

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.

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.

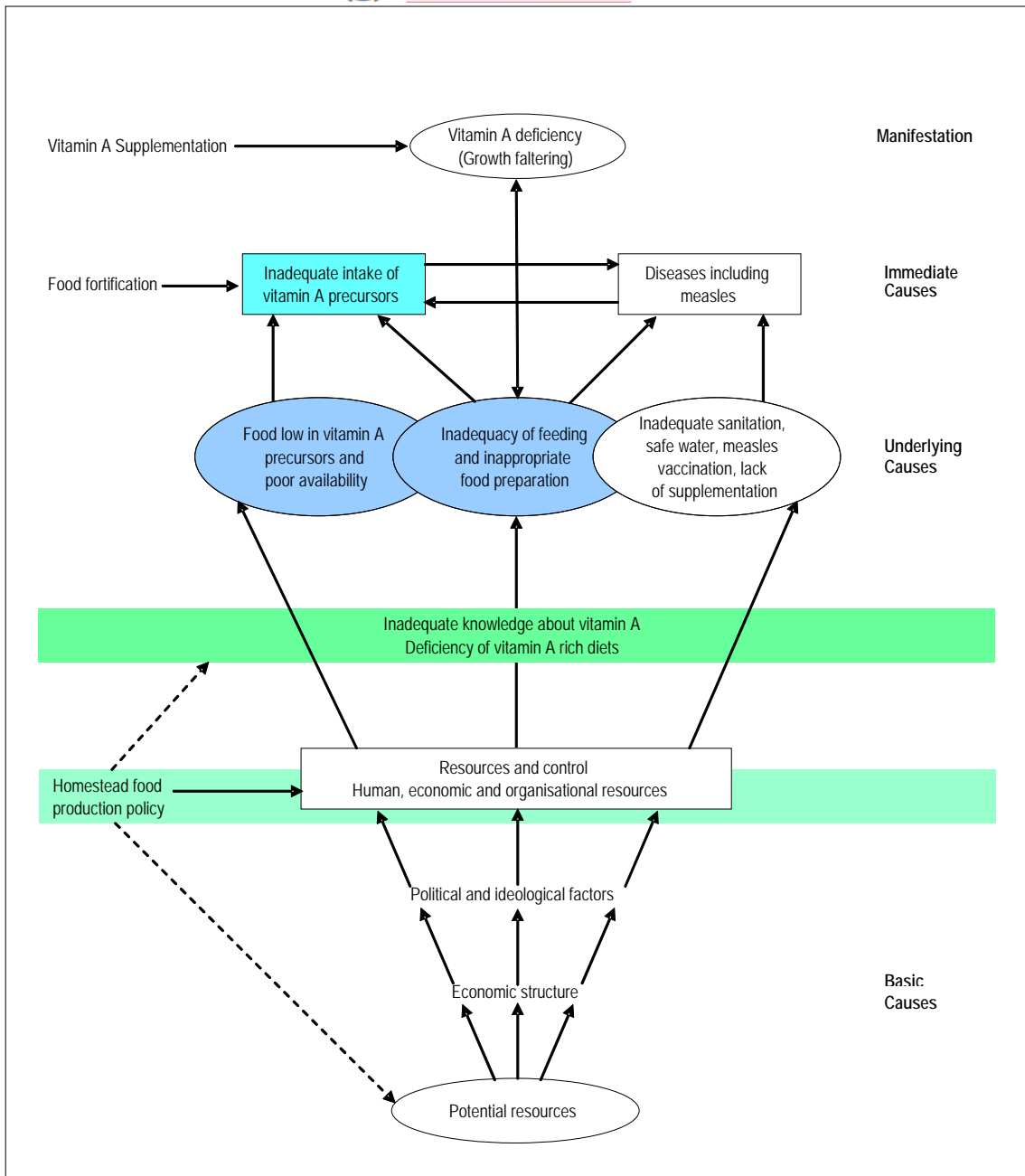


FIGURE 2.1: APPLIED UNICEF MODEL OF CAUSES OF VITAMIN A DEFICIENCY (Van Lieshout, Chopra & Sanders, 2004: 6)

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 convert 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). Yellow-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.

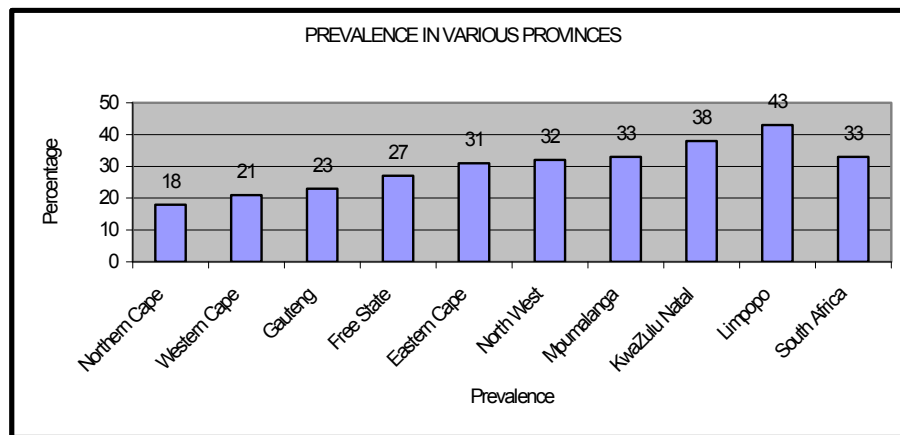


FIGURE 2.2: PREVALENCE OF VITAMIN A DEFICIENCY IN SOUTH AFRICAN 6-71 MONTH OLD CHILDREN [Labadarios *et al.*, 1995 as in Faber *et al.*, (2006:13)]

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 (Mauder & 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 & Loffi, 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.

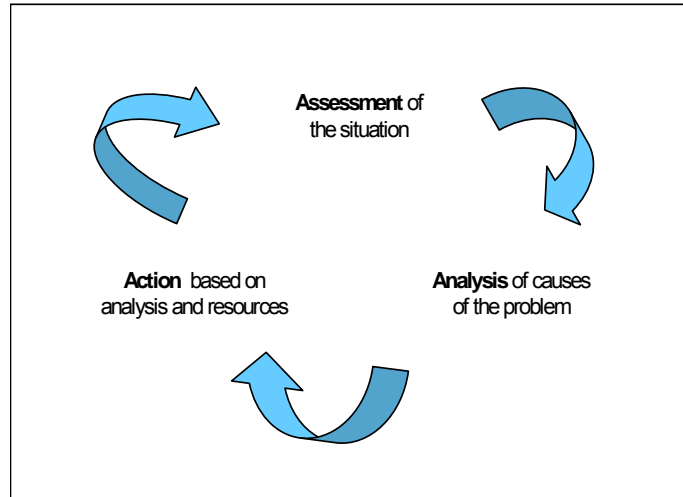


FIGURE 2.3: THE TRIPLE A CYCLE (Department of Health, 2004:1; Tontisirin & Gillespie 1999:47)

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; Cervinskaskas & 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 (Cervinkas & 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 (Cervinkas & 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 (Cervinkas & 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 (Cervinkas & Loffi, 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 Cervinkas 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 (Cervinkas & 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 (Cervinkas & 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 (Cervinkas & 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 (Cervinkas & 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; Cervinkas & 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; Cervinskaskas & 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; Cervinskaskas & 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.

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.

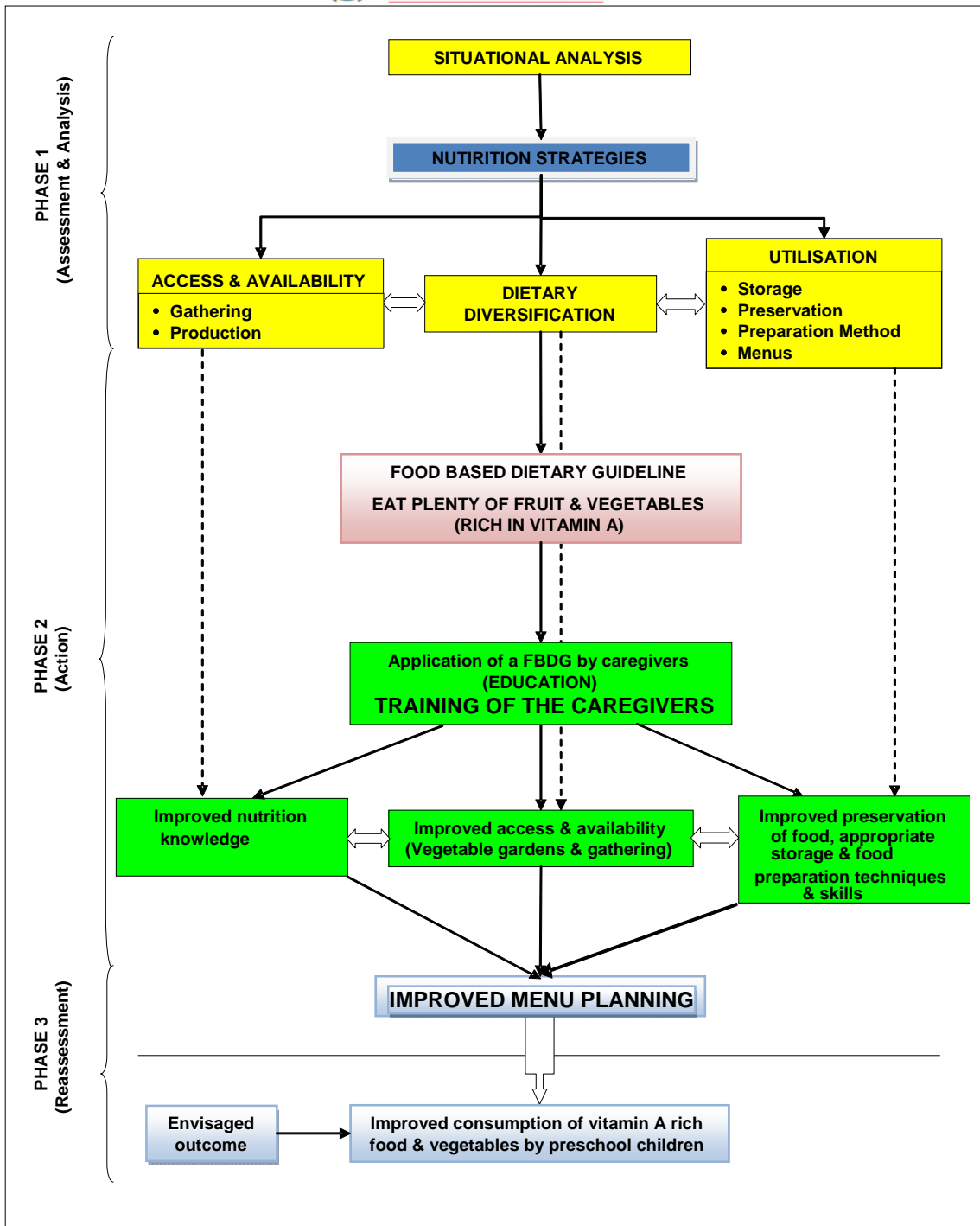


FIGURE 3.1: CONCEPTUAL FRAMEWORK OF THE NUTRITION STRATEGIES TO IMPROVE THE APPLICATION OF A FOOD-BASED DIETARY GUIDELINE

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)	<ul style="list-style-type: none"> ▪ Questionnaire Part A2 A.2.4 Part B2 B2.1- B2.9
	1.2 Availability and accessibility of vitamin A-rich vegetables and fruit	<ul style="list-style-type: none"> ▪ Questionnaire Part C1 C1.1- C1.5 Part C2 C2.1- C2.9 ▪ Observation
	1.3 Utilisation of vegetables and fruit	<ul style="list-style-type: none"> ▪ 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: <i>"eat plenty of vegetables and fruits everyday"</i> (with specific emphasis on vitamin A-rich vegetables and fruit)	<ul style="list-style-type: none"> ▪ 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: <i>eat plenty of vegetables and fruit every day.</i>	
	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.	<ul style="list-style-type: none"> ▪ 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.