume these species (Internet: Rubaihayo).

(iv) Reintroducing the consumption of indigenous vegetables

According to Weinberger and Swai (2006:98) food-based approaches to nutrition that focus on food that is available to society have certain advantages in that they are more sustainable and are an ideal long-term goal for society. As humans became more focused on domesticated cultivars, and paid less attention to wild species, the collective skill needed to identify and prepare wild foods has declined. As a result the consumption of wild plants that offered important flavours and supplied essential nutrients to the diet have declined in popularity (Grivetti & Ogle, 2000:31; Weinberger & Swai, 2006:87).

Lack of popularity and unavailability may be considered as possible reasons for the low consumption of indigenous vegetables (Faber *et al.,* 2007:411). Additionally there is an observed lower level of knowledge and esteem regarding traditional plants among younger people. Therefore the importance of educating the younger generation about traditional vegetables cannot be overlooked as they have little knowledge of wild green leafy vegetables (Faber & Wenhold, 2007:397; Maunder & Meaker, 2007:403).

Promoting dark green leaves as a vegetable may be difficult as there is a possibility that traditional plant food crops may be regarded as inferior to what is common practice today (Faber *et al.,* 2007:411). Nevertheless, based on several factors such as nutrient content, accessibility, affordability, acceptance and current use, it has been suggested that the use of indigenous crops in South Africans' diet should increase (Modi, Modi & Hendriks, 2006; Nesamvuni, Steyn & Potgieter, 2001). The consumption of cooked green leafy vegetables has been shown to have a beneficial effect on improving the vitamin A status of children (Faber *et al.,* 2007:411). Thus health educators should promote their consumption in order to increase micronutrients intake (Maunder & Meaker, 2007:403).

African indigenous vegetables and other nutrient-rich local foods can therefore be used as a strategy to overcome malnutrition such as vitamin A deficiency as these plants are nutritionally higher in vitamins and minerals than many exotic vegetables (Internet: Rubaihayo).

(v) Nutritional benefits of indigenous vegetables

Indigenous vegetables are regarded as richer sources of micronutrients and they have high carotene content. They add taste, increase palatability and complement the nutritional value of basic staple foods (Maunder & Meaker, 2007:403; Weinberger & Msuya, 2004). The consumption of indigenous plants is highly relevant for health as they often contain higher amounts of bioactive compounds than plants that have been under cultivation for many generations (Maunder & Meaker, 2007:403). Amaranth (*vowa*) and Nightshade (*muxe*) compared to others have been found to have the highest Beta-carotene content of up to 7.54 mg per 100 g of the edible portion (Maunder & Meaker, 2007:403; Weinberger & Msuya, 2004). Amaranth vegetables are highly nutritious (Mnkeni, Masika & Maphaha, 2007), but in many parts of South Africa they are hardly utilised as food. However, bitter greens are particularly perceived as being healthier (Nebel *et al.*, 2006:340).

There is the possibility of improving micronutrient intake by increasing the consumption of indigenous crops (Maunder & Meaker, 2007:405). Grivetti and Ogle (2000:39) aver that pre-school children who ate more indigenous food had a more diverse diet with a higher intake of vitamin A and other micronutrients such as vitamin C and iron. Caregivers should be informed about the nutritional benefits of indigenous vegetables and recognize the importance of improving vitamin A status of children through dietary diversity and ensuring an increased supply of vitamin A-rich indigenous vegetables (Faber *et al.*, 2001:15).

2.4.2 Dietary diversity

Dietary diversity refers to a number of different foods or food groups consumed over a given referenced period (Ruel, 2003:3911s). It has long been recognised by nutritionists as a key element of high quality diets. Increasing the variety of foods across and within food groups is recommended in most dietary guidelines internationally, because it is thought to ensure adequate intake of essential nutrients and to promote good health (Ruel, 2003:3911s). Dietary guidelines recommend dietary diversity in that in addition to including the recommended level of energy and nutrients, a healthy high quality diet should also contain many servings of vegetables and fruit (Ruel, 2003:3917s).

Lack of diversity in the diet is a particularly severe problem among the poorer populations living within the developing world and South Africa is no exception, because their diets, are predominantly based on starchy staples and often include little or no animal products and few fruit and vegetable servings (Maunder & Meaker, 2007:403; Ruel, 2003:3911s).

Studies that addressed the association between dietary diversity and household food security indicated that, as households diversify their diets, they tend to increase their consumption of prestigious, non-staple foods rather than increasing variety within the category of staple foods (Ruel, 2003:3917s). Based on the consistent association between dietary diversity, food consumption and food availability, dietary diversity holds promise as a means of ensuring food security, especially where resources are limited. Limited dietary diversity has been consistently associated with poor child nutritional status and growth in developing countries, reinforcing the contention that, at household level dietary diversity and food security are closely linked and that dietary diversity is strongly associated with individual nutrients adequacy and child nutritional status and growth (Ruel, 2003:3917s).

There is a concern that approaches to reduce the prevalence of micronutrient deficiency would not be sustainable and their impact would not be broad enough unless supported by food-based approaches that aim at dietary diversity (Weiberger & Swai, 2006:88). Hence diets that are high in variety of nutrient dense foods play an important role in improving nutritional status and reduce the risk of health problems (Chulahn, Engelhard & Young, 2006:418). As stated by Faber and Van Jaarsveld (2007), dietary diversity is a long-term strategy to address vitamin A deficiency. Pro-vitamin A carotenoids from food of plant origin are more affordable than preformed vitamin A from animal foods.

Many resource-poor households rely on yellow/orange fleshed vegetables and fruit and dark green leafy vegetables as their main source of vitamin A. Dietary diversity that increases vitamin A intake will often improve the status of other micronutrients. Diversity in the diet can also be achieved by other means such as social marketing and the promotion of home production (Faber & Van Jaarsveld, 2007).

If dietary sources of vitamin A are not readily available to those at risk of deficiency, intervention activities should aim at improving availability. Efforts may be needed to improve the production processing, preservation, pricing and marketing of such foods (Faber & Van Jaarsveld, 2007). Faber and Wenhold (2007:397) have the view that dietary diversity includes a variety of approaches that combine to increase the production of vitamin A-rich foods and ensuring their availability and access and consumption of these micronutrient-rich foods in the diet. Therefore dietary diversity can be improved through:

- Horticultural approaches, such as home gardening;
- Behaviour change to improve consumption;
- Communication, social marketing or nutrition education; and
- Improved methods of food preparation, preservation and cooking that preserve micronutrient content.

Dietary diversity and mixed cropping (diversification of crops) to increase the variety of foods in the diet are recommended as objectives to be included in each country's food-based dietary guidelines (Faber & Wenhold, 2007:397). The slogan "enjoy a variety of foods" which forms part of the South African food-based dietary guidelines has been recommended. Through reviewing relevant literature, it has become clear that improving micronutrient intake can take place through cultivating a range of different crops particularly indigenous to enhance the consumption of vitamin A-rich foods (Maunder & Meaker, 2007:403). Promoting mixed cropping can increase the availability of larger variety of nutritious foods, extend the harvesting period, and help to alleviate seasonal shortages of food (Faber & Wenhold, 2007:397; Wenhold, Faber, Van Averbeke, Oelofse, Van Jaarsveld, Jansen Van Rensburg, Van Heerden & Slabbert, 2007:330).

To attain good health and nutritional status, caregivers should feed their children a variety of foods in the right proportions. To achieve this, caregivers must have the essential knowledge of what constitutes a nutritious diet and how they can best utilise the available resources to meet their children's nutritional requirements (Department of Health, 2004:4; FAO, 1997a). Therefore to increase vitamin A food consumption advocacy, information, education and training are thus important (Faber *et al.*, 2006:24-26; Faber *et al.,* 2001).

2.4.3 Nutrition education and information

In addition to undesirable dietary habits and nutrition-related practices, the nutrition situation can be worsened by a lack of nutrition information and knowledge (Department of Health, 2004:4). According to Cervinskas and Lotfi (1996), nutrition education is an essential component of programmes aimed at preventing vitamin A deficiency. It is a strategy that could enable dietary diversity which in turn could lead to an increased consumption of food. To increase the intake of micronutrient-rich foods nutrition education and communication strategies can guide caregivers' food selection to increase the inclusion of vitamin A-rich vegetables and fruit (Cervinskas & Lotfi, 1996).

An awareness of the importance of vitamin A nutrition should be created through nutrition education and promotion. This could create a demand for more vitamin A-rich vegetables. Caregivers at crèches should have a basic knowledge of nutrition to enable them to improve the growth and well-being of children in their care (Engle, Bentle & Pelto, 1997:24; Krige & Senekal, 1997:22). The general objective of a nutrition education strategy should be to enable caregivers to make the best use of existing food resources including traditional food resources (indigenous/African vegetables and fruit) and to become knowledgeable about food-based dietary guidelines for good health and nutrition (FAO, 2001:70).

The guidelines based on locally available and consumed foods should form the foundation of nutrition education messages aimed to educate and motivate caregivers in order to improve the daily consumption of vegetables and fruit by children (Department of Health, 2004:7; Vorster *et al.*, 2001:2). Knowledge and information about indigenous vegetables is no longer systematically transferred from one generation to the next due to modernisation. As a result, the indigenous knowledge gap between the elderly and the youth tends to widen (Nebel *et al.*, 2006:341). Lack of proper knowledge, specifically of the nutritional value, methods of production, preservation and preparation, is an important deterrent to their utilisation (Internet: Rubaihayo).

Strategies to encourage the promotion of indigenous vegetables and fruit should be emphasised through nutrition education and must incorporate appropriate measures to increase both their production and consumption. Nutrition knowledge is important to caregivers to enable them to include adequate quantities of food to meet the nutritional requirements of children. Nutrition education should thus form an important part of any intervention programme that aims to improve the nutritional status of children and other target groups (Krige & Senekal, 1997:22).

Nutrition education directed to mothers and caregivers is important in improving the nutritional status of children (Engle *et al.,* 1997:24). Improving nutrition knowledge through nutrition education is one of the broad strategies that have been identified to improve the nutritional status of all South Africans (Department of Health, 2002:4). Undesirable food and nutrition-related practices, which are often based on insufficient knowledge, traditional beliefs and taboos or poor understanding of the relationship between diet and health, can adversely affect nutritional status (Kumar-Range, Naved & Bhattarai, 1997). However, people can adopt healthier diets and improve their nutritional well-being if they are sufficiently motivated (Kumar-Range *et al.*, 1997).

Together with promotion programmes, nutrition education can create an awareness of the importance of vitamin A for growth and development in children. It can promote local demand for a better supply and consumption of vitamin A-rich foods (Cervinskas & Lotfi, 1996; Internet: FAO, 1997b). A communication campaign that aims to improve micronutrient intake of young children must therefore be directed at the children's caregivers. Efforts should be made to dispel caregivers' attitudes that are harmful to children's micronutrient status such as the idea that vegetables are of low status and that they are associated with poverty (Cervinskas & Lotfi, 1996; Internet: FAO, 1997b).

Campaigns should incorporate reminders that micronutrients-rich foods should be introduced into an infant's diet from the age of six months and gradually increased in frequency (Internet: FAO, 1997b). Faber *et al.* (2006:24), postulates that communication and promotion strategies should create an awareness of the importance of vitamin A and health. For example, these strategies should:

- enable caregivers to introduce pro-vitamin A-rich vegetables such as locally produced and traditional vegetables to small children;
- teach mothers/caregivers how to prepare and process pro-vitamin A-rich vegetables in order to preserve the nutrients; and
- provide nutrition education, focusing on vitamin A; and
- monitoring the growth of preschool children.

Nutrition education is an integral part of the food-based approach and caregivers can therefore make informed decisions regarding food choices. Nutrition education to improve dietary intake of micronutrient-rich foods is one of the primary strategies available for intervention. It is an essential element in any strategy to reduce micronutrient deficiency (Cervinskas & Lotfi, 1996). However it should be known that nutrition education alone cannot be successful. Nutrition education can stimulate the demand for certain foods, but the individual must have the means and opportunities to act on that knowledge (Faber & Wenhold, 2007:397; Wenhold *et al*., 2007:331). This suggests that access to a supply of food is critically more important than education without ready access (Faber & Wenhold, 2007:397; Wenhold *et al.,* 2007:331).

Nutrition education should therefore provide an awareness of the importance of vitamin A, promote increased consumption of vitamin A-rich foods, suggest new preparation techniques or food combinations, motivate and teach caregivers' ways of growing, preserving, storing and preparing nutritious foods (FAO, 1997a:2; Cervinskas & Lotfi, 1996; Huffman & Martin, 1994:147).

2.4.4 Utilisation of food rich in pro-vitamin A

Food utilisation means that food must be properly used. Caregivers should have adequate knowledge and skills regarding proper food processing techniques and nutrition requirements. Intervention programmes designed to promote the consumption of vegetables and fruit should emphasise appropriate methods of cooking, preservation and storage to preserve micronutrient content (Reddy, 1999:88; FAO, 1997a:27). The potential contribution of plant foods to vitamin A status depends on the retention of pro-vitamin A carotenoids after storage, preparation and processing (Faber & Van Jaarsveld, 2007).

2.4.4.1 Storage and preservation of food

Storage areas for various products should be planned according to the requirements of the institution and may include dry storage areas, cold rooms and freezers. There should be separate storage for raw and cooked foods and no food should be stored directly on the floor (Steyn & Temple, 2008:606). Yellow/orange vegetables and fruit and dark green leafy vegetables are often highly seasonal. In situations where vitamin A vegetables are scarce food-based programmes should rely on increasing the availability of these foods, mostly through prolonged storage and food preservation (Cervinskas & Lotfi, 1996).

For pro-vitamin A-rich foods like mangoes, which ripen quickly, there are often substantial post-harvest losses due to the fact that the population cannot consume all the available fruit in the short period of time of their availability. Therefore vegetables and fruit can be preserved for year-round enjoyment (Schalau, 2001; Reddy, 1999:88; FAO, 1997a:27). Hence there is a need to teach proper techniques to preserve pro-vitamin A-rich foods in order to ensure an adequate supply through seasons of lower availability and to reduce post-harvest losses.

Strategies to increase broad availability of micronutrients include home processing, preservation and conservation techniques such as sun-drying and freezing that could extend the availability of vitamin A-rich foods (FAO, 1997a:27). Vegetables can be compacted when dried such as in the production of leaf concentrates. This method has the advantage of reducing the volume of the leaves and of increasing the concentration of pro-vitamin A carotenoids. This is particularly useful for young children who have high nutrient requirements. Because of their nutritional benefits leaf concentrates have been used in the formulation of special complementary foods for young children (Faber *et al.,* 2007:411). Preserved vegetables and fruit can be consumed everyday when fresh vegetables and fruit are not available (FAO, 1997a:27).

Solar drying is one of the most popular preservation methods for vegetables and fruit rich in pro-vitamin A and has been promoted in many countries in recent years. It is an improved alternative of the traditional sun-drying method, which results in significant losses of beta-carotene due to direct exposure to sunlight. With solar drying, food products are dried in the shade and high air temperatures and lower humidity in order to increase the drying rate, thus increasing the retention of pro-vitamin A and reducing the final moisture content. This in turn increases the micronutrient concentration in the dried products and allows longer storage time. It was found that in certain areas (including Venda, which is the most northerly province of Limpopo), harvesting of the leaves is mainly during summer and the surplus is stored either as dried cooked or in dried raw form for at least six months (Faber *et al.,* 2007:411; Chweya & Eyzaquirre, 1999; Labadarios *et al.,* 1999).

At the crèche level, these techniques can be practically applied primarily to increase year-round availability of seasonal micronutrient-rich foods (mainly vitamin A-rich vegetables and fruit) for everyday consumption by children (Barker, Cornelissen, De Villiers & Turley, 2005:51). The preservation of surplus vegetables and fruit could reduce seasonal variations in the availability of vitamin A-rich foods and make it possible for vegetables and fruit to be consumed out of season. Vegetables and fruit can be easily stored once they are processed (Schalau, 2001).

During the periods of relish shortage, especially in the dry seasons, traditional vegetables previously preserved by drying become very important in household food security. They offer variety and can contribute to broadening the food base. Being accessible to low-income communities they offer an opportunity to provide affordable nutrition to avert malnutrition (Internet: Rubaihayo). Chweya and Eyzaquirre (1999) maintain that even after drying the nutrient content of traditional leafy vegetables is still high and should therefore be included in the meals and menus.

2.4.4.2 Menu planning and food preparation

As mentioned in chapter 1, the menu-planning skills of crèche caregivers are of great concern in this study. Crèche menus should exemplify dietary diversity. It is therefore necessary for caregivers to have menu planning skills so that they know what to include in crèche meals in order to add variety to children's diets, more so to promote the consumption of vitamin A-rich vegetables and fruit. The objective of menu planning is to integrate different food items in a specific plan to satisfy the needs of the people to be served. It determines the ingredients to be purchased and equipment to be used for preparation. The menu should suit

the age, nutritional needs and health of individuals who will be served that menu (Steyn & Temple, 2008:597).

It is important for caregivers to take food-based dietary guidelines into consideration when planning menus (Steyn & Temple, 2008:597). The menu should include food items that are locally available. As availability of foods is determined by season, it is important to have summer and winter menus. However, preferably, cycle menus that offer different food items from day to day can be used (ibid.). The main objective is to plan balanced menus which contain the right nutrients in the right quantity and which children will enjoy eating. A week's menu must be planned to ensure the inclusion of a variety of vegetables and fruit and must provide interesting combinations of different flavours, textures, consistency, temperature and colours (ibid; Barker *et al.,* 2005:51). Day by day the crèche menu must exemplify the best that is known regarding child feeding.

The nutritional value of any meal depends on the individual food items used and how they are prepared and cooked. Therefore, it is important to know the effective ways of cooking and preparing food so that they still contain their respective nutrients. Food preparation includes all processing of food before it is cooked such as washing, soaking, cutting, cleaning, carving, shredding, measuring and peeling. When preparing vegetables and fruit for cooking, care should be taken not to discard more than it is necessary (Steyn & Temple 2008:407; Barker *et al.*, 2005:73; De Wet, Holm, Norval & Van Pletzen, 2005:71). For example, they should be washed before peeling or cutting. The same applies when peeling or cutting vegetables and fruit, some part of the food may be thrown away if not prepared properly.

Salad vegetables should not be chopped or grated more than necessary. Prolonged cooking and soaking of fresh vegetables and fruit should be avoided as it contributes to nutrient loss. The flavour, colour, texture and the nutritive value of foods are all affected by preparation and cooking. These food preparation processes influence the availability of nutrients in food. Some nutrients will be lost during these processes (Barker *et al.*, 2005:73; De Wet *et al.,* 2005:71)

The cooking processes may vary from area to area depending on local culture and habits. Nevertheless it is important to promote effective cooking methods to preserve the nutrient value and to enhance the bio-availability of vitamin A (Faber *et al.*, 2006). Cooking methods that preserve nutrients such as steaming, stewing and stir-frying or microwave cooking, should be used more often (Barker *et al.*, 2005:73; De Wet *et al.,* 2005:71). Vegetables, particularly green vegetables, should be cooked in a minimum amount of boiling water.

Caregivers should be advised to mash vegetables for smaller children and to add a little oil to enhance the absorption of vitamin A. Additives such as bicarbonate of soda should not be added to cooking water as these destroy nutrients. Vegetables should be served immediately and cooking water can be used for gravies and soups (Barker *et al.*, 2005:73; De Wet *et al.,* 2005:71).

2.5 SUMMARY

It is clear from the literature review that children's consumption of vegetables and fruit rich in vitamin A is still considered as very low (Ruel, 2003:3911; Maunder & Meaker, 2007:403). Therefore the meals and snacks provided to children in crèches and/or preschools should aim at providing plenty of vegetables and fruit for this vulnerable group (Pietersen *et al.*, 2002:5). The food-based dietary guideline *"eat plenty of vegetables and fruits everyday"* is thus a priority. It is important that strategies to improve the application of this dietary guideline be developed and implemented.

The findings from earlier reviews, recommended that home gardening, education and proper food utilisation have the real potential to increase access and availability of vitamin A-rich foods, especially vegetables and fruit, (Faber *et al.,* 2007:407; Faber & Wenhold, 2007:297; Maunder & Meaker, 2007:403; Faber *et al.,* 2006:14-15; Engelberger *et al.,* 2003:311; Ruel & Levin 2000; Cervinskas & Lotfi, 1996).

Ultimately the implementation of nutrition strategies should be seen as an integral part of this research. This is illustrated in the conceptual framework of this study in chapter 3 (Figure 3.1) as a possible means for improving the consumption of vitamin A-rich foods that will in turn have an effect on the growth and development of young children attending crèche facilities (FAO, 1997a; Pietersen *et al*., 2002:13).

Providing information on the nutritional value of foods; the components of an adequate diet; making appropriate food choices and purchases from available resources; appropriate preparation, storage and preservation of food and menu planning skills of caregivers will all contribute to the quality of meals provided within crèches (Faber *et al.,* 2007:407; Maunder & Meaker 2007:403; Cervinskas & Lotfi, 1996). Caregivers should be encouraged to produce food all year round, to ensure proper storage and engage in correct cooking methods to maintain the vitamin A value of food (INP, 2003).

The control of vitamin A deficiency has been identified as a priority in any food-based intervention and it should aim at reducing the number of vitamin A deficient children in South Africa (Faber *et al.,* 2006:13).

The methodology used and the research design for this study is explained in chapter 3 that also highlights the conceptual framework of the study.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter addresses the research approach and the techniques used to measure the concepts of this study. It describes the research design, the aim and objectives, study population, sampling procedure, operationalisation as well as the relevant data collection procedures that were used to generate the data that was collected in three phases for this study.

3.2 RESEARCH DESIGN

The research is empirical in nature and was conducted within the quantitative paradigm following a positivistic orientation to address a real life problem, an approach explicated by other scholars such as Babbie and Mouton (2001: 22-28 & 47-53). It is applied action research in which the researcher and the respondents were equally involved in the process of solving a nutrition problem, namely that vitamin A deficiency amongst children is influenced by a lack of access and availability to the nutrient, and absence of dietary diversity, poor nutrition knowledge and inadequate utilisation of vitamin A-rich vegetables and fruit by the caregivers of these children. The researcher and respondents took equal responsibility for the accomplishment of the specific aim and envisaged outcome of the research endeavour as suggested by Neuman (2000:24-25).

The quantitative paradigm places emphasis on variables in describing and analysing human behaviour (Babbie & Mouton, 2001:49). Subsequent to a thorough literature review the quantitative research paradigm was considered to be a suitable research approach that could be used to address the research problem. The problem was solved by collecting new or primary empirical data (data collected by the researcher). The research was cross-sectional in nature which, according to Bless and Higson-Smith (1995:60), is typical of studies in which data is collected within the same period of time.

The research took place in three phases where the triple A cycle of assessment, analysis and action was applied. Though the research was based on the triple A cycle process, the phases of the study tended to overlap in line with its stated procedure. Phase one was based on the assessment and analysis of the situation at the crèches to provide baseline information. Phase two focused on the development and implementation of the nutrition strategies, namely food production and gathering, dietary diversity, food utilisation and nutrition education, which involved training the caregivers on the application of a food-based dietary guideline, representing action. In phase three the crèche situation was reassessed by implementing the relevant food-based dietary guideline through vegetable gardens and improved menus developed as nutrition strategies.

3.3 AIM OF THE STUDY

The aim of the study was to develop and implement nutrition strategies to improve the application of a Food-based Dietary Guideline for use by crèche caregivers to enhance the consumption of vitamin A-rich vegetables and fruit by crèche (preschool) children in the Thulamela municipal area in the Limpopo province, South Africa.

The following objectives and sub-objectives are derived from the aim of the study.

3.4 OBJECTIVES AND SUB-OBJECTIVES

For the **first phase** of the study that deals with assessment and analysis, the following objectives and sub-objectives were formulated:

1. To assess the situation at crèches in order to determine:
    - 1.1 The consumption of vitamin A-rich vegetables and fruit (dietary diversity)
    - 1.2 Availability and accessibility of vitamin A-rich vegetables and fruit
    - 1.3 Utilisation of vegetables and fruit
    - 1.4 Current nutrition knowledge of caregivers concerning the application of the food-based dietary guideline: *eat plenty of vegetables and fruits everyday* (with special emphasis on vitamin A-rich vegetables and fruit).

The **second phase** of the study involves the action part of the triple A cycle which was to develop and implement the nutrition strategies, and the objective and sub-objectives were formulated as follows:

2. To develop nutrition strategies to improve:
   - 2.1. dietary diversity
   - 2.2. food availability
   - 2.3. food utilisation
   - 2.4. nutrition knowledge

That serves the purpose of implementing the food-based dietary guideline: *eat plenty of vegetables and fruits everyday*.

3. To train the caregivers to implement the developed nutrition strategies.

For the **third phase** of the study that deals with the re-assessment and analysis of the nutrition strategies, the following objective was formulated:

4. To reassess if there was an improvement of caregiver's application of a food-based dietary guideline through the implementation of the developed nutrition strategies.

3.5 CONCEPTUAL FRAMEWORK

The applied UNICEF model of the causes of vitamin A deficiency (Figure 2.1) was used as a point of departure in the theoretical foundation of this study. Figure 3.1 gives the conceptual framework of the study designed to guide the collection of data in this research. It addresses the nutrition strategies that would improve the application of a food-based dietary guideline that would lead to the appropriate consumption of vitamin A-rich vegetables and fruit by crèche children. The different phases of the study are depicted in the conceptual framework that illustrates what each phase of the study entails and it also conveys the aim and objectives of the study. The envisaged outcome of the study which is considered important for the purpose of this research is also highlighted in the conceptual framework.

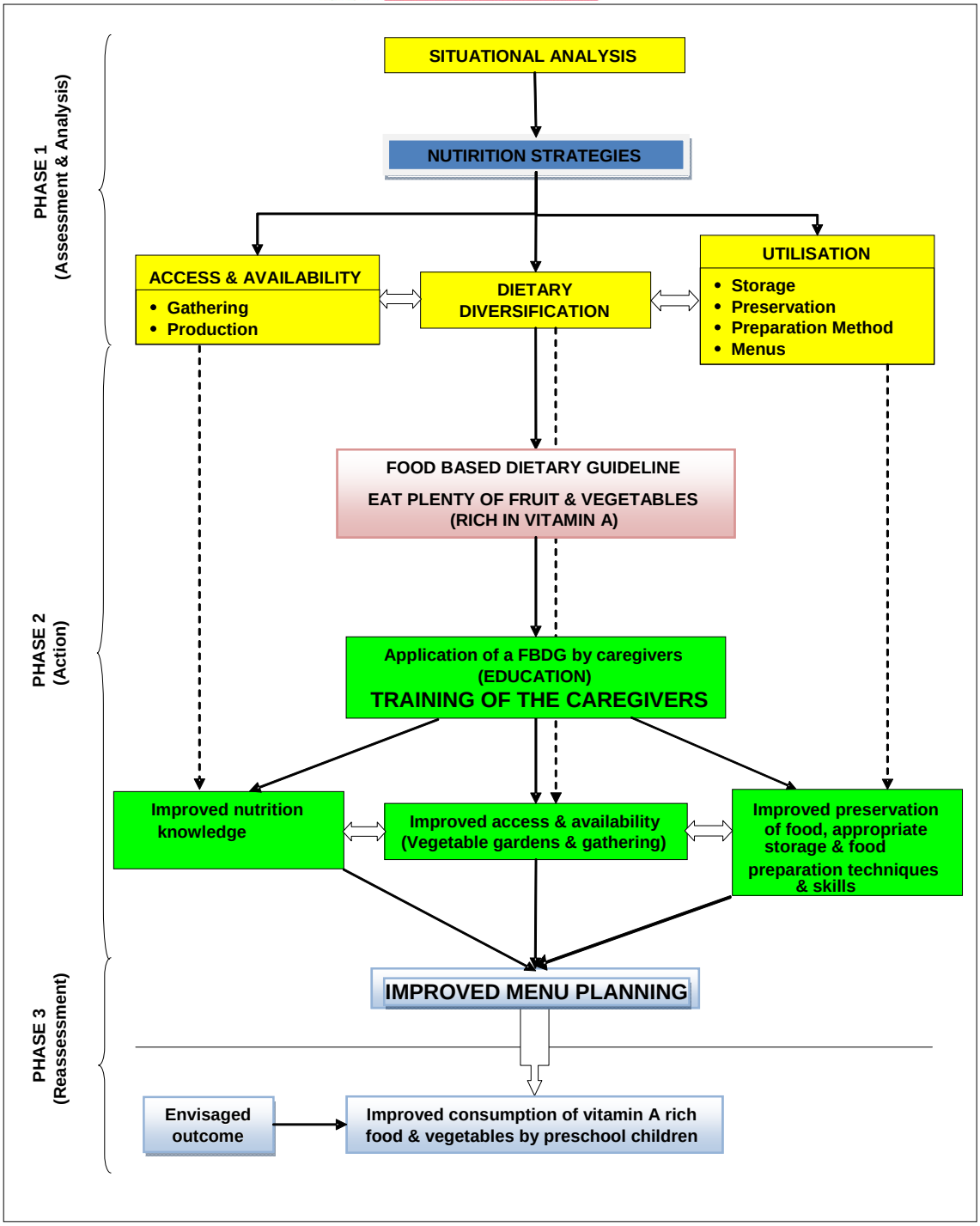


FIGURE 3.1: CONCEPTUAL FRAMEWORK OF THE NUTRITION STRATEGIES TO IMPROVE THE APPLICATION OF A FOOD-BASED DIETARY GUIDELINE

3.6 CONCEPTUALISATION

The following concepts included in the framework are defined as they apply to this study:

3.6.1 Situational analysis

Situational analysis in this study refers to the collection of baseline information from the caregivers to determine current knowledge and available nutrition strategies on the application of the food-based dietary guideline "*eat plenty of vegetables and fruits everyday*".

3.6.2 Food-based dietary guidelines

Food-based dietary guidelines are qualitative statements that express dietary goals in terms of foods, rather than nutrients. They reflect the most current scientific understanding of nutrition's role in health and present this information as simple practical advice for choosing optimal dietary habits (Vorster *et al.,* 2001). For the purpose of this study, the guideline "*eat plenty of vegetables and fruits everyday"* was specifically considered and used in the assessment of the accessibility and availability of vegetables and fruit to the crèches in order to determine the dietary diversity and utilisation of the directive.

3.6.3 The food-based dietary guideline "Eat plenty of vegetables and fruit"

Eating plenty of vegetables and fruit in this study means that children should be given at least five portions of vegetables and fruit every day, including vegetables and fruit rich in vitamin A. According to the Department of Health (2004:27), this could be achieved by including these foods in every meal and as snacks in everyday menus of crèche meals.

3.6.4 Access

Access refers to what food is available and affordable for the use at crèches. This depends on what is available in the environment in terms of food production, and includes food seasonality, preservation and storage capacity (Huffman & Martin, 1994:138), as well as the financial means to purchase food.

3.6.5 Availability

Availability is defined as the food available in the environment (Blijham, De Kan & Niehof, 2006). In the case of this research crèches represent the environment, and food specifically refers to vegetables and fruit as an important source of vitamin A.

3.6.6 Food gathering

Food gathering refers to the use of food resources from the environment just as they exist without any attempt to improve or increase the available supply (Maunder & Meaker, 2007; McIntosh 1995:17). In this study it refers to the collection of available indigenous vegetables and fruit such as amaranth, blackjack, *muxe, delele, tshiphaswi* (traditional green leafy vegetables), and mangoes that grow naturally.

3.6.7 Food production (gardening)

Food production (gardening) refers to fruit and vegetable cultivation and it implies that an area around the crèche is cultivated to enhance the production of vitamin A-rich vegetables and fruit that could be grown seasonally or throughout the year (Helen Keller International, 2003b).

3.6.8 Dietary diversity

Dietary diversity is defined as a number of foods or food groups consumed over a given reference period (Ruel, 2003:3911s). It includes a variety of approaches that aim to increase production, availability and access to micronutrient-rich foods, as well as consumption of these foods and their availability in the diet (Faber & Wenhold, 2007:397). In this study it means adding more vegetables and fruit to a staple food such as porridge, frequently adding a vegetable dish to a meal as well as eating more vitamin A-rich vegetables and fruit as a snack, a viewpoint supported by the national Department of Health (2004:27; 2002:8) and the FAO (1997a:55).

3.6.9 Food utilisation

Food utilisation means that food is properly used from its natural state (in terms of preservation, cooking and storage) and that caregivers should have adequate knowledge of nutrition and menu planning skills as endorsed by the FAO (1997a).

3.6.10 Food storage

Food storage in this study refers to the manner in which crèche caregivers keep food before and after preparation.

3.6.11 Food preservation

Food preservation means to keep food longer and safe for consumption when there is a limited supply. It is done to reduce seasonal variations in the availability of food as well as to add variety to the diet in that food can be eaten out of season (Van Zyl, Groenewald & De Bruin, 2003:104).

3.6.12 Food preparation methods

Food preparation methods refer to the manner in which food is cooked to attain maximum nutrient retention and palatability (Van Zyl *et al.,* 2003:104). It also includes all processing of food before it is cooked such as washing, soaking, cutting, cleaning, carving, shredding, measuring and peeling (Steyn & Temple 2008:407; Barker *et al.*, 2005:73; De Wet, *et al.,* 2005:71).

3.6.13 Nutrition strategies

Nutrition strategies in this study refer to food-based approaches such as gardening, dietary diversity, nutrition education, food gathering and food utilisation that were used to improve the consumption of vitamin A-rich vegetables and fruit by children.

3.6.14 Training caregivers

Training caregivers in this study means providing information to caregivers with regard to the consumption and availability of vitamin A from vegetables and fruit as well as training them on nutrition strategies that they can use to improve the application of a food-based dietary guideline "*eat plenty of vegetables and fruits everyday*".

3.6.15 Caregiver

Caregiver in this study refers to any person (whether teachers, ladies who cook food, crèche managers or owners) responsible (as described) for the children's meals.

3.6.16 Nutrition knowledge

Nutrition knowledge in this study refers to the awareness and skill of being familiar with food choices and vitamin A (specifically vitamin A-rich vegetables and fruit) acquired by the caregivers through training.

3.6.17 Menu planning

While a menu is a detailed list of food to be served for a meal, menu planning refers to the integration of different food items in a specific menu plan that is known to satisfy the needs of the people to be served. It determines the ingredients to be purchased and equipment to be used for preparation (Steyn & Temple 2008:597).

3.7 OPERATIONALISATION AND MEASURING INSTRUMENTS

Table 3.1 summarises the operationalisation of the main concepts and indicates how the objectives and sub-objectives were measured. For this research, three data collection techniques were the instruments used, a questionnaire, observation and a game. These techniques were effectively used in all the phases of data collection and were considered suitable for achieving the research objectives.

TABLE 3.1: SUMMARY OF OPERATIONALISATION AND MEASURING INSTRUMENTS

PHASES	OBJECTIVES AND SUB-OBJECTIVES	MEASURING INSTRUMENTS
Phase one	1. To assess the situation at the crèche in order to determine:	
	1.1 The consumption of vitamin A-rich vegetables and fruit by children (dietary diversity)	▪ Questionnaire Part A2 A.2.4 Part B2 B2.1- B2.9
	1.2 Availability and accessibility of vitamin A-rich vegetables and fruit	▪ Questionnaire Part C1 C1.1- C1.5 Part C2 C2.1- C2.9 ▪ Observation
	1.3 Utilisation of vegetables and fruit	▪ Questionnaire Part D D1- D8. Part E E1- E7 ▪ Observation
	1.4 Current nutrition knowledge of caregivers concerning the application of a food-based dietary guideline: "*eat plenty of vegetables and fruits everyday"*(with specific emphasis on vitamin A-rich vegetables and fruit)	▪ Questionnaire Part B1 B1.1- B1.8 ▪ Game
Phase two	2. To develop and implement the nutrition strategies to improve:	
	2.1 Dietary diversity 2.2 Food availability 2.3 Food utilisation 2.4 Nutrition knowledge	
	In order to apply the food-based dietary guideline: *eat plenty of vegetables and fruit every day*.	
	3. To train caregivers to implement the developed nutrition strategies.	
Phase three	4. To reassess if there was an improvement of caregivers' application of a food-based dietary guideline.	▪ Questionnaire Part A.2 A.2.4 Part B1 & B2 Part C1 & C2 Part D Part E ▪ Observation ▪ Game

3.7.1 Questionnaires

Self-administered questionnaires (Addendum A) were developed and used to collect data before and after the development and implementation of the nutrition strategies. The questionnaire consisted of fifty-five questions which were divided into five parts that included questions to gather data on caregivers' and children's demographics, nutrition knowledge, availability and accessibility as well as food utilisation as follows:

Part A - General information

Information regarding the caregivers' age, gender, experience and educational level as well as information concerning the children's ages, gender, time they spend at crèches and the meals they eat was collected to describe the demographic profile of caregivers and the children at crèches.

Part B - Nutrition knowledge

Caregivers were tested on their knowledge of vitamin A nutrition focusing on dietary diversity and knowledge of vegetables and fruit rich in vitamin A. The questionnaire also tested caregivers' knowledge on the importance of vegetables and fruit intake and vitamin A to children.

Part C - Food Availability and accessibility

Data on the availability and accessibility with regard to production (gardening) and gathering of vitamin A-rich vegetables and fruit was collected.

Part D and E - Utilisation

Information on food utilisation (which included food preparation, food preservation, food storage and menu planning) was gathered. The questionnaires were available in both English and the vernacular; however the English version was mostly used. Although an open-ended question was included, the questionnaire contained many closed questions. The questions were answered by ticking boxes, a technique advised by Veal (1997:147-164) or by selecting from amongst a list of options on the questionnaire as suggested by Babbie and Mouton (2001:233). The questionnaire provided a systematic and structured way to obtain data that was accurate and easily quantifiable (Babbie & Mouton, 2001:74-75). The closed questions were appropriate as they gave greater uniformity of responses, were easier and quicker for respondents to answer and were more easily processed (Babbie & Mouton, 2001:233, Neuman, 2003:261).

The initial questionnaire was assessed by two subject specialists in the field of study and a professional statistician for the purpose of clarification in terms of length, wording, content and concepts. This is an acceptable research strategy as it ensures that the content of the questionnaire reflects the objectives of the study and favours use of the most suitable and relevant statistical methods for the analysis of the data (Babbie & Mouton, 2001:124-125;

244-245;). The suggestions and amendments given were incorporated where necessary. The questionnaire was pre-tested at a preschool which was not selected for data collection and consequently the necessary changes based on the pilot test were made.

The intention with this exercise was to attend to making completing the questionnaire easy particularly with regard to its length and clarifying the wording and concepts. The length of the questionnaire was limited to avoid respondent fatigue and the possibility that they would become discouraged and unwilling to participate. The final questions were easy to understand and relevant to the topic and research procedure.

3.7.2 Observation

Data was also collected using simple observation whereby the researcher was regarded as an outside observer. Observation was advantageous in that it could be done at anytime. Moreover, the observing, thinking researcher was there at the scene of action and notes were taken on the observations as suggested by Babbie and Mouton (2001:294). Findings were recorded on observation sheets which were designed for this purpose (see Addendum B). The following was observed:

Food Availability

Information on food availability was collected through observation. The observed information on gathering of indigenous vegetables and fruit, availability of fruit trees and vegetable gardens was recorded on observation sheets. Where there were vegetable gardens, the presence and type of vegetables grown were recorded to determine the availability of vitamin A-rich vegetables and fruit in the crèches.

Utilisation

Observations were also made on caregivers' ways of storing food (e.g. availability of freezer or refrigerator), preservation methods applied to vegetables (such as drying vegetables) and cooking techniques. Particular note was taken to see whether the caregivers were preparing and preserving some of the vegetables or fruit from their gardens.

Menu planning

Menu planning, as seen in written menus and meal plans as well as the food served, was checked to see if the caregivers were making use of menus, if the menus were properly written, varied and whether they included vitamin A-rich vegetables and fruit.

3.7.3 Game

A game was developed to collect information on the caregivers' nutrition knowledge. The same game was used both in phases one and three to test the caregivers' nutrition knowledge before and after the implementation of the nutrition strategies. The game consisted of five questions which were awarded a score (five marks in total) (see Addendum C). The questions were specifically formulated to test caregivers' knowledge of vitamin A nutrition. The content of the game was based on questions regarding vitamin A vegetables and fruit as well as the deficiency symptoms of vitamin A. Score sheets were designed (Addendum D) to score and record caregivers' responses. Every correct answer counted one mark and if the answer was incorrect it was given a score of zero. Score sheets helped in the collection of data.

At each crèche the respondents were divided into two groups and then asked questions which required them to show knowledge and understanding of vitamin A nutrition. Groups of caregivers within the same crèche competed against each other and the group with the highest scores won the game. The two groups of respondents were asked to step into a circle drawn round a dot. They were asked the questions while standing inside the circle and the group that gave the correct answer first got one mark. However, if a member of a group got the answer wrong, she was penalised and had to step out of the circle thereby disadvantaging her own group. If all members of the opposite group were penalised before all the questions were asked, the remaining group obviously won the game. The caregivers enjoyed the game and they were eager to know their scores especially in phase three.

The information collected through the game and observation supplemented data collected using questionnaires. The use of more than one method of data collection in this study such as those described above supported the construct validity of the research (Mouton, 1996:128).

3.8 SAMPLING AND STUDY POPULATION

The research was conducted in 20 crèches operating in the Thulamela municipal area in Venda. The technique used to select the sample for this study was convenience sampling, which is a non-probability sampling technique (Leedy & Ormrod, 2005; Leedy, 1993:200; Kumar, 1999:161). Convenience sampling confines a sample to an accessible section of the population (Kumar, 1999:161) and was used in this study for the purpose of choosing the crèches and the respondents. The members of the subset were easily identified as recommended by Babbie and Mouton (2001:66) and all the caregivers from the identified crèches were included since their total number in each crèche was small.

The study population was therefore the caregivers at the crèches and the sample consisted of 100 respondents who were 21 years of age and older. They included managers and owners, teachers as well as the ladies who prepared the food. These people were all responsible for either providing food and/or taking care of children at these crèches. The number of respondents who participated in the research provided a sizeable and representative sample of the targeted population. The caregivers were thus the unit of analysis which, according to Babbie and Mouton (2001:174), refers to the element from which information is collected.

3.9 DATA COLLECTION

The study was conducted in three phases similar to the triple A cycle process. However, the actual data collection was conducted in phases one and three from crèche caregivers whereas phase two focused on the development and implementation of nutrition strategies.

Phase 1 (Assessment and analysis)

The initial situation assessment and analysis was undertaken to gather baseline information. It was important to do a situation assessment in this study in order to determine the constraints and note what had already existed before developing and implementing the nutrition strategies.

Structured questionnaires were completed. To assist inexperienced caregivers to fill in their responses correctly, the questionnaires were completed under close supervision of the researcher as an interview. Some respondents preferred to write their responses themselves whilst others preferred to respond verbally and requested the researcher to read out the question and write down their responses. This approach is endorsed in the literature (Babbie & Mouton, 2001:249). This was also done where there was a low level of literacy among the respondents. However, care was taken so that respondents did not influence each other. Although this method was time-consuming the researcher had the opportunity to probe for answers when necessary. The questionnaires were coded and with the help of the statistician data was captured for analysis.

Observation sheets were used to record information gathered by directly observing and talking to people. Observation was done on aspects such as the availability of land and water, existing gardening practices, use of indigenous vegetables, existing dietary practices, availability and use of menu plans and recipes (whether or not they included pro-vitamin A vegetables and fruit) as well as existing food utilisation strategies (storing, preserving and preparing techniques).

A game score sheet was used in this phase to gather information on nutrition knowledge, particularly vitamin A nutrition. Demographic information regarding the children and the caregivers was also gathered during this phase.

Phase 2 (Action)

Phase two commenced immediately after the baseline information had been collected and analysed. This phase focused on the development and implementation of the nutrition strategies that would improve the application of a food-based dietary guideline "*eat plenty of vegetables and fruits everyday*". The main intention of this phase was to train the crèche caregiver. Various training methods such as lecturing, discussions, question and answer sessions and demonstrations were used. The training focused mainly on educating caregivers on vitamin A nutrition (providing awareness on the importance of vitamin A to children as well as the consequences of its deficiency). Caregivers were made aware of the fact that green leafy vegetables and yellow and orange vegetables and fruit are rich in vitamin A. They were also taught how they could ensure year-round access and availability of vitamin A-rich vegetables and fruit.

The training materials that were used were a vitamin A chart from the national Department of Health, two charts and a 2007 calendar from the Agriculture Research Council (ARC-Roodeplaat Vegetable and Ornamental Plant Institute) illustrating vitamin A-rich vegetables, the South African Food-based Dietary Guidelines, the ten reasons for eating vegetables and fruit everyday and a pamphlet illustrating the complications that children with vitamin A deficiency experience. Each of the twenty crèches received these materials that they could keep. Caregivers were therefore trained on:

- How to start a vitamin A vegetable garden
- Menu planning skills
- Proper storage, preparation and cooking techniques and preservation (drying and freezing) of vitamin A-rich vegetables and fruit.

During this phase vegetable gardens were established at crèches. The gardening demonstrations were facilitated by gardening guidelines obtained from the ARC-Roodeplaat Vegetable and Ornamental Plant Institute which assisted in training the caregivers on vegetable gardening. The gardening guidelines by Faber *et al.* (2006:55-78) that give instructions on how to plan and implement a home garden for planting pro-vitamin A-rich vegetables was also used in this study. Each crèche was supplied with these guidelines (see Addendum E).

The guidelines focused mainly on vegetables such as orange-fleshed sweet potatoes, spinach, carrots and pumpkins, and the caregivers were encouraged to plant all these vegetables. Those who already had gardens were encouraged to grow vitamin A-rich vegetables and plant fruit trees. The caregivers were also encouraged to grow vitamin A-rich indigenous vegetables such as African nightshade as well as using locally available vegetables and fruit rich in vitamin A such as, cowpeas, blackjack, okra, amaranth, mangoes, banana and paw-paws. The vegetables took between two and four months to grow before they were ready for harvesting.

Criteria for menu planning that emphasised the application of a food-based dietary guideline that would improve the consumption of vitamin A-rich vegetables and fruit were given to the caregivers. Caregivers were encouraged to include vitamin A-rich vegetables and fruit in their meals every day. Caregivers were taught about vitamin A and its importance to children. In order to maintain the vitamin A value of vegetables and fruit effective ways of cooking and preparing these foods were introduced to the caregivers. They were also trained on proper storage and preservation techniques such as freezing and drying to increase year-round availability of vegetables and fruit.

The caregivers were provided with vitamin A-rich recipes which included food products from their gardens (see Addendum F). After training, the researcher visited the crèches from time to time to observe the gardens and caregivers to see how the strategies were put into practice and the information was recorded. Pictures of the vegetable gardens were taken at different stages, for instance, when gardens were being prepared; when vegetables were planted and harvested; and then when they were prepared and cooked. The children were also photographed while they were being served meals in which then vitamin A-rich vegetables from the crèche gardens had been used.

Phase 3 (Re-assessment)

Phase three was based on re-assessment, where caregivers were evaluated on how they had implemented the devised nutrition strategies in which they had been trained during phase two. Re-assessment was also meant to check if there were improvements in the application of the food-based dietary guideline focusing on vitamin A-rich vegetables and fruit. Phases one and three had the same number of respondents.

The researcher used the measuring instruments of phase one without any alterations to assess if the strategies were implemented. For instance, information on the presence of vegetable gardens and the gathering of available indigenous vegetables and fruit, appropriate storage and meal preparation techniques, improved preservation of food and skills on menu planning were collected and recorded using questionnaires and an observation sheet.

Taking into consideration the reaction of the respondents to the questionnaire during phase one with regard to time required for completion, its level of comprehensibility and the ease with which the questions were answered, the final version was distributed to willing respondents to complete under the researcher's supervision, while others still needed the researcher's assistance. This procedure is endorsed by other scholars (Mouton, 1996:156-157). A game was used to test improvements on caregivers' nutrition knowledge. Data was relatively easy to obtain and to process. The information collected was analysed and interpreted statistically.

3.10 DATA ANALYSIS

All data from questionnaires was entered and analysed in statistical analysis system, SAS (version 8.2) and the BMDP statistical software programmes. Descriptive and inferential statistical procedures were used to analyse data. Descriptive statistics places events in contexts that are more understandable and transparent. It helps to organise and summarise the data in a more comprehensible format, which included graphs, frequencies, summary tables and percentage distributions (Mouton 1996:163). Inferential statistics refers to a detailed interpretation and representation. The main aim of inferential statistics (two way tables, Kruskal Wallis and McNemar's tests) was to view and discuss all the underlying correlations, relationships, combination and interactions between different variables (Babbie & Mouton, 2001:459-460; Steyn, Smit & Du Toit, 1984:453). Data was prepared and the results were then interpreted and discussed in detail using tables and graphs as presentation techniques in this study.

3.11 ETHICAL CONSIDERATION

Approval to conduct the research was obtained from the Ethics Committee of the Faculty of Natural and Agricultural Sciences of the University of Pretoria before the research commenced. Permission to collect data and to implement training programmes was obtained from the Department of Education (see Addendum G). Ethical consideration with regard to the rights of the participants regarding confidentiality and anonymity was ensured when collecting data as is common research practice (Bless & Higson-Smith, 2000:100; Kumar, 1999:190). Personal information such as names, address and telephone numbers of respondents were not required. It was also promised that personal information such as their age, education level and experience that was required would not be disclosed for any other purpose outside the study domain. Participants were therefore not forced to be involved and all voluntarily participated after giving their informed consent.

Kumar (1999:192) states that informed consent implies that subjects are made adequately aware of the type of information the researcher wants from them, the reason for seeking information, the purpose the information will serve, how the subjects are expected to participate in the study, and how the study will directly or indirectly affect them. Participants were informed about the study and they were allowed to ask questions regarding the study.

They were also encouraged to be honest when answering questions. The collected information was only used for the stated purpose of the research.

3.12 METHODS TO COMBAT ERROR

The research was conducted in the setting of the participants, with their full permission and at times that suited them. The value and applicability of the results of this study depended on the validity and reliability of the respective data collection methods. All research should therefore aim to provide data that is valid and reliable. The quality of the study was therefore attended to through the elimination of potential errors in the following ways:

3.12.1 Validity threats

Validity is the extent to which an empirical measure adequately reflects the real meaning of the concept under consideration (Babbie & Mouton, 2001:122, Veal, 1997:35).

(i) Content validity

According to Babbie and Mouton (2001:123), content validity refers to the extent to which an assessment measure covers the entire range of meaning included within the concept. To support content and measurement validity in this study, questionnaires were evaluated by the statistician and the experts of the subject from the university's Department of Consumer Sciences (the supervisors). The questionnaire was again pilot tested to ensure content and measurement validity, a standard research practice (Babbie & Mouton, 2001:124-125).

(ii) Theoretical validity

To support and enhance theoretical validity of this study, before the compilation of questionnaires, a wide variety of sources were consulted and all the key concepts pertaining to the study were identified through a thorough review of literature (chapter 2). The concepts were defined and conceptualised against the body of existing theory and research (Babbie & Mouton 2001:10).

(iii) Construct validity

Construct validity is the extent to which a scale index measures the relevant constructs and appropriate terminology and not something else (Mouton, 1996:128). It is based on the logical relationships among variables (Babbie & Mouton, 2001:123). To support construct validity in this study more than one measuring technique was used to gather information and was linked to known theory in the area and with other related concepts, Bless and Higson-Smith (2000:133)'s advice that was heeded in this study. A questionnaire, observation and a game were used to collect data. A valid measurement instrument was obtained through sound conceptualisation. Triangulation was incorporated by counteracting the self-administered questionnaire with simple observation and a game as data collection methods.

(iv) Face validity

Face validity refers to the way the instrument appears to the participants. To Kumar (1999:138) face validity refers to the establishment of a link between each question and the objectives of the study. This was ensured in this study by using the objectives of the study to construct the questionnaire (see Table 3.1).

3.12.2 Reliability threats

Mouton (1996:136) indicates that the key for validity in data collection is reliability. Therefore a study cannot be considered valid unless it is reliable (De Vos, Strydom, Fouche & Delport, 2005:163; Babbie & Mouton, 2001:277). Reliability is a matter of whether a particular technique, applied repeatedly to the same object under the same conditions would yield the same results each time (De Vos *et al.,* 2005:163; Babbie & Mouton, 2001:119). It means that if the same measures were used and conditions under which data was collected were held constant, the results should be the same from time to time. That would imply that the extent to which the variables were measured was indeed free from errors of measurement (De Vos *et al.,* 2005:163).

To enhance reliability and to reduce errors during data collection, all constructs were clearly conceptualised, (De Vos *et al.,* 2005:163), multiple indicators of variables were used and the formulated questionnaire was pre-tested by means of a pilot study. These contributed to the accuracy and precision of information supplied by the respondents, thereby enhancing the reliability of the data collected for this study.

3.13 SUMMARY

Chapter three presented the research design and approach used in this study. An interactive approach was thus embarked upon in an attempt to address the research problem. This action approach would doubtlessly involve the caregivers in order to promote their interest and give them insight into the existing conditions thereby strengthening the possibility of alleviating the problem through sustainable methods. This would improve access, availability and utilisation of vitamin A-rich vegetables and fruit at the crèche level during child development. The nature of information to be gathered and the methods used for this survey were analysed. The findings of the data analysis are set out in chapter 4 revealing the results obtained from the questionnaire responses, observation and the game in which the participants engaged.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 INTRODUCTION

This chapter presents the results and discussion of the results collected during the various phases of the study. The analysis of the results is based on the research aim and objectives as outlined in chapter 3, par 3.4, and is divided into three phases structured according to the triple-A-cycle. Phase one (pre-intervention) focuses on the results obtained from the data collected during the month of April 2007 and was used to provide baseline information for the *situational assessment and analysis*. First a demographic profile of caregivers and the children at the selected crèches is presented as the basis of the discussion of the phase one results; and second, information about the nutrition strategies used by caregivers to improve the application of the food-based dietary guideline *"eat plenty of vegetables and fruits everyday"* is provided.

Phase one results served as guideline as to how phase two should be carried out. Phase two (intervention) is the *action* part which elucidates the developed and implemented nutrition strategies that were part of the respondents' training. Phase three (post-intervention) data was collected in September 2007 and its results concerned a *re-assessment* of the implemented nutrition strategies. The findings are therefore presented and discussed in line with the specific research aim and objectives.

4.2 DESCRIPTION OF THE STUDY AREA

The study was undertaken in the Thulamela municipal area of Vhembe district in Limpopo province, South Africa. Rural and semi-rural areas characterise the Thulamela municipality. A total of 20 crèches with a population of 100 caregivers were included in the study (see Figure 4.1). The number of caregivers in each of these crèches ranged from four to six. According to the Limpopo Department of Education (Tshilamba and Mutshindudi Circuits), all the crèches were controlled by both the Department of Education and the Department of

Health. Only seven of the crèches were owned and subsidised by these departments while the rest were privately owned and funded solely by their own resources. Just six of these crèches had proper buildings and facilities and the rest operated in small community-built structures or in churches. Children in all the crèches were given meals on a daily basis.

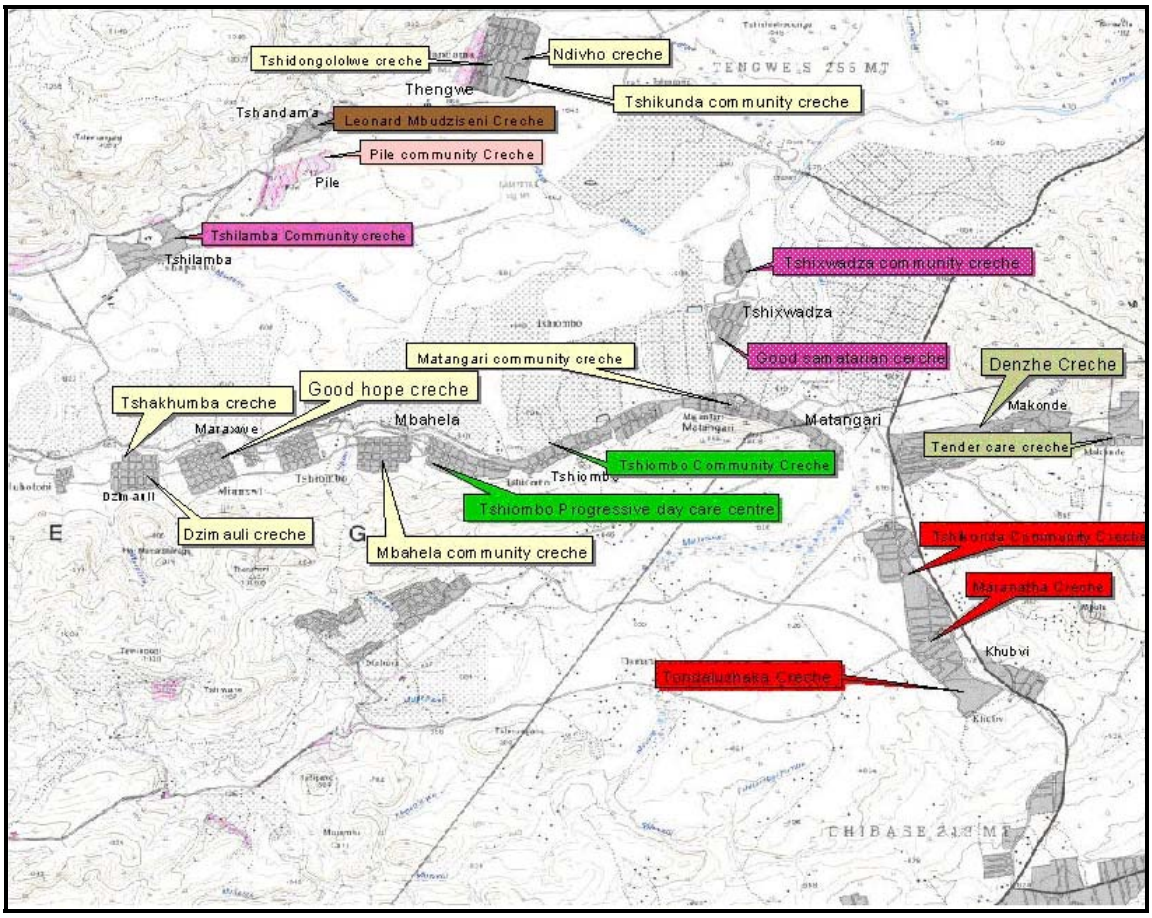


FIGURE 4.1: MAP OF THE STUDY AREA

The results of the study will be presented in three phases following the triple-A cycle process.

4.3 PHASE ONE

In accordance with the objectives set for phase one, a situational assessment and analysis was conducted at the crèches to determine dietary diversity, the availability and accessibility of vitamin A-rich vegetables and fruit, the utilisation of vegetables and fruit, as well as the caregivers' current nutrition knowledge of an application of the food-based dietary guideline

"eat plenty of vegetables and fruits everyday". Since only 100 respondents participated in this study, the frequency of the responses to the questions will be reported in actual numbers and, where applicable, in percentages. In cases where the numbers of the respondents who answered the question do not add up to 100, it means that there were some missing responses. The results are presented and discussed in the sections that follow.

4.3.1 Demographic profile

The demographic profile of the caregivers and children at the crèches includes variables that give a relevant indication of the participants' characteristics.

4.3.1.1 Demographic profile of the caregivers

All the respondents (n=100) in this study were females which strongly supports the general belief that women are habitually held responsible for childcare. Figure 4.2 presents the demographic profile of the caregivers with reference to their age, educational background, training and experiences in childcare.

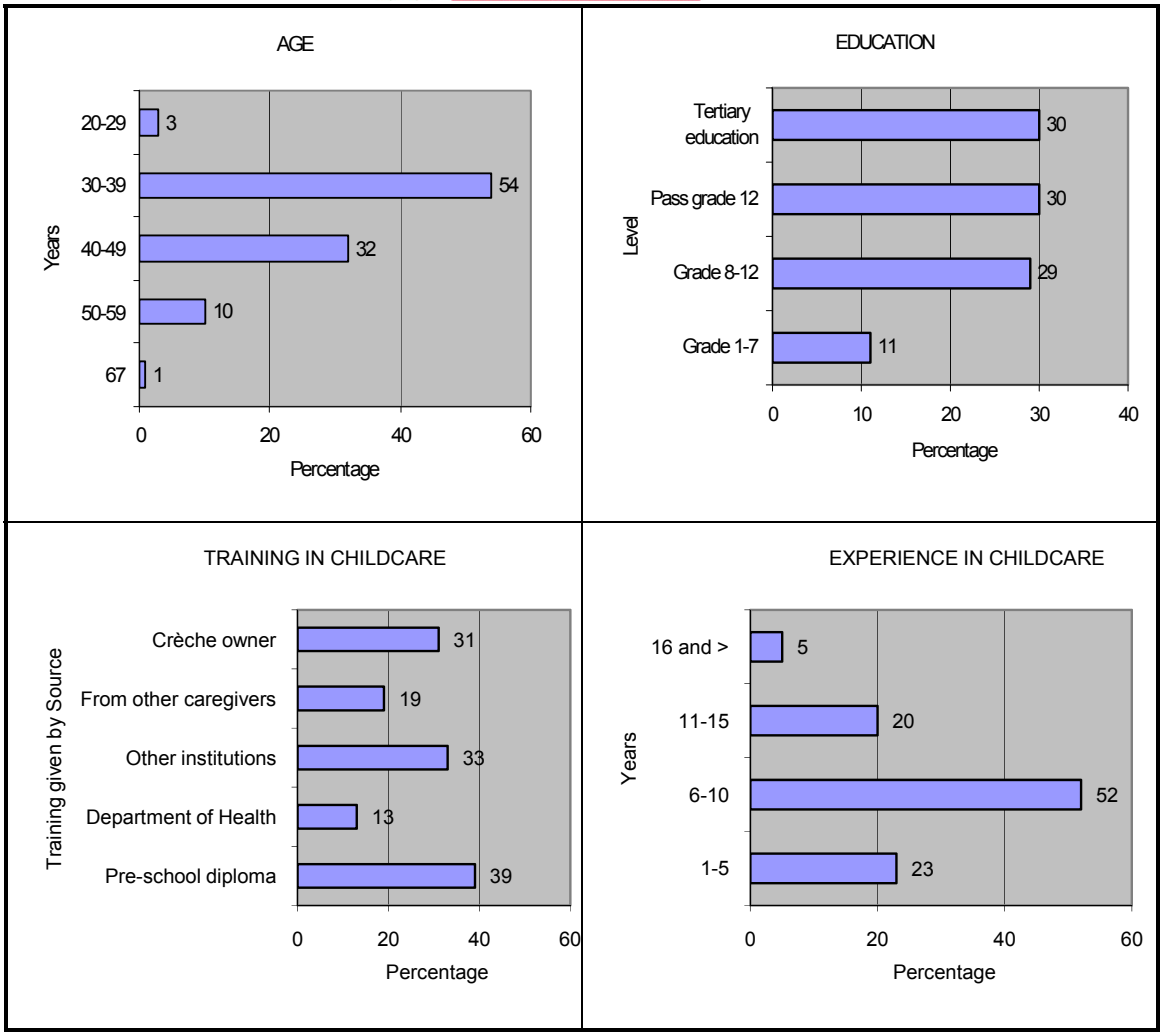


FIGURE 4.2: DEMOGRAPHIC PROFILE OF CAREGIVERS (n=100)

The age distribution of the respondents is seen from Figure 4.2. The ages ranged between 21 and 67 years. The majority (54%) of the respondents were between 30 and 39 years of the age. Thirty-two per cent were between 40 and 49 years old whereas 10% were between 50 and 59 years old. Three per cent of the respondents were between the ages of 20 and 29 and one per cent was a 67 year old respondent.

For the purpose of this research the caregivers' educational background was identified. To describe the respondents' educational background their educational level was categorised as follows: grade 1-7; grade 8-11; passed grade 12; and as having had some tertiary education. The results clearly indicate that although 40% of the respondents had lower than a grade 12 level of education, the majority of the respondents (60%) had moderate to high level of education as 30% had grade 12 and yet another (30%) had above grade 12 education (tertiary education) (see Figure 4.2).

The respondents also had to indicate if they had had childcare training. As reflected in Figure 4.2, 39% of the respondents had pre-school teaching diplomas, 19% had learnt about childcare from other caregivers, while 31% were trained by the owners of the crèche and 13% had been trained by the Department of Health. Another 33% indicated that they had been trained by various other institutions such as the Department of Education and some non-governmental organisations.

The caregivers' experience in childcare was of significance in this study. The assumption here was that the more experienced the caregivers were the better they would be able to take care of the children. Knowing that children dislike vegetables, experienced caregivers would know how to best feed the children including persuading them to eat vegetables. The results indicated that the respondents' experience varied between one and twenty five years as clearly reflected in Figure 4.2.

4.3.1.2 Demographic profile of children

Crèche children's demographic information in terms of age and gender, and the time they spend at crèche each day were important aspects for this study to depict the situation of the crèches (see Figure 4.3).

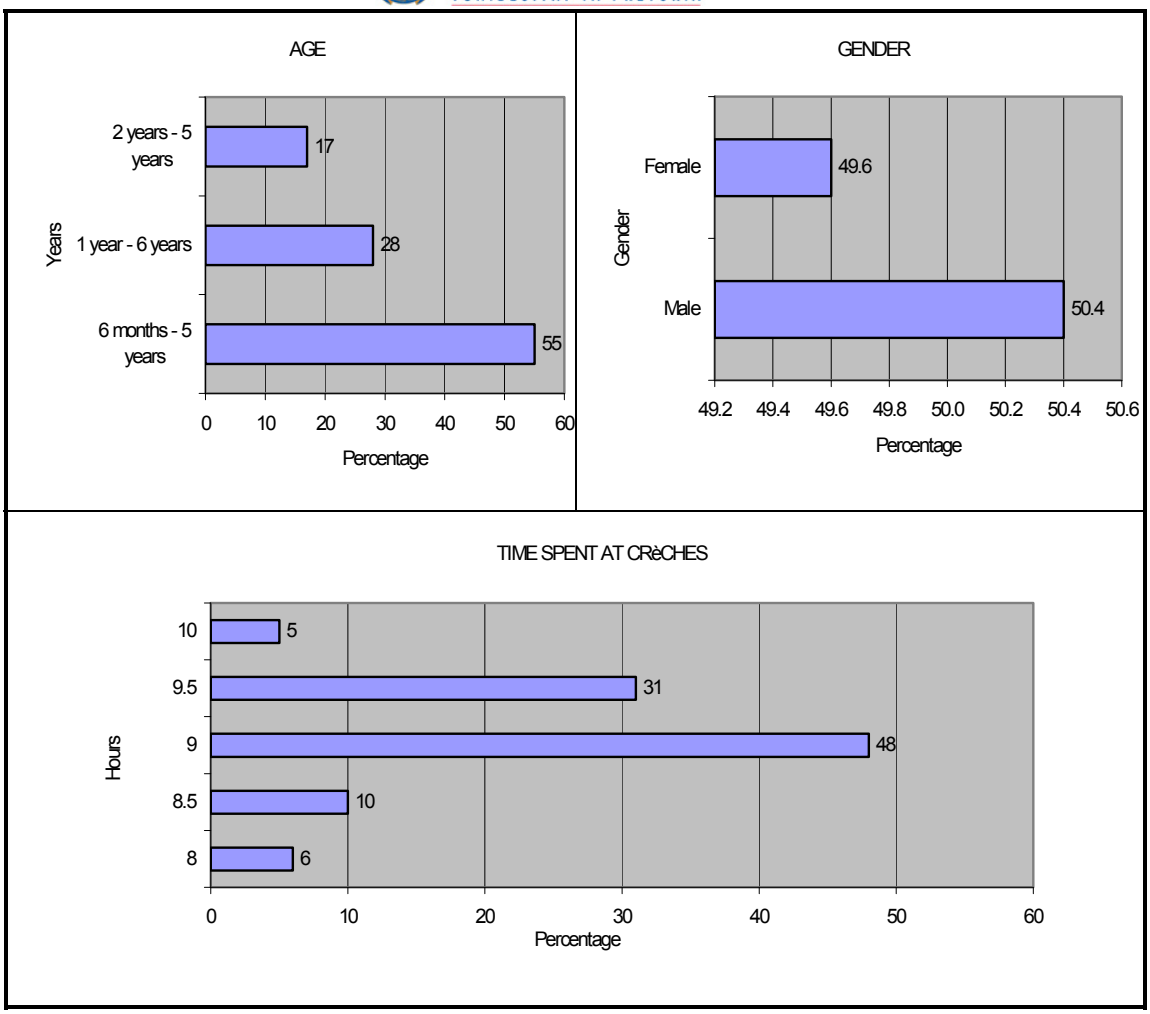


FIGURE 4.3: DEMOGRAPHIC PROFILE OF CHILDREN AT CRECHES (n=100)

Children from both gender groups were fairly equally represented in the crèches. Of the total of 988 children from all the twenty crèches that participated in this study 498 (50.4%) were males and 490 (49.6%) were females. Findings by Pietersen *et al.* (2002) led to the general comment that about 21% of all South African children under the age of six years attend crèches which seems true for this study area too. The ages of children attending the selected crèches ranged from six months to six years and different ages for entry were indicated by the survey participants. The majority (55%) of the respondents indicated that they cared for children between the ages of six months and five years, and 28% cared for children between one and six years whereas 17% cared for children between the ages of two and five years. These results, as depicted in Figure 4.3 confirm that children were attending crèches from a very young age.

The length of time children spent at the crèche during the day is of utmost importance. It might be possibly assumed in this study that the longer the children stay at the crèche, the more reliant they would be on the caregivers to provide them with adequate meals and snacks while they are there. The findings revealed that crèches operated between 6.30 and 17.30 for five working days each week. The time spent differed from crèche to crèche ranging between eight and ten hours a day. The majority of the respondents (48%) indicated that children spent nine hours at crèches, followed by 31% who showed that they spent nine and half hours (see Figure 4.3). It can be concluded that a striking majority of the children are at crèche for nine or more hours a day and all children are there for at least eight hours a day. This scenario could then raise a concern about the importance of nutritional knowledge and menu planning skills of caregivers employed at crèches.

4.3.2 Assessment and analysis of the nutrition strategies

4.3.2.1 Dietary diversity

This section gives the results related to the composition and variety of the meals which were served to children at crèches.

(i) Meals and snacks served to children at crèches

Figure 4.4 shows the meals, foods and snacks which were served to children.

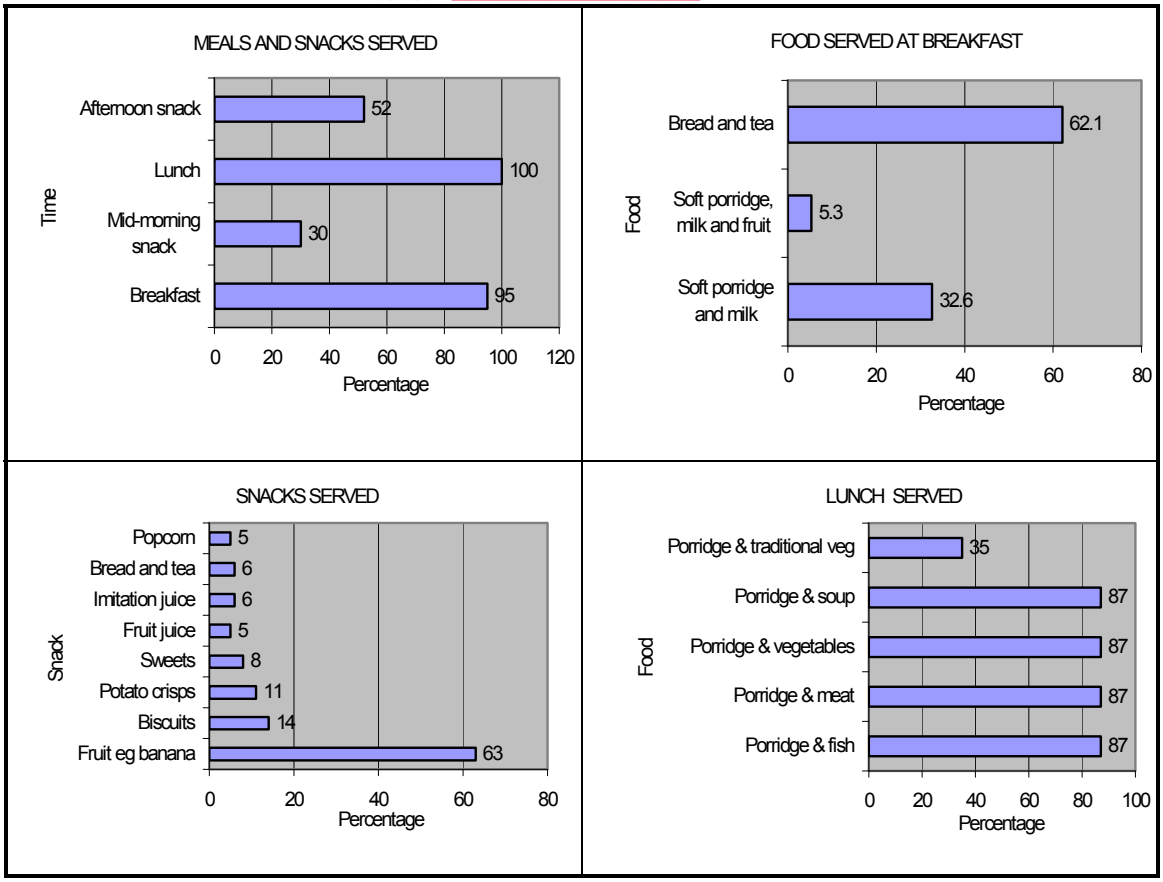


FIGURE 4.4: MEALS AND SNACKS SERVED TO CHILDREN (n=100)

As reflected in Figure 4.4 all the respondents (100%) served lunch for the children. Breakfast was the first meal of the day and it was provided by the majority (95%) of the respondents. While only 30% offered a morning snack, 52% of the respondents indicated that they served an afternoon snack.

It was observed that only one crèche representing 5% of the respondents did not give the children breakfast. It can thus be presumed that these respondents assumed that children would have had breakfast at home before they came to the crèche as they started their day as late as eight o'clock. Though some respondents served morning and afternoon snacks, it was observed that it was actually not a daily practice. Through observation it was noted that the actual meals that were regularly served to children were only breakfast and lunch. Overall a conclusion could be drawn that the time gap between lunch and supper requires that an additional snack should definitely be provided.

- ***Foods served to children for breakfast*** indicated to be similar at the different crèches with the majority (62.1%) of the respondents serving bread and tea. Some respondents (32.6%) indicated that they served soft porridge and milk, whereas less than six per cent (5.3%) served fruit in conjunction with soft porridge and milk (see Figure 4.4). Results revealed that the respondents very seldom gave different types of foods for breakfast. Through observation, it was realised that the children were given the same kind of food every day. It was also noticed that some of those who said that they served fruit at breakfast were not doing so on a daily basis. Observation also revealed that those who reported that they served soft porridge and milk were sometimes omitting the milk. These findings reveal that the breakfast meals lacked diversity.

- ***Food served to children for lunch*** varied from crèche to crèche. The majority (87%) of the respondents indicated that maize meal porridge was served as a basic food with either meat/fish/cultivated vegetables or soup as an accompaniment. Thirty five per cent reported that they also served indigenous vegetables when they were available. Although different foods were provided at different days of the week, it was observed that the food served at lunch reflected limited variety in that only one accompaniment was served at a meal. For example, if children were served porridge and meat, no other food was served. A further observation was that maize meal porridge was accompanied by sour milk for lunch at some crèches.

- ***Snacks and drinks served to children at crèches***

  The respondents had to specify the snacks they served to children at crèches. The results as depicted on Figure 4.4 revealed that various snacks, ranging from sweets to fruit, were served to children at crèches. Although the majority (63%) of the respondents indicated that fruit was served as a snack, it was obvious that unhealthy snacks such as sweets (8%), potato chips (11%), biscuits (14%), popcorn (5%) and imitation juice (6%) were served to children. Nevertheless, with the exception of 8% of the respondents who indicated that they were not serving snacks to the children, 5% indicated that they were serving 100% fruit juice and 6% were offering bread and tea.

Observation results showed that some of the snacks mentioned such as sweets, popcorn, potato chips and biscuits, were actually not served to children at all. The respondents just mentioned them in order to impress the researcher. This indicates that the respondents had misconceptions about the health value of the snacks. They considered these snacks to be

healthy and of high status. It was also observed that fruit as a snack was not really served on a daily basis, but only occasionally when there were surpluses. In some crèches there was evidence that some children brought their own snacks such as fruit, yoghurt, biscuits, sweets, potato chips, imitation fruit juices and popcorn from home. Another observation was that bread and tea was only served at breakfast and not as snacks and no 100% fruit juices were served to children at the crèches.

(ii) Frequency of vegetables and fruit consumption

In order to determine dietary diversity, it was important to assess the consumption of vegetables and fruit (particularly vitamin A-rich vegetables and fruit). Figure 4.5 indicates how frequently vegetables were on the menu, the kind of vegetables and fruit served and the kind of vegetables crèche children liked.

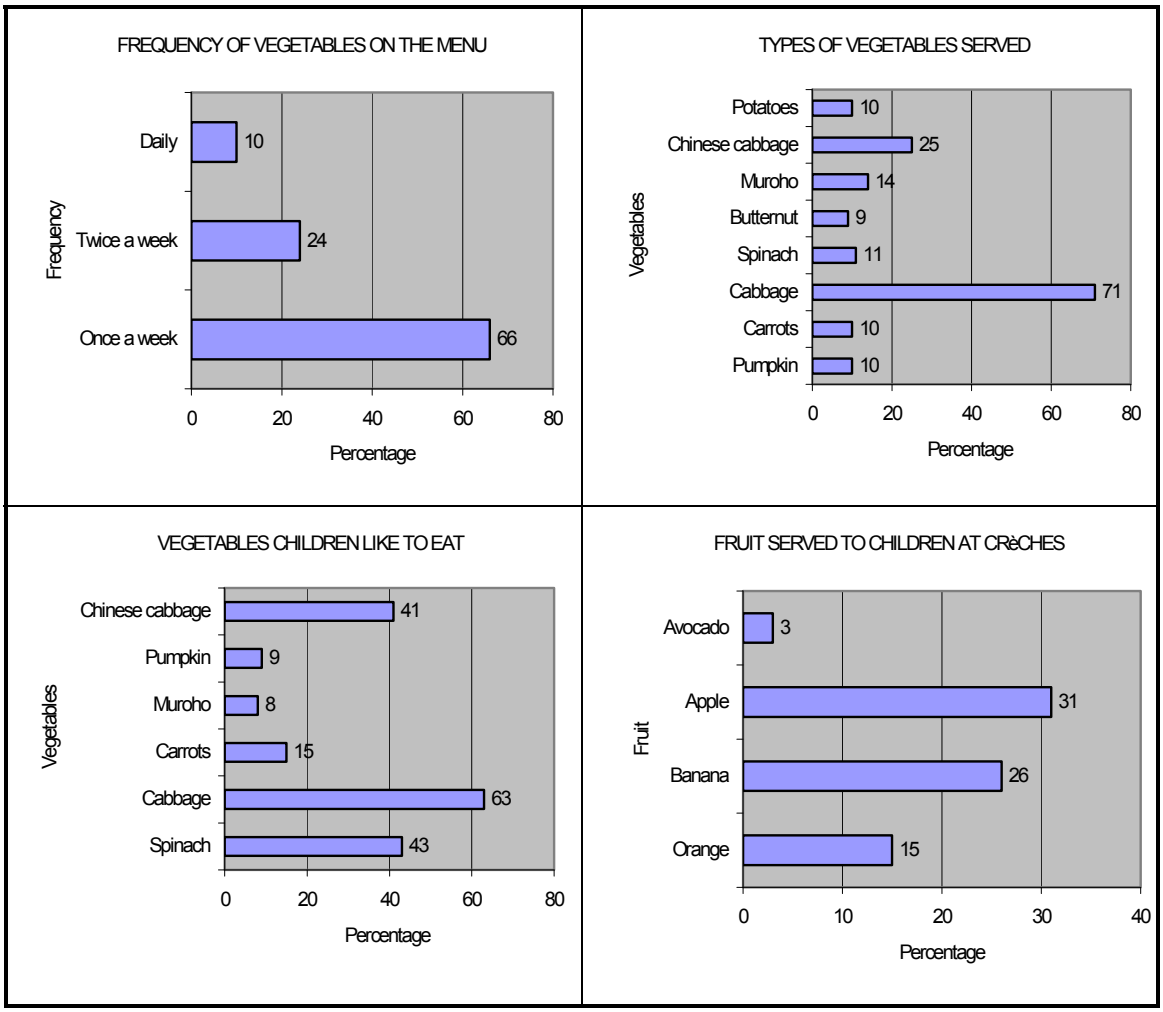


FIGURE 4.5: CONSUMPTION OF VEGETABLES AND FRUIT (n=100)

Frequency of vegetables on the menu

Figure 4.5 reflects that the majority of the respondents (66%) served vegetables only once a week followed by 24% who did so twice a week. Only 10% served vegetables on a daily basis. It was observed that the frequency of serving vegetables to children was influenced by having a vegetable garden at the crèche. The respondents who served vegetables on a daily basis were those who had vegetable gardens at their crèches. These results are reason for concern, because, as indicated by Vorster *et al.* (2001:2) vegetables and fruit are foods that must be eaten on a daily basis because they contain nutrients that are good for health. From the results it can thus be concluded that children at crèches were not served enough vegetables.

These findings substantiate Bere and Klepp's (2005) finding that most children eat less vegetables and fruit than is recommended. Similarly, Love and Sayed (2001:24) indicate that a considerable number of children do not meet the South African food-based dietary guideline of consuming five portions of vegetables and fruit every day. It is therefore important for this study to acknowledge that the dietary guideline '*eat plenty of vegetables and fruits everyday*' should form the core of nutrition information aimed to educate and motivate caregivers in order to improve the daily consumption of vegetables and fruit by children. Furthermore the promotion of locally available and consumed foods should be the core initiative (Department of Health, 2004:7; Vorster *et al.,* 2001:2).

The respondents were also asked to report how frequently indigenous vegetables were on the menu. The majority (70%) of respondents said that indigenous vegetables were served once a week. It was observed that the availability of these vegetables depended mostly on their seasonality. When in season they were served to children as a supplement to cultivated vegetables. On the other hand, observation results revealed that indigenous vegetables were not a regular part of the children's diet at crèches as they were not even part of the menus.

Types of vegetables served

Figure 4.5 illustrates the kinds of vegetables the children were served. The majority (71%) of the respondents favoured cabbage. A possible reason for the popularity of cabbage could be attributed to its affordability, familiarity and year-round availability. This question was also meant to assess the variety of vegetables and availability of vitamin A-rich vegetables. The findings revealed that only a few respondents served vitamin A-rich vegetables such as spinach (11%), pumpkin (10%), carrots (10%), butternut (9%), *muroho* (14%) and Chinese

cabbage (25%) to the children. Although serving yellow sweet potatoes could have been an option from this category, not one respondent chose to place it on the menu.

From these results it could be concluded that the meals served to children at crèches lacked vitamin A-rich vegetables. These results corroborate with those of Faber *et al.* (2001), who maintain that half of South Africa's children consume less than half of the required amount of vitamin A. A limited number (14%) of the respondents served indigenous vegetables like *muroho*. The reason for the low intake of indigenous vegetables could be ascribed to the exclusive promotion of cultivated vegetables and fruit which resulted in indigenous vegetables being regarded as inferior, although many are nutritionally superior (Maunder & Meaker, 2007:402).

Lastly, the respondents had to indicate whether the vegetables were served cooked or raw. With the exception of five per cent who served raw carrots, results showed that the majority of the respondents served cooked instead of raw vegetables to the children.

Vegetables children liked eat

The respondents had to indicate if children liked the vegetables (both indigenous and cultivated) they were served at the crèche. Table 4.1 shows the children's liking for vegetables. Generally the majority of the respondents (73) perceived that the children liked the cultivated vegetables whereas 27 said that they only liked these vegetables sometimes (see Table 4.1).

TABLE 4.1: CHILDREN'S LIKING FOR VEGETABLES AS PERCEIVED BY RESPONDENTS (n=100)

RESPONSES	CULTIVATED VEGETABLES	INDIGENOUS VEGETABLE
	FREQUENCY	FREQUENCY
Yes	73	53
No	0	32
Sometimes	27	15

The respondents were also asked to explain why they thought children did or did not like to eat the vegetables served at the crèche. Most of the respondents (73) indicated that children who liked the vegetables finished their servings and sometimes they even asked for more. Those who indicated that children sometimes liked the vegetables thought that it depended on how the vegetables were cooked as well as the children's familiarity with the vegetable. This confirms Bere and Klepp's (2005) postulation that acceptability and preferences of children have shown to be strong correlates of vegetables and fruit intake.

In terms of the indigenous vegetables, 53 respondents reported that their children ate these vegetables, while 32 indicated that children did not like eating indigenous vegetables and 15 said that children sometimes liked indigenous vegetables (see Table 4.1). Another follow-up question was posed to verify why the children did not like eating indigenous vegetables. The respondents gave the following reasons:

- They just refused to eat.
- Children did not like the taste of indigenous vegetables.
- Indigenous vegetables are not included in the menu.
- It was dependent on the type of vegetable and also the way in which it had been cooked.
- Children only liked those vegetable that they were accustomed to.
- Children's parents do not want their children to eat indigenous vegetables.

It was realised that the reason why parents did not want their children eating indigenous vegetables was that they regarded these vegetables as inferior and of low status. Some even saw them as animal fodder or weeds and they insisted that their children should not be given such vegetables. They even threatened that if their children were served these vegetables they would remove them from the crèche and register them at other crèches that do not serve indigenous vegetables. These results substantiate the claim made by Kepe (2008) and Faber *et al.* (2007:411) that promoting dark green leaf vegetables may be difficult because many people may regard traditional food crops as being inferior.

As was proposed by Faber *et al.* (2007:411), lack of popularity and unfamiliarity were also given as possible reasons for the low consumption of indigenous vegetables. This finding also confirms the viewpoints documented by Kepe (2008), Maunder and Meaker (2007:403) and Faber and Wenhold (2007:397), that there is an observed lower level of knowledge and esteem regarding traditional plants especially among the younger generation. However, barriers such as unavailability due to seasonal fluctuations were also seen as a cause of the low consumption of indigenous vegetables.

Overall the results show that the majority of the respondents indicated that children at crèches liked to eat the vegetables they were served. To confirm this, the respondents had to identify the vegetables that children liked to eat. The results showed that the majority (63%) of the respondents said that cabbage was indeed the favourite vegetable, followed by spinach (43%) and then Chinese cabbage (41%). Vegetables such as carrots (15%), pumpkin (9%) and *muroho* (8%) were not popular among the children (see Figure 4.5).

Although the respondents named cabbage as the vegetable children liked most, it was observed that cabbage was the vegetable that the respondents liked to prepare for the children. Another explanation was that cabbage was the children's parents' preference.

Types of Fruit served

To determine if children were served fruit, and whether it was rich in vitamin A, the respondents had to specify the kind of fruit that they gave the children. The fruits most commonly served by the majority of the respondents (31%) were apples, followed by bananas (26%), then oranges (15%) and the least served were avocado pears (3%) (see Figure 4.5). Apples and bananas were predominant because they were easily and cheaply acquired. It was, however, surprising to find that avocadoes, which were in season at the time of data collection, and are rich sources of vitamin A, were not provided as often as one would expect.

It is apparent from the results that some vitamin A-rich fruit such as mangoes and paw-paws were not served to the children at all. Although these fruits were not in season at the time of data collection, it was observed that even when they were in season, they were not included in the menu. When in season mangoes grow in the home gardens and this was given as the reason why the respondents did not give them to children at the crèche even though they are found in abundance in the area. The crèche staff believed that children would eat these fruit at their homes since almost every household has a mango tree or even several in their yards. These results uphold the FAO (1997a:55) statement that although micronutrient rich foods may be available they are often not consumed in sufficient quantities. Looking at the number (25) of the missing responses, it shows that some respondents were not giving fruit to children at all (see Figure 4.5).

Based on these findings it could be concluded that there is a general lack of dietary diversity and a dislike of indigenous vegetables which resulted in a limited intake of vitamin A-rich vegetables by children at the crèches. This study therefore aims to ensure dietary diversity by increasing availability and accessibility through promoting the production, gathering and consumption of vitamin A-rich vegetables and fruit, as advocated by Helen Keller International (2003b).

4.3.2.2 Availability and accessibility of vegetables and fruit

The availability of vegetables and fruit at crèches was determined by the presence of vegetable gardens and, if vegetables were planted and fruit trees were growing, whether

vegetables and fruit were being gathered and, if so, where were these vegetables and fruit usually gathered.

(i) Availability of vegetable gardens at crèches

The respondents had to indicate whether they had vegetable gardens at the crèches. In cases where the respondents did not have gardens, they were required to provide reason(s) why. As mentioned in par. 4.2, each crèche had between four and six caregivers. This means that certain number of the respondents who answered yes to having vegetable gardens did not necessarily mean having their own specific garden but were referring to one garden in a particular crèche. Results showed that only 39 respondents from seven crèches cultivated gardens at the crèches whereas 61 (from 13 crèches) indicated that they did not have vegetable gardens. This was confirmed by the observation that most of the crèches did not have vegetable gardens and, what was also noticeable was that, although some crèches had vegetable gardens, very few were producing enough vegetables to feed the children at their crèches.

Another observation was that most of the crèches that had vegetable gardens were forced to do so because they were funded by the Department of Health and their officials wanted to see a vegetable garden whenever they visited the crèche. However, even though there were gardens at these crèches they were not flourishing. Thus the majority of the respondents reported not having their own supply of vegetables and fruit which meant that most of the vegetables that were served to children at crèches were purchased.

The reasons for not having vegetable gardens varied from crèche to crèche and they were:

- No space (18)
- No water (34)
- Not knowing how to make a garden (22)
- No fence (15)
- No person to take care of the garden (41)
- The gardener is careless and lazy (6)
- Working on a hired facility (9)
- No funds (4)

It is to be noted that, besides the reasons mentioned above, gardening activities were also hampered by insufficient gardening tools and equipment as well as the fact that roaming livestock destroyed the crops because of unfenced yards. Faber *et al.* (2007:116) found

similar circumstances in their study. At the same time it was also noticed that some of the reasons mentioned could be attributed to a general lack of interest as well as knowledge about the importance of having a vegetable garden. Such findings clearly emphasise the need for basic training on gardening practice.

To further assess the availability and accessibility of vegetables and fruit, the respondents had to indicate the kinds of fruit trees that were grown, the kind of vegetables planted and indigenous vegetables gathered.

Kinds of vegetables available at crèche gardens

Availability of vegetables was determined by the respondents' indication of the vegetables that they planted in their gardens. Many (34%) of the respondents chose to plant spinach; while 17% chose to plant pumpkin; 16% Chinese cabbage; and another 16% cabbage. Ten per cent of the respondents planted beetroot; 9% carrots; 8% indigenous vegetables, namely m*uxe* and at least 6% planted tomatoes. It was gratifying to find that, except for cabbage, most of the vegetables that were grown were rich in vitamin A. Although the yellow/orange sweet potato was one of the options in the questionnaire no respondent mentioned planting these vegetables (see Figure 4.6).

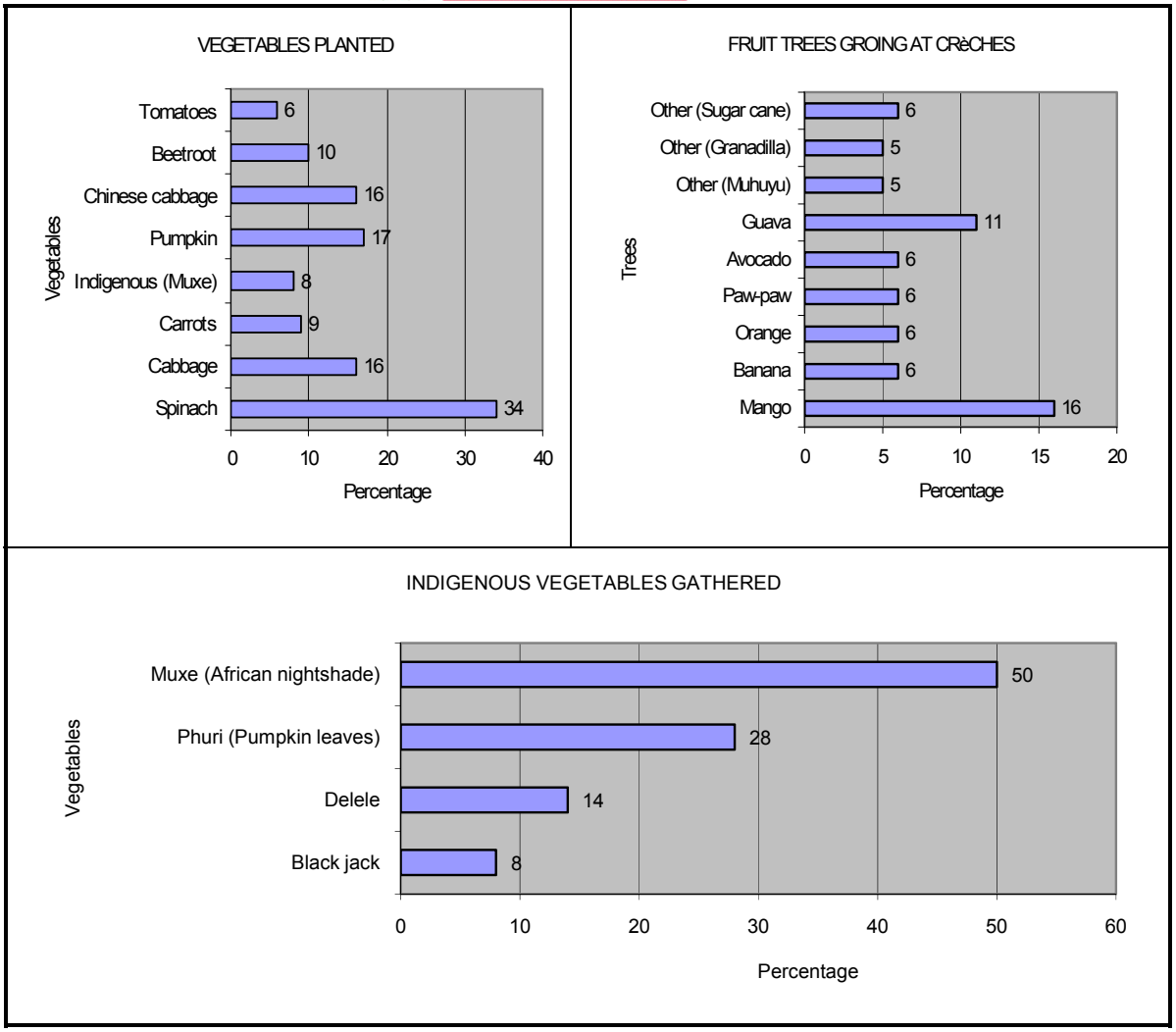


FIGURE 4.6: AVAILABILITY AND ACCESSIBILITY OF VEGETABLES AND FRUIT (n=100)

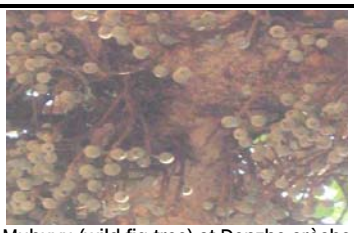
Fruit trees available at crèches

The majority of the respondents (66%) indicated that they did not have fruit trees while 34% did have fruit trees at their crèches. To substantiate these results the respondents had to actually name the kind of fruit trees that were growing in their crèche yards. Sixteen per cent had mango trees, followed by 11% who had guava trees and then 6% had avocado trees. Another 6% had paw-paw, orange, banana and sugar cane while 5% had *muhuyu* (wild fig tree) and another 5% had granadilla plants (see Figure 4.6). It is evident from the results that fruit trees at the crèches were limited.

Although not all the crèches had fruit trees, observation results confirmed that these kinds of trees were found at some crèche sites. To substantiate these results photographs of sugar cane and fruit trees were taken at different crèches (see Figure 4.7).

Sugar cane at Tshilamba crèche

Mango tree at Tshilamba crèche



Muhuyu (wild fig tree) at Denzhe crèche

FIGURE 4.7 FRUIT TREES AT THE CRECHE

(ii) Gathering of indigenous vegetables and fruit

The respondents had to state whether they gathered indigenous vegetables and fruit, to mention their types and the locations where they were gathered.

Accessibility of indigenous vegetables

If they gathered indigenous vegetables the respondents were merely required to answer yes or no. Seventy respondents said they did gather indigenous vegetables whereas 30 did not. To support this, the respondents had to specify the type of vegetables that they gathered. The results, as presented in Figure 4.6, show that 50% of the caregivers gathered *muxe* (African nightshade). It is worth noting that *muxe* was in fact being gathered by the majority of the respondents because *muxe* is one of the indigenous vegetables that is rich in vitamin A (Maunder & Meaker, 2007:403; Faber *et al.*, 2006:28; Weinberger & Msuya, 2004; Louw, 2001; McLaren & Frigg, 1997).

The results also showed that 28% of the respondents gathered *phuri* (pumpkin leaves), 14% *delele* (jute mallow) and 8% gathered black jack (see Figure 4.6). Although these vegetables were being gathered by the minority it was encouraging because they are rich in beta-carotene. However it was disappointing that amaranth, which is known to be rich in vitamin A (Weinberger & Msuya, 2004), was not gathered at all. This confirms the statement made by Mnkeni, Masika and Maphaha (2007) who maintain that amaranth vegetables are highly nutritious, but in many parts of South Africa they are hardly utilised as food.

The respondents identified several locations where they usually found indigenous vegetables. The most common were the fields, the open-market, the backyard and the supermarket. The respondents could make use of any one of the mentioned locations that were applicable. The majority of the respondents (53) gathered indigenous vegetables from the fields. The fields here are where villagers usually grow their seasonal crops such as mealies (maize), or where they practise agricultural activities. Twenty eight respondents procured these vegetables from the open market (a place where local stallholders sell their food products); whereas 20 gathered them in their backyards; and six bought them from the supermarket.

From these results it can be concluded that some of the indigenous vegetables that the respondents listed (see Figure 4.6) as being gathered, were not only gathered but were also cultivated or domesticated indigenous vegetables and these could be found being sold at the local markets and at the fields. For example, it was observed that *muxe, phuri* and *delele* were very popular at the open markets. The findings corroborate with Jansen Van Ransburg *et al.* (2007:318) who purport that African people obtain leafy vegetables in different ways. They may be harvested from the wild or from fallow and ploughed fields or they may be cultivated plant species that are used as leafy vegetables.

It was confirmed through observation that the majority of indigenous plants occur naturally in the study area as wild plants. Although some of these vegetables are still growing wild and are harvested as wild plants, others such as *muxe* and *phuri* are being domesticated. Observing the availability of indigenous vegetables showed that a variety of indigenous vegetables were available but the type was dependent on the season. Though these vegetables are highly seasonal, when they were in season respondents included them in the meals they were providing. Overall the respondents confirmed that they were giving indigenous vegetables to children once a week.

Accessibility of indigenous fruit

In terms of gathering indigenous fruit, the results revealed that only 14 respondents were doing so. With regard to the kind of fruit gathered, 5% of the respondents collected *mahuyu (figs)*; another 5% gathered *pfuka* whereas four per cent picked the *mazwilu* (wild medlar). Most of these fruit came from the crèche yard where they were growing. It was observed that the crèches that had indigenous fruit trees were those situated in the mountainous areas. However, during fieldwork it was noticed that the fruit from these trees was not served to children as part of their daily meals at the crèche, nor were they listed in the menus. When the fruit was in season it was usually eaten as a snack by the children who just picked the

fruit whenever they felt like it especially when they were playing outside. The children enjoyed their sweet taste.

From the results it can be said that indigenous fruit was hard to get as they were neither grown in the crèche yards nor sold at the market. Seasonality was also a factor that affected the availability and accessibility of fruit. This contributed to the lack of fruit in the children's diets. The researcher was unable to find out about the vitamin A content of these fruits. Figure 4.8 shows one of the indigenous fruit trees (*muhuyu)* growing at one of the crèches.

FIGURE 4.8 A MUHUYU (WILD FIGTREE) BEARING FRUIT

The results reveal low availability of vegetables and fruit especially the indigenous varieties. Nevertheless from the findings it can be concluded that there is potential for improving the availability and accessibility of vegetables and fruit. Effort is needed to improve the frequency of vegetable consumption through increased production as well as the gathering and cultivation of indigenous vegetables at crèches. Moreover the general intake of vegetables and fruit could be enhanced if caregivers were to use the commodities appropriately.

4.3.2.3 Utilisation of vegetables and fruit

One of the sub-objectives formulated for phase one deals with the utilisation of vegetables and fruit. For the purpose of this study utilisation of food was defined as the proper use of food from its natural state in terms of cooking, storage and preservation. To determine how the available vegetables and fruit were utilised the respondents were questioned on menu planning and food preparation as well their purchasing, storage and preservation practices.

(i) Menu planning and training

To investigate the issue of the utilisation of vegetables and fruit data was collected concerning menu planning and on how the caregivers decided what to serve the children on a daily basis. They also had to indicate if they had been trained on how to plan a menu and how their training took place. The results are reflected in Table 4.2.

TABLE 4.2: MENU PLANNING AS PART OF UTILISATION (n=100)

WHO DECIDES WHAT TO SERVE TO CHILDREN			TRAINING IN MENU PLANNING			HOW RESPONDENTS WERE TRAINED	
REPONSES	NUMBER		RESPONSES	NUMBER		RESPONSES	NUMBER
Followed own written menu	62		Yes	45		Attended workshops	66
The manager of the crèche decides	8					Trained at a cooking school	16
Follow menu from the Dept of Health	25		No	55		Trained by the Dept of Health	14
Cooks decide	5					Trained while doing pre-school diploma	2
						Learnt from other caregivers	2

The majority of the respondents (62) followed their own written menu, whereas eight respondents indicated that the manager of the crèche decides what to cook and 25 followed the menu supplied by the Department of Health. Five respondents indicated that the cooks decide what to prepare. The cooks were caregivers themselves who took turns to prepare children's meals. Observation results revealed that, although the majority of the respondents had written menus, they were seldom used. Another observation was that the written menus remained the same throughout the year without being changed nor was attention paid to encouraging the use of a variety of dishes. These menus were not balanced except for those that were supplied by the Department of Health and these accommodated the use of a variety of different foods.

In some cases the menus from the Department of Health were not used as such but were only kept on display to impress officials from the Department of Health should they come to monitor the work being done in crèches, in which case they would want to see the menus. This practice was only seen in some of the crèches that were funded by the Department of Health. It was only done out of apprehension that if they were not following the model menus provided, the Department of Health might withdraw the subsidies paid to these crèches claiming that they were not complying with the regulations. The crèches that were privately owned felt at liberty to use their own menus, although the Department of Health encouraged them to use the menus which they supplied.

In terms of training only 45 respondents indicated that they had been trained for menu planning. In an open-ended question the respondents were asked to indicate how they were trained and the results show that the majority of the respondents (66) had attended some training workshops and only two respondents had not received any formal training (see Table 4.2).

(ii) Purchasing

As part of the investigation into the utilisation of vegetables and fruit, data was also collected on frequency of purchase, persons responsible for the purchasing and where vegetables and fruit were obtained. The results are summarised in Figure 4.9.

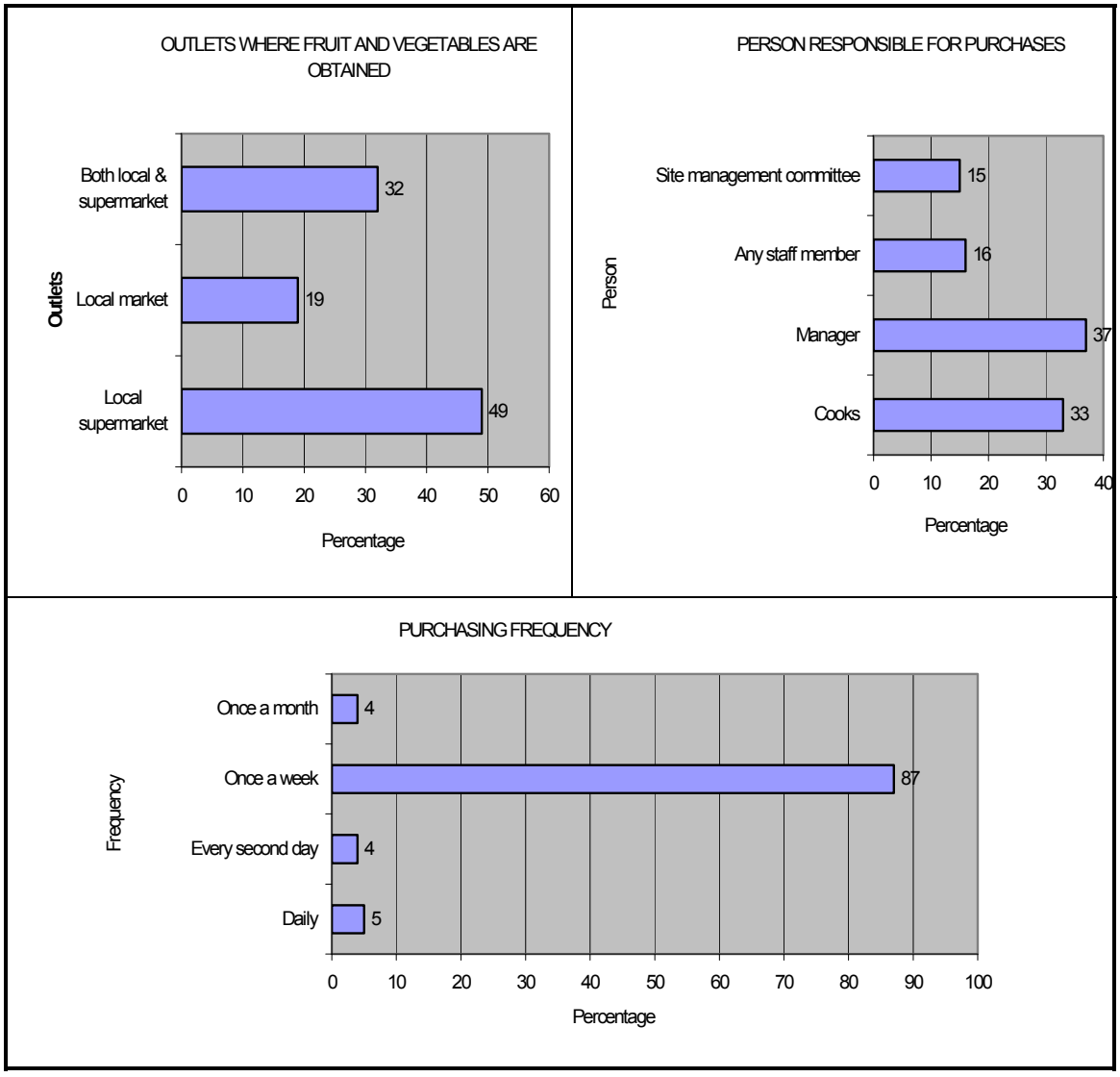


FIGURE 4.9: UTILISATION OF VEGETABLES AND FRUIT (n=100)

Figure 4.9 illustrates that 33% of the respondents indicated that the cooks were responsible for buying the vegetables and fruit, 37% said that the manager was responsible, whereas 16% reported that any staff member could buy the food. Another 15% cited the site management committee as responsible for buying the vegetables and fruit.

In terms of purchasing frequency, only 5% of the respondents indicated that they bought vegetables on a daily basis. The majority (87%) of the respondents did so once a week, while four per cent did the buying once a month. Another 4% of the respondents bought vegetables and fruit every second day (see Figure 4.9). With regard to where they procured vegetables and fruit 49% went to the local market whereas 19% shopped at the supermarket and 32% got their supplies at both the local market and the supermarket (see Figure 4.9).

Though the information differed from crèche to crèche, the choice and purchase of vegetables and fruit were the sole responsibility of the respondents themselves. This enabled them to buy the kind of vegetables and fruit that they could afford and were able to cook. The findings revealed that not one respondent used fruit or vegetables from their own gardens.

(iii) Preparation of the vegetables and fruit

Data on vegetable preparation was collected through questions regarding the use of recipes, how vegetables were cooked and what was added to vegetables during the cooking process. The results are reflected in Figure 4.10.

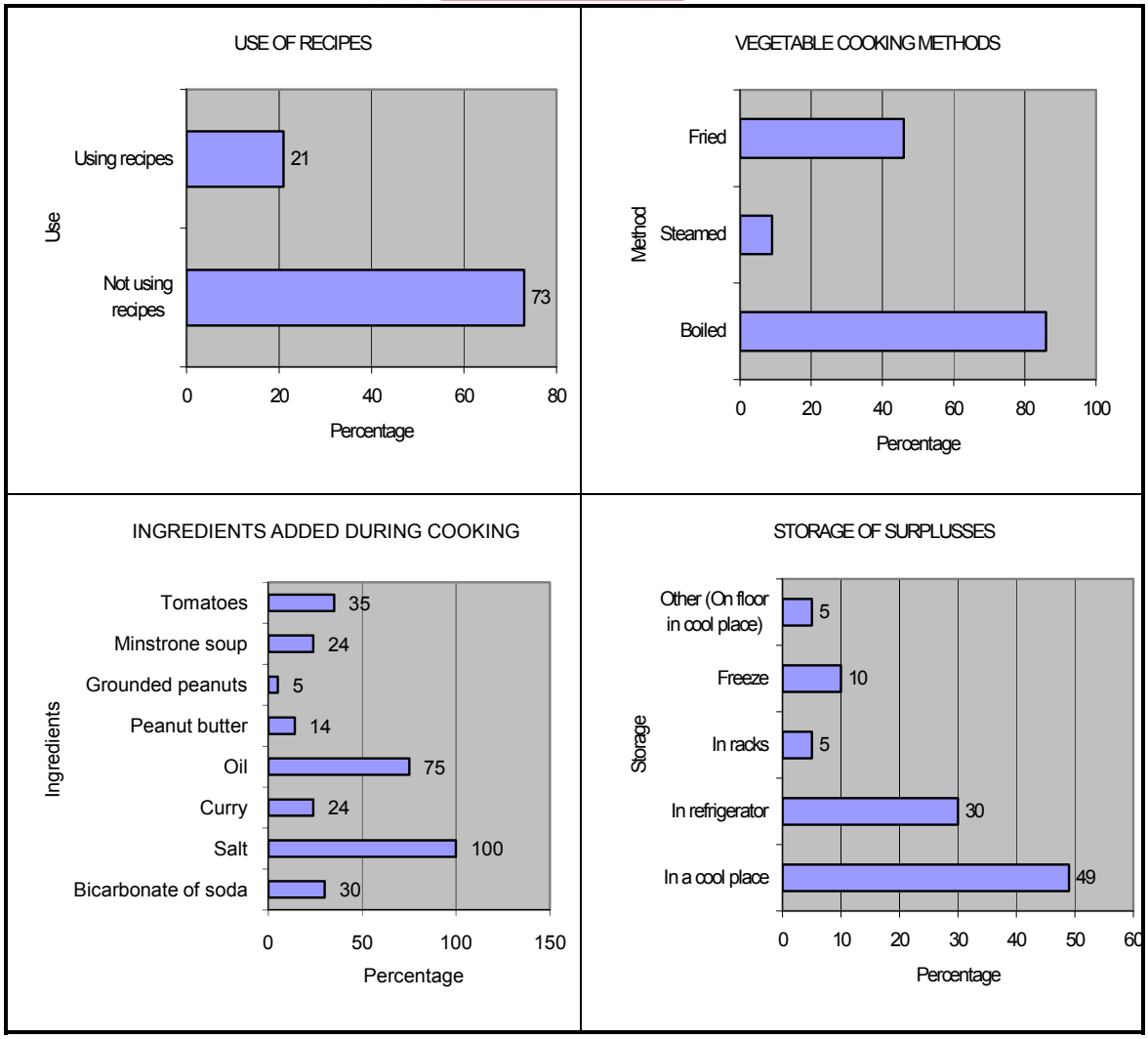


FIGURE 4.10: FOOD PREPARATION PRACTICES (n=100)

The majority (73%) of the respondents did not use written recipes when cooking, only 21% did (see Figure 4.10). Although some respondents chose more than one option, the results show that only three methods were used for cooking vegetables at the crèches. Forty six per cent of the respondents indicated that they fried vegetables, while 9% steamed them and 86% boiled their vegetables. Although respondent were given an open option, '*other'*, no one made use of it as the options supplied covered their desired responses.

In another question the respondents were asked about the use of additives in cooking. Figure 4.10 shows the various kinds of ingredients that were added to vegetables during cooking. All the respondents (100%) added salt to the vegetables. Other additives such as oil, bicarbonate of soda, curry, peanut butter, pounded peanuts, minestrone soup and tomatoes were used. Except for bicarbonate of soda which was mentioned by 30% and curry

by 24%, the other ingredients such as oil or margarine, peanut butter, pounded peanuts and tomatoes contributed to the nutrition value of the dish. Although only 30% of the caregivers mentioned using bicarbonate of soda, when observing the cooking process it was seen to be a very common practice. It seemed that the respondents already knew that bicarbonate of soda destroys the nutrients in vegetables, but chose to use it because it softens and preserves the green colour of vegetables.

It was found that a large percentage (75%) of the respondents add oil to the vegetables, which is necessary for the absorption of vitamin A by the body. However, through observation it was noticed that oil was only added to cultivated vegetables such as cabbage and spinach and it was never added to indigenous vegetables. Another observation was that tomatoes were added to almost all the vegetable dishes in conjunction with the other ingredients and, in accord with cultural culinary practice, pounded peanuts and peanut butter were only added to indigenous vegetables.

The respondents were asked what they did with excess water once the vegetables were cooked. Eighteen of the respondents threw any excess water away and 10 respondents stated that excess water was served as gravy. Thirty respondents indicated that they added excess water to the children's porridge, while 16 said that after cooking the vegetables no water was left.

(iv) Storage and preservation of vegetables and fruit

To determine the nature of storage facilities for vegetables and fruit the respondents had to indicate how they stored the raw surpluses and cooked leftovers. From the purchasing frequency of vegetables (see Figure 4.9) it is clear that proper storage facilities would be required to store the surpluses to prevent deterioration.

The respondents had to indicate the storage methods they were using for their surplus vegetables and fruit. The results are reflected in Figure 4.10. Almost half (49%) of the respondents stored their surpluses in a cool place, whereas 30% used a refrigerator and 10% used freezers. Five per cent used vegetable racks, and another 5% put their vegetables on the floor in a cool place. However, generally surplus stock was not a problem as the respondents indicated that they had no surpluses.

In terms of storing the cooked leftovers, some respondents (34%) indicated that they had no leftovers, 37% indicated that they stored their leftovers in the refrigerator, while 11% froze the leftovers and 5% put them in containers. Although it seems as though leftovers were

stored in one way or the other, there were 13% of the respondents who said that they threw leftovers away.

With regard to preserving vegetables and fruit, the respondents were asked whether they did this and how. The majority of the respondents (99) indicated that they did not preserve fruit or vegetables. There was one missing response and, as a result, it can be concluded that none of respondents preserved vegetables.

In general, the results show inadequate knowledge and skills regarding menu planning, food preservation and storage techniques. The respondents also show incorrect food preparation methods such as the addition of bicarbonate of soda and throwing away excess water. As suggested by Krige and Senekal (1997:22), knowledge of appropriate food preparation practices should be available so that food can be handled and cooked in a manner that will prevent nutrient losses, so it is important that the correct ways of food utilisation should be encouraged.

4.3.2.4 Nutrition knowledge

This section presents the results of the respondents' current knowledge about the application of the food-based dietary guideline that places special emphasis on vitamin A-rich vegetables and fruit. Thus the caregivers' current knowledge of vitamin A, vitamin A-rich vegetables and fruit, and the importance of children eating vegetables and fruit rich in vitamin A are assessed. The caregivers were asked questions about the children's consumption of vegetables and fruit and what could happen to them if they do not eat them. Caregivers were also required to report on the number of vegetables and fruit portions, and their size, that children should consume daily. In addition their knowledge of vegetables and fruit that are rich source of vitamin A, and their view of the importance of vitamin A for the health of children, was tested.

(i) Children's consumption of vegetables and fruit

In response to whether children should eat vegetables and fruit, the majority of the respondents (93) agreed that children should be served vegetables and fruit. Only seven respondents said that eating vegetables and fruit was at times adequate and no-one thought that children should not eat vegetables and fruit (see Table 4.3).

TABLE 4.3: KNOWLEDGE ON VEGETABLES AND FRUIT CONSUMPTION AND THE IMPORTANCE OF VITAMIN A (n=100)

QUESTION	RESPONSE	FREQUENCY
Should children eat vegetables and fruit?	Yes	93
	No	0
	Sometimes	7
What is the best form of vegetable to serve to children, if available?	Frozen	0
	Tinned	7
	Fresh	93
What will happen if children do not eat vegetables and fruit?	They will have poor health	78
	They are at risk of disease	67
	Growth faltering	44
	Weak immune system	17
	Increased early childhood deaths	4
	Lack of vital nutrients	34
Why is Vitamin A important?	Prevent growth faltering	26
	Increase resistance to diseases	52
	Prevent eye diseases and blindness	23
	Decrease child mortality	15

The respondents were also given the opportunity to indicate the best way of serving available vegetables to children. They had to choose the best option between, frozen, fresh and tinned vegetables. The responses are reflected in Table 4.3. It was found that the majority of the respondents (93) already knew that fresh vegetables are better than processed vegetables. Only seven respondents suggested that children should be served tinned vegetables and no respondent chose frozen vegetables as an answer.

The respondents were also asked to indicate why the consumption of vegetables and fruit during childhood is to be encouraged. Primarily the respondents showed little knowledge and they stated more general health than nutrition-based reasons, and specified as: to build the body, to prevent diseases, to prevent weight loss, for strength, for growth and for good health, to mention but a few.

In another open-ended question the respondents were asked to mention what would happen if children did not eat vegetables and fruit. Due to the fact that the respondents came up with so many reasons, the responses were grouped together and then categorised to give more meaningful information (see Table 4.3). Despite the fact that the majority of the respondents (93) already knew that children should be served vegetables and fruit, they showed little understanding with regard to what could happen if they never ate them. Some respondents did not know exactly what would happen if children did not eat vegetables and fruit.

The majority (78) revealed general knowledge such as indicating that children will have poor health, though there were 67 who claimed that the children would be at risk of contracting diseases. Important reasons such as growth faltering, the development of a weak immune system and a lack of vital nutrients were mentioned by some, but these were in the minority (see Table 4.3).

The respondents were also asked to describe the size of the portion of vegetables and fruit they served to the children. The portion sizes differed from crèche to crèche as well as from child to child according to their age.

Fruit portions

Although the caregivers who did respond to the question on the portion size of fruit indicated that they served either a whole, a half or mashed fruit to the children depending on their age, a large number of respondents did not answer this question. For example, 61 respondents ignored the serving of fruit to children aged six to ten months which could mean that the majority of respondents did not serve fruit to children of this age. It was observed that in most crèches the children aged six months to one year were not served fruit at all.

It was also seen that, when children were served fruit at crèches, all the children from the age of two to six years old were given one whole fruit irrespective of their age. For example, if they were eating apples all the children would be given a whole apple yet the younger children were unable to finish the fruit which they were served. It would thus be better if these children were served softer fruits as suggested by Faber *et al.* (2006) who maintain that fruit for younger children should be mashed for easy digestion.

Vegetable portions

Results show that respondents used serving spoons, tablespoons as well as cups to measure the helping of vegetables served to children. Children could be served a quarter, half or a full cup of vegetables depending on their age. Older children were served larger portions such as two serving spoons whereas younger children were served less vegetables such as one or half a serving spoon. However, children who demanded some more vegetables were given a second serving as the caregivers did not consider it to be overeating. Results also showed that at some crèches children were not served vegetables at all. For example 32 respondents were not serving vegetables to the six months old children and ten were not serving vegetables to the one year old children.

Through observation, it was revealed that all the children were served the same amount (large portions) of vegetables irrespective of their age and it seemed that, caregivers were giving children as much food as possible. Photographs of plates filled with porridge and cooked vegetables were taken at some crèches during lunch time to give an idea of the quantity being served. Figure 4.11 shows the portion size (one cup) of vegetables that was served to a 3 year old child in one of the crèches in this study.

FIGURE 4.11: CHILDREN BEING SERVED PORRIDGE AND SPINACH AT THE CRÈCHE

(ii) The importance of vitamin A to children

The findings of why vitamin A is important to children are summarised in Table 4.3. The results show that the respondents had limited knowledge of the importance of vitamin A to children. Though 52 of the respondents knew that vitamin A increases resistance to certain diseases, only 26 knew that vitamin A could prevent growth faltering, 23 knew that vitamin A can prevent eye diseases and blindness and only 15 knew that vitamin A could decrease child mortality. These results were also confirmed by the game used as a data collection method as the highest score was two out of five.

(iii) Knowledge of vegetables and fruit rich in vitamin A

The respondents' knowledge about vitamin A-rich vegetables and fruit was assessed by letting them choose from a list of vegetables and fruit. They had to indicate which vegetables and fruit were rich in vitamin A. The respondents were also encouraged to mention some *other* fruit or vegetables which were not on the list. To simplify analysis and reporting responses on the *other* option, related responses were reduced to categories according to those that were rich in vitamin A and those that were not rich in vitamin A. Figure 4.12 represents the respondents' knowledge of vitamin A-rich vegetables and fruit.

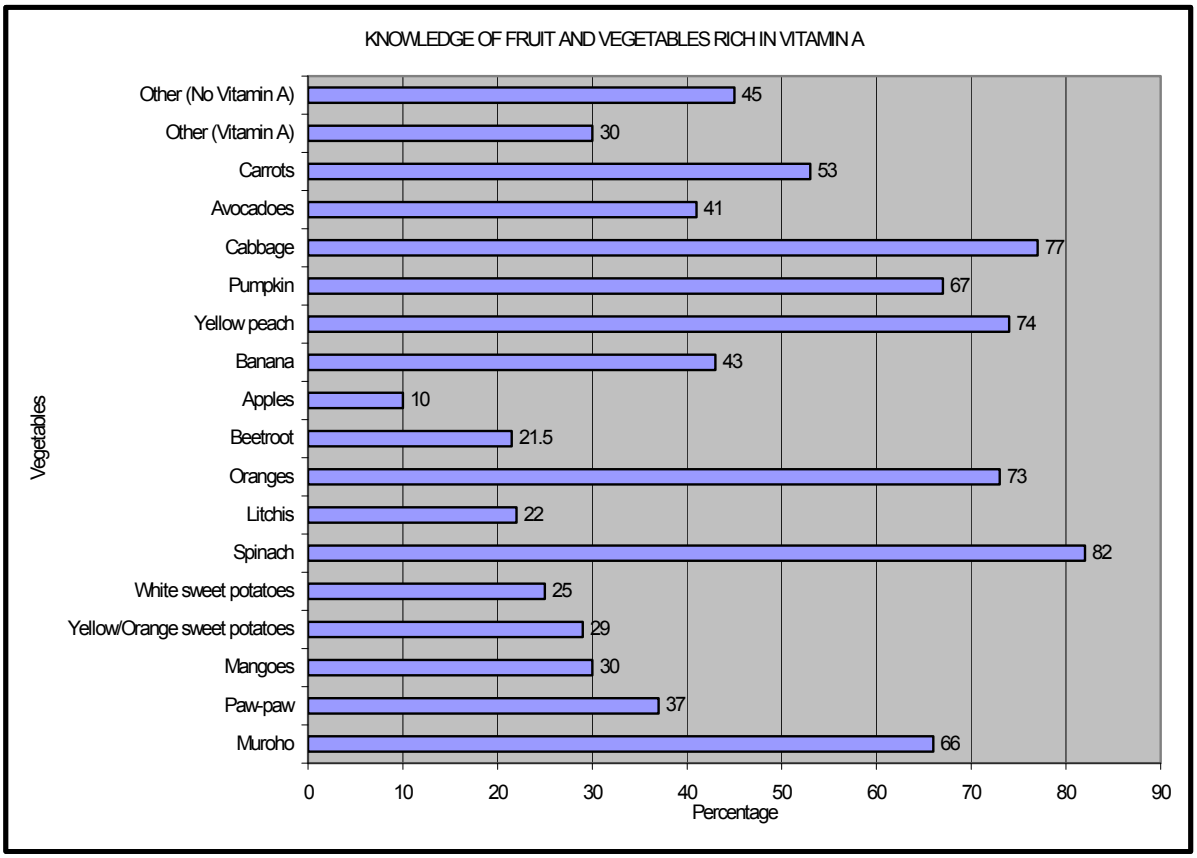


FIGURE 4.12: KNOWLEDGE OF VEGETABLES AND FRUIT RICH IN VITAMIN A (n=100)

The results as reflected on Figure 4.12 show that some respondents knew that certain vegetables and fruit contain vitamin A. For example, 82% chose spinach, 74% yellow peach, 67% pumpkin, 66% *muroho* and 53% carrots which are rich in vitamin A. A small percentage (29%) of the respondents knew that yellow/orange sweet potatoes and mangoes (30%) are rich in vitamin A. Only 30% of the respondents had added other vegetables and fruit that are rich in vitamin A and 45% had added others that are not rich in vitamin A.

Looking at the number of respondents who chose vegetables and fruit that are not rich in vitamin A, it is concluded that the respondents' knowledge of vitamin A-rich vegetables and fruit was lacking. The game was also used to assess the respondents' knowledge of vegetables and fruit rich in vitamin A. The results of the game showed that the respondents had little knowledge of vegetables and fruit rich in vitamin A as the majority scored one and two out of five. The lower game scores could mean that the respondents were just guessing when choosing vegetables and fruit rich in vitamin A.

From these results it is evident that caregivers need to have knowledge about vitamin A-rich vegetables and fruit as emphasised by Engle *et al.* (1997:24) and Krige and Senekal (1997:22) who maintain that caregivers at crèches should have at least a basic knowledge of nutrition to enable them to help improve the well-being of children in their care. Vitamin A has been recognised as a critical factor in children's health and survival. Young children need vitamin A because it plays the most important overall function in the body's immune system as well as affecting vision and eye health (Faber *et al.,* 2006:27; Reddy, 1999). It is therefore important to create an awareness of the importance of vitamin A nutrition through nutrition education and promotion (Engle *et al*., 1997:24; Krige & Senekal, 1997:22), as recommended in this study.

4.3.2.5 Summary

The assessment made from the information gathered in phase one revealed a general lack of knowledge of nutrition and an absence of appropriate information about vitamin A and vitamin A-rich vegetables and fruit in particular, as well as evidence of a lack of dietary variety and presenting meals low in vitamin A. A lack of menu planning skills, poor food utilisation as well as low availability of vegetables and fruit at crèches (very few had flourishing vegetable gardens) was evident. These results are clearly similar to findings in other studies (Pietersen *et al.*, 2002:5; Maunder & Meaker, 2007:403) which maintain that children's consumption of vegetables and fruit rich in vitamin A is still very low. The findings can also be linked to the applied UNICEF framework given in Figure 2.1 which depicts amongst other factors, that an inadequate dietary intake of vitamin A precursors, caused by a food intake low in vitamin A precursors, as well as poor availability, inappropriate food preparation and inadequate knowledge about vitamin A-rich diets, are the immediate and major causes of vitamin A deficiency in young children (Van Lieshout *et al*., 2004:6).

The food-based dietary guideline *"eat plenty of vegetables and fruits everyday"* is the principal focus of this study. It is important that strategies to improve the application of this dietary guideline be developed and implemented. The first priority should therefore be on the development and implementation of nutrition and food-based strategies that would ensure access and availability, as well as optimal consumption of vegetables and fruit by crèche children. In similar vein to the work of Sharma and Nagar (2006:141) it was deemed important in this study to provide caregivers with proper knowledge and specific education related to childcare practices that would reduce the incidence of faulty feeding and to promote practices that would contribute to positive growth and development.

Phase two of this study was therefore an action-based phase, to engage caregivers in developing the various nutrition strategies to improve access and availability and enhance the consumption of vitamin A-rich vegetables and fruit by crèche children.

4.4 PHASE TWO

Phase two can be regarded as the action part of the triple-A cycle, the intervention phase, that is based on the findings of phase one. This second phase addresses the objectives which involve the development and implementation of nutrition strategies. The main aim was to enhance availability, access and proper utilisation of vitamin A-rich vegetables and fruit by crèche caregivers. Therefore the interventions focused mainly on nutrition awareness with particular attention being paid to enhancing knowledge about vitamin A, the cultivation of vitamin A-rich vegetables and fruit, dietary diversity, menu planning and food preparation as well as the importance of proper storage and the preservation of vegetables.

In phase two the recommendations by Labadarios *et al.* (1999) were followed. According to them nutritional aspects are often neglected, and it is important to address these aspects through education, gardening and correct utilisation of foods through training the caregivers. All caregivers were exposed to training on gardening activities regardless of whether they had a garden at the crèche or not. They were trained in skills related to cultivation, processing and preparation of vegetables and fruit. They received nutrition education to increase their knowledge of the link between vegetables and fruit consumption and health, as well as the importance of vitamin A in the diet of children. Based on the baseline information, Figure 4.13 represents the steps that were followed and the activities that were carried out when implementing the nutrition strategies. It also highlights the desired outcomes of the action phase.

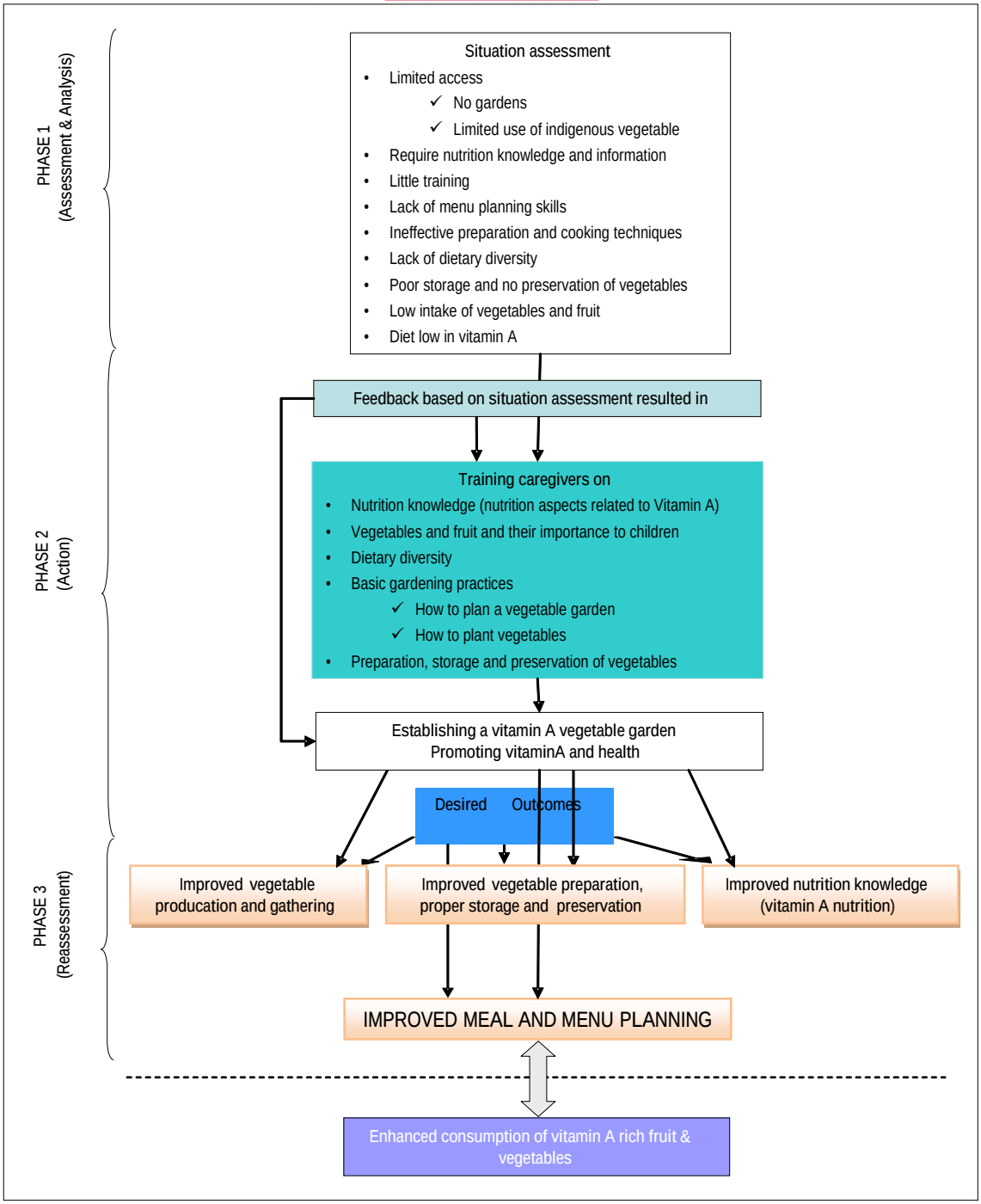


FIGURE 4.13: IMPLEMENTING THE NUTRITION STRATEGIES

4.4.1 Nutrition strategies

In this study nutrition strategies refer to food-based approaches used to improve the application by crèche caregivers of the food-based dietary guideline "*eat plenty of vegetables*

and fruits everyday" in order to enhance the consumption of vitamin A-rich vegetables and fruit by the children in their care. These strategies involve nutrition education, the promotion of fruit and vegetable consumption and training on fruit and vegetable production, as well as menu planning, proper storage, preparation and preservation of vegetables and fruit.

4.4.1.1 Nutrition education and training

This phase focused on increasing caregivers' nutrition knowledge and awareness of vitamin A-rich vegetables and fruit. Cultivation and proper utilisation of vegetables and fruit were promoted in order to enhance their access and availability to the crèches and ultimately to improve their consumption by the children. Table 4.4 indicates the topics covered concerning caregivers' education and training.

TABLE 4.4: NUTRITION EDUCATION AND TRAINING

TOPIC	EMPHASIS ON
Basic education concerning vitamin A and the consumption of vegetables and fruit	• Importance of vegetables and fruit to children • What is vitamin A? • The functions of vitamin A and its importance to children • Vitamin A deficiency (causes, warning signs and symptoms) • Identification of vegetables and fruit rich in vitamin A • Gathering of indigenous vegetables and their value in the diet
Preparation of vegetables for maximum nutrient retention	• Grating vegetables such as carrots • Avoid soaking and overcooking vegetables • Washing vegetables before cutting • Cook in only a little water • Addition of oil to enhance vitamin A absorption • Add excess cooking water to soups or children's porridge • Avoid bicarbonate of soda • Chop vegetables to enhance absorption of vitamin A
Strategies to improve consumption of vegetables and fruit	• Adding ingredients such as oil and soup to vegetables • Making salads • Giving fruit as a snack • Mashing vegetables for small children
Cultivation of vitamin A-rich vegetables and fruit and vegetable gathering	• Soil preparation, fertilisation, planting and sowing dates • Plant spacing, irrigation, weeding • Maintenance, disease management and pest control • Harvesting
The importance of a crèche garden as a source of vitamin A-rich vegetables and fruit	• Year- round availability • Direct access and availability
Dietary diversity and menu planning	• Include a variety of vegetables and fruit in a week's menu • Planning a colourful menu by including different vegetables and fruit • Quick recipe ideas
Preservation techniques and proper storage	• Drying • Refrigeration • Freezing • Use of closed containers

Simple, inexpensive education materials such as posters, charts, pamphlets and calendars were used to aid nutrition education and the general training of the caregivers. To facilitate and enhance understanding and to ensure enduring nutrition knowledge, caregivers were given posters and calendars from the Agricultural Research Council (ARC) to keep at their crèches. These posters and calendars illustrated vitamin A-rich vegetables on the front and on the back vegetable cultivation is explained. These education materials were a great help as they facilitated the exposition of vitamin A nutrition. Copies of the eleven South African food-based dietary guidelines were also distributed to all the caregivers. Caregivers also received Vitamin A recipes that were obtained from the ARC (see Addendum F). It was believed that these recipes would help the caregivers add variety to the children's meals.

The outcomes for the training of caregivers were formulated:

- To establish vegetable gardens for year round availability
- To improve vegetable production and gathering
- To improve vegetable preparation, proper storage and preservation
- To improve nutrition knowledge (vitamin A nutrition)
- To improve meal and menu planning skills
- To contribute to an increased daily consumption of vegetables and fruit (vitamin A-rich in particular).

Not only did the study provide awareness of the importance of vitamin A nor did it just increase the caregivers' skills with regard to the proper utilisation of vegetables, but it also enhanced year-round availability by promoting the cultivation and gathering of vitamin A-rich vegetables and fruit by crèche caregivers.

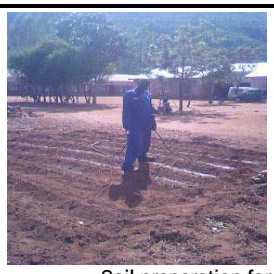
4.4.1.2 Promoting the production and gathering of vegetables and fruit

The production of yellow/orange fleshed fruit such as paw-paws and mangoes as well as vegetables such as carrots, pumpkin and sweet potatoes was promoted. The production of dark green leafy vegetables whether with high vitamin A content such as spinach or having low vitamin A content such as Chinese cabbage was considered important in this study and therefore it was encouraged. The researcher undertook to provide the caregivers with sweet potato cuttings obtained from the ARC. The caregivers were also persuaded to grow indigenous vegetables such as *muxe* (African nightshade) in their crèche gardens. Gathering indigenous vegetables was emphasised and their consumption, whenever they were in season, was advocated.

4.4.1.3 Cultivation of vegetables and fruit

The training course addressed the theoretical and practical aspects regarding vegetable production. Aspects such as soil preparation, fertilisation, planting and sowing dates, plant spacing, irrigation, weeding, maintenance, disease management and pest control as well as harvesting were included in the training sessions as recommended by Faber *et al.* (2006:117). Caregivers were trained on how to plant vitamin A-rich foods such as carrots, pumpkins, orange-fleshed sweet potatoes and spinach, and were encouraged to plant these vegetables at the crèches in addition to other existing crops. To facilitate vegetable production gardening manuals obtained from the ARC were used (see Addendum E). The manual used, and distributed to the caregivers, illustrated soil preparation, planting vegetables, the application of fertilisers, watering, weeding, pest control and harvesting.

Fruit trees such as mangoes, paw-paws and bananas were also planted at the crèches. At some crèches the gardening project was appreciated as fun. The children were taught about the importance of eating vegetables and were asked to bring plants from home to grow their own vegetables at the crèche. This practice succeeded as the children and caregivers brought plants such as spinach and Chinese cabbage, as well as paw-paw and mango trees, for planting at the crèches. The gardens were therefore established at various crèches with vegetables such as spinach, muxe, carrots, pumpkins, orange-fleshed sweet potatoes and green beans and the gardens were monitored regularly. Knowing that the researcher would return to see the developments, the caregivers wanted to excel in order to impress the researcher. They worked very hard to ensure that their gardens flourished. It was exciting for the researcher to experience that the caregivers were very positive about developing the gardens. The photographs (Figure 4.14) bear evidence of some vegetable gardens that were established, improved or resuscitated at different crèches.



Soil preparation for planting new crops



Transplanting of spinach and carrots



Transplanted spinach and carrots



Newly established vegetable gardens of spinach, carrots and green beans



African nightshade being planted alongside Chinese cabbage



Orange-fleshed sweet potatoes

FIGURE 4.14: NEWLY ESTABLISHED, IMPROVED AND RESUSCITATED CRECHE GARDENS

It was observed that the caregivers had a positive attitude towards implementing the strategies provided as guidance. This was seen when caregivers engaged in developing vegetable gardens even though some conditions were not that conducive. For example 34 respondents had no water, 15 had no fence and 41 had no gardener to help them. However, the caregivers were eager and willing to have their own vegetable gardens although they had various expectations from the researcher for improving their circumstances. These included providing funds, fencing, water provision from boreholes and seeds.

4.4.2 Summary

The implementation of the nutrition strategies was based on the applied framework which focused on vitamin A status as adapted from UNICEF's model (Figure 2.1). This model indicates that an adequate dietary intake of food rich in vitamin A precursors, enhanced by appropriate food preparation, year-round access and availability as well as adequate knowledge about and information on vitamin A-rich diets could lead to improved consumption

of vitamin A-rich foods, and hence vitamin A status. This in turn could lead to good health, sustained growth and development of the children attending the crèche. It was therefore important to implement the gardening strategies because yellow/orange-fleshed vegetables and fruit, orange roots and dark green leafy vegetables are the main sources of pro-vitamin A (Faber *et al.*, 2006:28; Louw, 2001; McLaren & Frigg, 1997). Promotion of indigenous green leafy vegetables such as *muxe, phuri* and Chinese cabbage was done following the guidelines set by Maunder and Meaker (2007:403), who regard these vegetables as good sources of pro-vitamin A.

The effect of the implemented strategies on the dietary intake of vitamin A-rich vegetables and fruit was reassessed in phase three of the study.

4.5 PHASE THREE

Reassessment was done in order to measure the change that the intervention (gardening, nutrition education and training) had made in the application of the food-based dietary guideline. Phase three was therefore undertaken mainly to see if the intervention was successful. It also helped the researcher determine the extent to which the research objectives had been achieved. The same pattern as applied in phase one was followed when reporting phase three's results. The findings are therefore presented in a manner in which the differences between phases one and three are highlighted and the status of statistical significance was given where applicable. The statistical procedures will be fully explained the first time they are mentioned and thereafter reference will only be made to the procedure described.

4.5.1 Reassessment of the nutrition strategies

4.5.1.1 Dietary diversity

Dietary diversity (Ruel, 2003:3911) is recognised by nutritionists as a key element of high quality diets that ensure adequate intake of essential nutrients and promote good health. As dietary diversity was recommended in phase two, the respondents were reassessed on how they were addressing this issue of introducing a variety of food in the children's diets at crèches and the results are as follows:

(i) Meals and snacks served to children at crèches

Table 4.5 gives a comparison of phase one and phase three results about the types of meals which were served to children at the crèches. Analysis of the results is thus made and the differences discussed.

TABLE 4.5: A COMPARISON OF MEALS SERVED IN PHASES ONE AND THREE (n=100)

MEALS SERVED	FREQUENCIES	
	PHASE ONE	PHASE THREE
Breakfast	95	95
Morning snack	30	36
Lunch	100	100
Afternoon snack	52	84

In both phases all the respondents served lunch and the majority also served breakfast. In comparison with phase one, phase three results showed an increase in the number of caregivers who were now serving snacks. An increase in the number of caregivers serving a snack would contribute to children being served a variety of food as well as an increased intake of vegetables and fruit.

To reflect on the changes, two-way frequency tables were used to summarise the number of respondents who reported that they served morning and afternoon snacks (see Tables 4.6 and 4.7). The rows represent phase one while the columns represent phase three. The “yes” and “no” refers to whether they served the snack or not. To determine whether a significant change from phase one to phase three took place, McNemar’s tests were performed and the results are found in Addendum H.

TABLE 4.6: PHASE ONE AND THREE MORNING SNACK (n=100)

PHASE ONE	PHASE THREE		
	Morning snack served (NO)	Morning snack served (YES)	Total
Morning snack served (NO)	64	6	70
Morning snack served (YES)	0	30	30
Total	64	36	100

Table 4.6 illustrates that in phase one only 30 respondents served morning snacks and 70 did not serve morning snacks. In phase three 36 respondents served morning snacks and 64 did not serve morning snacks. The table further indicates that of the 70 respondents who were not serving a morning snack in phase one, 64 were still not serving this snack while six

respondents had changed and were serving a morning snack in phase three. Furthermore, the results indicate that in phase three there were no respondents (0) who changed from serving to not serving the morning snack. McNemar's test indicated a statistically significant change or difference (p-value<0.05) between phase one and phase three as there was an increase in the number of caregivers who were serving a morning snack.

TABLE 4.7: PHASE ONE AND THREE AFTERNOON SNACK (n=100)

PHASE ONE	PHASE THREE		
	Afternoon snack served (NO)	Afternoon snack served (YES)	Total
Afternoon snack served (NO)	15	33	48
Afternoon snack served (YES)	1	51	52
Total	16	84	100

With regard to the afternoon snack (Table 4.7), phase three results show a higher intake of afternoon snacks as compared to phase one results. Phase three scores increased from 52 to 84 in the number of respondents who were serving an afternoon snack. McNemar's test results indicate a significant change in the number of respondents who were serving afternoon snacks (p-value<0.05). It can be concluded that intervention was successful in changing from not serving to serving more afternoon snack, the same also holds true for the morning snack (p-value<0.05) (see Addendum H).

One of the objectives of this study was to investigate if there was an improvement in the application of the food-based dietary guideline by the caregivers. Based on these reported results, it can be concluded that a significant increase in the number of respondents serving afternoon and morning snacks to children had occurred in phase three. This point to positive results of nutrition education in the improved application of the food-based dietary guideline regarding the importance of vegetables and fruit in the daily diet, through improving the type of meals given to children at crèches. The results showed a greatly increased consumption of afternoon snacks (see Table 4.7) compared to the morning snack (see Table 4.6). Taking into consideration the time children spend at the crèche each day, a late afternoon snack is recommended. It is assumed that adjustment in the meals given might increase dietary diversity, enhance the nutritional value of meals served to children and could contribute to increasing the daily intake of vegetables and fruit by children.

Food served to children for breakfast

The same types of foods were served at both phases. However, a change could be seen in phase three results where a larger number (70 versus 5) of the respondents were serving fruit to children at breakfast either with soft porridge and milk or with bread and tea (see Table 4.8).

TABLE 4.8: FOOD SERVED TO CHILDREN FOR BREAKFAST (n=100)

BREAKFAST MEAL SERVED	FREQUENCIES	
	PHASE ONE	PHASE THREE
Soft porridge and milk	31	30
Soft porridge, milk and fruit	5	45
Bread and tea	57	0
Bread and tea and fruit	0	25

According to the results it seems that bread and tea were served by the majority (57) in phase one and replaced by other healthier options that included fruit in phase three (see Table 4.8). It could thus be concluded that the increased intake of fruit at breakfast would more than likely contribute to achieving the dietary guideline *"eat plenty of vegetables and fruits everyday"* and perhaps lead to an increased intake of pro-vitamin A foods among the children. The more fruit children eat daily the higher their intake of pro-vitamin A. It could thus be assumed that children who were served a breakfast that included a fruit were able to improve their vitamin A intake.

Food served to children for lunch

A change in the food that was served for lunch in phase three was noticeable. Along-side meat, fish and soup, 90 as opposed to 35 respondents were including indigenous vegetables. All the respondents (100 versus 87) indicated that they provided cultivated vegetables (see Table 4.9). This was also stated in their menus. Observation results showed that sweet potato leaves were mixed with other traditional green leaves and cooked together. The gardening project resulted in an increased intake of dark green leafy vegetables. However, seasonal variations in the availability of these vegetables were still observed. This corroborates the findings by Faber *et al.* (2006:118).

TABLE 4.9: FOOD SERVED TO CHILDREN FOR LUNCH (n=100)

LUNCH SERVED	FREQUENCIES	
	PHASE ONE	PHASE THREE
Porridge with either meat/ fish/ soup	87	87
Porridge with cultivated vegetables	87	100
Porridge with indigenous vegetable	35	90

There was a notable increase in the number of caregivers who were serving indigenous vegetables to the children. This signifies an improvement in the caregivers' knowledge of the nutritional value of indigenous vegetables. As highlighted by Maunder and Meaker (2007:403) and Weinberger and Msuya (2004) this in turn complemented the nutritional value of basic staple foods at crèches and at the same time increased the consumption of vitamin A-rich vegetables by children.

Snacks and drinks served to children at crèches

Table 4.10 reflects a comparison of the snacks that were served to children before and after the intervention.

TABLE 4.10: SNACKS SERVED TO CHILDREN (n=100)

SNACKS SERVED	FREQUENCIES	
	PHASE ONE	PHASE THREE
Fruit e.g. banana	63	100
Potato chips	11	0
Sweets	8	0
Biscuits	14	0
Other	30	0

Unhealthy snacks such as sweets, popcorn, imitation juice, biscuits and chips which were served to children in phase one were no longer served in phase three. All the respondents (100) indicated that they were only serving fruit to children as snacks. Observation results revealed that respondents who planted sweet potatoes sometimes served it as a snack. The caregivers cooked the sweet potatoes and then sliced them, giving the slices to the children (see Figure 4.15).

FIGURE 4.15: SLICED COOKED SWEET POTATOES GIVEN TO CHILDREN AS SNACKS

It is concluded that most of the respondents understood that it was important to serve healthy snacks such as fruit to children as this also contributed to the application of the dietary guideline *"eat plenty of vegetables and fruits everyday"*. However, it was also noted that, at some crèches, children were still bringing their own snacks such as yoghurt, fruit juice and fruit. No children were seen with unhealthy snacks such as potato chips, popcorn and sweets as happened during phase one. This might mean that parents were also aware of the importance of giving healthy snacks to their children.

These findings suggest that nutrition education succeeded in increasing the respondents' awareness of healthy, nutritious diets. It also shows that food production has made a significant contribution to the availability of vitamin A-rich vegetables and fruit at crèches. Consequently giving the children more nutritious snacks such as fruit, in turn, improved the children's consumption of vegetables and fruit and at the same time reduced the intake of fat and sugar from the unhealthy snacks such as sweets and potato chips. These results substantiate the work of Ruel (2003:3911s) who purports that a healthy, high quality diet should contain a limited amount of fat and sugar but also many servings of vegetables and fruit. It was observed that in terms of beverages, the consumption of tea was high during breakfast. In contrast to phase one where the respondents had mentioned serving 100% fruit juices and imitation juices, in phase three no other beverages were being served to the children.

(ii) Frequency of vegetables and fruit consumption

As the main purpose of this study was to improve the application of the dietary guideline "*eat plenty of vegetables and fruits everyday*", it was important to consider the frequency of vegetable consumption. It was also important to ensure an increased daily consumption of

vegetables and fruit (both cultivated and indigenous vegetables) in order to enhance the vitamin A intake of crèche children.

Frequency of vegetables on the menus

Table 4.11 reflects a comparison of how often children were served vegetables before and after the intervention.

TABLE 4.11: THE FREQUENCY OF VEGETABLES ON THE MENU (n=100)

HOW OFTEN ARE CHILDREN SERVED VEGETABLES	FREQUENCIES	
	PHASE ONE	PHASE THREE
Once per week	66	0
Twice per week	24	0
Three times per week	0	15
Four times per week	0	75
Daily	10	10

Although only 10 respondents had vegetables on the menus on a daily basis, an increase in the weekly consumption of vegetables is noted. The majority (75) of the respondents were serving vegetables to the children four times a week. It is remarkable to find that in phase three no respondents (as opposed to 66 previously) were serving vegetables only once a week.

There was improvement in the serving of indigenous vegetables to the children in that this was done far more frequently. The majority of the respondents (62) indicated that they served indigenous vegetables three times per week when they were available, 23 served them four times per week, whereas only two served them once a week in phase one. It is recognised that with the cultivated indigenous vegetables like *muxe* seasonality is still a limiting factor when considering the availability of these vegetables. However, the results are notable in that the progress is principally due to the efforts of the caregivers who sought to increase the availability of less expensive locally produced or gathered vegetables, and promote their inclusion in the menus throughout the week for as long as they were in season.

The respondents reported greater use being made of vegetables on the weekly menu despite the popular views that indigenous vegetables have a low status and were not to be actually served to children in this form as found by Faber *et al.* (2007:411). However, there was slight evidence of change in phase three as indigenous vegetables were also included on the menu. These results give the impression that caregivers were becoming aware of the

importance of eating vegetables and fruit every day, consequently showing an understanding of the value of indigenous vegetables in children's diet.

The results also showed the contribution made by the vegetable gardens to the availability of vegetables. It could thus be concluded that an increase in the supply of vegetables, through vegetable garden production resulted in increased weekly consumption of vegetables. Moreover, the gardening strategy showed that locally produced vegetables could provide the caregivers with direct access to foods rich in vitamin A, making a valuable contribution to the intake of vitamin A-rich vegetables by children which is what Faber *et al.* (2006:24-26) recommend.

Types of vegetables served

This study focused on the consumption of vitamin A-rich vegetables and fruit by crèche children. The respondents were asked to specify the type of vegetables they served to children. They also had to indicate whether the vegetables were served raw or cooked for the sake of adding variety to the diet. Phase one results were therefore compared with the phase three results in order to identify if there were changes (see Table 4.12).

TABLE 4.12: VEGETABLES SERVED TO CHILDREN IN PHASE ONE AND THREE (n=100)

TYPE OF VEGETABLE	PHASE ONE RESPONSES		PHASE THREE RESPONSES	
	RAW	COOKED	RAW	COOKED
Pumpkin	0	10	0	30
Carrots	5	10	49	89
Yellow sweet potatoes	0	0	0	11
Cabbage	0	71	18	91
Spinach	0	11	0	100
Butternut	0	9	0	14
Muroho (indigenous vegetable)	0	14	0	25
Chinese cabbage	0	25	0	50
Potatoes	0	10	0	0

Cooked and raw vegetables were not seen separately but were grouped together. The reason for this strategy was to check if the respondents were serving the vegetables in different ways. The results from both phase one and phase three showed that a variety of vegetables were on offer and the majority of the respondents served them cooked rather than as raw vegetables. Change happened in phase three as the number of respondents serving raw carrots had increased from 5 to 49, and from zero to 18 in the case of raw cabbage. Although the number of the respondents who served cabbage in phase three

increased from 71 to 91, it is clear that more vitamin A-rich vegetables were being given to the children in phase three than in phase one (see Table 4.12).

As reflected in Table 4.12, 89 respondents, instead of 10, served cooked carrots, 30 instead of 10, served cooked pumpkin and 11 served yellow fleshed sweet potatoes which previously no one was serving. The consumption of spinach was highest in phase three with all the respondents (100) serving it whereas before only eleven did. There was also an increase in the number (25 against 14) of the respondents serving *muroho* and more caregivers were serving Chinese cabbage, an increase from 25 to 50. A general increase in the consumption of dark green as well as yellow vegetables was observed in phase three.

Two-way tables of analysis were used to demonstrate the difference between phase one and phase three results. Each vegetable served was analysed and compared separately to see if there was a significant improvement in the number of respondents who served a particular vegetable to the children in phase three. The tables indicated the extent of change by showing the number of respondents who changed and those who remained not serving the vegetable. For example, Table 4.13 below shows that only 10 respondents served carrots in phase one. However, phase three results showed that 89 instead of 10 respondents now did serve carrots. This means that of the 90 respondents who were not serving carrots in phase one, 79 changed to serving this vegetable and only 11 remained not serving carrots.

To determine if the changes was statistical significant, McNemar's test was performed and indicated a significant change (p-value<0.05). Table 4.13 gives amongst others carrot as an example, however the same holds for butternut, *muroho* and pumpkin (p-value<0.05) (see Addendum H).

TABLE 4.13: THE DIFFERENCE OF CARROTS SERVED IN PHASE ONE AND THREE (n=100)

PHASE ONE	PHASE THREE		
	Carrots served (NO)	Carrots served (YES)	Total
Carrots served (NO)	11	79	90
Carrots served (YES)	0	10	10
Total	11	89	100

Statistics for Table 4.13

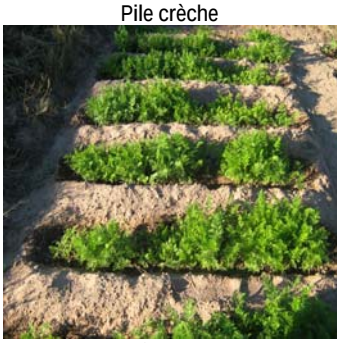
McNemar's Test	
Statistic (S)	79
DF	1
Pr > S	<.0001

From these results it can be concluded that there was a significant improvement in the number of the respondents who were serving vitamin A-rich vegetables in phase three and this was seen to be so during site visits to the crèches. It was also noted that the number of the respondents serving vitamin A-rich vegetable had increased as a result of the availability of these vegetables in crèche gardens. Figure 4.16 shows the vegetable gardens at different crèches.

Tshakhumba crèche

Yellow sweet potatoes

Pile crèche



Carrots

Tshandama crèche

Spinach and Chinese cabbage

Tshilamba crèche

Chinese cabbage

FIGURE 4.16: VITAMIN A VEGETABLE GARDENS AT CRECHES

It is clear that crèche gardens played a role in vegetable consumption. This is in line with studies done by others (Helen Keller International, 2003a; Ruel & Levin, 2000; Engelberger *et al.,* 2003; Cervinskas & Lotfi, 1996) who maintain that a strong nutrition education component together with the production of yellow and dark green vegetables may not only provide direct access and increased year-round availability of vitamin A-rich vegetables and fruit but also improves the consumption of beta-carotene by children.

In comparison with phase one, phase three results showed a greater acceptance of cultivated vegetables where all the respondents indicated that children enjoyed the vegetables served to them. No respondent reported that the children only liked the vegetables they were served sometimes (see Table 4.14).

TABLE 4.14: CHILDREN'S LIKING OF VEGETABLES (n=100)

RESPONSES	CULTIVATED VEGETABLES		INDIGENOUS VEGETABLES	
	PHASE ONE	PHASE THREE	PHASE ONE	PHASE THREE
Yes	73	100	53	82
No	0	0	32	8
Sometimes	27	0	15	10

Table 4.14 reflects an increase in the children liking indigenous vegetables in phase three from 53 to 82. Only eight instead of 32 indicated that their children did not like these vegetables while 10 respondents indicated that children only liked to eat indigenous vegetables sometimes.

In response to the question why children liked vegetables, the respondents intimated that the ways in which vegetables were cooked explained why children liked the vegetables more in phase three than in phase one. They were now adding soup or meat stock to some vegetable dishes which increased the children's appreciation for both cultivated and indigenous vegetables more. This was confirmed by watching the children enjoy the vegetables that were cooked like this. Figure 4.17 shows the photographs of crèche children really enjoying their lunch of porridge and spinach to which minestrone soup was added to enhance the flavour.

FIGURE 4.17: CHILDREN ENJOYING PORRIDGE WITH SPINACH FROM THE CRÈCHE GARDEN

In terms of eating indigenous vegetables, results in phase three showed that no respondents reported that the children refused to eat or that they did not like the taste of indigenous vegetables. Although the results signify an improvement in the consumption of indigenous vegetables, there were some respondents who still maintained that their children were not eating these vegetables because parents did not want their children to eat them.

Vegetables children liked to eat

The respondents were asked to specify the vegetables that their children liked to eat. In phase one cabbage was the most popular vegetable (63%). Although cabbage was still enjoyed by most (96%) in phase three, there was a higher preference for spinach (100%), followed by carrots (88%), Chinese cabbage (74%), *muroho* (66%), pumpkin (57%) and yellow sweet-potato (19%). In comparison with phase one, phase three results shows improvement in children liking both cultivated and indigenous vegetables, amongst which were vegetables particularly rich in vitamin A (see Figure 4.18).

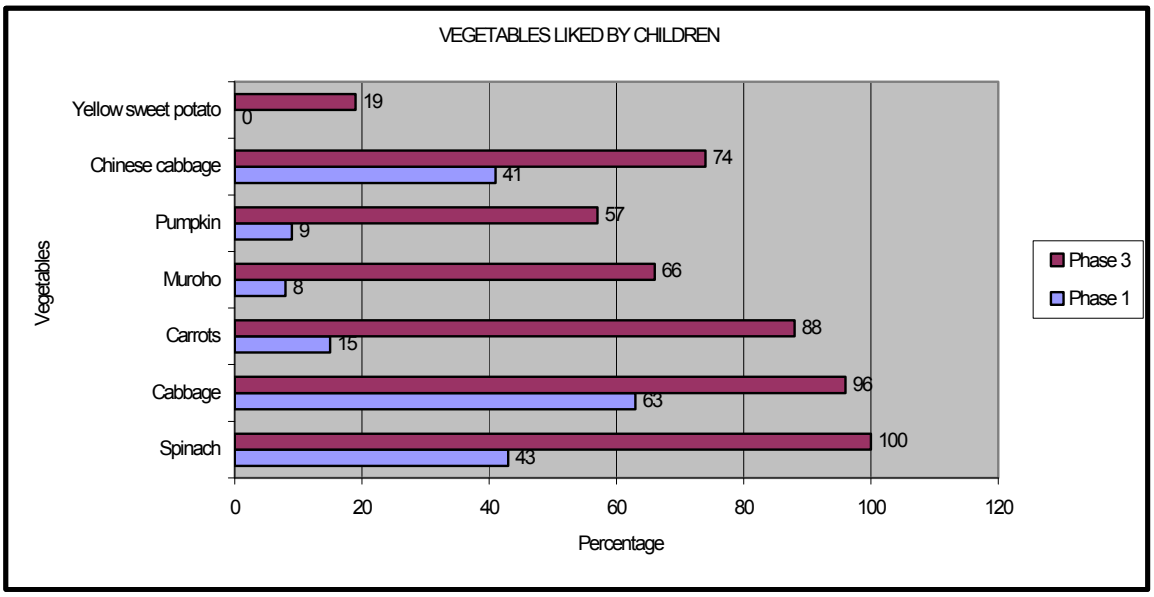


FIGURE 4.18: VEGETABLES LIKED BY CHILDREN

The extent of change in children's liking of these vegetables in phase three was further tested to determine if it was statistically significant. McNemar's test demonstrated a positive statistical significant change (p-value<0.05) in the percentage of the respondents who recorded the children's liking of vegetables (see Addendum H). Table 4.15 shows that the increase in children's liking of vegetables in phase three is significant by indicating the p-values of each.

TABLE 4.15: VEGETABLES LIKED BY CHILDREN (n=100)

VEGETABLES LIKED BY CHILDREN	PHASE ONE FREQUENCY	PHASE THREE FREQUENCY	P-VALUE
Pumpkin	9	57	0.0001
Muroho	8	66	0.0001
Carrots	15	88	0.0001
Cabbage	63	96	0.0001
Spinach	43	100	0.0001

These results confirmed that respondents were preparing vegetables in phase three in a way that appealed to the children more. For example, children enjoyed the vegetables to which minestrone soup had been added. From the results it can be said that through gardening and adapting preparation methods, there was a higher consumption of dark green leaves and yellow/orange fleshed vegetables by crèche children in phase three. The conclusion can thus be drawn that nutrition education, in conjunction with vegetable gardening activities, not only resulted in an increase in the overall accessibility and availability of vitamin A-rich vegetables but also improved crèche children's consumption of vegetables.

Types of fruit served

The same kinds of fruit (namely, banana, apples, oranges and avocadoes) were served to children in phase three as in phase one. However, there was an increase in the number of respondents who served fruit to children in phase three. Contrary to the situation in phase one where the majority served apples, in phase three the majority (85) of the respondents served bananas. This could be that bananas were readily accessible and are available in the area all the year round. Though there was an increase (to 65 from 15) in the number of respondents who served oranges in phase three, their availability was also affected by seasonality. The findings also revealed that the number of caregivers who served avocadoes increased from 3 to 51 and those who served apples also increased from 31 to 59 (see Table 4.16).

TABLE 4.16: FRUIT SERVED TO CHILDREN AT CRECHES (n=100)

TYPE OF FRUIT SERVED	PHASE ONE RESPONSES	PHASE THREE RESPONSES
Orange	15	65
Banana	26	85
Apple	31	59
Avocado	3	51

The observation on fruit consumption showed that a variety of fruit was available; however, the kind of fruit consumed was dependent on the season. Fruit high in vitamin A such as

mangoes, paw-paws and peaches can be grown easily by crèches and during a good season fruit is abundant and obtained easily from households or cheaply at the local market. However, results showed that these fruit were not served to the children in both phases. The reason for not serving peaches and paw-paws could be limited availability as well as seasonality. But mangoes were not served because caregivers still believe that children could eat mangoes from home as almost every household has mango trees in their yards.

4.5.1.2 Availability and accessibility of vegetables and fruit

(i) Availability of vegetable gardens at crèches

There was an increase (from 39 to 89) in the number of the respondents who had vegetable gardens in phase three, which means that the respondents who did not have vegetable gardens at their crèches in phase one were now having them (see Table 4.17).

TABLE 4.17: AVAILABILITY OF VEGETABLE GARDENS AT CRÈCHES (n=100)

AVAILABILITY OF A GARDEN	PHASE ONE RESPONSES	PHASE THREE RESPONSES
Yes	39	89
No	61	10

These results implies an increase in the presence of vegetable gardens at crèches which is very important in this study because it would consequently contribute to increased accessibility of vegetables as well as the consumption thereof by crèche children. Only 10 respondents indicated that they did not have gardens and, as observed, these were the respondents who did not have water supply. The reasons for not having vegetable gardens declined, as reasons such as lazy gardener, no space, no funds and not knowing how to make or take care of the garden were not given in the later questionnaire. However there were some few respondents (10) who reported the absence of a fence and lack of water as reasons for not having vegetable gardens.

Although not all the newly established vegetable gardens flourished, the results reflect that the respondents had gained knowledge and skills on how to cultivate vegetables. It was observed that those who operated from a hired facility, such as the church, were also establishing vegetable gardens. Therefore the decline in the number of respondents who did not have a vegetable garden can be attributed to the training they received in phase two. The observation made was that, out of the 20 crèches in this study, only 3 crèches remained without vegetable gardens.

Kinds of vegetables and fruit trees available at crèche gardens

Table 4.18 illustrates the kind of fruit trees and vegetables that were planted at different crèches in phase one and three. The results showed that in phase three there was an increase in the number of the respondents who planted vegetables. The number of the respondents who planted spinach increased from 34 to 90 followed by Chinese cabbage (90), then carrots (86) and pumpkin (84). It was remarkable to see that some vitamin A-rich vegetables such as yellow sweet potatoes, green beans and *muxe* that were not cultivated in phase one were now being planted by the majority of respondents. For instance 79 respondents planted *muxe*, 20 green beans and 63 planted yellow sweet potatoes. Of the vegetables that were cultivated all, except for cabbage, tomatoes and beetroot, are rich in vitamin A. These results are considered important as it could contribute to improving the application of a dietary guideline *"eat plenty of vegetables and fruits everyday".*

TABLE 4.18: VEGETABLES AND FRUIT TREES THAT WERE PLANTED (n=100)

VEGETABLES PLANTED	RESPONSES		FRUIT TREES PLANTED	RESPONSES	
	PHASE 1	PHASE 3		PHASE 1	PHASE 3
Spinach	34	90	Mango	16	76
Chinese cabbage	18	90	Banana	6	43
Cabbage	16	32	Orange	6	6
Yellow sweet potatoes	0	63	Paw-paw	6	38
Muxe (African Night shade)	0	73	Avocado	6	80
Green beans	0	20	Guava	11	17
Carrots	9	86	Peaches	0	4
Pumpkin	17	84	Other (*Muhuyu)*	5	5
Other (Tomatoes)	6	6	Other (Granadilla)	5	11
Other (Beetroot)	6	6	Other (Sugar-cane)	6	6

As opposed to phase one, in phase three all the crèches had fruit trees in their yards. To confirm the availability of fruit trees the respondents had to indicate the fruit trees that were planted at their crèches by choosing from a list of fruit trees that was provided. It was remarkable to see an increase in the number of respondents who now had vitamin A-rich fruit trees (see Table 4.18). Although there was an increase in the number of respondents having fruit trees, it will take a while before these fruits can be served to children. Meanwhile the respondents relied on buying from the local market.

Vegetable gardens were observed at different stages of production. The respondents were observed when they prepared their gardens for cultivation, when the vegetables were planted, while they were growing and when they were harvested ready for the children to eat. The photographs below of newly established vegetable gardens were taken at different crèches and they provide evidence to the existence of vegetable gardens. However, it was

observed that shortage of water and fencing were the limiting factors in some of these gardens.

FIGURE 4.19: NEWLY ESTABLISHED VEGETABLE GARDENS

(ii) Gathering of indigenous vegetables and fruit

Accessibility of indigenous vegetables

Gathering vitamin A-rich indigenous vegetables as an alternative to cultivated vegetables was emphasised in phase two of the study. Results from phase three show an increase in the number of the respondents (from 70 to 96) who gathered indigenous vegetables. Even though these vegetables are highly seasonal, results reveal that when they were in season caregivers gathered and prepared them for the children. That indigenous vegetables were gathered was confirmed through scrutiny of the written menus. Results showed that only four respondents had not gathered indigenous vegetables during phase three.

With regard to indigenous vegetables gathered, phase three results show an increase in the number of the respondents who gathered a particular type of indigenous vegetable. For example, change is evident as 95% versus 50% gathered *muxe,* 91% *phuri* and 88% *delele* (jute mallow) whereas before the percentages were 50%, 28% and 14% respectively. The

results show considerable improvement in that some vitamin A-rich indigenous vegetables such as *dzaluma* (17%) and amaranth (90%) which were not gathered in phase one but were gathered in phase three (see Figure 4.20).

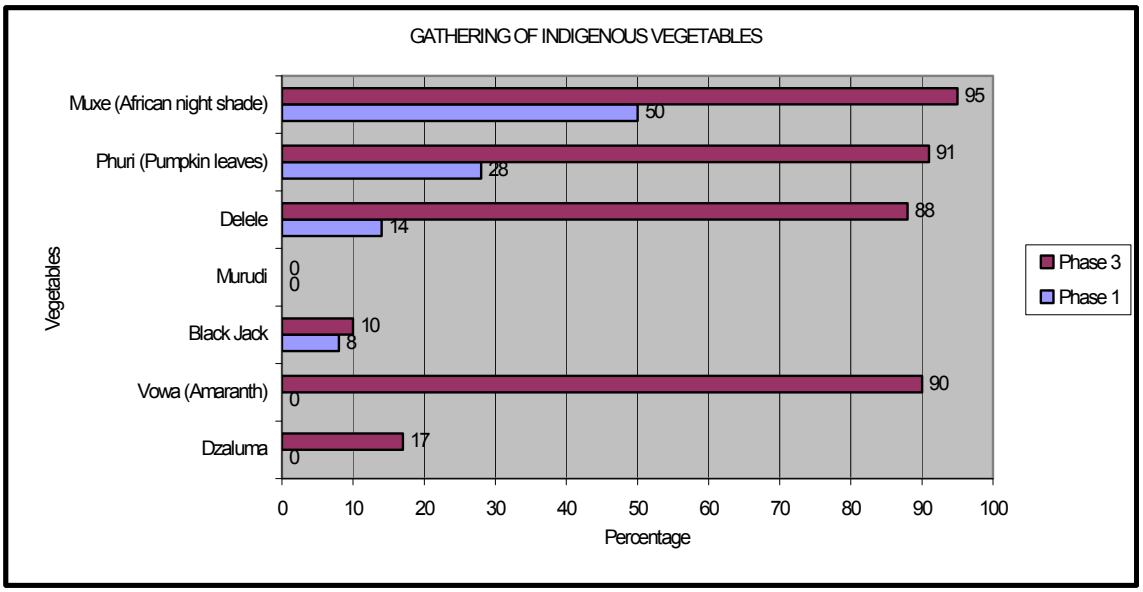


FIGURE 4.20: GATHERING OF INDIGENOUS VEGETABLE (n=100)

The results in Figure 4.20 indicate an increase in the number of the respondents who gathered indigenous vegetables. Two-way tables were used to compare the results of phases one and three to illustrate the differences between them and McNemar's test (see Addendum H) was used to determine if the change was statistically significant or not. The change was considered significant as the results showed evidence of a statistically significant change (p-value<0.05) to vegetables such as *delele, muroho* and *muxe.* However, some results showed no statistical significance (p-value>0.05), as for black jack (see Table 4.19).

TABLE 4.19: THE GATHERING OF INDIGENOUS VEGETABLES (n=100)

VEGETABLES	PHASE ONE RESPONSES	PHASE THREE RESPONSES	P-VALUE
Muxe	50	95	0.0001
Phuri (muroho)	28	91	0.0001
Delele	14	88	0.0001
Black jack	8	10	0.5271

An increase in the number of respondents gathering indigenous vegetables suggests that the crèche children were eating vitamin A-rich indigenous vegetables and what was encouraging was the observation that these changes were also supported by an increase in the frequency

of intake of these vegetables. Table 4.20 details these results and draws attention to the location of production.

TABLE 4.20: PLACES WHERE TRADITIONAL VEGETABLES WERE OBTAINED (n=100)

PLACE	PHASE ONE	PHASE THREE
Backyard	20	85
Bush	0	6
Field	53	90
Supermarket	6	0
Open market	28	75

There was an increase in the number of respondents who obtained vegetables from the crèche's backyard, the fields and or bought at the open market. Those who gathered from the bush increased from zero to six. The number of those who bought from the supermarket dropped from six to zero (see Table 4.20). This proves that the respondents were opting for cheaper ways of getting indigenous vegetables.

Observations showed that the respondents who recorded that they gathered the vegetables from the fields were gathering those that grow naturally as weeds adjacent to other cultivated crops. Those who indicated obtaining from backyards were referring to vegetables that grow naturally or to domesticated indigenous vegetables such as *muxe*. It was also observed that while the majority of all cultivated vegetables could be purchased from the market, the majority of indigenous vegetables were gathered from fields or the backyards. However it was seen that not all indigenous vegetables served at crèches were gathered but also bought from the open market.

Accessibility of indigenous fruit

Phase three revealed that very few respondents engaged in gathering indigenous fruit. As opposed to phase one, six instead of five respondents indicated that they gathered *mahuyu* (wild figs). No respondent stipulated gathering fruit such as *pfuka* and *mazwilu* as was being done prior to the phase one survey. The fact that the number of the respondents gathering indigenous fruit in phase three was less than the earlier period was not surprising as these fruits are hard to get. Beside the fact that they are scarce and highly seasonal, another reason for not gathering them could be that these fruits were not promoted enough as a result of lack of knowledge about their nutritional value. From observation these fruits were seen to still not being part of the more recent menus. It was also observed that the scarcity of these fruits was due to environmental deterioration as a result of deforestation.

Unavailability of seeds and seedlings also contributed to scarcity of these fruits as they could not be planted. These results uphold the ideas of Nebel *et al*. (2006:341) and Grivetti and Ogle (2000:31) who maintain that there is a decline in the knowledge and use of wild plants.

4.5.1.3 Utilisation of vegetables and fruit rich in vitamin A

The respondents were required to indicate how they were preparing, storing and preserving vegetables. They also had to explain how they were planning their menus.

(i) Menu planning

Phase three results showed an increase in the number of respondents (83 versus 62) who were following their own written menus. There was a decline from 25 to 17 respondents who followed the menu compiled by the Department of Health. In contrast to phase one, paying attention to menu planning practices revealed that the respondents had gained knowledge as their menus included a variety of foods. The main improvement noticed was that fruit or vegetables were part of every meal. This is in line with Barker *et al.* (2005:51), who suggest that a week's menu must be planned to ensure the inclusion of a variety of vegetables and fruit and that it must provide interesting combinations of different flavours, textures and colours. The progress made with regard to menu planning was as a result of the respondents' training during the intervention phase of the study. Thus the respondents no longer relied on the Department of Health to provide them with a written menu.

Phase three results showed that all the respondents were trained on how to plan a menu and prepare food which was not the case during the first survey. In terms of who trained them, the results did not differ in the two phases. However, 80 respondents chose the *other* option and indicated that they had been trained by the researcher.

(ii) Purchasing

As in phase one the responsibility of choosing and purchasing food rested with the respondents themselves and they could get what was planned on the menus or had the authority to adapt it to accommodate supply. In terms of obtaining the vegetables the results showed that the respondents generally bought from the local market and supermarket as well as using vegetables from the crèche gardens. Initially only 11 respondents used vegetables from the crèche gardens but phase three results showed that 51 respondents used their own produce. A change in terms of using their own produce was evident in phase three.

To determine if the change was statistically significant the results of the two phases were presented on a two-way frequency table (see Table 4.21) and McNemar's test was applied. The results were proven to have been statistically significant (p value<0.05) (see Addendum H).

TABLE 4.21: PHASE ONE AND THREE USE OF OWN VEGETABLES (n=100)

PHASE ONE	PHASE THREE		
	Use own produce (NO)	Use own produce (YES)	Total
Use own produce (NO)	49	40	89
Use own produce (YES)	0	11	11
Total	49	51	100

There was an increase in the number of caregivers who were using vegetables from the crèche gardens. This was also verified by an increase in the number of respondents who indicated that they were buying vegetables only once a month because they were also using vegetables from their gardens (see Table 4.22).

TABLE 4.22: FREQUENCY OF PURCHASING VEGETABLES AND FRUIT (n=100)

VEGETABLES	PHASE ONE FREQUENCY OF RESPONSES	PHASE THREE FREQUENCY OF RESPONSES
Daily	5	0
Every second day	4	20
Once a week	87	32
Once a month	4	48

Using their own vegetables contributed to stretching the crèche budget and even, more importantly, improving the consumption of vitamin A-rich vegetables and fruit by crèche children. These results substantiate the findings by Faber *et al.* (2006:24-26) who aver that advocacy, information, education and training are important when encouraging increased consumption of vitamin A-rich food. It can thus be said that the implemented nutrition strategy of food production was bearing some fruit in this study area.

(iii) Preparation of vegetables and fruit

The respondents were also taught how to prepare vegetables. For example, they were taught that they should wash vegetables before cutting them up because washing vegetables after cutting resulted in certain nutrients leaching into the water. On watching the respondents engaging in food preparation it was clear that they were opting for healthier practices when preparing vegetables. For example they would wash vegetables such as

spinach and Chinese cabbage before cutting. The photograph below (Figure 4.21) shows a caregiver washing spinach from the crèche garden.

FIGURE 4.21: A CAREGIVER PREPARING SPINACH BEFORE COOKING

The researcher shares the opinion of Faber *et al.* (2006:24-26) that introducing caregivers to food preparation techniques, providing them with nutrition information and encouraging the adoption of more healthy dietary habits can be beneficial for the health of children.

Phase three results showed that all respondents specified boiling, steaming and frying as the methods they used to cook vegetables as was the case in phase one and no other cooking methods were used. However, from observation it was noticed that cooking methods were dependent on the type of vegetable being cooked. For example, Chinese cabbage, sweet potatoes and *muxe* were boiled while cabbage and sweet potato leaves were fried. Although the respondents mentioned steaming as one of the methods that they used, this method was not actually seen in practice and it was concluded that this method was not really applied in practice.

Respondents were given vitamin A recipes during the intervention phase. As a result of this intervention, in phase three there was an increase (83) in the number of caregivers who were using recipes when preparing the vegetables. In phase three only 17 were not using recipes whereas in phase one as many as 73 respondents were not doing so.

As was happening in phase one, additive ingredients were used to enhance the flavour of the vegetable dishes but, as a result of nutrition education and training, phase three results reflected an improvement in the types of additives that were used (see Table 4.23). For example, there was a decrease (from 30 to zero) in the use of bicarbonate of soda. There was a noticeable increase in the use of additives that improved the nutritional value of

vegetables, such as the addition of oil to vegetables as a method that is known to enhance the absorption of vitamin A by the body.

TABLE 4.23: ADDITIVES ADDED TO THE VEGETABLES (n=100)

WHAT WAS ADDED	PHASE ONE RESPONSES	PHASE THREE RESPONSES
Bicarbonate of soda	30	0
Salt	100	100
Curry	24	0
Oil	75	100
Peanut butter	14	35
Grounded peanuts	5	42
Minestrone soup	24	80
Tomatoes	35	55

Regarding the use of additives, McNemar's statistical tests were applied to the raw data to determine the statistical significant of the difference. Results showed no statistical significant changes (p-value>0.05) (see Addendum H).

The respondents had to indicate what they were doing with the excess cooking water. In contrast to phase one not one respondent suggested throwing it away. All the respondents disclosed that they were using the excess water either in soups or adding it to the children's porridge. This implies that the respondents now knew that throwing excess cooking water away means throwing away the valuable nutrients that had dissolved in the water.

(iv) Storage of vegetables and fruit

Change was evident in phase three regarding the manner in which the respondents were storing their surpluses. As reflected in Table 4.24, 69 versus 49 respondents indicated that they were storing the vegetables in cool places, 50 versus 30 were using a refrigerator and six were blanching and drying the vegetables and then storing them as dried vegetables for future use. In phase three vegetables were not frozen or stored on the floor as was done in phase one. However, 26 respondents pointed out that they still never had a surplus and 5 were using vegetable racks.

TABLE 4.24: STORING SURPLUSES AND LEFTOVERS (n=100)

STORING OF SURPLUSSES	PHASE ONE RESPONSES	PHASE THREE RESPONSES
In cool place	49	69
In refrigerator	30	50
In racks	5	5
In freezer	10	0
Other (on floor in cool place	13	0
No surpluses	26	26
STORING OF LEFTOVERS	PHASE ONE RESPONSES	PHASE THREE RESPONSES
Freeze	11	11
In refrigerator	37	58
In containers	5	0
Throw away	19	0
No leftovers	34	31

With regard to storing leftovers phase three results showed that 11 respondents were still freezing the leftovers. On the other hand, 58 were using the refrigerator whereas before only 37 respondents were doing this. The number of respondents with no leftovers dropped and not one was throwing leftovers away or using containers to store them (see Table 4.24). Following the suggestion by Faber *et al.* (2006:31) that it is better not to store cooked vegetables but to use them all, it is recommended in this study that the caregivers should buy or harvest just enough for complete use for one meal.

(v) Preservation of vegetables and fruit

Preserving vegetables was an important issue in this study as it could help to ensure the availability of vegetables in off-season times. Phase three results showed that 36 respondents instead of zero in phase one were drying vegetables when they were plentiful. Though the number of those who were preserving vegetables was still considered low, it was considerable, as it was something that had not been done before or recorded as a method for storing vegetables in phase one.

These findings reveal that, after training the caregivers about the importance of preserving vegetables, some respondents applied the strategy and this contributed to extending the availability of vegetables all year round. No other method of preserving vegetables was used. Observation showed that only the respondents who had large vegetable gardens at their crèches were preserving the vegetables. It was noticed that vegetables such as spinach, *muxe*, and Chinese cabbage were preserved. These vegetables were first blanched, placed on a flat corrugated iron sheet and then put in the sun to dry. As the drying of vegetables was a new practice for caregivers, the dried vegetables were cooked and served to see if children

would prefer them. The following photograph (Figure 4.22) shows a plate of cooked dried spinach to which tomatoes were added as served to children at one of the crèches.

FIGURE 4.22: COOKED DRIED SPINACH

4.5.1.4 Nutrition knowledge

The respondents were also reassessed on their nutrition knowledge. Their knowledge of vitamin A and vitamin A-rich vegetables and fruit, the importance of fruit and vegetable consumption by children as well as the importance of vitamin A to children were reassessed.

(i) Children's consumption of vegetables and fruit

The results show that in phase three all the respondents (100 opposed to 93 previously) agreed that children should eat vegetables and fruit. Moreover, they agreed that, if they were available, fresh vegetables were the best choice for the preparation of meals for the children. Not one respondent in phase three felt that children should only eat vegetables and fruit sometimes, nor did anyone say that tinned vegetables were the best way of eating vegetables (see Table 4.25). These results suggest that nutrition education and training of the caregivers in phase two contributed to their awareness of the importance of eating fresh vegetables, and perhaps of the consequences of not eating vegetables and fruit every day.

With regard to why children should be encouraged to eat vegetables and fruit, the respondents in phase one reflected only general knowledge about the issue. They gave vague or non-specific reasons as to why the consumption of vegetables should be encouraged during childhood. Furthermore they showed little understanding and awareness of what the consequences could be if children did not eat vegetables and fruit regularly. In phase three, results showed that most of the respondents had some specific knowledge as

they gave more nutrition-related than general health reasons (see Table 4.25), when answering this question.

TABLE 4.25: KNOWLEDGE OF THE IMPORTANCE OF VITAMIN A AND VEGETABLES AND FRUIT CONSUMPTION (n=100)

QUESTION	RESPONSE	FREQUENCIES	
		PHASE ONE	PHASE THREE
Should children eat vegetables and fruit?	Yes	93	100
	No	0	0
	Sometimes	7	0
If available, what is the best form of vegetable to give to children?	Frozen	0	0
	Tinned	7	0
	Fresh	93	100
What will happen if children do not eat vegetables and fruit?	They will have poor health	78	0
	They are at risk of disease	67	100
	Poor growth and development (Growth faltering)	44	23
	Weak immune system	17	57
	Increased early childhood deaths	4	63
	Lack of vital nutrients(nutrient deficiency)	34	81
Why is Vitamin A important?	Prevent growth faltering	26	99
	Increase resistance to diseases	52	100
	Prevent eye diseases and blindness	23	100
	Decrease child mortality	15	98

As is apparent from the data presented in Table 4.25, phase three results signify an increase in the number of respondents who knew what could happen if children did not eat vegetables and fruit. Caregivers' knowledge certainly changed for the better as is evident in phase three results that show that all the respondents (100) identified that children who did not eat vegetables and fruit were at risk with regard to the possibility of contracting diseases. In the phase one survey only 67 were aware of this. It was remarkable to realize that general health reasons such as poor health that were mentioned by the majority (78) in phase one were not given as a response in phase three. Further statistical tests were performed to see if there was significant improvement in the respondents' knowledge of what could happen if children did not eat vegetables and fruit. A two-way frequency table was used to illustrate the difference in the respondents' knowledge level between phase one and phase three results.

The responses were analysed separately before and after the intervention to determine whether there was a change in the respondents' knowledge of specific consequences of not eating vegetables and fruit. These are given in Table 4.26 which shows the responses to the question of whether not eating vegetables and fruit could cause nutrient deficiency. The change in the respondents' knowledge is illustrated by indicating the number of those who knew (yes) and those who did not know (no) that not eating vegetables and fruit could result in lack of vital nutrients in the body.

Confirming this trend are the results on this issue in phase one where only 34 respondents knew that not eating vegetables and fruit could result in nutrient deficiency, but in phase three 81 respondents knew. A positive change is evident in phase three in that, out of the 66 who did not know in phase one, phase three showed that 54 changed from not knowing to knowing and only 12 remained not knowing. Of the 34 who knew in phase one, only seven changed from knowing to not knowing and 27 remain saying they know that not eating vegetables and fruit could result in nutrient deficiency. McNemar's test showed a statistically significant difference (p-value<0.05) between phase one and phase three (see Addendum H). Thus it is clear that the caregivers seemed to have gained knowledge about the importance of eating vegetables and fruit, thus providing evidence of the success of the nutrition education programme implemented in phase two.

TABLE 4.26: NOT EATING VEGETABLES AND FRUIT AND NUTRIENT DEFICIENCY (n=100)

PHASE ONE	PHASE THREE		
	Will cause nutrient deficiency (NO)	Will cause nutrient deficiency (YES)	Total
Will cause nutrient deficiency (NO)	12	54	66
Will cause nutrient deficiency (YES)	7	27	34
Total	19	81	100

Although there were positive changes in the respondents' knowledge in phase three, unfavourable results were also identified. There was a statistically significant difference (p-value<0.05) in the number of respondents who indicated that the growth of children who did not eat vegetables and fruit would not falter (see Addendum H). But it was, however, disappointing to see that the difference (an increase from 56 to 77) was in a negative direction, which of course was contrary to the dominant trend of the positive effect of the training intervention. The results showed that 27 of the respondents who indicated in phase one that children's growth would be affected negatively if they did not eat vegetables and fruit changed to saying that children's growth will not be affected (see Table 4.27).

TABLE 4.27: NOT EATING VEGETABLES AND FRUIT AND GROWTH FALTERING (n=100)

PHASE ONE	PHASE THREE		
	Growth will be affected (NO)	Growth will be affected (YES)	Total
Growth will be affected (NO)	50	6	56
Growth will be affected (YES)	27	17	44
Total	77	23	100

Fruit portions

Though the portion size of a helping of fruit and/or vegetables was not actually measured, changes were evident in the size of the portion of fruit served to the children in phase three. Phase three results revealed that different portion sizes were served to children according to their age. As opposed to phase one, younger children were served smaller fruit portions and older children were served a bigger portion. For example, the one year old children who were served a whole fruit that they could hardly finish were now served half a fruit instead, as recorded in phase three. The three year olds who were served half a fruit were now served the whole fruit. It is evident from the results that the number of respondents who initially indicated that they were not serving fruit to children decreased from 43 to only 6. In phase one only 10 respondents instead of 30 indicated that they were not serving fruit to the children aged six to ten month old. Another 28 respondents working with the six year olds said they were not serving fruit to these children but this situation changed and all caregivers were serving fruit to these children in phase three.

There was also a decrease in the number of missing responses, which could mean that more respondents were serving fruit to the children. For example, there were 61 missing responses in phase one regarding the question of serving fruit to the six to ten month olds, and there were not any in phase three. Judging by the number of respondents who responded to this question in phase three, it can be assumed that there was an increase in the number of children who were served fruit at the crèches.

Vegetable portions

The portion sizes of vegetables served to children at crèches were all the same as in phase one. However, there was an increase in the number of respondents (32 versus 2) who were serving vegetable soup to the six month old children. Not one respondent reported not serving vegetables to children at all. The number of those who were not serving vegetables dropped from 42 to zero. Through observation the researcher realised that even though all the respondents had indicated that they were serving vegetables to the children, at times during the visits at crèches, some respondents were still not serving vegetables to younger children, the six to ten months age group.

Generally as was the case in phase one, children were served bigger food portions and they were expected to finish their plate of food no matter how big the portion was. The photograph below (Figure 4.23) bears evidence of the portion size of vegetable that was served to children in one of the crèches in this study.

FIGURE 4.23: THREE YEAR OLD CHILDREN EATING PORRIDGE AND SPINACH AT THE CRÈCHE

(ii) The importance of vitamin A to children

The results provide evidence of an improvement in the respondents' knowledge of the importance of vitamin A to children. Compared to phase one, phase three results as reflected in Table 4.25 show that 99 versus 26 respondents knew that vitamin A can prevent growth faltering, while 98 instead of 15 responded that vitamin A can decrease child mortality and all (100) versus 23 knew that vitamin A could prevent eye diseases. All the respondents versus only 52 previously indicated that vitamin A increases resistance to disease. Overall phase three results provide evidence that the majority of the respondents knew the importance of vitamin A to children. These significant findings could be ascribed to the nutrition education that the respondents received in phase two of the study.

The game was also used to re-assess the respondents' nutrition knowledge. In terms of the importance of vitamin A and the symptoms related to vitamin A deficiency, the respondents could give three to four correct answers instead of one out of five as happened during phase one. This confirms that there was an improvement in the respondents' knowledge in phase three.

(iii) Knowledge of vegetables and fruit rich in vitamin A

Figure 4.24 illustrates a comparison between phase one and phase three results regarding the respondents' knowledge of vitamin A-rich vegetables and fruit. As a result of nutrition education the respondents' knowledge of vitamin A-rich vegetables and fruit had improved considerably in phase three. The respondents were able to associate all the green, yellow- and orange-coloured vegetables and fruit with vitamin A. There was a decrease in the

number of the respondents who chose the vegetables and fruit which are poor in vitamin A. Therefore all the respondents knew that yellow/orange sweet potatoes, mangoes, *muroho.* carrots, pumpkin, avocadoes, spinach and paw-paw are rich in vitamin A. The respondents did not list white sweet potatoes, beetroot and litchi as containing vitamin A, nor did any respondent mention vegetables and fruit that are not rich in vitamin A in the *other* option.

In phase three, all the respondents only named vegetables and fruit that are rich in vitamin A in the *other* option. The absence of the respondents who mentioned other vegetables that are not rich in vitamin A suggests that nutrition education has contributed beneficially to the caregivers' knowledge of vitamin A-rich vegetables and fruit. From the results it is evident that the respondents had gained more knowledge with regard to vegetables and fruit rich in vitamin A and the change is noteworthy. Although the majority of the respondents showed an improvement in their knowledge of vitamin A-rich vegetables and fruit there were respondents who still chose fruit or vegetables that are not rich in vitamin A such as oranges (25) and cabbage (11) (See Figure 4.24).

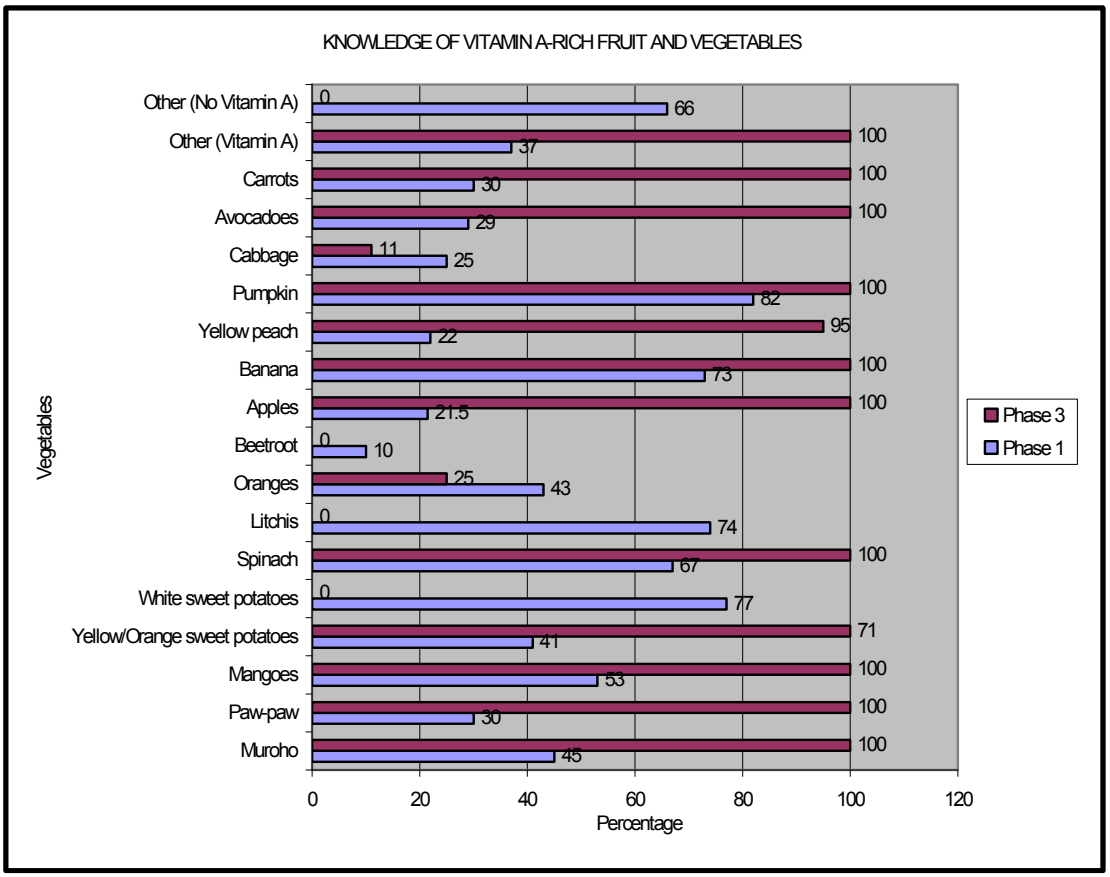


FIGURE 4.24: KNOWLEDGE OF VITAMIN A-RICH VEGETABLES AND FRUIT (n=100)

McNemar's test was performed to determine if the change was significant. The results were found to be statistically significant (p value<0.05) (See addendum H). Table 4.28 shows the difference in the respondents' knowledge of vitamin A-rich vegetables and fruit and the p-values thereof.

TABLE 4.28: KNOWLEDGE OF VITAMIN A-RICH VEGETABLES (n=100)

VEGETABLES	KNOWLEDGE OF VITAMIN A-RICH VEGETABLES		
	PHASE ONE RESPONSES	PHASE THREE RESPONSES	P-VALUE
Carrots	30	100	0.0455
Spinach	67	100	0.0046
Muroho	45	100	0.0001
Yellow sweet potatoes	41	100	0.0001

The results of the game played as a means to collecting data also confirmed an increase in the nutrition knowledge of the respondents as they were giving more correct answers to the same questions that were asked in phase one. The highest score was four out of five and some respondents scored five out of five. With regard to the question on the colour of vitamin A-rich vegetables and fruit, the caregivers were scoring better in phase three than they were in phase one and the majority were relating yellow and dark green colour with vegetables rich in vitamin A. From these results, it can be concluded that the nutrition education improved the respondents' knowledge of vitamin A-rich vegetables and fruit. The fact that there was an improvement in the caregivers' knowledge supports the views of Krige and Senekal (1997:22) and Engle *et al.* (1997:24) who maintain that caregivers at crèches should have enough knowledge of nutrition to enable them to help improve the growth and well-being of children in their care.

4.5.1.5 Relationship between caregivers' educational background and their nutrition knowledge

Literature indicated that lack of knowledge of optimal dietary practice is one of the primary causes of vitamin A deficiency and other nutritional problems facing preschool children (Faber *et al.,* 2001; Vorster *et al.,* 2001; Ruel & Levin, 2000). The authors also cited that the situation could be worsened if the children's mothers were not educated. As caregivers replace mothers at crèches it was therefore considered important to look at the relation between the caregivers' education level and their nutrition knowledge in phase one so that efforts could be made to increase nutrition awareness in phase two of the study. The relationship was again reassessed in phase three to see if there were changes in the respondents' nutrition awareness after the intervention.

The Kruskal Wallis test, a non-parametric one-way analysis of variance, was used to test the relationship between the nutrition knowledge of caregivers and their education level in both phase one and phase three. The chi-square test was therefore performed to compare the caregivers' score according to their education level. This was done by comparing the difference between the scores of respondents within the different education levels. Phase three results were thus compared with phase one results to see if there were changes in the respondents' nutrition knowledge and if the changes were statistically significant.

In terms of why should the consumption of vegetables and fruit be encouraged during childhood, phase one results showed a statistical significant difference (p-value<0.05) in the scores of the respondents with different levels of education. The respondents with grade 1-11 scored significantly lower than those with matriculation and tertiary education. Phase three results showed no statistically significant difference in the respondents' scores (p-value>0.05). This means that in phase three the respondents with grade 1-11 scored the same as those with matriculation and tertiary education.

In phase one there was a statistically significant difference (p-value<0.05) in the scores of the respondents with different level of education regarding knowledge of why vitamin A is important to children. Change is evident in phase three where there was no statistically significant difference (p-value>0.05) in the respondents' scores. In phase one the respondents with grade 1-11 scored lower than those with matriculation and tertiary education whereas in phase three all the respondents with different education levels scored the same. The results showed that the higher the education level achieved by respondents the more aware and knowledgeable they were about nutrition (vitamin A nutrition in particular).

Statistical tests were also done to test the relationship between the respondents' educational background and knowledge of vitamin A-rich vegetables and fruit. No relationship was found as the results showed no statistically significant difference (p-value>0.05) in the scores of the respondents at different levels of education in both phase one and phase three.

Overall, in phase one there is a statistically significant relationship between the respondents' education level and their nutritional knowledge. This indicates that the respondents with a higher level of education had better nutrition knowledge and understanding of vitamin A than those with low education level. This strongly suggests the need for an effective nutrition education to improve the caregivers' nutrition knowledge.

Phase three results differed from phase one results as there appeared to be no evidence of a statistically significant relationship between the respondents' various education levels and their nutritional knowledge. The difference in the respondent's knowledge in phase three could be linked to the nutrition education and training that the respondents received during phase two of the study. It can thus be concluded that the changes in the respondents' knowledge in phase three indicate the effectiveness of nutrition education and training, which then commends the importance of education for the caregivers.

4.5.1.6 Summary

Overall there was a positive direction of change which supports the assumption by Goosen and Klugman (1996:20) that increasing women's (in this case the caregivers') access to necessary resources improve the effectiveness of micronutrient interventions. In this study the necessary resource skills related to nutrition knowledge, accessibility and availability (gardening and gathering expertise) and the proper utilisation of vitamin A-rich vegetables and fruit. Thus nutritional benefits in phase three were not only statistically noteworthy but were also fundamental. Improved frequency of vegetables consumption and intake of vitamin A-rich vegetables that was evident in phase three can be attributed to increased availability of yellow and dark-green leafy vegetables such as spinach, pumpkin leaves, amaranth, *muxe,* Chinese cabbage sweet potato leaves, carrots, orange sweet potatoes and pumpkin in the crèche children's diets. Therefore the reassessment results showed that the gardening strategy that was linked to nutrition education appeared to have resulted in improved knowledge regarding vitamin A, improved dietary diversity, increased access and availability of vitamin A-rich vegetables and fruit and most probably enhanced the dietary intake of vitamin A of the 6 month to 6 year old children at the crèches.

The next chapter will deal with the conclusion and recommendations of the study.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

This chapter presents the concluding remarks in terms of the research findings. Based on these conclusions, recommendations are made. The chapter also has an evaluation of the study that could help future researchers.

The aim of this study was to develop and implement nutrition strategies that would improve the application of the food-based dietary guideline *"eat plenty of vegetables and fruits everyday"* to ensure increased availability, sustained access and subsequent consumption of vitamin A-rich vegetables and fruit. This would in turn address the prevalence of vitamin A deficiency which is one of the major problems facing South African children today. The research, in setting out to address this problem in the study area, followed the triple-A cycle of assessment, analysis and action. The study proceeded progressively, starting with a situational analysis (phase one), then the introduction of an improvement action-based task geared to the limitations identified in phase one (phase two), followed by a reassessment of improvements made (phase three). A fundamental intention of this study was to use a participatory process - action research that engaged caregivers in developing and implementing nutrition strategies.

This chapter provides the final conclusions, discusses the contribution the study has made and its limitations, and finally, makes recommendations and suggestions for further research. It reflects on the various aspects that were discussed in the preceding chapters that relate to the development and implementation of the nutrition strategies to be applied by crèche caregivers in order to enhance the consumption of vitamin A-rich vegetables and fruit by crèche children. These will be in accordance with the objectives set for this research (as stated in chapter 3, par.3.4) and discussed according to the three phases of the research process as presented in the preceding chapters.

5.2 PHASE ONE REVIEWED

Phase one was a baseline study that addressed the first objective of the study concerning dietary diversity with regard to the consumption of vitamin A-rich vegetables and fruit, their availability, extent of utilisation and the caregivers' knowledge of nutrition. The conclusions are presented below.

5.2.1 Demographic profile

Selected demographic information about the caregivers and the children was collected. That females are responsible for child care, is traditionally acknowledged in all cultures, and in this study, the crèche caregivers were adult females whose experience in this role ranged from six to ten years. Their educational background could be regarded as generally low since 61% of the research participants did not have a diploma in preschool education. It could be concluded that further training is required so that these respondents would have sufficient knowledge, and all the skills, needed to care for all aspects of crèche children's well-being. The demographic profile of the children attending the crèches under investigation showed that there were both male and female children and their ages were from six months to six years. A particular finding is that, on average, these children spend nine hours a day at the crèche, a finding similar to the study by Pietersen *et al.* (2002). This means that, for the largest part of their day, every day of the week, these children are totally dependent on the caregivers to give them proper and nutrient-rich food in their diets.

5.2.2 Dietary diversity

The situation assessment showed that the diet of the children at the crèches comprised a limited number of food items, and therefore lacked variety. Generally, the children were served a distinctly cereal-based diet, with maize meal porridge being the staple food. There was a low consumption of vegetables and fruit, and the meals, in general, were deficient in vitamin A.

The children's meal pattern generally consisted of two meals a day (breakfast and lunch) with one or no snack between them. All the caregivers in the sample served lunch and the majority (95) served breakfast. However, these meals lacked variety as the same types of foods were on offer every day. Unhealthy foods such as sweets, biscuits, popcorn and chips

were given as snacks while healthy snacks such as fruit were occasionally served to children. It was observed that fruit was handed out as a snack only when there were surpluses.

There was a low consumption of vegetables by crèche children as the majority (65) of the respondents only served vegetables once a week, with cultivated vegetables being provided more than indigenous vegetables. With the exception of five respondents who indicated that they served raw carrots, cooked vegetables were far more common. This was a cause of concern as it contributed to the lack of variety in the meals served to crèche children.

Several other significant observations were made. Clearly there was seasonal variation in the serving of dark-green vegetables such as Chinese cabbage, *miroho,* and spinach as these were only served when they were available. As a result, the majority of the respondents (71) provided cabbage because it was easily accessible and affordable. Although some respondents indicated that they served pumpkin and butternut, it was observed that children's meals lacked yellow and orange vegetables. Generally, children's meals were deficient in fruit as only a small minority of the respondents indicated that they served fruit. Fruit were not served on a daily basis and the fruits most commonly given to the children were bananas and apples that are not rich in vitamin A. It was disappointing to realise that mangoes, which grow abundantly in the area and are very rich in vitamin A, were not served at all, as not one respondent even mentioned it as a fruit served to their children. The same situation applies to avocadoes which were served by only three respondents (see Figure 4.5).

It can thus be concluded that the low consumption of vegetables and fruit (including yellow and orange vegetables and fruit), as well as not serving fruit at snack time, led to a low intake of beta-carotene-rich food by crèche children. In view of the fact that most of the children spend long hours (8-10 hours) at the crèche and they arrive early without having had breakfast, it is particularly important that they receive adequate meals at the crèches. Therefore there was a need to increase availability and accessibility of vegetables and fruit, and to include more vitamin A-rich vegetables and fruit in the children's diets.

5.2.3 Availability and access to vitamin A-rich vegetables and fruit

For the purpose of this study food availability means that the food is available in the children's environment, that is, at the crèche. Unavailability and lack of access to vitamin A-rich foods was a major concern that was observed from the beginning of the survey during

the implementation of phase one. Accessibility and the type of fruit and vegetable obtainable were dependent on the existence of gardens, the particular season of the year as well as the purchasing capacity of the crèche.

5.2.3.1 Gardening

For various reasons (such as those given in chapter 4, par.4.4.2.1), 61 respondents did not have vegetable gardens at their crèches. Some crèches experienced major obstacles to growing vegetables which included the cost of fencing, no access to planting materials or seeds, limited land and an inadequate supply of water. However, some obstacles, such as limited land, could have been overcome if the respondents had been better informed about vegetable gardening, because only a small plot is actually needed for cultivating enough vegetables to meet daily requirements. Engelberger *et al.* (2003:311) validate that this is true.

It was noteworthy that those who had vegetable gardens at their crèches were planting vitamin A-rich crops, namely pumpkin, spinach, Chinese cabbage, *muxe* and carrots but the quantity produced was too low for consumption by all the children. Therefore most of the caregivers relied on purchasing vegetables. The majority of caregivers (66) had no fruit trees growing in the crèche yards. Although 34 respondents indicated having fruit trees, all the fruit served to children was bought at the supermarkets or open markets. Vitamin A-rich fruit trees such as mango, paw-paw and avocado were available at some crèches, even though these fruits were not served to the children. The results posed a need to train caregivers on gardening and to educate them about the importance of having a vegetable garden.

5.2.3.2 Gathering of indigenous vegetables and fruit

The majority (70) of the respondents gathered and served indigenous vegetables such as jute mallow, *phuri*, African-nightshade and black jack to the children. Although the backyard and the fields were mentioned as places where these vegetables were gathered, it was observed that some vegetables, such as African-nightshade and *phuri,* were cultivated at the crèche gardens and also obtained from the supermarket or open market. Therefore these vegetables were not solely gathered but also bought. Indigenous vegetables were used as a substitute for cultivated vegetables and the frequency of their consumption, which was usually once a week was based on their availability. However, the children did not like these vegetables (see Figure 4.4). An unacceptable taste, unfamiliarity and low prestige value explained why this was so.

As a result of the diminishing popularity of indigenous fruit, only the respondents who had these fruit trees in their yards allowed the children to eat them. Lack of knowledge about the importance of indigenous vegetables and fruit contributed to a decline in their use. Thus the availability and accessibility of indigenous fruit was low. This contributed to a decreased consumption of fruit by children at crèches. Such findings illustrated the potential for education to make use of what is available and growing in the natural environment that could lead to increased production of vitamin A-rich vegetables and fruit.

5.2.4 Utilisation

Utilisation includes menu planning, food preparation, food storage and preservation. Caregivers displayed inadequate knowledge of the proper utilisation of vegetables and fruit in phase one.

5.2.4.1 Menu planning

It was clear that the respondents had not had training in menu planning. Although written menus were available, they were not followed as set out. The food prepared was based on what was available and not on what was on the menu. The respondents did not seem to understand the reason for having written menus because these menus remained the same for the whole year. They even included fruit or vegetables which were out of season. Some menus included foods that were never served to the children, whereas some just indicated the type of meal and not the food included in that meal. Lack of training, coupled with the respondents' low level of education, affected their ability to use recipes. These findings necessitated the need for education and training in menu planning.

5.2.4.2 Food preparation

A small number of respondents were adding ingredients that enhanced the nutritional value of certain vegetable dishes. Ingredients such as pondered groundnuts (peanuts), oil and minestrone soup mix were used. Although oil was added to enhance the taste of vegetables, this was a preferred practice as it aids the absorption of vitamin A by the body. Results revealed that the respondents were preparing and handling vegetables in such a manner that they lost valuable nutrients through prolonged cooking, throwing away cooking water, the addition of bicarbonate of soda, boiling in too much water and the habit of soaking vegetables. It was therefore necessary that the respondents should be made aware of the appropriate preparation and processing methods for vegetables.

5.2.4.3 Storage and preservation of food

It was noticed that storage facilities were poor in that the majority of the respondents had no refrigerators or freezers to store surpluses or leftovers. Though some respondents were buying just enough to use, others were throwing the leftovers away because of a shortage of storage space. It was disappointing to realise that not one respondent was preserving vegetables, not even those with vegetable gardens. Consequently it was realised that there was a need to make the caregivers aware of techniques to preserve pro-vitamin A-rich vegetables in order to improve their keeping quality, and to ensure that they had an adequate supply during seasons of lower availability. Such a strategy would increase their year-round availability. This suggestion is supported by Schalau (2001) who purports that the preservation of surplus vegetables and fruit could reduce seasonal variations in the availability of vitamin A-rich foods by making it possible to have vegetables and fruit available in the off-season. It is also suggested by Barker *et al.* (2005:51) that, preservation techniques should be practical and easily applied at the crèche level to increase the children's everyday consumption of vegetables and fruit.

5.2.5 Nutrition knowledge

The respondents' nutrition knowledge was seen to be inadequate during phase one of this research investigation. Although the majority knew that children should eat vegetables and fruit, they displayed little knowledge as to what could happen if children did not eat these foods. Regarding the importance of vegetables and fruit consumption during childhood, and the importance of vitamin A to children, they cited ordinary health reasons, based on common understanding and general knowledge that vegetables and fruit are good for health because they contain vitamins.

In line with the findings by Maunder and Meaker (2007:403) and Faber and Wenhold (2007:397) there was a lower level of knowledge and lack of esteem for indigenous plants. This underscored the urgent need to emphasise the nutritional value of indigenous vegetables, and the importance of nutrition education in this connection.

The respondents did not seem to know that the portion sizes of vegetables and fruit served to children should be controlled. The findings revealed that there was no portion control at all and the respondents did not really care about measurements. Although they said that portion sizes of vegetables and fruit served to children were measured, the portions were far too large for children as they believed in giving more generous helpings.

Though it is important to control the size of helpings, the way in which vegetable portions were dished up for the children in this study, could perhaps be condoned, and even supported and optimistically be encouraged, taking into account Faber *et al.* (2006:248)'s opinion that, to promote more vegetables and fruit in the diet of children, caregivers should give them double the normal servings of vegetables.

The results from phase one showed a significant association between the caregivers' educational level and their nutrition knowledge, which revealed in this question that the respondents with grade 11 and lower, scored significantly lower than those with matriculation and tertiary education. These results confirmed that there was a need for nutrition education and training for the caregivers as far as food provision for the children in their care was concerned.

5.3 PHASE TWO REVIEWED

The lack of knowledge of vitamin A, the absence of variety in meals presented, poor availability and accessibility of vitamin A-rich vegetables and fruit were factors identified in phase one that led to the development and implementation of nutrition strategies that could improve the application of the food-based dietary guideline *"eat plenty of vegetables and fruits everyday"* by crèche caregivers. Nutrition strategies focused on food-based activities and involved:

- nutrition education on vitamin A and the value of indigenous vegetables and fruit;
- training in gardening through demonstration; and
- training in menu planning, food preparation, proper storage and preservation.

Nutrition education, training and gardening demonstration provided the caregivers with the knowledge and skills they needed to enhance the consumption of vitamin A-rich vegetables and fruit by crèche children.

5.3.1 Nutrition education

Nutrition education was found to be an essential component of this study that aimed to increase caregivers' knowledge about vitamin A and awareness of ensuring that the issue of the availability and accessibility of vitamin A-rich vegetables and fruit was addressed, in

order to improve the consumption of these foods by young children attending crèches**.** Nutrition education focused mainly on the identification of vitamin A-rich vegetables and fruit and its importance for children's health, as well as being alert to the symptoms of vitamin A deficiency (Faber *et al.,* 2006:117). This led to an emphasis on dietary diversity**,** food preparation methods, preservation techniques and the importance of a vegetable garden as a source of vitamin A-rich foods. Although it was important to provide nutrition education to the caregivers, the educational level of some respondents was found to be a barrier for grasping some of the higher level nutrition information. A low literacy level too resulted in reduced access to educational materials about nutrition.

5.3.2 Gardening

The study did not only provide nutrition education but also increased the caregivers' skills in vegetable cultivation. Following Faber *et al.* (2006:24-26)'s recommendations and gardening manuals, caregivers were trained on how to establish and maintain vegetable gardens. They received some gardening support and were encouraged to cultivate vegetables such as carrots, spinach, pumpkin, *muxe,* Chinese cabbage and a new variety of beta-carotene rich sweet potatoes.

Realising the importance of these vegetables for children's health, caregivers were very positive about vegetable gardening. This resulted in the establishment of new vegetable gardens and the resuscitation of existing ones at the crèches. Caregivers in many crèches were thus planting vitamin A-rich vegetables as well as fruit trees, such as avocado, paw-paw and mango trees. The intervention was well received by the caregivers who showed some interest and were totally engaged in the gardening project.

5.3.3 Gathering of indigenous vegetables and fruit

Furthermore the training contributed to the use of vitamin A-rich indigenous vegetables by crèche caregivers. The respondents were informed about the nutritional benefits of indigenous vegetables. They were also made aware of vitamin A-rich indigenous vegetables such as *vowa, delele* and *muxe.* Gathering, cultivation and the use of indigenous vegetables and fruit were encouraged. Their inclusion in the menu, as well as their consumption by children, while in season, was also emphasised.

5.3.4 Menu planning and food preparation

The respondents were trained in menu planning, proper food storage, vegetable preparation and the preservation of vegetables for sustainability. Practices such as the grating of carrots, the addition of oil or fat, washing vegetables before cutting, cooking in little water for a short time, adding cooking water to children's porridge and the mashing of vegetables for small children were all promoted. Caregivers were also encouraged to sun-dry vegetables such as spinach, Chinese cabbage, *muxe* and pumpkin leaves while they were in season or when plentiful, for future use.

5.4 PHASE THREE REVIEWED

In phase three the reassessment of the intervention strategies to improve the crèche caregivers' application of the food-based dietary guideline *"eat plenty of vegetables and fruits everyday"* was undertaken to determine if there was an improvement in the application of this dietary guideline. This was once again determined through the assessment and analysis of dietary diversity, availability, accessibility and utilisation of vitamin A-rich vegetables and fruit in the crèches. These aspects serves as an indication of the success of the intervention applied in phase two.

5.4.1 Dietary diversity

Almost the same types of foods, as was the case in phase one, were served. However, valuable changes in the dietary composition of the meals were noticed. The majority of the respondents now served fruit at breakfast. There was an increase in the number of respondents who were serving raw cabbage to the children at lunch, alongside meat and porridge. This added to increased variety in meals served at crèches. The results also demonstrated an increase in the weekly vegetable consumption at crèches as the majority of the respondents were serving vegetables four times a week. It can thus be concluded that increased frequency of vegetable consumption would increase the crèche children's intake of beta-carotene.

There was an improvement from 52 to 84 respondents who offered afternoon snacks, thereby increasing the regularity of serving food to the children. Taking into account the length of time that children spend at the crèche, it is important to serve a snack in the

afternoon. Furthermore, this practice creates the opportunity for better food diversity, which implies more intakes of vitamin A-rich foods, particularly vegetables and fruit.

Consumption data showed that the children were eating an increased amount of dark green vegetables such as spinach, Chinese cabbage, African nightshade and *muroho.* Dark green vegetables are important sources of beta-carotene. When in season they were being frequently consumed by children. Although there was an improvement in the consumption of vitamin A-rich vegetables, the consumption of yellow/orange vegetables was still low, well below the amount that would be considered as adequate.

Healthier snacks, such as fruit were being served, and no mention was made about other snacks. These results are noteworthy, as they contribute positively to the nutritional adequacy of meals served at crèches in that it increased the crèche children's intake of fruit. Seasonal variation in the availability of fruit was observed as an important factor that contributed to better access to fruit at crèches. Contrary to the situation in phase one, the consumption of fruits such as avocadoes, was high during the winter season and this is important as they provide vitamin A.

Although the findings revealed substantial improvement in the consumption of fruit in phase three, some vitamin A-rich fruit such as mangoes and paw-paw, which are plentiful in the area, were not given to the children. Mangoes were not considered an important fruit that the crèche should provide as children could get them at home. The consumption of indigenous fruit was low. This was not solely as a result of seasonality, but was also due to scarcity and lack of popularity of this commodity.

It can be concluded that nutrition education and the demonstration of gardening practices in phase two resulted in an improved intake of vegetables and fruit. Variety was also added to the diet of the children and consequently the intake of vitamin A-rich vegetables increased.

5.4.2 Availability and access to vitamin A-rich vegetables and fruit

Re-assessment of the nutrition strategies was done to determine the extent of change in the availability and accessibility of vitamin A-rich vegetables and fruit.

5.4.2.1 Gardening

The presence of gardens at crèches had improved as the number of the respondents who indicated that they had vegetable gardens had increased from 39 to 89. In actual fact all except three crèches had vegetable gardens in phase three. This resulted in more vegetables being eaten more frequently in different crèches which, in turn, led to improved application of the food-based dietary guideline *"eat plenty of vegetables and fruits everyday".* This was also confirmed by an increase in the number of respondents who indicated that they were buying vegetables only once a month because they were also using vegetables from the crèche gardens.

The gardens provided direct access to fresh vegetables and also contributed to increased dietary diversity as more vitamin A-rich vegetables were being planted. This implies an increase in the consumption of vitamin A-rich vegetables by crèche children. Though all the respondents reported that they had fruit trees at their crèches, it did not mean that children were necessarily being served fruit from the crèche gardens as the trees had just been planted and were still too small to bear fruit. However, this implies that, in future, caregivers could be serving the children vitamin A-rich fruit from their own gardens.

Although the time span of the study was of short duration, the gardening project nevertheless yielded positive results, despite the relatively short period. Such success justifies the importance of training, advocacy, information and education, and endorses the point made by Faber *et al.* (2006:24-26) that this is so. It can therefore be concluded that the establishment of vitamin A-rich fruit and vegetable gardens at crèches contributes to an increase in crèche children's consumption of green leafy vegetables.

5.4.2.2 Gathering of indigenous vegetables and fruit

Although the results showed an increase in the number of the respondents (96) who were gathering indigenous vegetables, generally the consumption of these vegetables was low. The indigenous vegetables that were regularly consumed were those that were cultivated, like *muxe* that could be bought from the local market. It was observed that indigenous vegetables were not necessarily gathered even though they might be in season. These findings agree with Grivetti and Ogle (2000:31) as well as Weinberger and Swai (2006:87) who uphold that the habit of collecting non-cultivated plants is declining. As humans become more focused on domesticated cultivars, and pay less attention to indigenous species, the skills and knowledge needed to identify, collect and prepare indigenous foods are also declining.

It would, however, be wrong to believe that indigenous vegetables are purely subsistence crops for poor consumers, because indigenous vegetables may offer good opportunities to increase vitamin A intake amongst children. This is also maintained by other scholars in their studies (Faber *et al.,* 2007:411; Grivetti & Ogle, 2000:31-32, 39-41; Weinberger & Swai, 2006:87).

5.4.3 Utilisation

As is highlighted by Faber and Van Jaarsveld (2007), the potential contribution of plant foods to vitamin A status depends on the retention of pro-vitamin A carotenoids after storage, preparation and processing. It was therefore anticipated that caregivers would display adequate knowledge of proper food utilisation during the phase three investigation.

5.4.3.1 Menu planning

It was important for caregivers to have menu planning skills so that they would know what to include in the children's meals. Although all the respondents indicated that they had been trained in menu planning, it was clear that their menu planning skills and knowledge of food preparation techniques improved after they had been exposed to the training offered as part of the research study. This was evident from the written menus which now began to show dietary diversity. An increase in the use of vitamin A-rich vegetables in particular was clearly noticeable as these foods were more frequently included in the written menus. Moreover, what appeared on the menus was what was actually being offered to the children, which was not the case in phase one where what was served did not match the prepared written menus. Another positive observation was an increase in the number of respondents who were using recipes, and this can definitely be ascribed to the training received by the caregivers in phase two.

5.4.3.2 Food preparation

The results from phase three showed an improvement in the preparation of the vegetables. Clearly the children's increased enjoyment of eating vegetables can be attributed to this, as properly prepared and cooked vegetables taste good and are more palatable. Additionally, the frequency of consumption of vitamin A-rich vegetables and fruit in comparison to what was observed in phase one, had now become adequate, meeting desired expectations. This study shows that using different ways to prepare the vegetables, such as the addition of

ingredients to enhance flavour, contributed to the increased consumption of vegetables thus concurring with similar findings by Faber *et al.* (2006:29).

5.4.3.3 Storage and preservation of food

Although various methods of food preservation were introduced to the respondents, disappointingly only a small number (32) of caregivers were sun-drying cooked green leaves when these were plentiful, such as spinach and Chinese cabbage. The reason for not preserving vegetables was partly due to the fact that, since only a small area was available for cultivation, just enough vegetables as were required for immediate consumption, were produced – there was no surplus. Another reason could be that the parents would not have liked their children being served dried vegetables as these were regarded as having low status and associated with poverty. The majority (58) of the respondents was also using the refrigerator to store leftovers and none were throwing leftovers away. These are gratifying results.

5.4.4 Nutrition knowledge

There was a marked positive change for the better in the caregivers' level of nutrition knowledge in phase three. The respondents' familiarity with the symptoms of vitamin A deficiency had improved and the number of respondents who knew that vitamin A could prevent growth faltering had increased from 26 to 99. More respondents knew that children who do not eat vegetables and fruit are at risk of contracting specific diseases. Contrary to the situation in phase one, the majority of the respondents related green and yellow/orange vegetables and fruit to vitamin A. It can be concluded that the caregivers' increased knowledge of vitamin A would hopefully improve the crèche children's consumption of vitamin A-rich vegetables and fruit. This would support Kumar-Range's *et al. (*1997) notion that caregivers' nutrition knowledge is important for the nutritional well-being of children.

Caregivers' access to nutrition information could therefore raise the level of children's nutrition status (Kumar-Range *et al.,* 1997) through improving the nutritional value of meals served, particularly that of vitamin A. Accordingly, nutrition awareness had benefited the respondents and, in turn, would contribute to better health for the children in their care, as more vegetables and fruit would probably be served at the crèche meals. Although a small percentage of caregivers still had little knowledge and understanding of vitamin A and the consumption of vegetables and fruit from a scientific point of view, it can be concluded that the study was successful in improving the caregivers' knowledge and, what is important,

better practices related to vitamin A intake would be in force. The results associated with this study concur with the work of Faber and Van Jaarsveld (2007) who also indicated that training is a successful way of improving the knowledge, awareness, attitude and practices of caregivers regarding the importance of vitamin A in the diets of crèche children.

Consequently, participation in this study gave caregivers greater insight and knowledge and develop their skills on how to:

- increase the production, availability and access to vegetables and fruit;
- increase the consumption of these foods by crèche children; and
- enhance the availability of foods rich in precursors of vitamin A in the diet, through proper storage and preservation techniques.

Overall, a well-founded conclusion could be drawn that states that the introduction and application of the food-based dietary guideline that encourages the daily eating of vegetables and fruit, not only increased the caregivers' realisation of the value of vitamin A-rich vegetables and fruit, but also led to increased consumption of these foods by crèche children.

5.5 RECOMMENDATIONS

Based on the above findings and conclusions, the following recommendations are made to crèche caregivers, health workers, programme planners, policy makers and future researchers.

5.5.1 Recommendations to caregivers

Caregivers are advised:

- to consider the guideline *"eat plenty of fruit and vegetable everyday"* and regard its implementation as a necessity in the lives of the children in their care, realising that it can be achieved in the following ways:
  - having either a vegetable or a fruit as part of every meal served at the crèche;
  - using different vegetables and fruit regularly to add variety to the diet;
  - including plenty of vegetables and fruit when they are affordable, available and accessible;

- establishing vegetable gardens and introducing indigenous vegetables as crops;
- increasing the consumption of indigenous vegetables by including them in the menu; and
- improving preparation methods to enhance their taste and natural flavour, thereby increasing the consumption of vegetables.

- to ensure year-round availability and accessibility of vitamin A-rich vegetables and fruit. Caregivers should preserve vegetables when they are plentiful so that they are available when they are out of season.

- to enhance availability of vitamin A-rich vegetables and fruit in children's diets, caregivers should include:
  - more yellow/orange vegetables and fruit as they are high in vitamin A; and
  - vitamin A-rich indigenous vegetables and fruit in children's meals.

5.5.2 Recommendations to health workers and programme planners

As the consumption of *muroho* is low, eating it should be encouraged and promoted. Health workers should enhance indigenous knowledge of indigenous plants. More emphasis should be placed on neglected indigenous vegetables so that they form part of the daily food intake. Indigenous vegetables and fruit should be supported as a culturally acceptable and affordable alternative to cultivated vegetables and fruit. Increasing fruit and vegetable intake should be a priority when planning strategies to overcome vitamin A deficiency. For the success of this type of intervention an effective management programme should be developed. This includes the evaluation and monitoring of the vegetable garden programme.

Furthermore, a vitamin A promotion programme should be integrated with other programmes concerned with the health and well-being of children such as school-feeding programmes and school gardening projects. Special attention should be given to the education of caregivers and nutrition knowledge should be improved. Equally important is training that focuses on the South African Food-based Dietary Guidelines. Educational material should take low literacy levels into account and be available in a language that caregivers understand. Programme planners should therefore create opportunities to increase the caregivers' contribution to children's nutrition status through education, sensitising them on the issue in a comprehensible manner using various promotional strategies.

5.5.3 Recommendations to policy makers

Emerging nutrition policies should ensure that everyone, including the less privileged, has the opportunity to have access to a diet that meets the dietary guidelines formalised by government, particularly as far as a diet high in vegetables and fruit is concerned. Policy-makers should prioritise local food production when placing it on the agenda of local and national food policies in order to sustain the use of indigenous vegetables. It is thus important that nutrition policy-makers take note of the results of this study.

5.5.4 Recommendations for future research

This study has demonstrated that a food--based intervention can contribute to the improvement of vitamin A intake, and that continued intervention at this level of early childhood care, has merit. In accord with the context of this particular study, it is recommended that this specific food-based dietary guideline that has been applied to improving the consumption of vitamin A by crèche children should be extended for further research that would focus on:

- the sustainability of implemented nutrition strategies;
- undertaking more action research particularly in the application of other food-based dietary guidelines;
- replicating this study in other crèches in the Thulamela municipal area could yield significant gains for the entire community, and it could benefit the caregivers as well as the children, by ensuring continuation of the nutrition strategies already implemented; and
- the nutritional potential of indigenous vegetables and their health benefits should be considered when formulating future interventions.

5.6 EVALUATION OF THE STUDY

Although an overview of the reliability and validity of the study has already been given (chapter 3, par 4.12) it was considered valuable for the purpose of this study to evaluate the research objectively. This was done mainly to assess the validity and reliability of the methods of data collection and the usefulness of the data to the research. The achievement

of the objectives set out for the research and the benefits of the study to the caregivers too, are evaluated.

5.6.1 Reliability and validity

The reliability of an empirical study can produce difficulties with replication as the results may differ if the research were to be repeated at a later stage with a different sample of respondents. To overcome this problem, the reliability of this study was further enhanced by the use of the theoretical model from the planning stage of the study. Various techniques of data collection that complemented each other were used, and consequently served as cross-validation to ensure the reliability and enhance validity of the study (see 3.12.1 and 3.12.2).

5.6.2 Data collection methods and their usefulness to the research

The questionnaires, the game devised and regular observation at the participating crèches proved to be the correct methods of data collection for this study, as they provided the information that was required to meet the objectives of the study. The game was useful in gathering data regarding nutrition information and knowledge about vitamin A-rich vegetables and fruit. The data collected was easy to process, and the results of the final analysis and interpretation of the information gathered proved that the methods of data collection were worthy instruments. To combat the risk of error, data was collected under the same conditions for all the participating crèches in both phases of data collection.

5.6.3 Achievement of the objectives of the study

It is clear from the interpretation and discussion of the results and the conclusions reached that the objectives set out for this study (chapter 3, par. 3.4) were effectively realised. However, the objectives relating to the utilisation of vegetables and fruit, particularly with regard to their preservation, also the accessibility and availability of indigenous fruit were minimally achieved.

5.6.4 Benefit to caregivers and the children

Training and skill development supported the empowerment of caregivers and in the process, built a sense of achievement and self-worth, instilling confidence. Combining the

cultivation of gardens that produced vitamin A-rich vegetables and fruit with nutrition education ensured that caregivers had a better understanding of vitamin A nutrition. The process was an investment in that the training that the caregivers received, allowed them to develop food-based nutrition strategies. It can be reasonably presumed that the skills they learnt, and used, would most likely stay with them, to be used again and again. Similarly, the training received in the cultivation, preservation and preparation of vegetables could presumably be useful over the long term and could, in fact, even be transferable amongst caregivers.

The participatory research process used ensured that the intervention was responsive to the participants' needs and proved to be acceptable to them as they were very positive and eager to learn. This suggests that such interventions might be more sustainable than those that would be brought into the community from the outside or even sold to the community. The nutrition strategies proved to be successful as the consumption of vegetables and fruit increased significantly, affording a greater opportunity for an improved vitamin A intake.

5.6.5 The success of the study

The establishment of vegetable gardens and the production of vitamin A-rich vegetables contributed significantly to the success of this study. Consistent with the findings from earlier studies as documented in relevant literature sources, the experience of caregivers at the selected crèches in the Thulamela municipal area, points to the real potential of gardening and education interventions that would improve the availability and consumption of vitamin A-rich foods as recorded in the work of other scholars like Smitasiri and Dhanamitta (1999) and English and Badcock (1998) found in other settings.

As a result of the training done there was a definite change for the better in the respondents' menu planning skills and vegetable preparation techniques. In this study, the researcher not only used her own knowledge and skills, but also relied on collaboration with a multidisciplinary collegial team. This meant bringing together the technical and disciplinary expertise that rested in different institutions as well as drawing on the skills of the researcher. Such an approach was applied in this study where the Agricultural Research Council assisted with gardening training and there was a partnership agreement (a friendly contact) with the Department of Health that contributed to providing information about vitamin A.

5.7 THE SIGNIFICANCE OF THE STUDY

To apply a food-based dietary guideline is possible. Considering available resources, this study has suggested that it was the value of building on existing knowledge and practices that led to the development and implementation of the nutrition strategies it proposed. It was this approach that contributed significantly to the success of the intervention and supports the viewpoint of Faber *et al.* (2006:15-16) who maintain that people are more likely to adopt a new or improved practice when the change is linked with comfortable or at least familiar practices. Baseline data of the sample suggested that an existing level of knowledge and experience was present and there was a sense of readiness to accept change that would serve as fertile ground on which to build the innovation. Thus the relatively short time needed to achieve beneficial results in this particular study could be attributed, in part, to the fact that the researcher built on what already existed. However, it also showed that even people with a low level of literacy can be taught nutrition principles.

5.8 LIMITATIONS OF THE STUDY

- Broad generalisations should be made cautiously for, the following reasons:
  - convenience sampling was used and, to some extent this technique limits the applicability of generalisation of the findings.
  - a limited number of crèches in the study area were involved in the investigation and
  - the time span of the study was limited to a few months and the results of such a study do not fully capture the long-term effects of the intervention.
- Constraints were present, such as being unable to go back to the crèches now that the research project has been completed, could hamper the sustainability of the gardens of some crèches, especially those that have just started. A lack of monitoring and evaluation of the established gardens could lead to these gardens ceasing to exist.

5.9 CONCLUDING REMARKS

The study has shown the success that well-designed nutrition strategies can achieve, resulting in a significant increase in the consumption of vegetables and fruit. It can therefore be concluded that vegetable gardening, coupled with nutrition education, is positively associated with the dietary guideline *"eat plenty of vegetables and fruits everyday"*. If implemented, it would, in turn, increase the consumption of vitamin A-rich vegetables and fruit and thereby decrease the risk of vitamin A deficiency. That is, to provide for vitamin A, children's diets should include regular consumption of a variety of yellow/orange-fleshed and dark-green vegetables and fruit. This study demonstrated that a focus on vegetable production alone would not yield the nutritional benefit, but a combination of activities focusing on nutrition education, production and utilisation of food could improve the application of the food-based dietary guideline *"eat plenty of vegetables and fruits everyday"* by crèche caregivers.

The fact that the intervention yielded consistently positive results within a relatively short period of time, should help dispel the belief that this type of intervention takes a long time before it shows results. This study provides evidence that food-based intervention can work in a short time. The improvements in the respondents' knowledge in phase three indicate the effectiveness of the nutrition strategies developed in phase two of the study. But the question of sustainability of the gardens is a big concern. The gardens might have initially flourished because the respondents knew that the researcher would come back to assess the gardens. Yet it is strongly suggested in this study that a follow-up research endeavour could help to ensure the sustainability of the achieved outcomes.

In conclusion, the findings of this study confirm that it is one thing to recommend eating plenty of vegetables and fruit every day, but the challenge lies in demonstrating its application in practice in communities with limited natural and human resources. Therefore, increasing fruit and vegetable intake is still the best overall advice that can be given to caregivers. If these can happen in Thulamela, why not in other rural areas worldwide?

REFERENCES

ACC/SCN, 2002. SCN News. *A periodic review of developments in international nutrition compiled from information available to the ACC/SCN*. Volume 25.

ACC/SCN, 1995. *Controlling vitamin A deficiency.* SCN News. A periodic review of developments in international nutrition compiled from information available to the ACC/SCN. No: 8.

ACC/SCN, 1997. SCN News. *A periodic review of developments in international nutrition compiled from information available to the ACC/SCN*. Volume 15.

ALLEN, L & GILLESPIE, S. 2001. *What works? A Review of Efficacy and Effectiveness of Nutrition Interventions*. Administrative Committee on Coordination and Subcommittee on Nutrition in Collaboration with Asian Development Bank. Geneva. United Nations.

BABBIE, E & MOUTON, J. 2001. *The practice of social research*. Oxford University Press. Cape Town.

BARKER, A, CORNELISSEN, J, DE VILLIERS, S & TURLEY, C. 2005. *Doing Consumer Studies*. Grade 10 learners' book. Juta Gariep. Cape Town.

BEATON, GH, MARTORELL, R, ARONSON, KJ, EDMONSTON, B, MCCABE, G, ROSS, AC & HARVEY, B. 1993. *Effectiveness of Vitamin A supplementation in the control of young child morbidity and mortality in developing country*. ACC/SCN State of the art series nutrition policy discussion paper. Volume 13.

BERE, E & KLEPP, KI. 2005. Changes in accessibility and preferences predicted children's future fruit and vegetable intake. *International Journal of Behavioural Nutrition and Physical Activity,* 2(15)(Dol:10):1186/1479-5868-275.

BLESS, C & HIGSON-SMITH, C. 2000. *Fundamentals of social research methods*. 3rd edition. Juta. Cape Town.

BLIJHAM, N, DE KAN, L & NIEHOF, A. 2006. Determinants and adequacy of food consumption in LA Trinidad, the Philippines. *International Journal of Consumer Sciences*, 10:1-13.

CERVINSKAS, J & LOTFI, M. 1996. *Vitamin A deficiency key resources in its prevention and elimination.* Second edition. The Micronutrient Initiative Information Paper no1. [Wwwdocument2005/06/10]. Available at: http://www.micronutrien.org/resource/publications /pub21.htm. (accessed 26 April 2006).

CHULAHN, B, ENGELHARDT, K & JOUNG, H. 2006. Diet Variety is Associated with Socio-Economic Factors. *Ecology of Food and Nutrition*, 45: 417-430.

CHWEYA, JA. *Identification and nutritional importance of indigenous green leaf vegetables in Kenya.* Available at: http://www.actahort.org/books/153/153-13htm (accessed 14 June 2007).

CHWEYA, JA & EYZAQUIRRE, PB. 1999. *The biodiversity of Traditional leafy vegetables*: International Plant Genetic Resource Institute. Rome.

DANHAUSER, A, JOUBERT, G & NEL, M. 1996. Nutritional status of preschool children in Bloemfontein district. *South African Journal for Food Science and Nutrition*, 1(8):14-21.

DEPARTMENT, OF HEALTH. 2000. *Information for Health Workers on Vitamin A supplementation.* Directorate Nutrition.

DEPARTMENT OF HEALTH. 2002. *Integrated Nutrition Programme. A foundation for life.* Issue 2. Department of Health. South Africa.

DEPARTMENT OF HEALTH. 2004. *Integrated Nutrition Programme. A foundation for life.* Issue 4. Department of Health. South Africa.

DE PEE, S, WEST, CE, PERMAESIH, D, MARTUTI, S, MUHILAL-KARYADI, D & HAUTVAST, JGAS. 1998. Orange fruit is more effective than are dark green, leafy vegetables in increasing concentrations of retinol and B carotene in school children in Indonesia. *The American Journal of clinical nutrition,* 68:1058-1067.

DE VOS, AS, STRYDOM, H, FOUCHE, CB & DELPORT, CSL. 2005. *Research at grass roots*. 3rd Edition, Van Schaik. Pretoria.

DE WET, G, HOLM, LL., NORVAL, J & VAN PLETZEN, M. 2005. *OBE for FET Consumer studies. Grade 10 learner's book.* Nasau Via Africa. Cape Town.

ENGELBERGER, L, DARNTON-HILL, I, COYNE, T & FITZGERALD, MH. 2003. Carotenoid rich Bananas. A potential food source for alleviating Vitamin A deficiency. *Food and Nutrition Bulletin,* 24(4):303-306.

ENGLE, PL, BENTLE, M & PELTO, G. 1997. The role of care in nutrition programmes: current research and a research agenda*. Proceedings of the nutrition society,* 59:25-35.

ENGLISH, R & BADCOCK, J. 2007. Community Nutrition Project in VietNam: Effects on child morbidity*. Food, Nutrition and Agriculture*, 22(15).

FABER, M, LAURIE, SM & VENTER, SL. 2006. *Home gardens to address vitamin A deficiency in South Africa*. Roodeplaat Vegetable and Ornarmental Plant Institute: Nutrition Intervention Research Unit of the Medical Research. Pretoria.

FABER, M & VAN JAARSVELD, PJ. 2007. The production of pro-vitamin A-rich vegetables in home-gardens as a means of addressing vitamin A deficiency in rural African communities. *Journal of the Science of Food and Agriculture,* 87(3): 366-377 (12).

FABER, M, VAN JAARSVELD, PJ & LAUBSCHER, R. 2007. The contribution of dark green leafy vegetables to total micro-nutrient intake of two to five year-old children in a rural setting. *Water SA,* 33(3).

FABER, M, VENTER, SL & BENADE, AJS. 2001. Increased vitamin A intake in children aged 2-5 years through targeted home gardens in rural South African community. *Public Health Nutrition,* 5(1):11-16.

FABER, M & WENHOLD, F. 2007. Nutrition in contemporary South Africa*. Water SA,* 33:(3).

FAO. 1990. *Preventing micronutrient malnutrition guide to food based approaches. A manual for policy makers and programme planners.* International Life Sciences Institute. ILSI Press. Washingtod DC.

FAO. 1997a. *Agriculture Food and Nutrition for Africa- a resource book for teachers of agriculture*.[wwwdocument0/9/2001].URL. Available at: http://www.fao.org/docrep/wooo78e /woo78e.htm: (accessed 26 August 2007).

FAO, 1997b. *Preventing micronutrient malnutrition a guide to food-based approaches- Why policy makers should give priority to food-based strategies.* Web definitions. (WWW document-27/01/2006). Available at: http://www. Foa.org//docrep/x0245e/ x0245e 00.htm (accessed 26 October 2006).

FAO. 2001. *Targeting of Nutrition improvement: Resources for advancing nutritional well-being.* FAO. Rome.

GILLESPIE, S & MASON, J. 1994. *Controlling vitamin A deficiency*. ACC/SCN state of the art series. Nutrition policy discussion paper no.14. A repot based on the ACC/CSN. Consultative group meeting on strategies for the control of VAD. 28-30 July 1993. Ottawa. Canada.

GOOSEN, M & KLUGMAN, B. 1996. *The South African Women's Health Book*. Oxford University Press. Cape Town

GRIVETTI, LE & OGLE, BM. 2000. Value of traditional foods in meeting macro- and micronutrient needs: the world plant connection. *Nutrition Research Review,* 13:31-46.

HANDS, ES. 2000. *Nutrients in foods.* Lippincott Williams & Wilkins. USA.

HAYES, D & LAUDAN, R. 2009. *Food and Nutrition:* Volume 7. Marshal Cavendish corporation. New-York

HELEN KELLER INTERNATIONAL. 2003a. *The complete manual for vegetable and food production. Handbook for home gardening in Cambodia.* Phnom Penh Helen Keller worldwide.

HELEN KELLER INTERNATIONAL. 2003b. *Integration of animal husbandry in home gardening programmes to increase vitamin A intake from foods: Special issue.* Asia Pacific. Bangladesh, Cambodia and Nepal.

HOWSEN, CP, KENNEDY, ET & HORWITZ, A. 1998. *Prevention of micronutrient deficiencies. Tools for policy makers and public health workers.* National Academy Press. Washington, DC. 207.

HUFFMAN, SL & MARTIN, LH. 1994. First feed: Optimal feeding of infants and toddlers. *Nutrition Research,* 14:127-159.

INTEGRATED NUTRITION PROGRAMME, 2003. *Guideline for nutrition interventions at health facilities to manage and prevent child malnutrition*. Department of Health. South Africa.

INTERNATIONAL VITAMIN A CONSULTATIVE GROUP (IVACG), 1999. *Vitamin A and other micronutrients:* Biologic Interactions and Integrated Intervention. Report of The Sixth International Vitamin A Consultative Group Meeting. 8-11 March 1999. Durban.

JANSEN VAN RENSBURG, WS, VAN AVERBEKE, W, SLABBERT, R, FABER, M, VAN JAARSVELD, P, VAN HEERDEN, I, WENHOLD, F & OELOFSE, A. 2007. African Leafy Vegetables in South Africa. *Water SA*, 33(3).

KENNEDY, G., NANTEL, G & SHETTY, P. 2003. *The scourge of 'hidden hunger': Global dimensions of micronutrient deficiency*. Food, Nutrition and Agricultural Series 32, Food and Agricultural Organisation. Rome, Italy.

KENNEDY, E. 2004. *Dietary Diversity, Diet Quality, and Body weight Regulation*. Nutrition Reviews, 62(7).

KEPE, T. 2008. Social dynamics of the value of wild edible leaves (imifino) in a South African rural area. *Ecology of Food and Nutrition,* 47:531-558.

KRIGE, MU & SENEKAL, M. 1997. Factors influencing the nutritional status of pre-school children of farm workers. Stellenbosch district. *South Africa Journal food Science Nutrition,* 1(9):14-23.

KUMAR, R. 1999. *Research methodology. A step-by-step guide for beginners*. Sage. London.

KUMAR-RANGE, SK, NAVED, R & BHATTARAI, S. 1997. *Child care practices associated with positive and negative nutritional outcomes for children in Bangladesh*: A descriptive analysis. Food Consumption and Nutrition Division: International Food Policy Research Institute. Washington, DC. Discussion Paper No.23 (202) 467-4439.

LABADARIOS, D & VAN MIDDELKOOP, A. 1995. Children aged 6-71 month in South Africa, 1994: The anthropometric, vitamin A, iron and immunisation coverage status. The South African Vitamin A Consultative Group. *South African Medical Journal*, 86: 354-357.

LABADARIOS, D, STEYN, NP, MAUNDER, E, MACINTRYRE, U, GERICKE, G, SWART, R, HUSKISSON, J, DANNHAUSER, A, VOSTER, HH, NESAMVUNI, AE & NEL, JH. 1999. The National Food Consumption Survey (NFCS): South Africa. *Public Health Nutrition,* 8(5):533-543.

LABADARIOS, D., STEYN, N.P., MAUNDER, E., MACINTRYRE, U., GERICKE, G., SWART, R., HUSKISSON, J., DANNHAUSER, A., VOSTER, HH., NESAMVUNI, AE & NEL, JH. 2005. The National Food Consumption Survey (NFCS): South Africa. *Public Health Nutrition,* 8(5):533-543.

LEEDY, PD. 1993. *Practical research. Planning and design*. 5th edition. Macmillan. New York

LEEDY, PD & ORMROD, JE. 2005. *Practical research. Planning and design*. 8th edition. Pearson Prentice Hall. USA.

LOUW, J. 2001. Vitamin A Geneeskunde*: The Medical Jour*nal, 43 (4): 1-2.

LOVE, P & SAYED, N. 2001. Eat plenty of vegetables and fruits everyday. *South African Journal Clinical Nutrition (Supplement),* 14(3): 524-532.

MACHAKAIRE, V, TURNER, AD & CHIVENGE, OA. *Agronomic and Nutrition studies of two indigenous vegetables in Zimbabwe.* Available at: http://www.actahort.org/books/513/513-17htm (accessed 26 August 2007).

MANNAR, MGV. 2000. *Who We Are? Solutions for Hidden Hunger:* Micronutrient Initiative.

MAUNDER, EMW & MEAKER, JL. 2007. The current and potential contribution of home-grown vegetables to diets in South Africa. *Water SA,* 33(3).

MCINTOSH, EN. 1995. *American food habits in historical perspective*. Westport. Preager.

MCLAREN, DS & FRIGG, M. 1997. *Sight and Life Manual on Vitamin A Deficiency Disorders (VADD).* Task Force Sight and Life, Basel, Switzerland.

MNKENI, AP, MASIKA, P & MAPHAHA, M. 2007. Nutrition quality of vegetable and seed from different accessions of Amaranthus in South Africa*. Water SA,* 33(3).

MODI, M. MODI, AT & HENDRIKS, S. 2006. Potential role for wild vegetables in household food security: a preliminary case study in KwaZulu-Natal. *African Journal of Food, Agriculture, Nutrition and Development,* 6(1):2-13.

MOODLEY, J & JACOBS, M. 2000. *Research to Policy and Action: The Case of Vitamin A in South Africa*. Technical Report.

MOUTON, J. 1996. *Understanding social research*. Van Schaik. Pretoria.

NEBEL, S. PIERONI, A & HEINRICH, M. 2006. Wild edible greens in the Graecanic area in Calabria, Southern Italy. *Appetite,* 47:333-342.

NESAMVUNI, C. STEYN, NP & POTGIETER, MJ. 2001. Nutritional value of wild, leafy plants consumed by Vhavenda. *South African Journal of Science,* 97:51-54.

NEUMAN, WL. 2000. *Social Research Methods- Qualitative and Quantitative Approaches.* 4th edition. Allyn & Bacon. Boston.

NEUMAN, WL. 2003. *Social Research Methods- Qualitative and Quantitative Approaches.* 5th edition. Allyn & Bacon. Boston

NICUS, 1999. *Nutrition Information Center, University of Stellenbosch*. Available at: http://www.sun.ac.za/nicus/ (accessed 27/01/2006).

PALAFOX, NA, GAMBLE, MV, DANCHECKS,B, RICKS, MO, BRIAND, K & SEMBA RD. 2003. Vitamin A, iron-deficiency, and anemia among preschool children in the Republic of the Marshall Islands. *Science Direct*, 19(5):405-408

PIETERSEN, C, CHARLTON, KE, DU TOIT, L & SEBEKO, L. 2002. An assessment of the nutrition content meals provided and facilities presented at state funded crèches in Cape Town*. The South African Journal of Clinical Nutrition,* 15(2):5, 15-18.

REDDY, V. 1999. *Prevention of micronutrient deficiencies-base approach.* World Agricultural Forum. 1999. World congress.

REINAERTS, E, DE NOOIJER, J, CANDEL, M & DE VRIES N., 2007. Explaining school children's vegetables and fruit consumption: The contribution of availability, accessibility, exposure, parental consumption and habit in addition to psychological factors. *Appetite,* 48:48-258.

ROLFES, SR, PINNA, K, WHITNEY, E & WADSWORTH, T. 2006. *Understanding Normal and Clinical Nutrition*. 7th Edition. Thomson Wadsworth. Australia.

RUBAIHAYO, EB. *Conservation and use of traditional vegetables in Uganda*. NARO Kawanda Agricultural research Institute. Kampala. Uganda. Avalable at http://www.bioversityinternational.org/publications /Web version/500/ch15.htm (accessed 18 June 2007).

RUEL, MT & LEVIN, CE. 2000. *Assessing the potential for food-based strategies to reduce vitamin A and iron deficiencies: A review of recent evidence*. Food Consumption and Nutrition division of the International Food Policy Research Institute. Discussion paper 92.

RUEL, MT. 2003. Animal sources foods to improve micronutrient nutrition and human function in developing countries: Operationalising Dietary Diversity: A Review of Measurement Issues and Research Priority[1, 2]. *Journal of Nutrition,* 133:3911s-3926s.

SCHALAU, J. 2001. *Backyard Gardener- Preserving Your Summer Harvest.* Agriculture and Natural resources Arizona Cooperative Extension, Yavapai County. (WWW document-10/10/ 2005). Available at: hptt://cals.arizona.edu/yavapai/anr/hort/byg/archive/foodpreservation. html (accessed 18 June 2007).

SHARMA, S & NAGAR, S. 2006. Impact of educational intervention on knowledge of mothers regarding child care and nutrition in Himachal Pradesh. *Journal of Social Science,* 12(2):139-142.

SLINGERLAND, M, KONING, N, MERX, D & NOUT, R. 2003. *Food-based approaches for reducing micronutrient malnutrition. A review and some reflections.* North-South discussion paper no. 2.

SMITASIRI, S & DHANAMITTA, S. 1999. *Sustaining behavior change to enhance micronutrient status: Community and women-based interventions in Thailand*. OMNI Research Report Series No. 2, International Center for Research on Women, Washington, DC.

SOLOMONS, NW. 1999. Plant Sources of Vitamin A and Human Nutrition: How much is too little? *Nutrition Reviews*, 57 (11): 350-361.

SOMMER, A & WEST, KP. 1996. *Vitamin A Deficiency, Health, Survival and Vision*: Oxford University Press. New York.

STADLER, KK & TEASTER, PB. 2002. *As you Age eat more vegetables with vitamin A.* Publication no 348-197. January 2002.

STEYN, NP & TEMPLE, N. 2008. *Community Nutrition Textbook for South Africa: A Rights-Based Approach.* CREDA Communications.

STEYN, AGW, SMIT, CF & DU TOIT, SHC. 1984. *Moderne statistiek vir die praktyk*. J C Van Schaik. Preotria.

TOMPSON, T & MANORE, M. 2005. *Nutrition: An applied approach*. San Francisco Pearson United Nations Children's fund (UNICEF). 2007. Progress for children. A world fit for children statistical review. UNICEF.

TONTISIRIN, K & GILLESPIE, S. 1999. Linking community-based programmes and service delivery for improving maternal and child nutrition*. Asian Development Review*, 17(1/2):33-65.

VAN LIESHOUT, M, CHOPRA, M & SANDERS. 2004. *Micronutrient malnutrition course for Southern Africa.* Conceptual framework for understanding and combating micronutrient deficiencies.

VAN ZYL, AP, GROENEWALD, ME & DE BRUIN, FM. 2003. *Active Home economics STD 9.* De Jager-HAUM. Pretoria.

VEAL, AJ. 1997. *Research Methods for Leisure and Tourism- A practical guide*. 2nd edition. Pearson Education. London.

VORSTER, HH, LOVE, P & BROWN, C. 2001. Development of food-based dietary guidelines for South Africa-the process. *The South African Journal of Clinical Nutrition,* 14(3):S1-S3.

WEINBERGER, K & MSUYA, J. 2004. Indigenous Vegetable in Tanzania-Significance and Prospect. AVRDC-The World Vegetable Center. *Technical Bulletin*, 31:04.600.70.

WEINBERGER, K & SWAI, I. 2006. Consumption of traditional vegetables in central and northern tanzania. *Ecology of Food and Nutrition,* 45:87-103.

WENHOLD, FAM, FABER, M, VAN AVERBEKE, W, OELOFSE, A, VAN JAARSVELD, PJ, JANSEN VAN RENSBURG, WS, VAN HEERDEN, I & SLABBERT, R. 2007. Linking smallholder agriculture and water to household food security and nutrition. *Water SA,* 33(3).

WHITNEY, E & ROLFES, SF. 2010. Understanding Nutrition. Wardsworth Group. London

WHO (World Health Organization). 1995. Global prevalence of vitamin A deficiency. Micronutrient deficiency information system. *WHO MDIS Working Paper # 2*. WHO, Geneva.

WILLIAMS, MH. 2002. *Nutrition for Health, Fitness and Sport*. 6th edition. McGraw-Hill. New York

ADDENDUM A

QUESTIONNAIRE

FOR OFFICE USE

Nutrition strategies to improve the application of a Vitamin A Food-Based Dietary Guideline by crèche caregivers.

Date of Interview		V1
Respondent Number		V2
Name of crèche		V3

Part A: General Information

Place a cross next to the applicable box and also provide information where applicable.

A.1 Background information on the caregivers

1. What is your age in years? Please indicate your date of birth?

D	M	Y	
			V4

2. Please indicate your gender?

Male	1	V5
Female	2	

3. What is your highest educational level?

Nor formal education	1	V6
Grade 1-7	2	
Grade 8-11	3	
Pass matric	4	
Tertiary education	5	
Other, specify	6	

4. Indicate the number of years you have been taking care of the children at the crèche.

	V7

5. Where did you learn how to care for children?

Have done a preschool diploma	1	V8
Trained by the department of Health	2	V9
Trained by the owner of the crèche	3	V10
Learned from other caregivers	4	V11
Other, specify	5	V12

A.2 Background information of children

1. Indicate the number of children in the crèche.

Male		V13
Female		V14

2. The ages of children at the crèche range from [ ] to [ ] years old V15 [ ] V16 [ ]

3. How many hours per day do the children stay at the crèche? Please indicate as follows: The crèche starts from [ ] to [ ] V17 [ ] V18 [ ]

4. What meals excluding milk for babies are offered to children at the crèche?

Meals given		
Breakfast		V19
Morning snack		V20
Lunch		V21
Afternoon snack		V22
Other, specify		V23

Part B: Nutrition information

Mark the correct answer with an X, and also provide information where applicable.

B.1 Nutrition knowledge

1. Should children eat vegetables and fruit?

Yes	1	
No	2	
Sometimes	3	V24

2. Why is the consumption of vegetables and fruit encouraged during childhood?

Reasons		
Source of vitamins	1	V25
Source of fiber	2	V26
Source of minerals	3	V27
Promote growth	4	V28
Protects them from diseases	5	V29
Other, specify	6	V30

3. How much servings or portions of vegetables and fruit do you give the children to eat at crèche per day?

	Fruit	*Vegetable*				
6 months			V31		V32	
1 year			V33		V34	
2 years			V35		V36	
3 years			V37		V38	
4 years			V39		V40	
5 years			V41		V42	
6 years			V43		V44	

4. What will happen if children do not eat vegetables and fruit?

		V45
		V46
		V47

5. Why is vitamin A important for children?

Prevent growth faltering	1	V48
Increase resistance to diseases	2	V49
Prevent eye diseases and blindness	3	V50
Decrease child mortality	4	V51
Other, specify	5	V52

6. Which of the following locally available vegetables and fruit are rich in Vitamin A?

Muroho	1	V53
Paw-paw	2	V54
Mangoes	3	V55
Yellow/Orange sweet potatoes	4	V56
White sweet potatoes	5	V57
Spinach	6	V58
Litchis	7	V59
Orange	8	V60
Beetroot	9	V61
Apple	10	V62
Banana	11	V63
Yellow peach	12	V64
Pumpkin	13	V65
Cabbage	14	V66
Avocadoes	15	V67
Carrots	16	V68
Other, specify	17	V69

7. What kind of snacks do you give to the children at the crèche?

Fruit salad	1	V70
Fruit, e.g. banana	2	V71
Potato chips, e.g. cheese curls	3	V72
Sweets	4	V73
Biscuits, e.g. Marie	5	V74
Sandwich	6	V75
Other, specify	7	V76

8. Which of the vegetables below would be best to give to children at crèche if available?

Frozen	1	
Fresh	2	
Tinned	3	V78

B.2 Dietary diversification

1. What food combinations are usually given to children at breakfast?

Soft porridge and milk	1	
Cornflakes and milk	2	
Soft porridge, milk and fruit	3	
Other, specify	4	V79

2. What kind of foods do you give children for lunch?

Porridge and meat or fish	1	V80
Porridge and muroho (traditional vegetable)	2	V81
Porridge and vegetables	3	V82
Porridge and soup	4	V83
Rice and soup	5	V84
Rice and meat	6	V85
Other, specify	7	V86

3. How often do you give vegetables to the children?

Once per week	1	
2 X per week	2	
3 X per week	3	
4 X per week	4	
Daily	5	V87

4. What vegetables did you prepare for children in the last five days?

Type of vegetable	*Raw*	*Cooked*				
Pumpkin	1	11	V88		V89	
Carrots	2	12	V90		V91	
Yellow/Orange sweet potatoes	3	13	V92		V93	
White sweet potatoes	4	14	V94		V95	
Cabbage	5	15	V96		V97	
Lettuce	6	16	V98		V99	
Spinach	7	17	V100		V101	
Butternut	8	18	V102		V103	
Muroho	9	19	V104		V105	
Other, specify	10	20	V106		V107	

5. Do the children like the vegetables that are prepared at crèche?

Yes	1	
No	2	
Sometimes	3	V108

6. Why do you say so?

They eat all the vegetables given to them and they sometimes ask for some more	1	V109
They eat the other food and leave vegetables on the plate	2	V110
It depends on how the vegetable is cooked	3	V111
Other, specify	4	V112

7. If yes, which vegetables do they like to eat?

Types of vegetables they like		
Spinach	1	V113
Cabbage	2	V114
Yellow/Orange sweet potato	3	V115
White sweet potato	4	V11
Green beans	5	V117
Pumpkin	6	V118
Pumpkin leaves	7	V119
Imifino (Muroho)	8	V120
Butternut	9	V121
Carrots	10	V122
Other, specify	11	V123

8. Which fruit did you give to children at crèche in the last five days?

Types of fruit given		
Paw-paw	1	V124
Orange	2	V125
Banana	3	V126
Apple	4	V127
Mango	5	V128
Yellow peach	6	V129
White peach	7	V130
Guava	8	V131
Watermelon	9	V132
Avocado	10	V133
Other, specify	11	V134

9. Which drinks besides water do you give to children at crèche?

Drinks that are given		
Fizzy, e.g. coke	1	V135
Milk	2	V136
Mango juice	3	V137
Apple juice	4	V138
Orange juice	5	V139
Tea/coffee	6	V140
Imitation juice, e.g. Oros	7	V141
Other, specify	8	V142

Part C: Availability

Place a cross next to the applicable box and also provide information where applicable.

C.1 Production

1. Do you have a vegetable garden in the crèche?

Yes	1	
No	2	V143

2. If no, why? Give reason/s.

Reasons for not having a garden		
No space	1	V144
No water	2	V145
Don't know how to make a garden	3	V146
No interest	4	V147
Prefer to buy	5	V148
No fencing	6	V149
Don't cook vegetables	7	V150
No one to take care of the garden	8	V151
Don't know which vegetables to plant	9	V152
Don't know how to care for them	10	V153
Other, specify	11	V154

3. If yes, which vegetables are you planting?

Cucurbits	1	V155
Spinach	2	V156
Wild spinach	3	V157
Cabbage	4	V158
Yellow/Orange sweet potatoes	5	V159
White sweet potatoes	6	V160
Muxe	7	V161
Green beans	8	V162
Carrots	9	V163
Pumpkin	10	V164
Other, specify	11	V165

4. Are there fruit trees in the yard of the crèche?

Yes	1	
No	2	V166

5. If yes, which trees are there?

Naartjie	1	V167
Mango	2	V168
Banana	3	V169
Orange	4	V170
Litchi	5	V171
Paw-paw	6	V172
Avocado	7	V173
Guava	8	V174
Yellow peaches	9	V175
Other, specify	10	V176

C.2 Gathering

1. Are there locally available indigenous vegetables that you gather and prepare for children?

Yes	1	
No	2	V177

2. If yes, which are they?

Dzaluma	1	V178
Amaranth	2	V179
Blackjack	3	V180
Murudi	4	V181
Delele	5	V182
Imifino (Muroho)	6	V183
Muxe	7	V184
Other, specify	8	V185

3. Where do you get wild vegetables when available?

Backyard	1	V186
Bush	2	V187
Field	3	V188
Supermarket	4	V189
Open market	5	V190

4. Do children eat wild vegetables at crèche when on the menu?

Yes	1	
No	2	
Sometimes	3	V191

5. If no, why? Give a reason?

They just refuse	1	V192
They say the taste is not good	2	V193
Other, specify	3	V194

6. Ho often do you give wild vegetables to children at the crèche?

Once per week	1
2 X per week	2
3 X per week	3
4 X per week	4
Daily	5

V195 ☐

7. Are there locally available wild fruit that you give to children?

Yes	1
No	2
Sometimes	3

V196 ☐

8. If yes, name them.

Name of fruit		
Nombelo	1	V198 ☐
Thaladzi	2	V198 ☐
Mahuyu	3	V199 ☐
Mbuyu	4	V200 ☐
Mavhungo	5	V201 ☐
Movha	6	V202 ☐
Other, specify	7	V203 ☐

9. How do you gather these fruits?

From the bush	1	V204 ☐
At home	2	V205 ☐
Other, specify	3	V206 ☐

Part D: Menu planning and food preparation

1. How do you decide what to give to the children?

Follow a written menu	1
The manager decides	2
The owner of the crèche decides	3
The cooks decide	4
The dept of health provide menu	5
Other, specify	6

V207 ☐

2. Who buys the food that you prepare for the children at crèche?

The cooks	1
The manager	2
The owner of the crèche	3
Other, specify	4

V208 ☐

3. Did you receive any training on menu planning and meal preparation?

Yes	1
No	2

V209 ☐

4. If yes, who trained you?

Attended workshops	1	
Went to a cooking school	2	
Taught by other cooks	3	
Other, specify	4	V210

5. Do you follow written recipes when preparing meals for children?

Yes	1	
No	2	V211

6. How do you cook most of your vegetables?

Fry	1	V212
Steam	2	V213
Boil	3	V214
Other, specify	4	V215

7. What do you add to vegetables when you cook them?

Bicarbonate of soda	1	V216
Salt	2	V217
Curry powder	3	V218
Oil	4	V219
Margarine	5	V220
Peanut butter	6	V221
Sugar	7	V222
Other, specify	8	V223

8. After cooking vegetables, what do you do with the cooking water?

Discard	1	V224
Use in soups	2	V225
Add to children's porridge	3	V226
None is left	4	V227
Other, specify	5	V228

Part E: Storage and preservation

1. Where do you buy vegetables and fruit?

Local market	1	
Supermarket	2	
Use own produce	3	V229

2. How often do you buy vegetables and fruit?

Every day	1	
Every second day	2	
Once a week	3	
Other, specify	4	V230

3. When you buy in bulk how do you store surplus?

In cool place	1	V231
In refrigerator	2	V232
In racks	3	V233
Dry and store	4	V234
Freeze	5	V235
Other, specify	6	V236

4. Do you preserve vegetables and fruit when plentiful?

Yes	1	
No	2	
Sometimes	3	V237

5. If yes, how do you preserve them?

Dry	1	V238
Freeze	2	V239
Bottle	3	V240
Other, specify	4	V241

6. Name the fruits and vegetables that you preserve and specify the method you use.

Fruit/Vegetable		*Method*			
Mango	1		8	V242	V243
Spinach	2		9	V244	V255
Cabbage	3		10	V256	V257
Wild spinach	4		11	V258	V259
Sweet potato	5		12	V260	V261
Banana	6		13	V062	V253
Other, specify	7		14	V264	V265

7. How do you store leftovers?

Freeze	1	V266
Refrigerate in containers	2	V267
In containers in dry place	3	V268
Throw away	4	V269
Other, specify	5	V270

ADDENDUM B

OBSERVATION CHECKLIST SHEET

TO BE OBSERVED	YES	NO	OTHER INFORMATION (SPECIFY)
1. Availability of vegetables and fruit			
1.1 Food gardens			
• Available vegetables and fruits - Spinach - Sweet potatoes - Butternut - Carrots - Mango trees - Paw-paw trees			
1.2 Gathering			
• Food gathered - Amaranth (vowa) - Delele - Mushidzhi - Tshiphaswi - Muxe			
2. Utilisation of vegetables and fruit			
2.1 Storage			
• Freezer • Vegetable racks • Cold storage • Cupboards • Containers • Refrigerator			
2.2 Preservation			
• Freezing • Drying			
2.3 Preparation techniques			
• Washing • Peeling • Soaking • Cooking methods - Boiling - Steaming - Frying			
3. Menu planning			
• Written menus • Is there diversity in food included in the menus? • Are the menus balanced • Do menus include vitamin A vegetables and fruit?			

ADDENDUM C

GAME RULES

1. All caregivers can participate
2. There can be 3-4 groups with at least two persons per group.
3. Each group choose a colour on the matt with 4 different colours
4. All member of the group stand on their coloured DOT
5. A question is asked and once the correct answer is given, the members remain inside the cycle. But if the answer is wrong the member of the group who got the wrong answer will step one foot out of the DOT/cycle
   - The person only goes out of the matt if the group has answered two questions wrongly in a row
   - If the group get the first questions wrongly and the next one correctly, the member with one foot out of the DOT goes back into the DOT
6. The first group to answer all questions correctly and all or the majority of its members remain in the dot on the matt WINS the game and receive a price (a sweet-potato recipe book)

ADDENDUM D

THE GAME SCORE SHEET AND THE QUESTIONS ASKED

NAME OF CRECHE: _____

GROUPS	SCORES					TOTAL
	1	1	1	1	1	[5]
A						
B						
C						

GAME QUESTIONS:

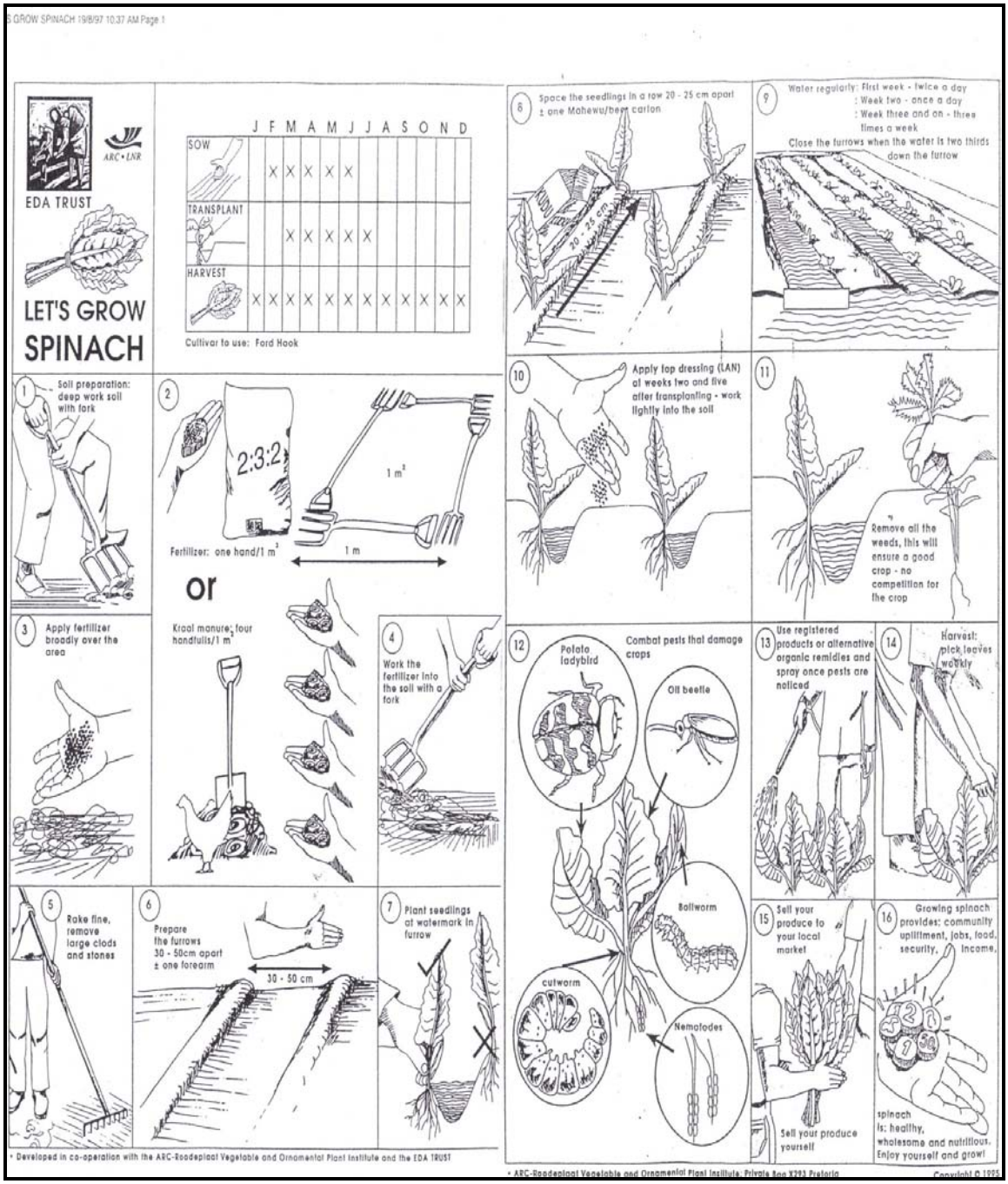
- Give the colour of vitamin A-rich vegetables
- Name the vegetables rich in vitamin A(including indigenous vegetables)
- Name the fruits that are rich in vitamin A
- Give the signs and symptoms of vitamin A deficiency
- Explain how you would prepare your vegetables before cooking, also indicate what should be avoided while cooking vegetables to prevent nutrient loss

ADDENDUM E

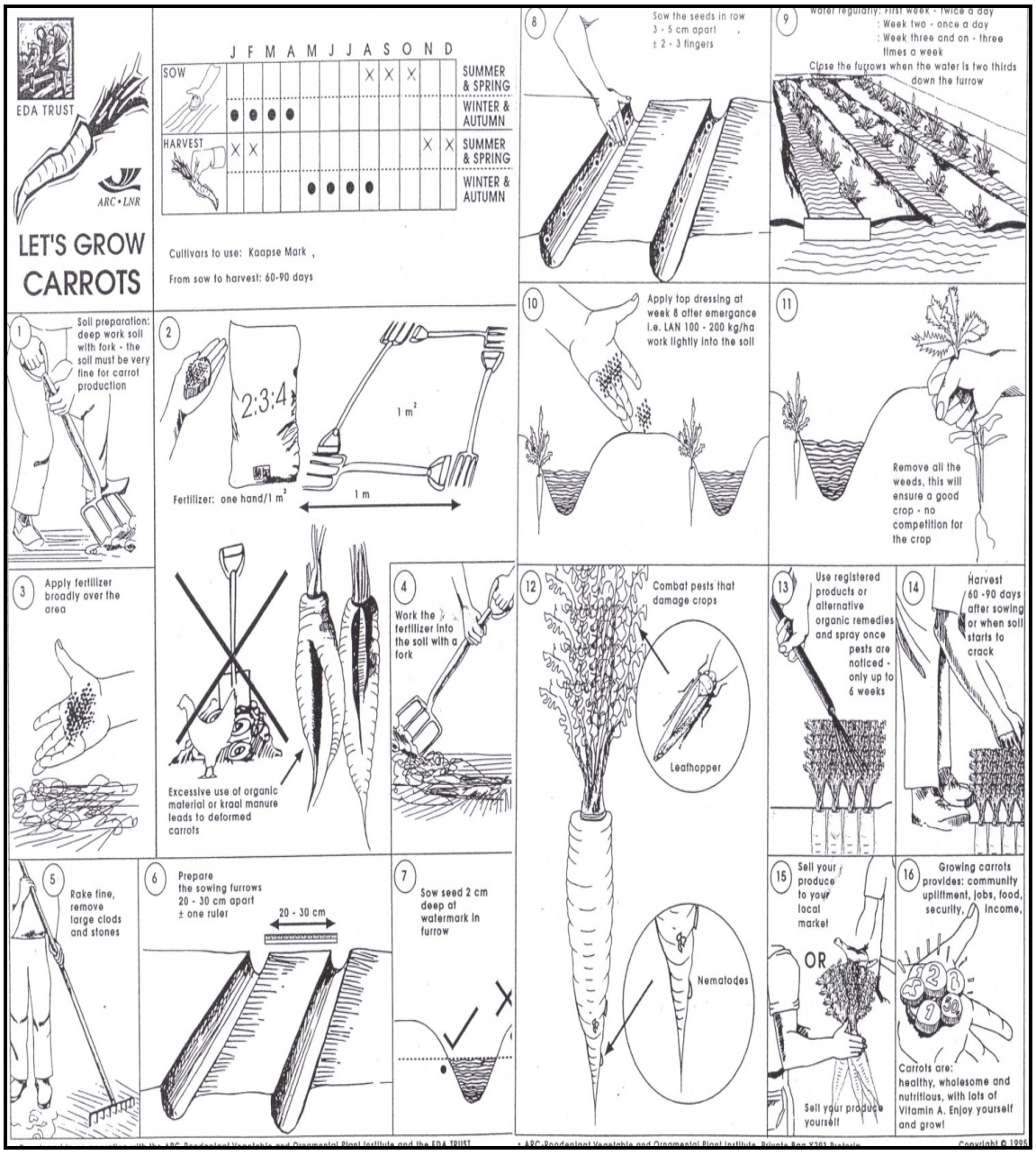
ARC GARDENING MANUALS FOR VITAMIN A-RICH VEGETABLES

(Obtained from ARC-Roodeplaat)

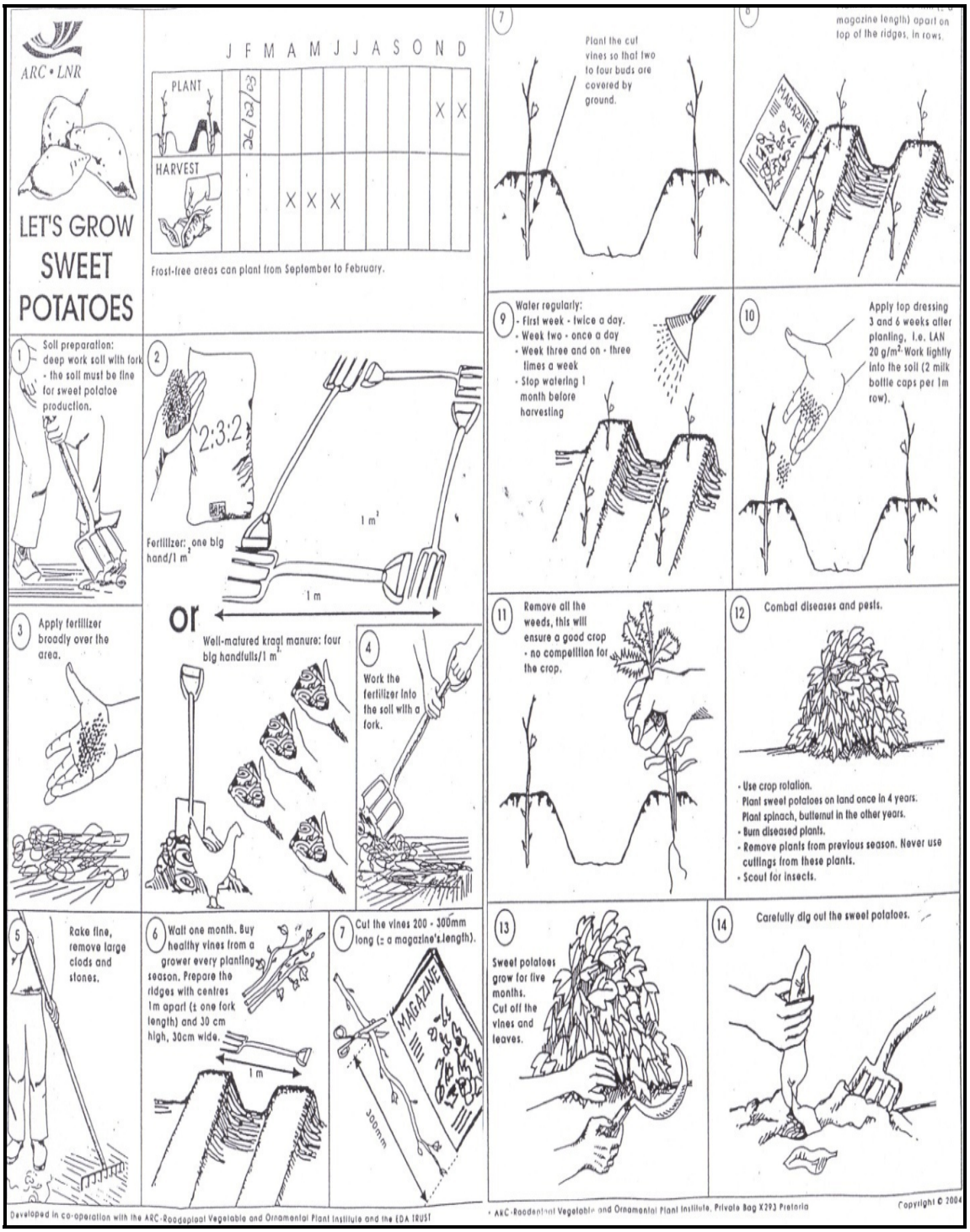
1. MANUAL FOR GROWING SPINACH



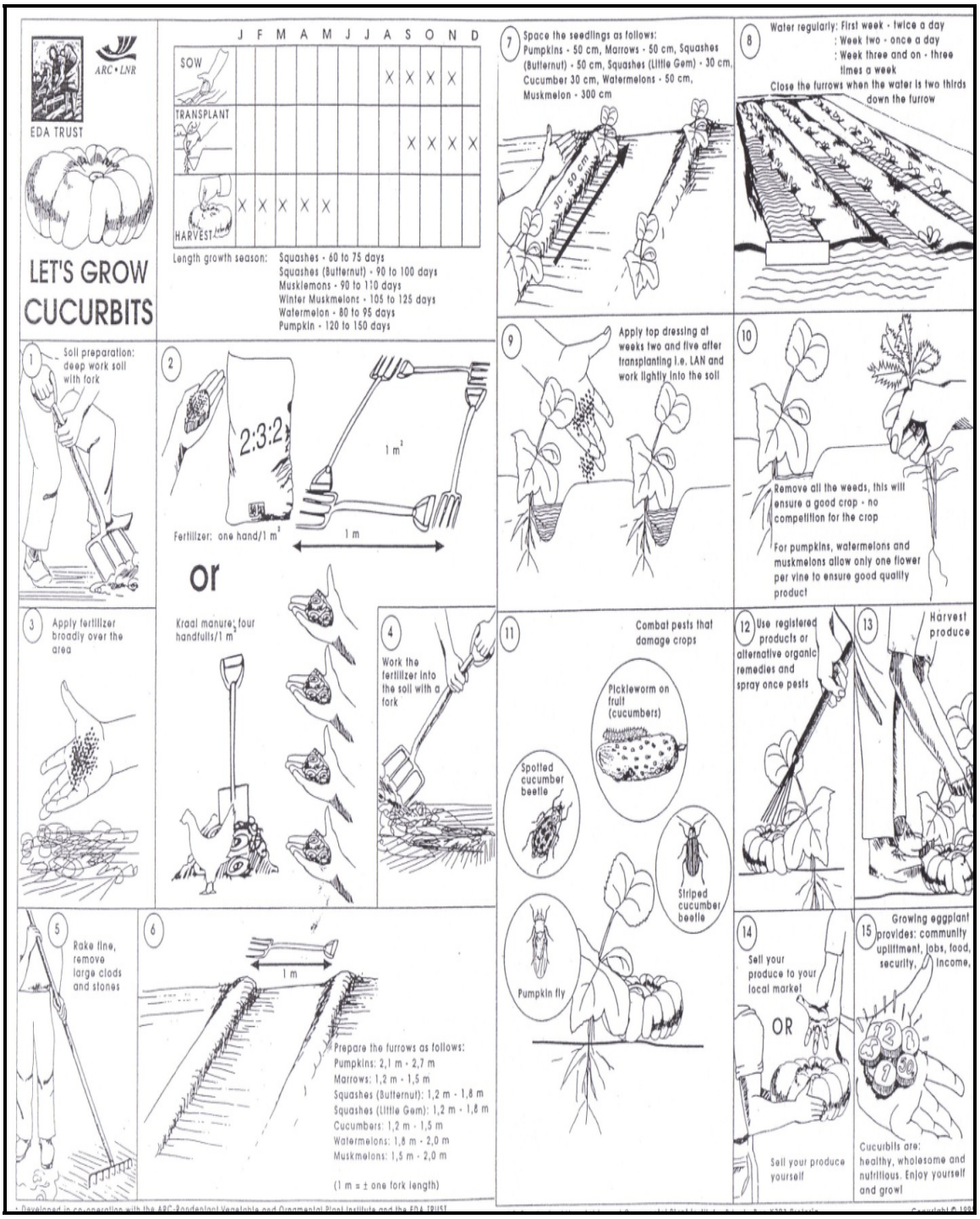
2. MANUAL FOR GROWING CARROTS



3. MANUAL FOR GROWING SWEET POTATOES



4. MANUAL FOR GROWING CUCURBITS



ADDENDUM F

RECIPES WITH VITAMIN A

(Obtained from ARC-Roodeplaat)

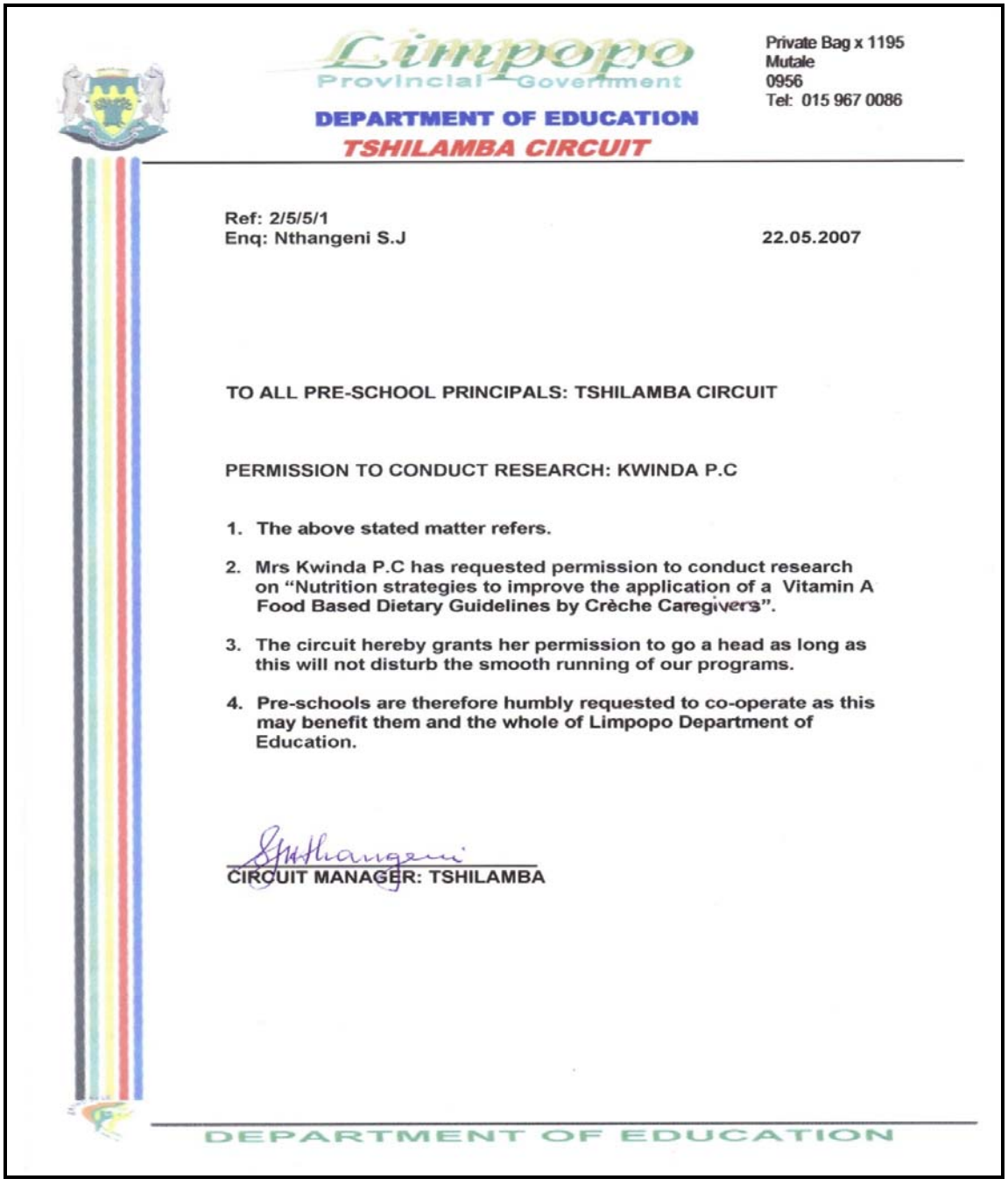
MIXED POTATO AND SPINACH	
INGREDIENTS:	METHOD:
5 medium potatoes 1 bunch of spinach 1 small onion 1 medium tomato 1 dessertspoon salt ½ cup cooking oil ½ cup water	1. Peel potatoes and onion. Chop spinach, tomato and potato 2. Fry onion in oil and curry powder 3. Add chopped potatoes, spinach, tomato, salt and water 4. Close the pot and decrease fire 5. Cook for 20 minutes
MIXED POTATO AND CARROTS	
INGREDIENTS:	METHOD:
5 medium potatoes 1 big onion 2 small tomato 1 dessertspoon salt ½ cup cooking oil ½ cup water 6 big carrots	1. Peel carrots and potatoes. Chop onion, carrots. tomato and potato 2. Fry onion in oil 3. Add chopped potatoes, carrots, tomato, salt and water 4. Close the pot and decrease fire 5. Cook for 20 minutes
POTATO AND CARROTS MASH	
INGREDIENTS:	METHOD:
3 big potatoes 2 dessertspoon margarine 1 teaspoon salt 180ml water 3 big carrots	1. Peel and chop carrots and potatoes. 2. Boil carrots and potatoes until soft. Add chopped potatoes, carrots, tomato, salt and water 3 Mash together in a bowl and add margarine and salt 4. Cook for 10 minutes
CABBAGE WITH CARROTS	
INGREDIENTS:	METHOD:
½ cabbage 1 bunch carrots 1 small onion 1 small tomato 1 teaspoon salt ½ cup cooking oil ½ cup water 6 big carrots	1. Chop onion, carrots. tomato and cabbage 2. Fry onion in oil 3. Add carrots, tomato and cabbage 4. Add salt and water and mix together 5. Close the pot and decrease fire 6. Cook for 20 minutes
GREEN BEANS AND CARROTS	
INGREDIENTS:	METHOD:
1 medium bowl green beans 1 medium bowl chopped carrots 1 small onion 2 small tomato 1 teaspoon salt ½ cup cooking oil 1 cup water	1. Chop beans, onion, carrots and tomato an 2. Fry onion in oil 3. Add carrots and beans the tomatoes, salt and water 4. Cook for 20 minutes

POTATO AND CARROT STEW	
INGREDIENTS:	METHOD:
3 medium potatoes 1 medium onion 1½ cube knorox 3 teaspoon salt ½ cup cooking oil 1½ cup water 6 medium carrots	1. Fry onion in oil 2. Add chopped potatoes and carrots and cook for 3 minutes 3. Add water and cook for 45 minutes 4. Add knorox and salt 5. Boil for 3 minutes
SWEET POTATO AND POTATO STEW	
INGREDIENTS:	METHOD:
2 medium potatoes 4 medium orange fleshed sweet potatoes Small onion 2 cubes knorrox 1 teaspoon salt 3 ½ dessertspoon oil ½ cup cooking oil 1½ cup water	1. Fry onion in oil 2. Add sweet potatoes and potato 3 After 5 minutes add water and boil for 40 minutes. 4. Add knorrox and salt 5. Cook for 3 minutes
ORANGE FLESHED SWEET POTATOES	
INGREDIENTS:	METHOD:
6 sweet potatoes 1 medium onion 2 cubes knorrox ½ teaspoon salt 5 tablespoon oil 1½ cup water	1. Fry onion in oil 2. Add chopped sweet potatoes 3. After 3 minutes add water and boil for 45 minutes 4. Add knorrox and salt 5. Boil for 5 minutes
CARROTS SALAD	
INGREDIENTS:	METHOD:
3 big carrots 1 medium onion ½ cube knorox 4 teaspoons oil	1. Grate carrots 2. Fry onion in oil 3. Add carrots and stir well all the time 4. After 5 minutes add in knorrox 5. Boil for 2 minutes
CARROTS STEW	
INGREDIENTS:	METHOD:
5 big carrots 1 medium onion 1 cube knorox 1 teaspoon salt 5 tablespoons oil 270ml water	1. Fry onion 2. Add chopped carrots 3. Add water and salt 5 minutes 4. Boil for 40 minutes 5. Add knorrox cube 6. Boil for 10 minutes
ORANGE FLESHED SWEET POTATO SOUP	
INGREDIENTS:	METHOD:
4 leeks 1 onion 65g margarine 1 cube chicken stock 600g orange fleshed sweet potatoes 750ml hot water 3ml salt 3ml turmeric 1 cup milk 50ml cream	1. Fry onion and leeks in margarine 2. Boil sweet potatoes then peel and slice 3. Dissolve stock in hot water 4. Add sweet potato and salt and cook for 25 minutes 5. Puree by pressing through a sieve 6 Add milk, turmeric and cream

CURRY ORANGE SWEETPOTATO	
INGREDIENTS:	METHOD:
4 orange fleshed sweetpotatoes 2 onion 25ml margarine 2 ½ teaspoon curry powder 1 granny smith apple 2 ½ teaspoon apricot jam 2 ½ teaspoons lemon juice 1ml salt 250ml water 25ml sugar	1. Fry onion in oil 2. Add chopped potatoes and carrots and cook for 3 minutes 3 Add water and cook for 45 minutes 4. Add knorox and salt 5. Boil for 3 minutes
SWEET POTATO SCONES	
INGREDIENTS:	METHOD:
250g cake flour 4 teaspoons baking powder 2 eggs 200g margarine 1 teaspoon salt 2½ teaspoons sugar 250ml cooked orange-fleshed sweet potato	1. Sift dry ingredients 2. Rub in margarine 3. Beat eggs and sweet potato 4. Mix all ingredients to form dough 5. Put spoonfuls in greased patty pans 6. Bake for 20 minutes at 200^0
FRIED ORANGE-FLESHED SWEETPOTATO LEAVES	
INGREDIENTS:	METHOD:
4 handfuls sweet potato leaves 2 tablespoons oil Salt to taste 1 medium onion 3 medium sliced tomatoes	1. Wash and shred leaves 2. Fry onion in oil 3. Add tomato and fry for 20 4. Add leaves and salt 5. Cook for 10 minutes

ADDENDUM G

PERMISSION LETTERS FROM THE DEPARTMENT OF EDUCATION



Limpopo
Provincial Government

DEPARTMENT OF EDUCATION
TSHILAMBA CIRCUIT

Private Bag x 1195
Mutale
0956
Tel: 015 967 0086

Ref: 2/5/5/1
Enq: Nthangeni S.J

22.05.2007

TO ALL PRE-SCHOOL PRINCIPALS: TSHILAMBA CIRCUIT

PERMISSION TO CONDUCT RESEARCH: KWINDA P.C

1. The above stated matter refers.
2. Mrs Kwinda P.C has requested permission to conduct research on "Nutrition strategies to improve the application of a Vitamin A Food Based Dietary Guidelines by Crèche Caregivers".
3. The circuit hereby grants her permission to go a head as long as this will not disturb the smooth running of our programs.
4. Pre-schools are therefore humbly requested to co-operate as this may benefit them and the whole of Limpopo Department of Education.

Sthangeni
CIRCUIT MANAGER: TSHILAMBA

DEPARTMENT OF EDUCATION

Limpopo
Provincial Government

Private Bag x 1195
Mutale
0956
Tel: 015 967 0086

DEPARTMENT OF EDUCATION
TSHILAMBA CIRCUIT

Ref: 2/5/5/1
Enq: Nthangeni S.J

22.05.2007

Mrs P.C. Kwinda
P. O. Box 534
Makonde
0984

REQUEST FOR PERMISSION TO CONDUCT RESEARCH IN OUR PRE-SCHOOLS

1. The above matter refers.
2. Kindly note that you have been granted permission to conduct research at our pre – schools.
3. We wish you well and only request you not to disturb the smooth running of our normal programs.

Sthangeni

CIRCUIT MANAGER: TSHILAMBA

ADDENDUM H

STATISTICS COMPARING PHASE ONE (PRE) AND PHASE THREE (POST)

PROG2
T06180 HHK9030 WH429560
Pre- and Post- responses - meals offered

The FREQ Procedure

Frequency		Table of Pre20 by Post20			
		Pre20(Morning snack)	Post20(Post20)		
			NO	YES	Total
		NO	64	6	70
		YES	0	30	30
		Total	64	36	100

Statistics for Table of Pre20 by Post20

McNemar's Test	
Statistic (S)	6
DF	1
Pr > S	0.0143

Simple Kappa Coefficient	
Kappa	0.8649
ASE	0.053
95% Lower Conf Limit	0.761
95% Upper Conf Limit	0.9687

Sample Size = 100

Frequency		Table of Pre22 by Post22			
		Pre22(Afternoon snack)	Post22(Post22)		
			NO	YES	Total
		NO	15	33	48
		YES	1	51	52
		Total	16	84	100

Statistics for Table of Pre22 by Post22

McNemar's Test	
Statistic (S)	30.1176
DF	1
Pr > S	<.0001

Simple Kappa Coefficient	
Kappa	0.301
ASE	0.0732
95% Lower Conf Limit	0.1575
95% Upper Conf Limit	0.4445

Sample Size = 100

PROG2
Charlotte Kwinda T06180 HHK9030 WH429560
What happens if children do not eat fruit & vegetables

The FREQ Procedure

Frequency		Table of PREGROWTH by POSTGROWTH			
		PREGROWTH(GROWTH WILL BE AFFECTED)	POSTGROWTH NO	YES	Total
		NO	50	6	56
		YES	27	17	44
		Total	77	23	100

Statistics for Table of PREGROWTH by POSTGROWTH

McNemar's Test	
DF	1
Pr > S	0.0003

Simple Kappa Coefficient	
Kappa	0.2943
ASE	0.0882
95% Lower Conf Limit	0.1214
95% Upper Conf Limit	0.4672

Sample Size = 100

Frequency		Table of PRENUTRIENT by POSTNUTRIENT			
		PRENUTRIENT(NUTRIENT DEFICIENCIES)	POSTNUTRIENT NO	YES	Total
		NO	12	54	66
		YES	7	27	34
		Total	19	81	100

Statistics for Table of PRENUTRIENT by POSTNUTRIENT

McNemar's Test	
Statistic (S)	36.2131
DF	1
Pr > S	<.0001

Simple Kappa Coefficient	
Kappa	-0.018
ASE	0.063
95% Lower Conf Limit	-0.1415
95% Upper Conf Limit	0.1055

Sample Size = 100

Frequency		Table of PREDISEASE by POSTDISEASE		
		PREDISEASE(DISEASE/HEALTH ISSUES)	POSTDISEASE YES	Total
		NO	6	6
		YES	94	94
		Total	100	100

PRE-CF. POST- HOW OFTEN GIVE VEGETABLES

The FREQ Procedure

Frequency Expected Cell Chi-Square

Table of PPRE87 by PPOST87

PPRE87(HOW OFTEN DO YOU GIVE VEGETABLES)	PPOST87 3OR4	PPOST87 DAILY	Total
1OR2	20 17.98 0.227	69 71.02 0.0575	89
DAILY	0 2.0202 2.0202	10 7.9798 0.5114	10
Total	20	79	99

Frequency Missing = 1

PRE-CF. POST- USE OWN FRUIT & VEGETABLES

The FREQ Procedure

Frequency

Table of PREOWN by POSTOWN

PREOWN(USE OWN PRODUCE)	POSTOWN NO	POSTOWN YES	Total
NO	49	40	89
YES	0	11	11
Total	49	51	100

Statistics for Table of PREOWN by POSTOWN

McNemar's Test	
Statistic (S)	40
DF	1
Pr > S	<.0001

Simple Kappa Coefficient	
Kappa	0.2123
ASE	0.0594
95% Lower Conf Limit	0.0958
95% Upper Conf Limit	0.3288

Sample Size = 100

PRE-CF. POST- ADDED TO VEGETABLES WHEN COOKING

The FREQ Procedure

Frequency

Table of Pre216 by Post216

Pre216(ADD BICARBONATE OF SODA)	Post216(Post216) NO	Post216(Post216) Total
NO	80	80
YES	20	20
Total	100	100

Frequency

Table of Pre219 by Post219

Pre219(ADD OIL)	Post219(Post219) YES	Post219(Post219) Total
YES	100	100

Frequency

Table of Pre220 by Post220

Pre220(ADD MARGARINE)	Post220(Post220) NO	Post220(Post220) Total
NO	96	96
YES	4	4

Frequency	

Table of Pre221 by Post221

Pre221(ADD PEANUT BUTTER)	Post221(Post221) NO	YES	Total
NO	76	10	86
YES	9	5	14
Total	85	15	100

Statistics for Table of Pre221 by Post221

McNemar's Test	
Statistic (S)	0.0526
DF	1
Pr > S	0.8185

Simple Kappa Coefficient	
Kappa	0.2339
ASE	0.126
95% Lower Conf Limit	-0.013
95% Upper Conf Limit	0.4808

Sample Size = 100

PRE-CF. POST- Vitamin A rich fruit & vegetables

The FREQ Procedure

Frequency	

Table of Pre54 by Post54

Pre54(Pre54)	Post54(Post54) NO	YES	Total
NO	5	29	34
YES	3	63	66
Total	8	92	100

Statistics for Table of Pre54 by Post54

McNemar's Test	
Statistic (S)	21.125
DF	1
Pr > S	<.0001

Simple Kappa Coefficient	
Kappa	0.1247
ASE	0.0798
95% Lower Conf Limit	-0.0317
95% Upper Conf Limit	0.2812

Sample Size = 100

Frequency	

Table of Pre55 by Post55

Pre55(Pre55)	Post55(Post55) YES	Total
NO	63	63
YES	37	37
Total	100	100

Frequency	

Table of Pre56 by Post56

Pre56(Pre56)	Post56(Post56) YES	Total
NO	64	64
YES	36	36
Total	100	100

Frequency	

Table of Pre57 by Post57

Pre57(Pre57)	Post57(Post57) NO	YES	Total
NO	0	71	71
YES	1	28	29
Total	1	99	100

Statistics for Table of Pre57 by Post57

McNemar's Test	
Statistic (S)	68.0556
DF	1
Pr > S	<.0001

Simple Kappa Coefficient	
Kappa	-0.0201
ASE	0.0201
95% Lower Conf Limit	-0.0596
95% Upper Conf Limit	0.0193

Sample Size = 100

Frequency		Table of Pre59 by Post59			
		Pre59(Pre59)	Post59(Post59)		
			NO	YES	Total
		NO	1	17	18
		YES	4	78	82
		Total	5	95	100

Statistics for Table of Pre59 by Post59

McNemar's Test	
Statistic (S)	8.0476
DF	1
Pr > S	0.0046

Simple Kappa Coefficient	
Kappa	0.0094
ASE	0.0821
95% Lower Conf Limit	-0.1515
95% Upper Conf Limit	0.1704

Sample Size = 100

Frequency		Table of Pre65 by Post65		
		Pre65(Pre65)	Post65(Post65)	
			YES	Total
		NO	90	90
		YES	10	10
		Total	100	100

Frequency		Table of Pre66 by Post66		
		Pre66(Pre66)	Post66(Post66)	
			YES	Total
		NO	57	57
		YES	43	43
		Total	100	100

Frequency		Table of Pre68 by Post68		
		Pre68(Pre68)	Post68(Post68)	
			YES	Total
		NO	59	59
		YES	41	41
		Total	100	100

Frequency		Table of Pre69 by Post69		
		Pre69(Pre69)	Post69(Post69)	
			YES	Total
		NO	47	47
		YES	53	53
		Total	100	100

PRE-CF. POST- cooked vegetables in last 5 days

The FREQ Procedure

Frequency		Table of Pre98 by Post98			
		Pre98(Pre98)	Post98(Post98)		
			NO	YES	Total
		NO	86	4	90
		YES	0	10	10
		Total	86	14	100

Statistics for Table of Pre98 by Post98

McNemar's Test	
Statistic (S)	4
DF	1
Pr > S	0.0455

Simple Kappa Coefficient	
Kappa	0.8113
ASE	0.0908
95% Lower Conf Limit	0.6334
95% Upper Conf Limit	0.9892

Sample Size = 100

Frequency		Table of Pre99 by Post99			
		Pre99(Pre99)	Post99(Post99)		
			NO	YES	Total
		NO	11	79	90
		YES	0	10	10
		Total	11	89	100

Statistics for Table of Pre99 by Post99

McNemar's Test	
Statistic (S)	79
DF	1
Pr > S	<.0001

Simple Kappa Coefficient	
Kappa	0.0271
ASE	0.0116
95% Lower Conf Limit	0.0044
95% Upper Conf Limit	0.0498

Sample Size = 100

Frequency		Table of Pre100 by Post100			
		Pre100(Pre100)	Post100(Post100)		
			NO	13	Total
		NO	89	11	100
		Total	89	11	100

Frequency		Table of Pre101 by Post101		
		Pre101(Pre101)	Post101(Post101)	
			No	Total
		No	100	100
		Total	100	100

Frequency		Table of Pre102 by Post102			
		Pre102(Pre102)	Post102(Post102)		
			No	Yes	Total
		No	5	24	29
		Yes	4	67	71
		Total	9	91	100

Statistics for Table of Pre102 by Post102

McNemar's Test	
Statistic (S)	14.2857
DF	1
Pr > S	0.0002

Simple Kappa Coefficient	
Kappa	0.1458
ASE	0.0926
95% Lower Conf Limit	-0.0356
95% Upper Conf Limit	0.3273

Sample Size =100

Frequency		Table of Pre103 by Post103		
		Pre103(Pre103)	Post103(Post103)	
			No	Total
		No	100	100
		Total	100	100

Frequency		Table of Pre104 by Post104		
		Pre104(Pre104)	Post104(Post104)	
			No	Yes
		No	89	89
		Yes	11	11
		Total	100	100

Frequency		Table of Pre105 by Post105			
		Pre105(Pre105)	Post105(Post105)		
			No	Yes	Total
		No	86	5	91
		Yes	0	9	9
		Total	86	14	100

Statistics for Table of Pre105 by Post105

McNemar's Test	
Statistic (S)	5
DF	1
Pr > S	0.0253

Simple Kappa Coefficient	
Kappa	0.7559
ASE	0.1032
95% Lower Conf Limit	0.5536
95% Upper Conf Limit	0.9581

Sample Size = 100

Frequency		Table of Pre106 by Post106			
		Pre106(Pre106)	Post106(Post106)		
			.	19	Total
		.	43	43	86
		19	5	9	14
		Total	48	52	100

Statistics for Table of Pre106 by Post106

McNemar's Test	
Statistic (S)	30.0833
DF	1
Pr > S	<.0001

Simple Kappa Coefficient	
Kappa	0.0669
ASE	0.0667
95% Lower Conf Limit	-0.0639
95% Upper Conf Limit	0.1977

Sample Size = 100

PRE-CF. POST- vegetables children like to eat

The FREQ Procedure

Frequency		Table of Pre113 by Post113		
		Pre113(Pre113)	Post113(Post113)	
			YES	Total
		NO	57	57
		YES	43	43
		Total	100	100

Frequency		Table of Pre114 by Post114			
		Pre114(Pre114)	Post114(Post114)		
			NO	YES	Total
		NO	0	37	37
		YES	4	59	63
		Total	4	96	100

Statistics for Table of Pre114 by Post114

McNemar's Test	
Statistic (S)	26.561
DF	1
Pr > S	<.0001

Simple Kappa Coefficient	
Kappa	-0.0778
ASE	0.0369
95% Lower Conf Limit	-0.1502
95% Upper Conf Limit	-0.0054

Sample Size = 100

Frequency		Table of Pre115 by Post115			
		Pre115(Pre115)	Post115(Post115)		
			NO	YES	Total
		NO	81	19	100
		Total	81	19	100

Frequency		Table of Pre116 by Post116			
		Pre116(Pre116)	Post116(Post116)		
			NO	YES	Total
		NO	97	3	100
		Total	97	3	100

Frequency		Table of Pre117 by Post117		
		Pre117(Pre117)	Post117(Post117)	
			NO	Total
		NO	100	100
		Total	100	100

Frequency		Table of Pre118 by Post118			
		Pre118(Pre118)	Post118(Post118)		
			NO	YES	Total
		NO	43	48	91
		YES	0	9	9
		Total	43	57	100

Statistics for Table of Pre118 by Post118

McNemar's Test	
Statistic (S)	48
DF	1
Pr > S	<.0001

Simple Kappa Coefficient	
Kappa	0.1389
ASE	0.0456
95% Lower Conf Limit	0.0496
95% Upper Conf Limit	0.2282

Sample Size = 100

Frequency		Table of Pre119 by Post119

Pre119(Pre119)	Post119(Post119)		
	NO	YES	Total
NO	11	49	60
YES	5	35	40
Total	16	84	100

Statistics for Table of Pre119 by Post119

McNemar's Test	
Statistic (S)	35.8519
DF	1
Pr > S	<.0001

Simple Kappa Coefficient	
Kappa	0.0493
ASE	0.0614
95% Lower Conf Limit	-0.0711
95% Upper Conf Limit	0.1696

Sample Size = 100

Frequency		Table of Pre120 by Post120		
		Pre120(Pre120)	Post120(Post120)	
			NO	YES	Total
		NO	30	62	92
		YES	4	4	8
		Total	34	66	100

Statistics for Table of Pre120 by Post120

McNemar's Test	
Statistic (S)	50.9697
DF	1
Pr > S	<.0001

Simple Kappa Coefficient	
Kappa	-0.0404
ASE	0.0447
95% Lower Conf Limit	-0.128
95% Upper Conf Limit	0.0473

Sample Size = 100

Frequency		Table of Pre121 by Post121		
		Pre121(Pre121)	Post121(Post121)	
			NO	YES	Total
		NO	56	35	91
		YES	5	4	9
		Total	61	39	100

Statistics for Table of Pre121 by Post121

McNemar's Test	
Statistic (S)	22.5
DF	1
Pr > S	<.0001

Simple Kappa Coefficient	
Kappa	0.0239
ASE	0.0696
95% Lower Conf Limit	-0.1125
95% Upper Conf Limit	0.1603

Sample Size = 100

Frequency		Table of Pre122 by Post122		
		Pre122(Pre122)	Post122(Post122)	
			NO	YES	Total
		NO	12	73	85
		YES	0	15	15
		Total	12	88	100

Statistics for Table of Pre122 by Post122

McNemar's Test	
Statistic (S)	73
DF	1
Pr > S	<.0001

Simple Kappa Coefficient	
Kappa	0.047
ASE	0.0176
95% Lower Conf Limit	0.0126
95% Upper Conf Limit	0.0814

Sample Size = 100

PRE-CF. POST- traditional vegetables gathered & prepared

The FREQ Procedure

Frequency		Table of Pre178 by Post178			
		Pre178(Pre178)	Post178(Post178)		
			NO	YES	Total
		NO	83	17	100
		Total	83	17	100

Frequency		Table of Pre179 by Post179			
		Pre179(Pre179)	Post179(Post179)		
			NO	YES	Total
		NO	10	90	100
		Total	10	90	100

Frequency		Table of Pre180 by Post180			
		Pre180(Pre180)	Post180(Post180)		
			NO	YES	Total
		NO	86	6	92
		YES	4	4	8
		Total	90	10	100

Statistics for Table of Pre180 by Post180

McNemar's Test	
Statistic (S)	0.4
DF	1
Pr > S	0.5271

Simple Kappa Coefficient	
Kappa	0.3902
ASE	0.1551
95% Lower Conf Limit	0.0863
95% Upper Conf Limit	0.6942

Sample Size = 100

Frequency		Table of Pre181 by Post181		
		Pre181(Pre181)	Post181(Post181)	
			NO	Total
		NO	100	100
		Total	100	100

Frequency		Table of Pre182 by Post182			
		Pre182(Pre182)	Post182(Post182)		
			NO	YES	Total
		NO	12	74	86
		YES	0	14	14
		Total	12	88	100

Statistics for Table of Pre182 by Post182

McNemar's Test	
Statistic (S)	74
DF	1
Pr > S	<.0001

Simple Kappa Coefficient	
Kappa	0.0434
ASE	0.0165
95% Lower Conf Limit	0.011
95% Upper Conf Limit	0.0758

Sample Size = 100

Frequency		Table of Pre183 by Post183			
		Pre183(Pre183)	Post183(Post183)		
			NO	YES	Total
		NO	38	34	72
		YES	5	23	28
		Total	43	57	100

Statistics for Table of Pre183 by Post183

McNemar's Test	
Statistic (S)	21.5641
DF	1
Pr > S	<.0001

Simple Kappa Coefficient	
Kappa	0.2653
ASE	0.0783
95% Lower Conf Limit	0.1118
95% Upper Conf Limit	0.4187

Sample Size = 100

Frequency		Table of Pre184 by Post184			
		Pre184(Pre184)	Post184(Post184)		
			NO	YES	Total
		NO	5	45	50
		YES	0	50	50
		Total	5	95	100

Statistics for Table of Pre184 by Post184

McNemar's Test	
Statistic (S)	45
DF	1
Pr > S	<.0001

Simple Kappa Coefficient	
Kappa	0.1
ASE	0.0434
95% Lower Conf Limit	0.015
95% Upper Conf Limit	0.185

Sample Size = 100