# EFFECTS OF VEGETABLES FROM A SCHOOL GARDEN, IN A SCHOOL FEEDING PROGRAMME, ON THE SCHOOL ATTENDANCE RATE AND GENERAL HEALTH OF CHILDREN IN A FARM SCHOOL

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(B.HONOURS IN HOME ECONOMICS)

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# DEDICATION

I dedicate this work in memory of the following people (not in order of preference):

- my husband – Dan,
- my father and mother - Mosimanegape and Gobona,
- my brother and sister – Michael and Bunny.

The memories will always be with me.

**"Come unto Me, all you who labour and are heavy laden, and I will give you rest"**

(Mt. 11:28)

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# ABSTRACT


**Background**

Poverty in the rural areas often results in people being unable to buy the necessary food to feed their families and at the end, the children suffer, as they do not get the necessary foodstuffs needed for their development. Workers living in rural or agricultural communities do not have adequate access to basic primary health care facilities. Children need to be immunized and have regular check-ups during their developmental years and this is often lacking in farming communities. Farm workers and their children are also often denied access to other Government services. They are often not informed of services which are available and which will benefit them.

Children attend schools without clean drinking water or proper sanitation, putting them at risk of disease. Some children travel far to reach the schools. A lack of state-funded transport from homes hinders access to education in commercial farming areas. Such exhausting conditions adversely affect the ability of these children to adequately participate in activities in the classroom. This results in poor performance, non-attendance or regular absence.

Children from families who are dependent on employment on commercial farms for their livelihoods are vulnerable due to low education status of their parents/guardians, low pay, poor working conditions and dependence on the farmer.

**Project aim**

The main aim of the project was to investigate the effects of a daily vegetable meal on the health of farm school children.

**Objective of the study**

The specific objectives of this study were to evaluate the effects of vegetables in the school feeding programme over a 15 week period on:

- the school attendance in the experimental and control schools,
- the prevalence of infections,
- the occurrence of sores in the school going learners of both the experimental and the control schools.

**Research setting**

This study was part of the larger FLAGH (Farm Labour And General Health) programme that was a follow up of the THUSA study. The FLAGH programme consists of a number of different projects and studies mainly aimed at improving the nutritional status and quality of life of black South African farm dwellers in the North-West Province. Two schools in the Rysmierbult district were selected to participate in this study. One of the schools was used as a control school and the other school was used as the intervention (experimental) school. The vegetable garden in the experimental school started in 2003 and in the control school it was started in 2001. In 2004 after the school opened, the garden in the control school was not functional due to some reasons. Therefore the school was used as a control school as the learners were not fed vegetables each day.

**Subjects**

A total number of 109 primary school learners between the ages of 6 and 14 years old took part in the study. The intervention school enrolment was 70 learners at the beginning of the study and at week 7 to 15 it was 67, as 3 learners had left school with no reason. The control school enrolment was 42 learners.

**Study design**

It was a comparative evaluation intervention study with baseline and end measurements to assess the effects of vegetable gardens in farm schools to supplement the school feeding programme. This was a comparison study of two farms schools. The

implementation of vegetable garden projects at schools was one of the interventions aimed at improving the nutritional status of the children.

**Research Methods**

Four types of instruments were used in the study namely:

- anthropometric measures (height and weight) were used to calculate the Body Mass Index (BMI) for age and Z-scores (by age) for all the children (Annexure II),
- observation of the occurrence of skin sores and infection (Annexure I),
- a structured face-to-face interview for learners (Annexure III),
- a questionnaire for teachers to get their views towards the vegetable garden project (Annexure IV).

**Results**

The school attendance for the control school was throughout the 15 week intervention period better than the experimental school. Although the anthropometric measurements of learners at baseline in the experimental school differed statistically significantly from those in the control school it was of low practical significance ($d$<0.5). The learners in the experimental school were more undernourished (Z-score for weight for age: -1.86 and height for age: -1.55) than those in the control school (Z-score for weight for age: -0.99 and height for age: -1.37). Over the 15 week period the children in the control school got more undernourished (Z-score for weight for age: -1.34 and height for age: -1.44) while the nutrition status of the children in the experimental school improved (Z-score for weight for age: -1.65 and height for age: -1.48).

No differences in the occurrence of infections in the children were observed between the two schools. However, the results on the occurrence of skin sores indicated a highly significant ($p$<0.001) improvement in the occurrence thereof in the experimental school.

**Conclusion**

Malnutrition is still a major problem worldwide and especially in Asia and Africa especially the Sub-Sahara area. There are a number of factors contributing to malnutrition. The underlying factors include access to food, caring practices, health services, the environment and lastly the immediate factors include dietary intake and infection/illness.

From the results of this study it seems as if a vegetable meal can improve the nutrition status of learners and it can help to reduce the incidence of skin sores in children. The fact that no improvement in the incidence of infections was measured during this study by the occurrence of symptoms such as colds, flu, coughs and a running nose was observed, might be due to the short period of the intervention (15 weeks) and the small number of children included in the study.

**Recommendation**

A multifaceted approach is recommended to improve the nutritional status of learners attending schools in the farming areas. One of these approaches can be to include vegetables in the daily school meal. The study period was too short (15 weeks) to determine an explicit outcome, so it would be more appropriate to extend the study to a longer period.

# ABSTRAK


## Agtergrond

Armoede in die landelike gebiede lei dikwels daartoe dat dit nie moontlik is vir mense om noodsaaklike voedsel wat hulle gesinne voed te koop nie en dan ly die kinders dikwels daaronder, omdat hulle nie die noodsaaklike voedingstowwe vir ontwikkeling ontvang nie. Werkers wat in landelike- en landbougemeenskappe woon het dikwels ook nie voldoende toegang tot basiese gesondheidsfasiliteite nie. Kinders moet tydens hulle ontwikkelingsjare geïmmuniseer en gereeld medies ondersoek word en dit gebeur dikwels glad nie in plaasgemeenskappe nie. Plaaswerkers en hulle kinders het ook dikwels nie toegang tot ander regeringsdienste nie. Hulle word dikwels nie oor dienste wat beskikbaar is en hulle sal bevoordeel, ingelig nie.

Kinders besoek ook skole sonder skoon drinkwater of behoorlike sanitasie wat hulle blootstel aan die risiko vir siektes. Sommige kinders woon ook baie ver van die skool af. 'n Gebrek aan staatsgefinansierde vervoer van hul huise na die skool het 'n negatiewe invloed op opvoeding in die kommersiële landbou-gebiede. Sulke swak toestande affekteer die vermoë van kinders om deel te neem aan aktiwiteite in die klaskamer negatief. Die resultaat hiervan is swak prestasie, ongereelde klasbywoning of gereelde afwesigheid.

Kinders van gesinne wat afhanklik is vir hulle bestaansreg van werkgeleenthede op kommersiële plase is kwesbaar as gevolg van die lae opvoedingspeil van hul ouers en voogde, lae besoldiging, swak werktoestande en afhanklikheid van die plaas eienaar.

## Projekdoelstelling

Die hoofdoelstelling van die projek was om die invloed van 'n daaglikse maaltyd wat uit groente bestaan op die gesondheid van kinders in plaasskole te ondersoek.

**Spesifieke doelstellings van die studie**

Hierdie studie se doelstellings was om die effek van bygevoegde groente tot die bestaande skoolvoedingsprogram oor 'n 15 week periode te ondersoek ten opsigte van :

- die skoolbywoning in 'n eksperimentele en 'n kontrole skool,
- die voorkoms van infeksies,
- die voorkoms van sere by die skoolgaande leerlinge in beide die eksperimentele en kontrole skole.

**Navorsingsopset**

Hierdie studie was deel van die groter FLAGH (Farm Labour And General Health) program wat 'n opvolgstudie van die THUSA-studie was. Die FLAGH program bestaan uit 'n aantal verskillende projekte en studies wat hoofsaaklik daarop gemik is om die voedingstatus en lewensgehalte van swart plaasbewoners in die Noordwes Provinsie te verbeter. Twee skole in die Rysmierbult distrik was gekies om aan die studie deel te neem. Een skool was as 'n kontrole skool gebruik en die ander vir die intervensie of die eksperimentele skool. Die groentetuin in die eksperimentele skool het in 2003 begin en by die kontrole skool het dit in 2001 begin. In 2004 na die skole heropen het was die groentetuin van die kontrole skool weens bepaalde redes nie funksioneel nie en die leerders het nie elke dag groente ontvang nie. Daarom is die skool as kontrole gekies.

**Proefpersone**

'n Totaal van 109 primêre skool leerders tussen die ouderdomme van 6 en 14 jaar oud het aan die studie deelgeneem. Daar was 70 leerders in eksperimentele skool aan die begin van die studie en tydens weke 7-17 was daar 67. Drie leerders het sonder enige rede die skool verlaat. Daar was 42 leerders in die kontrole skool.

**Studie-ontwerp**

Dit was 'n vergelykende, evaluerende, intervensie studie met basislyn- en endmetings om die effek van die groentetuine in plaasskole wat die skoolvoedingsprogram supplementeer, te ondersoek. Dit was 'n vergelykende studie van twee plaasskole. Die

implementering van groentetuine by die skole was een van die intervensies wat die verbetering van voedingstatus van leerders beoog het.

**Navorsingsmetodologie**

Vier tipes instrumente was gebruik, naamlik:

- antropometriese metings (lengte en gewig) was gebruik om die Liggaamsmassa Indeks (LMI) vir ouderdom and Z-tellings (volgens ouderdom) vir al die kinders te bepaal (Addendum II),
- observasie van die voorkoms van sere op die vel en infeksies (Addendum I),
- 'n gestruktureerde direkte onderhoud met leerders (Addendum III),
- 'n vraelys aan die onderwysers om hulle opinie oor die groentetuinprojek te kry (Addendum IV).

**Resultate**

Die skoolbywoning van die kontrole skool was gedurende die 15 week intervensie beter as die eksperimentele skool. Alhoewel die antropometriese metings van die leerders van die eksperimentele skool tydens die basislyn metings statisties van die kontroleskool verskil het, het dit 'n lae statistiese betekenisvolheid gehad ($d$<0.5). Die leerders in die eksperimentele skool was meer ondervoed (Z-telling vir gewig vir ouderdom: -1.86 en lengte vir ouderdom: -1.55) as die in die kontrole skool (Z-telling vir gewig vir ouderdom: -0.99 en lengte vir ouderdom: -1.37). Gedurende die 15 weke het die kinders van die kontrole skool meer ondervoed geraak (Z-telling vir gewig vir ouderdom: -1.34 en lengte vir ouderdom: -1.44) terwyl die voedingstatus van die kinders in die eksperimentele skool verbeter het (Z-telling vir gewig vir ouderdom: -1.65 en lengte vir ouderdom: -1.48).

Daar is geen verskil waargeneem in die voorkoms van infeksies by die twee skole nie. Die verskil in die voorkoms van sere was statisties baie betekenisvol ($p$<0.001) wat dui op die verbetering in die voorkoms daarvan by die eksperimentele skool.

**Gevolgtrekking**

Wanvoeding is 'n wêreldwye probleem, veral in Asië en Afrika, veral in die Sub-Sahara-area. Daar is verskillende faktore wat 'n bydrae tot wanvoeding lewer. Onderliggende faktore sluit die toegang tot voedsel, versorgingspraktyke, gesondheidsdienste, die omgewing en laastens direkte faktore insluitende dieetinname en infeksie/siekte.

Uit die resultate van die studie blyk dit dat 'n groentemaaltyd die voedingstatus van kinders kan verbeter en die voorkoms van sere by kinders kan verminder. Die feit dat daar nie 'n verbetering in die voorkoms van simptome soos verkoue, griep, hoes en loopneuse waargeneem is nie, kan wees as gevolg van die kort tyd wat die intervensie geduur het (15 weke) en die klein getal kinders ingesluit in die studie.

**Aanbeveling**

'n Multifaset benadering om die voedingstatus van leerders wat skole plaasskole bywoon word aanbeveel. Een van hierdie benaderings kan wees om groente in die daaglikse skoolmaaltyd in te sluit. Hierdie studie was te kort (15 weke) om 'n eksplisiete uitkoms aan te dui, en dit word aanbeveel dat die studie oor 'n langer tydperk herhaal word.

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| | |
|---|---|
| ANCOVA | Analysis of Covariance |
| ARC | Agricultural Research Council |
| BMI | Body Mass Index |
| DSSPAWCP | Department of Social Services and Poverty Alleviation of the Western Cape Province |
| DoH | Department of Health |
| FAO | Food Agriculture Organisation |
| FLAGH | Farm Labourer And General Health |
| GDP | Gross Domestic Product |
| IDA | Iron Deficiency Anaemia |
| IDD | Iodine Deficiency Disorders |
| MRC | Medical Research Council |
| NFCS | National Food Consumption Survey |
| NPI | Nutrition Policy Implementation |
| NRPNI | National Research Programme for Nutritional Intervention |
| OMNI | Opportunity for Micro Nutrient Interventions |
| RDA | Recommended Daily Allowance |
| SAS | Statistical Analysis System |
| SASVO | South African Student Volunteer |
| SAVACG | South African Vitamin A Consultative Group |
| SD | Standard Deviation |
| THUSA | Transition and Health during Urbanisation of South Africa |
| UNSID | United Nations Society for International Development |
| USAID | United State Agency for International Development |
| UNICEF | United Nations Children's Fund |
| VAD | Vitamin A Deficiency |
| WHO | World Health Organisation |

# CHAPTER 1: INTRODUCTION TO THE STUDY

## 1.1 INTRODUCTION

The **F**arm **L**abour **A**nd **G**eneral **H**ealth programme (FLAGH) is a multisectorial research and intervention programme started during 2001-2002. The main aim of the FLAGH programme is to improve the nutritional status and quality of life of farm dwellers. It was developed as a result of research findings of the **T**ransition and **H**ealth during **U**rbanisation of **S**outh **A**frica study (THUSA). The THUSA survey identified black farm workers in the North-West Province as the most vulnerable of all social strata with regard to income, physical and mental health status and household food security (Vorster *et al.*, 2000; Lemke, 2001).

In 2003, six farm schools in the Potchefstroom district were chosen in cooperation with the Department of Education (those schools most in need) to participate in a vegetable garden project. Two of these schools were included in this study, one of the schools was used as an experimental school and the other school was used as the control school.

The implementation of vegetable gardens at farm schools was one of the interventions launched by the FLAGH programme and aimed at improving the nutritional status and quality of life of the children living on the farms. The main objective of the project was to assist schools in developing a garden and maintaining it for their own consumption of vegetables, but which in the long term could also serve the purpose of generating an extra line of income for the school.

## 1.2 BACKGROUND

In developing countries malnutrition is a major cause of mortality. According to Bradshaw *et al.* (2003), investing in the health and well-

being of the children of South Africa is an investment in the future development of the country. They state that South Africa still has a relatively young population with a third of the population less than 15 years of age. According to Klugman (2005) children of the world are innocent, vulnerable and dependent on their parents and guardians. The children are said to actually be curious, active and full of hope, as they are the future of the world, tomorrow's leaders and decision makers. To assist in making their childhood days joyful, peaceful and playful, while reinforcing their chances of learning and growing as best they can, should certainly be regarded as rewarding efforts. The children's future should be shaped in harmony and cooperation, guiding them into responsible maturity. These statements clearly illustrate and emphasise the value of children growing up in a healthy way.

The paper on conditions on farms by the Department of Social Services and Poverty Alleviation of the Western Cape Province (DSSPAWCP, 2004) state that children on farms are among the most vulnerable persons in the society. By being among the marginalised persons in the society, they often suffer from poverty, homelessness, abuse, neglect, preventable diseases and unequal access to education and other services. This report is consistent with the THUSA study findings of the people living on farms (Vorster *et al.*, 2000).

Vorster *et al.* (2000) state that people, living and working on commercial farms have the lowest nutrient intake, and also the lowest nutritional, physical and mental health status. Results on dietary intakes in the FLAGH programme pilot study indicated a micronutrient intake of below 80% of Recommended Daily Allowance (RDA) especially in the children and men. Farm schools in South Africa offer appalling conditions for learners and feeding is inappropriate and not suitable (Anon, 2004). Since World War II, there has been an interest in school feeding on the part of some governments. The importance of improving

nutrition of vulnerable groups, including farm children, was stressed as far back as 1943 (FAO, 1953).

In South Africa, malnutrition was one of the key priority issues the new government undertook to address in 1994 and in the Nutrition Policy Implementation (NPI); the school feeding programme was the second objective for addressing household food security and was implemented on 1st September 1994. But surprisingly to date there are still some areas that are lagging behind in addressing this issue, especially in the vulnerable groups (Department of Health, 2005).

An undernourished child is said to be susceptible to infection or parasitic disease (Frisancho, 1981). It is also found that malnutrition weakens the immune system, whereby, the adverse effects of malnutrition increase the body's exposure to infection while at the same time decreasing its ability to fight the infection. What makes this state of affairs even worse is that loss of appetite usually occurs when infection sets in (Macallan, 2005). Infections, in turn are said to aggravate micronutrient deficiencies by reducing nutrient intake, increasing losses and interfering with utilization by altering the metabolic pathway. These interactions are of particular significance in poor children whose micronutrient status is already marginal, causing a high disease burden in poor communities.

Gillespie & Manson (1991) argued that controlling infectious diseases also involves improving the health environment and assuring access to adequate health services. They further stated that dietary prevention to protect the nutritional status also seeks to reduce the frequency and severity of infection by ensuring a safe and nutritionally adequate diet and limiting energy expenditure. Good nutritional status prevents infection by a number of mechanisms, notably through the immune system and maintaining the integrity of epithelial tissues.

Rao *et al.* (2005) state that education should be considered an important key to promote good nutrition of the community, and should start at a very early stage in life. It is also pointed out that nutrition and education information is an important means of implementation and that there are specific interventions through the health and nutrition system that would prove to be necessary (Gillespie & Manson, 1991).

## 1.3 PROBLEM STATEMENT

The socio-economic disadvantaged groups such as children in farm schools, as well as farm workers' lack of knowledge and skills on health issues can and should be attended to. Farm workers depend on employment by the farm owners for their livelihood, but they do very little themselves to improve their conditions, by, for example, having small gardens in their backyards, where they can produce vegetables for both feeding and selling. According to Love & Sayed (2001), the majority of South African children are malnourished (under-nutrition) and the majority is from the black community and range between the ages of 0 to 12 years.

## 1.4 AIM/PURPOSE OF THE STUDY

The main aim of the study was to investigate the effects of a daily vegetable meal on the health of farm school children. The study also aimed at finding out whether vegetables had an effect on some indicators of health status such as school attendance, prevalence of infection and presence of sores on the school children.

## 1.5 SPECIFIC OBJECTIVES OF THE STUDY

The objectives of the study were to evaluate the effects of added vegetables in the school-feeding programme and it was to be conducted over a 15-week period with special reference to the following aspects:

- the school attendance at both the experimental and control schools,
- the prevalence of infection with regard to both these selected

schools,

- the occurrence of sores in the school-attending learners of both the intervention and the control schools.

## 1.6 HYPOTHESES

The inclusion of vegetables in the school-feeding programme will improve the school attendance over a 15 week period. A vegetable meal once a day at school will diminish the presence of sores and infections in the children.

## 1.7 SIGNIFICANCE OF THE STUDY

It was expected that the study could be to the advantage of the schools, teachers, learners and the Government Departments such as Health, Agriculture and Education in, for example, the following ways:

- **schools** - the school as a whole would have better attendance by the students/pupils (good school attendance).
- **teachers** - with school attendance in place the teachers would better be able to meet the demands of school curriculum matters and to share the necessary information and knowledge with a bigger group at a time, and, for that matter, probably a more energetic, enthusiastic and susceptible group,
- **learners** - the learners would experience improved health conditions and school attendance, and that would inevitably lead to improved education, more stable possibilities of scholastic success and enjoyment of school for them,
- **Government** - this could help the Government Departments such as the Health Department in the sense that infection and malnutrition could be controlled. As a result, the Government Departments would be able to achieve some of their goals such as better community livelihood. The Department of Education also benefits in the sense that school attendance would improve and there would be active classroom participation by the learners.

## 1.8 ROLE OF THE CONSUMER SCIENTIST IN THE STUDY

### 1.8.1 The role of the consumer scientist in general

Consumer scientists study and investigate the needs of people as consumers of goods and services, and provide the consumers with advice (Anon, 2004). They are said to represent consumers' views to manufactures. Consumer science, also sometimes referred to as home economics, is said to be an applied field of study in that it offers solutions to problems faced by individuals, families and communities (Fairchild, 2005).

According to Fairchild (2005), the roles of consumer scientists are said to vary depending on the product or service specialist. Fairchild (2005) further state that consumer scientists work in many fields such as food-related organisation, local authority, journalism and publishing, research and product development, domestic appliances, fuel and energy industry and caring services, and generally they are there to represent the consumer in a variety of ways as deemed necessary.

The work of consumer scientist may involve the following (Anon, 2004):

- food product development - working for food manufacturers or large supermarket chains. Research is conducted on consumer tastes to design new dishes and food products,
- product and service development - advises on products ranging from household or leisure products to public amenities and financial services,
- quality assurance - developing testing programmes to ensure that products meet quality standards and legal requirements,
- marketing - using market research to advise on packaging design, and to plan the advertising and distribution of the product,
- consumer advice - representing the consumer's rights involves knowledge of specific legislation,

- education - providing advice on healthy living,
- Government - working for bodies, such as the Environmental Health departments.

### 1.8.2 Specific role of the consumer scientist as part of the study

According to Blackwell *et al.* (2001), the consumer scientist conducts comprehensive surveys on consumer behaviour, such as consumption patterns, quality of products and any other related matters and publishes reports on the findings.

In this study, as a consumer scientist, my role was to compare and assess the nutritional status of children in the two schools, then make recommendations regarding their nutritional status.

## 1.9 LIMITATIONS OF THE STUDY

The following were identified as limitations of the study:

- harsh climate - the North-West Province is known for its very hot and dry summers and frosty winters,
- the enthusiasm and the commitment of teachers to participate was a determinant of the success of the vegetable garden project and influenced the enthusiasm of the learners,
- a 15-week period is very short for a feeding trial to gain positive results,
- a lack of care for the gardens during the school holidays, forced the gardens to be started from scratch after a long holiday, such as the summer school holidays, which influenced the period of continuous feeding from the vegetable garden,
- the sample size was relatively small, especially in the control school.

## 1.10 DEFINITIONS OF TERMS

The following terms were, *inter alia,* used in the study and their definitions are provided in each case:

- **malnutrition** - is a condition that occurs when a person's body is not getting enough nutrients, the condition may result from an inadequate or unbalanced diet, digestive difficulties, absorption problems or other medical conditions (Owen, 2005),
- **under-nutrition** - is a condition caused by a poor diet resulting in problems such as inadequate growth in children,
- **nutritional status** - the nutritional status is the physical health of a person, as it results from consumption of food and utilisation of the body. It is described as the end result of utilisation of energy by the body, which indicates whether a particular individual is nourished, malnourished or whether there is an imbalance of nutrients (Mann & Trusswell, 2004),
- **nutritional screening** - refers to a proactive process that is used systematically in clinical practice to identify individuals who are malnourished or who are at risk of developing malnutrition. Nutrition screening identifies those individuals who subsequently undergo a comprehensive nutritional assessment (August *et al.*, 2002),
- **infectious disease** - a disease that can be transmitted from person to person or from organism to organism, and is caused by a microbial agent (e.g. cold or flu),
- **vulnerability** - refers to the full range of factors that place people at risk of becoming victims of something, e.g. in the case of this study, victim to food insecurity. The degree of vulnerability of individuals, households or groups of people is determined by their exposure to the risk factors and their ability to cope or withstand stressful situations (FAO, 2000).

Since the above are formal definitions, the researcher, for the purpose of the study, operationally defined the following terms:

- **vegetable meal** - a vegetable is added to a standard meal (part of school feeding scheme),
- **farm school** - these are schools that are located in the farming communities.

## 1.11 OUTLINE OF THE MINI-DISSERTATION

The mini-dissertation is divided into six chapters and they are outlined as follows:

- Chapter 1 is the introduction to the study, background, problem statement, aims, specific objectives, hypotheses, significance, limitations and the definition of terms,
- Chapter 2 provides a comprehensive literature survey, which covers the causes and consequences of malnutrition, nutritional status of South African children, farming in South Africa and vegetable gardening,
- Chapter 3 presents a description of the research design, methods used in the study, population and sampling procedures, instruments used for collecting data as well as how data were analysed,
- Chapter 4 provides the results of this study. The results are presented in five sections. Section 4.1 includes the results of school attendance, Section 4.2 the anthropometric measures results, Section 4.3 the results of the infection levels, Section 4.4 the results on the occurrence of sores and the last section refers to the results of responses based on the questionnaires,
- Chapter 5 provides the discussion based on the results from Chapter 4,
- Chapter 6 outlines the conclusions and recommendations in relation to the study findings.

# CHAPTER 2: LITERATURE REVIEW

## 2.1 INTRODUCTION

Starvation and malnutrition still remain among the most urgent problems worldwide, presenting at a high percentage among the world's underprivileged and poor. Under-nutrition is considered to be a major problem worldwide as well as in South Africa. In South Africa under-nutrition is said to be mainly prevalent among Black, Coloured and Asian children, and especially in the lower socio-economic communities (Krige & Senekal, 1997). Malnutrition worldwide includes a spectrum of nutrient-related disorders and deficiencies. In young children the consequences of malnutrition are growth retardation, increased risk of infection, high risk of death, blindness and anemia (WHO, 1992).

Grigsby (2003) estimated that approximately 150 million children are malnourished (26.7% children younger than 5 years) in developing countries. These estimates are based on their low weight in relation to their age. According to Diosady (2003), an estimated 2 billion people are micronutrient deficient (one third of the world's population is suffering from health effects due to the lack of three key micronutrients, being iodine, iron and vitamin A).

The South African Constitution recognises the right of everyone to have access to sufficient food and the right of children to basic nutrition. South Africa is said to still face the spectre of hunger and malnutrition, and it is estimated that about 2.5 million South Africans are currently undernourished. The problem is particularly acute with regard to previously disadvantaged groups and other groups that are especially vulnerable. Malnutrition among children in South Africa is said to be one of the biggest problems, especially with regard to micronutrient deficiency diseases (Labadarios & Steyn, 2001).

## 2.2 MALNUTRITION

According to Owen (2005) malnutrition is said to be the condition that occurs when a person's body is not getting enough nutrients and that the condition may result from an inadequate or unbalanced diet, digestive difficulties, absorption problems or other medical conditions.

### 2.2.1 Malnutrition worldwide

Malnutrition is said to be more than a medical problem. Its causes are dysfunctions in economic, demographic, cultural and ecological processes. The process of acquiring food permeates all aspects of human relationships with the environment and with society (Taylor & Taylor, 1997).

The United Nations Children's Fund (UNICEF, 2005) reported that in Sub-Saharan Africa, the number of malnourished people has risen from 170.4 million to 203.5 million since 1995. More than half of the world's children are suffering extreme deprivations from poverty, war and HIV/AIDS, and these conditions effectively deny children a childhood and hinder the development of nations. According to UNICEF (2005), more than 1 billion children are denied a healthy and protected upbringing as promised by the 1989 Convection on the Rights of the Child. This report stresses that the failure of Government to live up to the Convection's standards causes permanent damage to children and in turn blocks progress towards human rights and economic advancement.

**Table 2.1: Number of people hungry**

| 2005 (744 million hungry globally) | | 2010 ( 694 million hungry globally) | |
|---|---|---|---|
| **Region** | **Percentage** | **Region** | **Percentage** |
| Sub Saharan region | 44 | Sub Saharan region | 63 |
| Asia | 40 | Asia | 26 |
| Latin America | 8 | Latin America | 6 |
| North Africa | 6 | North Africa | 4 |
| **334 million Africans hungry** | | **435 million Africans hungry** | |

Source: FAO (2000)

Table 2.1 shows that in 2000, there were 744 million people hungry throughout the world and out of these, 334 million were hungry Africans. In the Sub-Saharan region, hungry people represented 44%, followed by Asia with 40%, Latin America with 8% and lastly North Africa with 6%. It is predicted that in the year 2010 there will be 694 million hungry people globally, with 435 million being Africans. It has been predicted that the highest percentage of hungry people would be from the Sub-Saharan region at a rate of 63%, followed by Asia with 26%, then Latin America with 6% and lastly North Africa with 4% (FAO, 2000).

### 2.2.2 Malnutrition in children

According to Table 2.2, the UNICEF (2001) report shows that 150 million children in developing countries were malnourished. South Asia had the highest percentage with 78% followed by Sub-Saharan Africa with 32%, East Asia Pacific with 27%, and then Middle East and North Africa both with 7%. Latin America and Caribbean both had 4% and lastly Baltic States had 2%.

**Table 2.2: Malnourished children in developing countries**

| Region | Percentage |
|---|---|
| South Asia | 78 |
| Sub-Saharan Africa | 32 |
| East Asia Pacific | 27 |
| Middle east | 7 |
| North Africa | 7 |
| Latin America/ Caribbean | 4 |
| Baltic States | 2 |

Source: UNICEF (2001)

According to Sanminiatelli (2005), hunger and malnutrition kill nearly 6 million children a year and more people are malnourished in Sub-Saharan Africa this decade than in the 1990s. Many of the children die of diseases that are treatable, including diarrhea, pneumonia, malaria and measles. Sub-Saharan Africa is among the worst hit regions.

### 2.2.3 Causes of child malnutrition

Malnutrition and its causes are well documented. The conceptual framework on the causes of child malnutrition was developed in 1997 as part of the UNICEF nutrition strategy. The framework shows the causes of malnutrition being multicultural, embracing food, health and caring practices. These causes are also classified as immediate, underlying and basic, whereby factors at one level influence other levels. The framework can be used at national, district and local levels to help plan effective actions to improve nutrition. It serves as a guide in assessing and analysing the causes of the nutrition problem and helps in identifying the most appropriate mixture of actions.

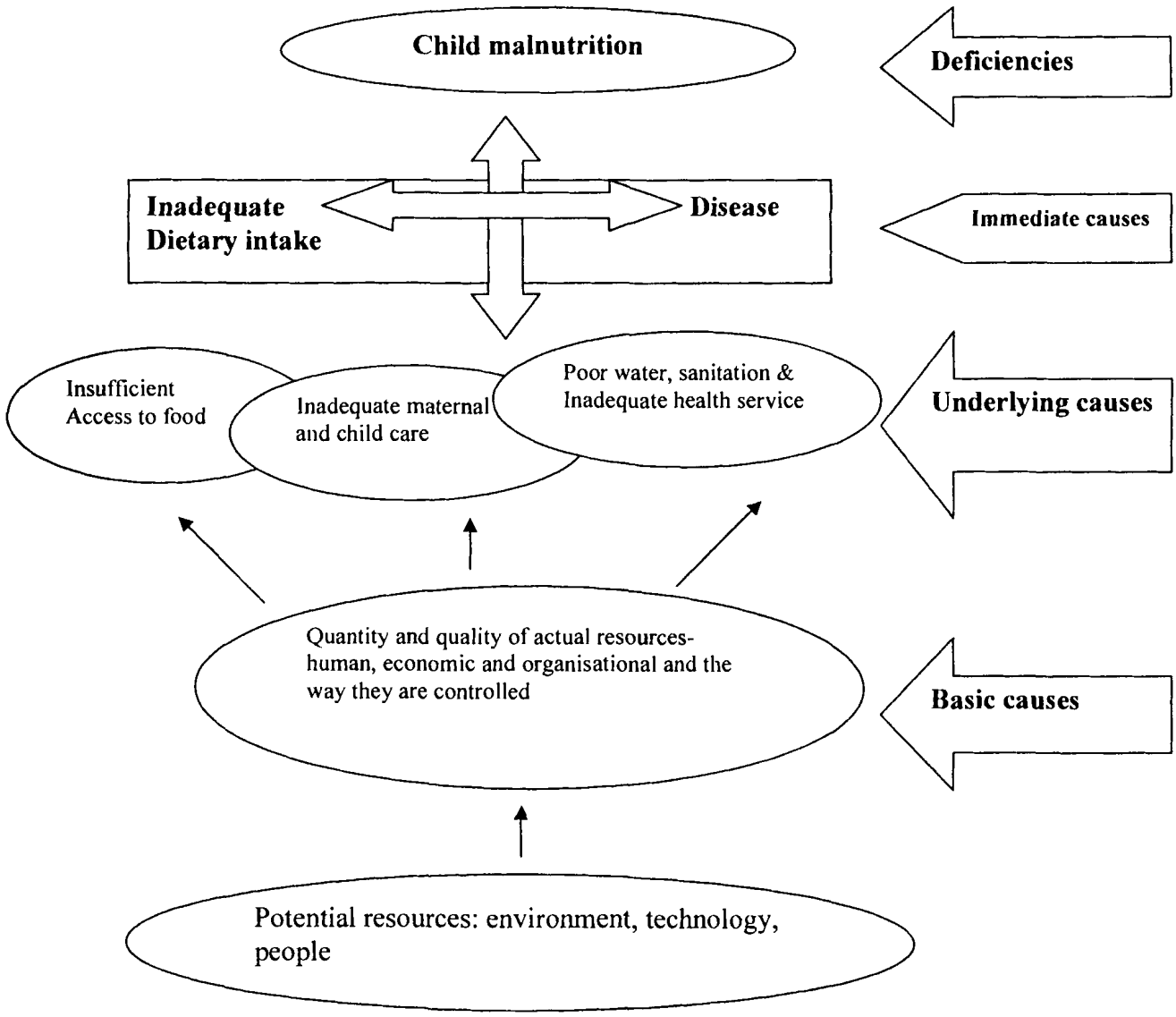


**Figure 1: Causes of child malnutrition** (Adopted from UNICEF, 1997)

### 2.2.4 Malnutrition and infection

The word "infection" according to the Collins English Dictionary and Thesaurus (1994) is the invasion of the body by pathogenic micro organisms.

It is found that the principle underlying causes of malnutrition and infection are inadequate dietary intake, which leads to low nutritional

reserves, which are manifested as weight loss or failure of growth in children (UNICEF, 1998). Depleted nutritional reserves are associated with a lowering of immunity with almost all nutrient deficiencies and under these circumstances, the incidence, severity and duration of diseases may be increased (Tomkins & Watson, 1989). These factors themselves worsen malnutrition, leading to further damage to defense mechanisms. At the same time, many diseases are associated with a loss of appetite. While other relationships play a part, these are some of the most important, and account for much of the high morbidity and mortality under circumstances of high exposure to infectious disease and inadequate diet, characterising many poor communities (Gillespie & Mason, 1991).

According to the Opportunity for Micro Nutrient Interventions (OMNI, 1996), indications are that malnutrition weakens the immune system, thereby easily exposing the children to infections and illness. Malnutrition is said to be a risk factor that increases susceptibility to and severity of infection on both innate and adaptive immunity. This is also supported by the report of the Food and Agriculture Organisation of the United Nations (FAO, 2005). It also reports that dietary deficiency diseases reduce the body's resistance to infections and adversely affect the immune system in the sense that the body has reduced the ability to defend itself against infections.

## 2.3 MICRONUTRIENT DEFICIENCY

Micronutrient deficiency is a term used to refer to diseases caused by dietary deficiency of vitamins and minerals (FAO, 2005; Anon, 2003). According to Stuijvenberg *et al.* (1997), deficiencies of iron, iodine and vitamin A are considered as public health problems in developing countries worldwide. These micronutrient deficiencies are sometimes referred to as the hidden hunger (OMNI, 1996; FAO, 2005).

In 2005 the United States Agency for International Development (USAID) found that micronutrient deficiency affects the health, economic and social development of individuals, communities and nations. The three main micronutrient deficiencies, being iodine, iron and vitamin A were identified to be a serious threat among women and children in developing countries (Bellamy, 1998; Diosady, 2003; UNICEF, 1990).

According to the UNICEF (1998), vitamin A deficiency is said to make children vulnerable to infection, to worsen the course of many infections and to weaken the immune system. Vitamin A deficiency is also the most common cause of blindness among children in developing countries according to the World Health Organisation (WHO, 2003). Iodine deficiency is said to be the leading cause of mental and physical retardation in infants and children worldwide (Anon, 2003).

The 1990 World Summit for children set the goal of eliminating iodine deficiency by the year 2010 (Anon, 2003; FAO, 2004). The goal set for iron deficiency reads as to "reduce the prevalence of anaemia (including iron deficiency by one third by 2010". Iron deficiency is said to be the main micronutrient deficiency in the world. It is estimated that more than 2 billion people worldwide are anaemic. Women and children are said to be the most vulnerable. The Vitamin A deficiency goal is to achieve the sustainable elimination of vitamin A deficiency by 2010. Vitamin A is said to be an essential micronutrient for the immune system (Harvest Plus, 2003).

**Table 2.3: Estimated percentage of people at risk of the three main types of micronutrient malnutrition**

| Region | Iron Deficiency Anaemia (IDA) | Vitamin A Deficiency (preschool children only) | Iodine Deficiency Disorders (IDD) |
|---|---|---|---|
| Africa | 46 | 32.1 | 22.7 |
| America | 19 | 17.3 | 6.5 |
| South East Asia | 57 | 33.0 | 14.9 |
| Eastern Mediterranean | 45 | 21.2 | 30.3 |
| Western Pacific | 38 | 14.0 | 15.5 |
| **Total** | | | |

Source: FAO (2005)

Table 2.3 indicates the estimated number of people in millions at risk of the three main forms of micronutrient malnutrition (iron, vitamin A and iodine deficiency). The Africa region has an iron deficiency of 46%, which ranks second in the region, with South East Asia being the highest with a percentage of 57%. In the Africa region, vitamin A deficiency is estimated at 32.1%, ranking second from the all the regions. Iodine deficiency in Africa is estimated at 22.7%, also ranked second after Eastern Mediterranean with 30.3% (FAO, 2005).

### 2.3.1 Micronutrient deficiency in South Africa

A national survey was conducted in 1994 (SAVACG, 1994) in response to the paucity of data on the micronutrient status of South African children. The results showed vitamin A deficiency rates among approximately 11 000 children, 6-71 months of age were found to be high. Night blindness was prevalent in 12%. Prevalence of low serum retinal was higher in the rural areas (38%) than in the urban areas (25%).

The National Research Programme for Nutritional Intervention (NRPNI) of the Medical Research Council (MRC) undertook a cross-sectional

nutritional survey in Ndunakazi, in a rural village in KwaZulu-Natal in 1995. The results showed deficiencies in vitamin A, iron and iodine. Iron and iodine deficiencies exceeded the level regarded as a public health problem. According to Stuijvenberg *et al.* (1997), deficiencies of iron, iodine and vitamin A, must be considered a public health problem in developing countries worldwide. These micronutrient deficiencies are said to have a negative effect on the mental development and learning ability of school children. Vitamin A affects the iron metabolism and has an impact on infections, and iron deficiency can also increase susceptibility to infection (UNICEF, 1998). According to the South African Vitamin A Consultative Group, one in three preschool children present a serum retinal concentration below 20ug/dl (SAVACG, 1994).

### 2.3.2 Addressing micronutrient deficiency in South Africa

There have been a number of programmes to address micronutrient malnutrition in South African children. Such programmes included food fortification, supplementary feeding, health workers providing counselling, information and education on healthy diets, and ways of preparation. The growing of vegetables has been highly encouraged for the provision of micronutrients (Stuijenerg *et al.*, 1997; Klugman, 2005).

In 1999 the Medical Research Council (MRC), the Agricultural Research Council (ARC) and the Ndunakazi Community collaborated to establish a household food production programme, focusing on promoting vitamin A rich food (yellow fruits and vegetables and dark-green leafy vegetables) as a long-term strategy to address the vitamin A deficiency). In this programme nutrition education was provided, focusing on the relationship between vitamin A and the health of children, in an attempt to motivate mothers to participate in the home base food production programme (Faber *et al.*, 2002).

According to Faber *et al.* (2002), the outcome of the programme was

that the home gardening programme had a favourable effect on serum retinol and it also added variety to the diet. It was concluded that the food production programme had a favourable effect on maternal knowledge about dietary intake of yellow and dark-green leafy vegetables and vitamin A status of the children (Faber *et al.*, 2002). Foods of animal origin are said to be the best source of vitamin A, but are very expensive and not affordable by most people in most developing countries (Faber & Benade, 2000). Fruits and vegetables that are rich in vitamin A are more affordable and can be produced at household level. Attempts to establish food-production programmes in South Africa were made, but some were unsuccessful due to the community not committing to the project. A general lack of infrastructure necessary for the nutritional education and agricultural training programmes, which would help to ensure the success of the projects, needs to be addressed (Faber & Benade, 2002).

### 2.3.3 Micronutrient malnutrition and infection

Padbidri (2002) reported that micronutrient deficiencies and infectious diseases often coexisted and exhibited complex interactions leading to the vicious cycle of malnutrition and infections among underprivileged populations of the developing countries. It has also been stated that infections, in turn, aggravate micronutrient deficiencies by reducing nutrient intake, increasing losses and interfering with utilisation by altering the metabolic pathway (WHO, 2003). These interactions are said to be of particular significance in poor children whose micronutrient status is already marginal and they account for a high disease burden in poor communities (Padbidri, 2002).

According to Dogra & Kumar (2003), poor standards of hygiene and overcrowding have an influence on infection. A variety of surveys conducted in developing countries have concluded that skin diseases are very common in children and adolescents, and that infections and

infestations in children are high on the list (Dogra & Kumar, 2003).

### 2.3.4 Effects of malnutrition on resistance to infection

It is argued that dietary deficiencies reduce the body's resistance to infections and adversely affect the immune system (Alderham *et al.*, 2004). Children with Kwashiorkor were shown to be unable to form antibodies to either Typhoid or Diphtheria Typhoid vaccines. Children with protein malnutrition have an impaired antibody response to inoculation with Yellow Fever vaccine. These studies indicate that the malnourished body has a reduced ability to defend itself against infection (Tomkins & Watson, 1989).

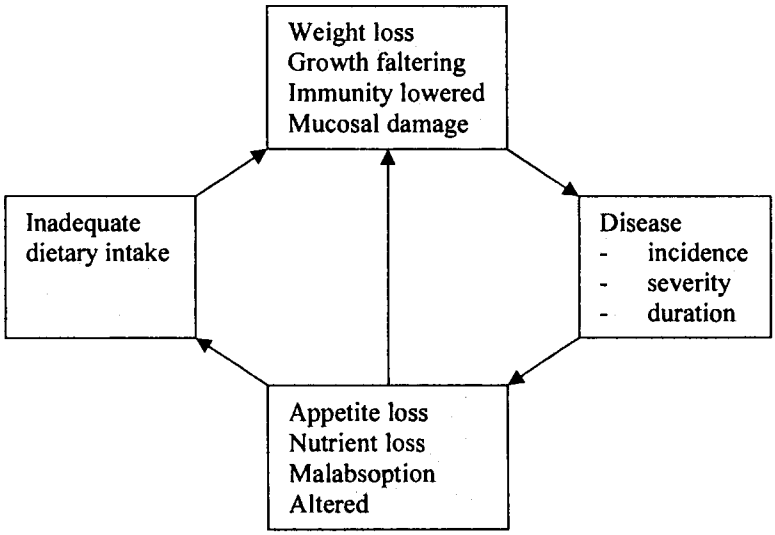


**Figure 2: Dietary intake and disease cycle** (Adopted from Tomkins & Watson, 1989)

Figure 2 shows the interaction between inadequate dietary intake and disease. It also shows how inadequate dietary intake and infection in a vicious cycle accounts for much of the high morbidity and mortality seen in developing countries. When children do not eat enough, their immune system defenses are lowered, resulting in greater incidence, severity and duration of disease. Disease speeds nutrient loss and

suppresses appetite, so sick children tend not to eat, as they should and the cycle continues (Tomkins & Watson, 1989).

## 2.4 NUTRITIONAL STATUS OF CHILDREN

### 2.4.1 Nutritional status of children worldwide

Nutritional status is described as the end result of utilisation of energy by the body, which indicates whether a particular individual is nourished, malnourished or whether there is an imbalance of nutrients. It is said to be the key indicator of both the development and the development potential of a given country (Mann & Trusswell, 2004).

According to UNICEF (2005) the nutritional status is implicated in more than half of the nearly 11 million deaths each year among children under the age of five. It is stated that malnourished children have lowered resistance to infection, they are more likely to die from lack of resistance to infection; they are more likely to die from common childhood ailments like diarrhoea diseases and respiratory infections, and those who survive frequent illness weaken their nutritional status, putting them into a vicious cycle of recurring sickness and faltering growth.

### 2.4.2 Nutritional status of South African children

In South Africa, it is stated that health is the most crucial problem facing children in the country, along with potential care and education. In 1994 the new South Africa Government promised children basic health care. It is also stated that health is very closely tied to race because the racial orientation determines nutrition, medical care, education and housing. In South Africa 8 million out of every 10 million children are black. The remaining 2 million are White, Coloured and Asian children. In many black homes children do not receive some of the basic necessities they require for staying healthy (e.g. water for bathing) (Anderson *et al.*, 2000). The children's health status in South Africa is often influenced by where they live and the income their family earns. The health of

Africans in rural areas, orphaned Coloured and Indian children is as bad as those living in the poorest countries in the world. Low income often lacks financial resources for food resulting in malnutrition and poor health (Steyn, 2000).

The South African Department of Health (2004) reports that malnutrition is a serious problem in South Africa and that it is one of the biggest contributors to childhood illness and death. It is estimated that about 30% of South African children are stunted due to lack of adequate nutrition in the early years of their lives. According to Labadarios *et al.* (1990), the National Food Consumption Survey (NFCS) showed at least 21.6% of children between the ages of 1 and 9 years old were stunted, indicating chronic past under-nutrition. Young children (1-3 years of age) were the most severely affected as well as those living on commercial farms (30.6%), in tribal and rural areas. Underweight affects 10.3% of children aged 1-3 years (18% on commercial farms).Wasting is an indicator of acute current nutrition and is not common in South Africa (3.7% of children between 1 and 9 years).

According to Schmidt *et al.* (2002), one in five South African children suffers from chronic malnutrition. According to the head of Community pediatrics, one in 10 children admitted to Africa's largest hospital, Soweto's Chris Hani Baragwanath, suffer from severe malnutrition.

### 2.4.3 Nutritional status of children in the North-West Province of South Africa

Poverty and unemployment are said to be the two primary contributors towards sub-standard living conditions and it is said to be more prevalent in the rural parts (Leonhauser *et al.*, 2003).

According to the Department of Health in the North-West Province (2004) records of noticeable diseases such as Malaria, Measles,

Tuberculosis and Hepatitis A and B, indicate that the incidence rate per 10 000 for all these diseases is below the national average for South Africa.

According to the State of the Environment Report (2002), the South African Vitamin A Consultative Group (SAVACG) reported the anthropometric status of the children between the ages of 6 months and 6 years in the North-West Province. According to this report 4.5% of the children present were moderate to severely wasted, 13% were moderate to severely underweight and 24.7% were moderate to severely stunt. There was a high level of poverty in the North-West Province and it was recognised that this was due to the low socio-economic status of the province.

## 2.5 FARMING IN SOUTH AFRICA

The Republic of South Africa is said to cover less than 4% of the African continent. South Africa is said to produce 17% of Africa's red meat, 20% of its potatoes, 27% of its wheat, 31% of its sugar, 45% of its corn, 54% of its wool and 1% of its sunflowers (Vorhies, 2004).

According to the report by the Department of Agriculture (2005), South Africa is said to have a dual agricultural economy, comprising of a well-developed commercial sector and a predominantly subsistence-oriented sector in the rural areas. Still in this report, it is reported that primary agriculture contributes about 2.6% of the Gross Domestic Product (GDP) of South Africa and almost 9% of formal employment.

According to the State of the Environment Report (2002), South Africa is said to have one of the best climates for agriculture in Southern Africa. Both the livestock and crop growing are at an advanced stage. A number of crops are grown such as corn, wheat, sunflowers and a variety of fruits and vegetables.

**Table 2.4: National agriculture statistics**

| PROVINCE | NWP | NCP | NP | FS | GP | MP | KZN | EC | WC |
|---|---|---|---|---|---|---|---|---|---|
| **No of commercial farming units** | 7512 | 6730 | 7273 | 11272 | 2342 | 4675 | 5037 | 6338 | 9759 |
| **Total number of workers** | 98349 | 58198 | 121757 | 118866 | 39295 | 101051 | 115496 | 63083 | 198378 |
| **Total gross farming income (R million)** | 3038.3 | 1418.9 | 3934.5 | 4302.0 | 2283.3 | 3972.8 | 4490.3 | 1957.2 | 7533.6 |

Source: PPT Pilots Project in South Africa (2004)

**NWP:** North-West Province
**NCP:** Northern Cape Province
**NCP:** Northern Province (Limpopo)
**FS:** Free State Province
**GP:** Gauteng Province
**MP:** Mpumalanga Province
**KZN:** Kwazulu Natal Province
**EC:** Eastern Cape Province
**WC:** Western Cape Province

In Table 2.4 the number of commercial farming units, total number of workers and the total gross farming income (R million) are illustrated. The highest commercial farming unit is the Free State Province with 11,272, the North-West Province being the third of the 9 provinces with 7,512. The province with the highest total number of workers is Western Cape Province with 198,378, the North-West Province at a total of 9,839, sixth on the list of the 9 provinces. For the total gross farming income, the province with the highest income is Western Cape Province (R7,533.6 million), North-West Province with R3,038.3 million is ranked in position 6.

### 2.5.1 Crops grown in South Africa

The State of Environment (2002) reported that corn is South Africa's most important crop, it is a staple food and also a source of livestock feed. Corn is grown commercially on large farms, and on more than

12,000 small farms, primarily in the North-West, Mpumalanga, Free State and KwaZulu-Natal Provinces.

Wheat production is concentrated at large, highly mechanised farms. Wheat cultivation spreads from the Western Cape where rainfall is reliable, to the Free State and the Eastern Transvaal. Other small grains are grown in localised areas of South Africa. Sorghum, for example, which is native to Southern Africa, is grown in parts of the Free State, as well as in the North-West and the Northern Provinces. Sorghum has been used since prehistoric times for food and brewing purposes. Barley is also grown, primarily in the Western Cape. South Africa also produces peanuts, sunflower seeds, beans and soybeans. The annual production of these crops varies significantly from year to year (State of the Environment Report, 2002).

Fruits, including grapes for wine, earn as much as 40% of agricultural export earnings in some years. Deciduous fruits, including apples, pears and peaches are grown primarily in areas of the Western and the Eastern Cape, where cold winters and dry summers provide ideal conditions for these crops. Almost 1 million tons of deciduous fruits were sold fresh locally or were exported each year in the early 1990s. Pineapples are grown primarily in the Eastern Cape and KwaZulu-Natal. Tropical fruits, especially bananas, avocados, and mangoes are also grown, mainly in the North East and some coastal areas (State of the Environment Report, 2002).

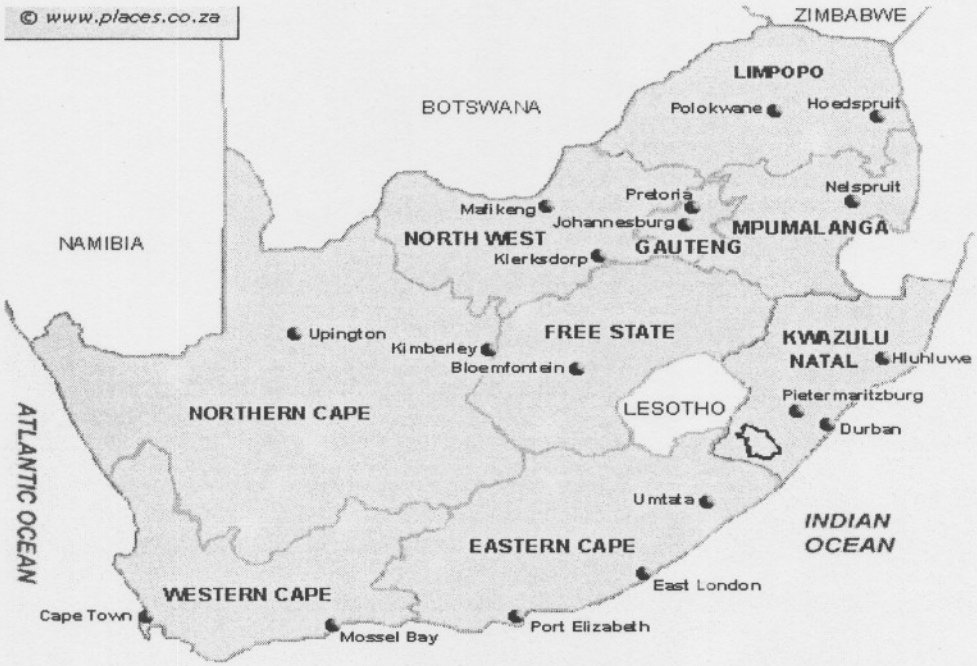


**Figure 3: South Africa's provinces**

### 2.5.2 Farming in the North-West Province of South Africa

The North-West Province is one of the smallest provinces of South Africa. The size of the land is 116,320km$^2$. About 3.5 million people live in the North-West province. It is one of the food baskets of the country. A third of the country's maize is produced in this region, as well as sunflower, groundnuts, fruits, tobacco, cotton and wheat. There are roughly 7,600 commercial farms in the North-West Province (North West Parks and Tourism, 1999). Potchefstroom, Rustenburg and Brits are important irrigation agricultural areas. The province is predominantly rural, with 65.1% of the population living in rural areas and 34.9% in urban areas. The rate of urbanisation is increasing, largely due to lack of employment opportunities in rural areas. Most of the land in the province is privately owned (PPT Pilots Projects in Southern Africa, 2004).

The main economic sectors are agriculture, mining and tourism. It has a

dualistic agricultural economy, which is comprised of a well-developed commercial sector and a predominantly subsistence sector in communal areas. The North-West Province is one of the most important food baskets of South Africa. A third of South Africa's maize is produced here, as well as sunflower, oil, groundnuts, fruit, tobacco and wheat (PPT Pilots Projects in Southern Africa, 2004).

The farming profile in the North-West Province constitutes the following: 30% farm workers, 63% sub-commercial farmers, 3% new-entrant farmers and 4% commercial farmers. At present, despite the relatively small percentage of commercial farmers, this group produces in excess of 80% of the agricultural produce in the province in terms of produce that are traded. Of the total surface area of the North-West Province, approximately 85% (10 million ha) can be classified as agricultural land, with 34% of the agricultural land classified as potentially arable and 66% as grazing land. However, much of the North-West Province consists of affected dry lands (30%), which are characterised by low annual rainfalls and high evaporation rates. These areas are sensitive and highly susceptible to erosion. As a result, irrigation schemes are practised in both arable land and established pastures (PPT Pilots Projects in Southern Africa, 2004).

The agricultural activities in the eastern, wetter parts of the province are mainly livestock and cropping, while extensive livestock and wildlife farming occurs in the drier western parts. Of the total arable land in the North-West Province, less than 3% is under irrigation (PPT Pilots Projects in Southern Africa, 2004). There are three major irrigation schemes located on the Crocodile, Vaal and Harts Rivers respectively. The Vaal-Harts irrigation scheme covers a total area of about 43,700 ha with wheat, maize and groundnuts taking 36%, 23% and 22% respectively of the total irrigated fields (PPT Pilots Projects in Southern Africa, 2004).

more efficient future farm worker. The farm workers were less likely to leave a farm when their children were receiving an education (Anon., 2004).

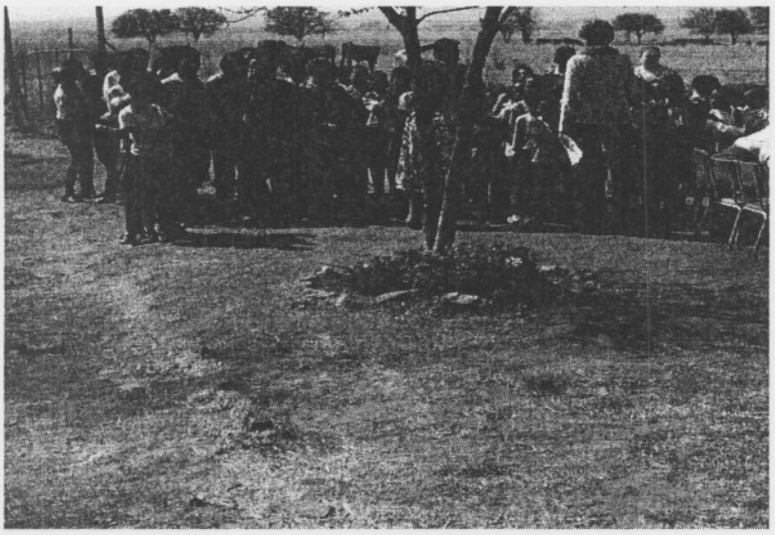

**Figure 4: A farm school in the North-West Province of South Africa**

Under the apartheid Government, the farmer built the school and claimed a subsidy from the Government. It was in the interest of the farmer to have a school on his farm. It has been reported that it kept the children busy while their parents were working in the fields, created an available future labour force and restricted possibilities for children outside the farm (Human Rights Watch, 2004).

## 2.7 VEGETABLE GARDENING

### 2.7.1 History of youth gardens

Gardening for children in Europe began as long ago as 1525. It started at an Italian University as a botanical garden for educational purposes. According to a quote by Comenius such a garden could in the 16$^{th}$ century be characterised by the following aspects: *"A school garden should be connected with every school where children can have opportunities for leisurely gazing upon trees, flowers and herbs and are*

**Table 2.5: North-West Province agricultural land use and land ownership**

| Arable Land (ha) | | | | | Ownership | | |
|---|---|---|---|---|---|---|---|
| Region | % of Agricultural area (ha) | % of Irrigated | % of cultivated pastures | % of Grazing (ha) | % of state trust tribal land (ha) | % of private property (ha) | % of rented or leased land (ha) |
| **Western** | 44 | 8 | 18 | 41 | 52 | 40 | 34 |
| **Central** | 42 | 72 | 72 | 50 | 33 | 49 | 57 |
| **Eastern** | 14 | 37 | 10 | 9 | 15 | 11 | 9 |
| **Total** | **100** | **100** | **100** | **100** | **100** | **100** | **100** |

Source: PPT Pilots Projects in Southern Africa (2004)

In the North-West Province of South Africa about 29% of the land is arable and 71% is grazing land, with the figures in commercial agriculture being 35% arable and 65% grazing land. There are said to be approximately 7,600 commercial farming units in the North-West Province. The main reason for this was an increase in settlements that occurred (Visser *et al.*, 2002).

## 2.6 FARM SCHOOLS IN SOUTH AFRICA

Farm schools are said to be neglected by the South African Government. Farm schools, however, must serve the purpose of providing the only educational opportunity for farm workers' children (Human Rights Watch, 2004).

Historically, education in farm areas in South Africa was designed to assert white domination and African race inferiority and continued under-development. Education was a privilege and not a right for Africans. The purpose of the schools was to create economic value for the farmers and to prevent migration into the cities. These schools, which were attended by African children, were primarily designed to benefit the farmer by providing a level of education that would create a

*taught to enjoy them*". In the 17th century school gardens spread throughout Europe. Early 20th century showed large United State cities incorporating school gardens, including Philadelphia, Cleveland and Washington D.C. In the 20th century the school gardens continued to grow in number (Jekyll, 2001).

Gardening in South Africa is not a new concept for rural South African communities; it long started even before the arrival of Van Riebeeck as far back as 1652. The varieties of crops grown were limited and were mainly restricted to maize, which is one of the staple foods today.

### 2.7.2 Vegetable garden projects in South Africa

There are quite a number of vegetable garden projects all over South Africa. These include the Southern African Student Volunteer (SASVO) project, which organises three-week projects during the December, April and July vacations each year, in which groups of about 15 students are stationed at development projects in communities across the country. The project activities include establishment of vegetables gardens, HIV/AIDS projects and building-renovation projects. One of the main aims of vegetable gardens was to control the micronutrient malnutrition through food diversification among other methods, with emphasis on the three main nutritional deficiencies of public health significance in the country (Department of Health, 2004).

Another project is the Woolworths project, which *inter alia* helps people in the rural areas and the vulnerable, such as orphanages, people living with HIV/AIDS, the poor and children in need (Department of Health, 2004).

Faber & Benade (2002) proved that after implementation of the home gardening project, the mean serum retinal concentration of children in an experimental village was significantly higher than at baseline

(p=0.0078) and compared with that of children from a control village (p=0.005). The study showed that locally produced vegetables can provide households with direct access to foods rich in beta-carotene and that home gardens can make a valuable contribution towards vitamin A intake and ultimately the alleviation of Vitamin A Deficiency (VAD). It is envisaged that incorporating aspects of this study into the Integrated Nutrition Programme will increase the dietary availability and mean consumption of foods rich in vitamin A for population groups at risk.

### 2.7.3 Vegetable gardens at schools

According to the FAO (2004), a review of school garden programmes over the past thirty years, show that the functions of school gardens can be classified as educational and economic in regards to food security.

**Table 2.6: Function of school gardens in educational aims**

| | |
|---|---|
| **Educational aims** | - increase the relevance and quality of education for rural and urban children by introducing into the curricula important life skills,<br>- teach students how to establish and maintain home gardens and encourage the production and consumption of micronutrient-rich fruits and green leafy vegetables,<br>- provide active learning by linking gardens with other subjects, such as mathematics, reading and writing,<br>- contribute to increasing access to education by attracting children and their families to a school that addresses topics relevant to their lives,<br>- improve children's attitudes towards agriculture and rural life,<br>- teach environmental issues, including how to grow safe food without using pesticides,<br>- teach practical nutrition education in order to promote healthy diets and lifestyles,<br>- provide students with a tool for survival at times of food shortages. |

Source: FAO (2004)

**Table 2.7: Functions of school gardens in economic and food security aims**

| | |
|---|---|
| **Economic and food security aims** | - familiarising school children with methods of sustainable production of food that is applicable to their homestead or farms and important for household food security.<br>- promoting income-generation opportunities.<br>- improving food availability and diversity.<br>- enhancing the nutritional quality of school meals.<br>- reducing the incidence of malnourished children attending school.<br>- increasing school attendance and compensating for the loss in transfer of 'life skills' from parents to children due to the impact of HIV/AIDS and the increasing phenomenon of child-headed households |

Source: FAO (2004)

According to FAO (2004) school gardens are said to be an excellent way to teach children about the food they eat. Children have the opportunity to grow fruits and vegetables, and they learn firsthand about different foods. Many programmes also let children prepare and eat the food they grow.

Vegetable gardens at schools are said to help in combating malnutrition among children. This was one of the conclusions at a workshop presented by the South African Agricultural Research Council's Institute in collaboration with the United Nations Society for International Development (UNSID) at the World Food Programme held at Stellenbosch in 2000.

During the same workshop it was reported that gardening positively exercises an impact on environmental attitudes, nutritional attitudes, self-esteem, achievement test scores, attitudes towards school, interpersonal skills, social concerns and student behaviour. It points out that those gardens are a fantastic learning tool for children. A garden

provides a natural laboratory where students can apply the knowledge they learn in the classroom. As far as the aspects of behaviour and values are concerned it makes students responsible for their garden because they realise that plants in the garden live or die depending on their dedication. Through gardens children learn about accountability and respect for living things and the interdependence of all living things. As part of the curriculum, gardens can be used in different subjects. In mathematics, for example, children can use the gardens as a planning tool. The children can figure out how many tomato plants should go into each bed, how far they should be placed apart and the expected harvest. In languages gardens would offer much to talk or write about.

Gardening is said to be an inclusive activity, regardless of ethnicity, background, economic status or academic achievement. Any child can nurture healthy plants and reap a bountiful harvest. A garden can therefore raise the self-esteem of a child who may be struggling in the classroom (Anon, 2003).

# CHAPTER 3: METHODOLOGY

## 3.1 INTRODUCTION

This chapter presents a description of the research design that was used in this study. It also presents the research methods of the study, population and sampling procedures, instruments used for collecting data as well as data analysis procedures that were employed.

## 3.2 STUDY DESIGN

The design of the study included the overall approach taken and detailed information about how the study was carried out. According to De Vos *et al.* (2004), a research design is defined as a plan on how one intends to conduct the research. In this study a longitudinal design was followed since it assessed the dependent variables at baseline and weekly for a period of 15 weeks.

The study technique was a comparative, evaluative intervention using both quantitative and qualitative approaches to gather information. The core approach was quantitative.

### 3.2.1 Evaluation

Evaluation research is regarded as the process of determining whether an intervention has produced the intended result. According to Babbie (2001), evaluation research is a form of applied research that can be conducted from a qualitative, quantitative or combined approach.

### 3.2.2 Intervention

De Vos *et al.* (2004) define intervention research as "studies carried out for the purpose of conceiving, creating and testing innovative human services approaches to prevent or ameliorate problems or to maintain quality of life". In this study, two schools were used. One school

represented the control and the other the experimental school. The experimental school had vegetables included in their school daily feeding programme meals and the control school had limited vegetables included. Anthropometric measures and physical observation were done in both schools during the first five months of this study. The baseline measurements were determined and so were the end measurements after 15 weeks.

### 3.2.3 Quantitative approach

According to several authors (Thomas, 2003; Gall *et al.*, 1997; De Vos *et al.*, 2004), a quantitative approach is a form of research that uses numbers and statistical methods. In a quantitative approach the researcher's role is that of an objective observer and studies are focused on specific questions or hypotheses that ideally remain constant throughout the investigation and could be easily replicated by other researchers. The quantitative paradigm is said to be based on positivism and its aims are to measure the social world objectively, to test hypotheses and to predict and control human behaviour (De Vos *et al.*, 2004). The positivist theory is based on an approach whereby the researcher can discover and measure true facts (Walsh, 2001).

In this study, the quantitative approach was used and the researcher recorded all the information. Weight and height of school-attending learners were taken on a monthly basis and the occurrence of sores as well as the prevalence of infections was monitored on a weekly basis. Everything was recorded numerically every week.

### 3.2.4 Qualitative approach

The qualitative approach involves non-numeric observations. It is emphasised that a qualitative approach focuses on the understanding of the social situation, meaning that individuals attach to behaviour. It is a more subjective approach whereby the researcher aims to understand

and interpret the experience of the individuals involved. This approach allows the respondents to give more information about the topic of investigation (Mursh & Keating, 1996).

The researcher used a limited qualitative approach whereby the teachers (Annexure IV) were given some open ended questionnaires to complete and the learners were interviewed (Annexure III). Their responses were recorded in order to illicit information on their views and opinions towards the vegetable garden project. This type of approach allowed the respondents to give more detailed information about the topic of investigation. Hence this limited qualitative approach was employed to seek some understanding of the learners' and teachers' perceptions and views regarding vegetables included in a meal and the vegetable garden itself.

## 3.3 RESEARCH SETTING

As mentioned in chapter one, this study forms part of a larger FLAGH programme, which was a follow up of the THUSA study. The FLAGH programme consists of a number of different projects and studies aimed at improving the nutritional status and quality of life of black South African farm dwellers in the North-West Province.

Since 2003, six farm schools were selected in cooperation with the Department of Education (those schools most in need) to participate in the vegetable garden project. Two schools in the Rysmierbult district were selected to participate in this study. The vegetable garden at the experimental school started in 2003 and the vegetable garden at the control school was started in 2001, but was not sustained due to many factors. Each year since then efforts have been made to get it started and going again. At the beginning of the school terms in 2004 the head teacher at the control school was not very keen on continuing with the vegetable garden and thus the necessary support was not given.

Therefore the school was used as a control school, as the children were not fed vegetables each day. The other school was used as the experimental school, as the learners there were fed with vegetables from the garden.

## 3.4 POPULATION SAMPLE

The targeted population of the study were all the learners and teachers of the experimental and control schools (Grades 1-7). Teachers were targeted because they have direct contact with learners and therefore can provide reliable and meaningful information on the study.

The study population consisted of a total of one-hundred-and-nine (n=109) learners between the ages of six (6) and eighteen (18). The control school was composed of forty-two (n=42) learners and the experimental school had sixty-seven (n=67).

### 3.4.1 Sampling procedures

All the learners attending both schools were used in the study and the researcher opted for a non-probability sampling approach, also referred to as a purposive sampling approach (Blaxter *et al.*, 1998). The nature of purposive sampling is as such that it increases the likelihood that variability common in any social phenomenon will be represented in the data (Maykut & Morehouse, 1999; Gall *et al.*, 1997). It is clear that purposive sampling is not designed to achieve population validity, but rather to achieve an in-depth understanding of selected individuals.

## 3.5 MEASURING INSTRUMENTS

Four (4) types of instruments were used in the study, namely: anthropometric measures - height and weight to calculate the Body Mass Index (BMI) (Annexure II), observation for sores and infection (Annexure I), a guided face-to-face structured interview for learners (Annexure III) and a questionnaire for teachers (Annexure IV).

### 3.5.1 Anthropometric measures

Anthropometric measures involve obtaining physical measurements of an individual and relating them to standards that would reflect the growth and development of the individual. These physical measurements serve as a component of the nutritional assessment and are useful for evaluating nutritional status. The anthropometric measures are used to monitor the effects of nutritional intervention. Anthropometric data are most valuable when it reflect accurate measurements and are recorded over a period of time (Lee & Nieman, 1996). Anthropometric measures are widely used to monitor infant growth and to estimate child nutritional status. Height and weight are predominantly used to assess the nutritional status of either an individual or a population (Cameron, 1991).

The learners involved in this study were weighed to the nearest 0.5kg on a portable electronic scale (Precision, A&D Company, Japan) in light clothing. The scale was calibrated before each session. Height was measured by making use of an upright stadiometer to the nearest 0.5cm. These activities were performed for the duration of five (5) months (February 2005 to June 2005).

### 3.5.2 Calculated indices

Indices are a combination of measurements necessary for interpretation of measurements, e.g. BMI [weight kg/height ($m^2$)], weight-for-age (WAZ) and height-for-age (HAZ). In children the three most commonly used anthropometric indices to assess growth status are weight-for-height, height-for-age and weight-for-age. There are ways of expressing child growth survey results using Z-scores, the cut-off-based prevalence and the statistics of the Z-scores (mean standard deviation, standard error and frequency distribution).

According to Blossmer & De Onis (1997), the Z-score indicates the

extent of standard deviation at a certain data point from the medians. It is the extent of standard deviation to which the learners differs from the medium, either positive (greater than the average group) or negative (less than the average for that group). In this database height-for-age (HAZ) and weight-adjusted-for-age (WAZ) and weight-for-height (BMI) was interpreted by using Z-scores. The Z-scores are widely recognised as the best system for analysing anthropometric data, especially at an individual level, because there is substantial recognition that Z-score usage renders the most appropriate description of malnutrition, health and nutrition centres (Blossmer & De Onis, 1997).

The WHO Global Database on Child Growth and Malnutrition (malnutrition indicators) uses a Z-score cut-off point of <-2 standard deviation (SD) to classify low weight-for-age, low height-for-age and low height as moderate and severe undernutrition and <-3 SD to define severe undernutrition. The cut-off point of >+2 SD classifies high weight-for-height as overweight in children (WHO, 1997).

The Z-score system expresses the anthropometric value as a number of standard deviation or Z-score below or above the reference mean or median value (Blossmer & De Onis, 1997).

Formula for calculating Z-score (Blossmer & De Onis, 1997).

$$\text{Z-score (SD-score)} = \frac{\text{(observed value)} - \text{(median value of the reference population)}}{\text{Standard Deviation value of reference population}}$$

Another index that was used was the BMI. The BMI in children is used to assess underweight, overweight and risk of overweight. Children's body fatness changes over the years as they grow. BMI is a calculation that uses a child's height, age and weight to estimate how much body fat the child has (Department of Health and Human Service, 2005).

The formula for calculating BMI is: $BMI = \frac{\text{Weight (kg)}}{\text{Height m}^2}$

### 3.5.3 Observation

The presence of sores and the prevalence of infection were observed and recorded on weekly visits (Annexure I).

### 3.5.4 Structured interviews

According to the Longman Dictionary of Contemporary English (LDCE) (2000), an "interview" is explained as a meeting (usually face-to-face) where interrogation by a representative (in the case of this study the researcher) takes place and it can be conducted individually or in group context.

A structured face-to-face interview guide was used for learners involved in this study (Annexure III). The researcher wrote down the responses while interviewing the students. The face-to-face interviews were conducted only from Grades 4 to 7, because they were able to express themselves better than the younger children.

### 3.5.5 Questionnaires

According to Walsh (2001), questionnaires are easy to analyse and they also enable the researcher to obtain factual information and present a variety of options. A questionnaire is an appropriate way of collecting information quickly (e.g. more than one person at the same time) and is relatively cheap. Participants need to be literate to a certain extent and questionnaires can also be adapted where necessary. There are disadvantages of using questionnaires such as respondents failing to respond appropriately. Respondents may also be reluctant and may therefore, provide irrelevant information or fail to submit the completed questionnaire (Walsh, 2001). For this study questionnaires were distributed among teachers to complete for a period of one week.

A structured questionnaire was developed (Annexure IV) for the teachers. The aim of the questionnaire was to find out the effects of vegetables in the school feeding programme on the school attendance, the prevalence of infection in children as viewed by the teachers and the teachers' attitudes towards the vegetable project.

## 3.6 VALIDITY AND RELIABILITY OF INSTRUMENTS

### 3.6.1 Validity

Validity as defined by De Vos *et al.* (2004) and Bell (2005) is an instrument, which actually measures the concept accurately. Walsh (2001) refers to validity as the issue of whether the data collected is a true picture of what is being studied. Wilkinson (2000) refers to validity as the extent to which the measure achieved its aim. Validity according to Bailey (1987) is said to have two implicit components. The first is that the instrument actually measures what it is meant to and the second is that the measures are accurate, that is, reproducible.

According to De Vos *et al.* (2004) and Mertens (1997), there are a number of validities, such as content, face, criterion and construct validity. Content validity is concerned with sampling adequacy of the content (e.g. topics) of an instrument. Face validity refers to how the instrument appears. Construct validity determines the degree to which an instrument successfully measures a theoretical construct. It is said to be difficult to measure as the construct can not be seen, felt or heard and cannot be measured directly, as its existence must be inferred from the evidence at hand. The criterion or criterion-related validity involves multiple measurements and is established by comparing scores on an instrument with an external criterion (De Vos *et al.*, 2004).

The validity in this study was obtained when the researcher used different measures, such as anthropometric measures, observation, questionnaires and interviews to find information on the nutritional

status of children in relation to the consumption of a vegetable meal on a regular basis.

### 3.6.2 Reliability

Several authors (Wilkinson, 2000; De Vos *et al.*, 2004; Blaxter *et al.*, 1998; Bell, 2005) define reliability as the accuracy or precision of an instrument, as the degree of consistency or agreement between independently derived sets of scores and yielding the same or similar results if repeated by different researchers. In summary, according to the authors, reliability means stability, consistency, predictability, accuracy, reproducibility, repeatability and generalibility. The researcher did all the anthropometric measures, the observations, conducted the questionnaires and interviews herself to ensure reliability and repeatability.

### 3.6.3 Pre-testing of instruments

In order to determine the above, the instruments were pre-tested. The questionnaires and the structured interview were piloted. Piloting, according to Blaxter *et al.* (1998), is the process whereby one tries out the research techniques and methods one has in mind, to see how well they work in practice and if necessary to modify the plans accordingly. Prior to distributing them among the teachers, the questionnaires for the teachers were piloted among colleagues in the Nutrition Department (Potchefstroom Campus) and also colleagues from the Consumer Science Department (Potchefstroom Campus). This was mainly done to facilitate the detection of ambiguities, the clarification of whether or not the instrument measured what it was intended to measure, as well as to determine consistency of the instruments, and to establish its content and face validity.

### 3.6.4 Triangulation

According to Mertens (1997) the term "triangulation" involves reviewing information that has been collected from different sources or by means of different methods for consistency of evidence across sources of data. De Vos *et al.* (2004) explain triangulation as a method used by the researcher to seek out different types of sources that can provide insights about the same events or relationships.

According to De Vos *et al.* (2004), there are different types of triangulation, e.g. triangulation of measures, triangulation of observers, triangulation of theory and triangulation of methods. Triangulation of measures means measuring something, as well as its possible different aspects, in more than one way. Another type of triangulation is that of observers. It involves the use of multiple observers or researchers where they add alternative perspective, background and social characteristics and will reduce the limitations. Combining data from a variety of observers is more likely to yield a more complete picture of the setting. There is also triangulation of theory that uses different frames of references in analysing the same set of data. Lastly triangulation of methods, means combining qualitative and quantitative styles of research and data (De Vos *et al.*, 2004).

In this study, the use of the triangulation of method was employed, while using different instruments such as anthropometry and observations to determine the effects that a vegetable meal on regular basis would have on the learners.

## 3.7 DATA COLLECTION

On a weekly basis, the researcher visited the schools to collect data on the prevalence of infections, the presence of sores and to check the attendance register. Anthropometric measures (height and weight) were taken and recorded by the researcher on a monthly basis.

## 3.8 DATA ANALYSIS

Data analysis is the process of bringing order to data by focusing on key issues, themes and categories, rather than merely presenting a description of the raw data (Vulliamy & Webb, 1992). According to De Vos *et al.* (2004), the purpose of data analysis is to reduce data to an intelligible and interpretable form so that the relations of research problems can be studied and tested, especially with a view to comparing and drawing conclusions.

To analyse the data, the Statistical Analysis System (SAS) was employed (2005, SAS Institute Inc., SAS OnlineDoc®, Version 9.1, Cary, NC). Differences at baseline between the two schools were calculated using *t*-tests. Differences within schools between baseline and after 15 weeks were calculated using paired *t*-tests. The Analysis of Covariance (ANCOVA) procedure, in which was adjusted for baseline differences were used to compare the results between the two schools after 15 weeks.

A *p*-value of $<0.05$ was regarded as statistically significant. According to Steyn & Ellis (2004), the *p*-value is a criterion giving the probability that the obtained value (or more extreme) could be obtained under the assumption that the null hypothesis (e.g. no difference between the population mean) is true. A small *p*-value (e.g. smaller than 0.05) is considered as sufficient evidence that the result is statistically significant. Statistical significance does not necessarily imply that the result is important in practice, as these tests have a tendency to yield small *p*-values (indicating significance) as the sizes of the data sets increase (Steyn & Ellis, 2004). A difference of practical significance was indicated by calculating the effect size (*d*-value) by using the following formula.

$$d = \frac{|\bar{x}_1 - \bar{x}_2|}{s_{max}}$$

Cohen (1988) gives the following guidelines for the interpretation of the effect size in the current case:

(a) small effect: $d<0.5$;

(b) medium effect: $d>0.5<0.8$;

(c) large effect: $d>0.8$.

In this study, a value of $d \geq 0.8$ was considered as being of practical significance.

## 3.9 STUDY APPROVAL

The ethical approval for the study has been obtained from the Ethics Committee of the North-West University (Potchefstroom Campus) for the FLAGH study (Nr 00M21).

According to Mertens (1997); Gall *et al.* (1997); Walsh (2001) and De Vos *et al.* (2004), ethical guidelines in research are needed to guard against obvious atrocities as, protection of rights, harm, positive contribution, etc. Problems such as deception and invasion of privacy must be given serious consideration in research planning.

## 3.10 STUDY LIMITATION

As already addressed in point 1.9 of Chapter 1, the harsh climate of the North-West Province is known for very hot summers and frosty winters, so the vegetables only flourished during certain times of the year (January to May and again late September to November). The enthusiasm and the commitment of teachers to participate would determine the success of the vegetable garden project and influence the enthusiasm of learners. The study period of 15 weeks could be extended, as it could be considered too short a period of time for a

feeding trial, especially as the focus of this study was on positive development of physical and mental abilities of children to be brought about by additional nutrition, to a great extent measured by growth and body weight, both of which are processes that do not take place overnight. One of the practical limitations accompanying the research was the lack of care for the gardens during the school holidays, rendering the garden useless and requiring renewed efforts to re-establish it.

# CHAPTER 4: RESULTS

## 4.1 INTRODUCTION

The following chapter comprises of the results of this study. The results are given in five Sections: 4.2 contains the results of the school attendance, 4.3 the results of the anthropometric measures, 4.4 the results of the infection levels, 4.5 the results of the occurrence of sores and 4.6 the results of the responses obtained from the questionnaires. The menus indicating what was fed to the children in both schools are included in Annexure V and the vegetables harvested have been listed in Annexure VI.

### 4.1.1 School attendance

The population sample consisted of forty-two (42) learners for the control school and sixty-seven (67) for the experimental school. The records included in this study represent attendance from the 21st February until 4th of June 2005. Only 13 of the 15 weeks have been recorded as two of the fifteen weeks were allocated to school holidays, (weeks 5 and 6). Attendance was calculated by determining the total number of days actually attended by the learners and the number of school days possible to attend. The number of possible school days was calculated by using the number of school days per week and multiplying it by the number of children, e.g. for the month of February there were 42 students and the possible school days were five (n=42x5=210 days). The actual attendances for the same week were counted to obtain the total of attendances for the week. The percentage of attendance was calculated by dividing the actual school attendance by the possible school attendance and multiplying it by 100.

**Table 4.1: School attendance at the control school from week 1 to 15**

| WEEKS | 1 | 2 | 3 | 4 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| n=42 | Days n=5 | Days n=5 | Days n=5 | Days n=5 | Days n=5 | Days n=5 | Days n=5 | Days n=4 | Days n=4 | Days n=5 | Days n=5 | Days n=5 | Days n=5 |
| Possible School Attendance | 210 | 210 | 210 | 210 | 210 | 210 | 210 | 168 | 168 | 210 | 210 | 210 | 210 |
| Actual School Attendance | 208 | 203 | 206 | 201 | 204 | 205 | 195 | 160 | 161 | 160 | 202 | 204 | 198 |
| Percentage | **99** | **96.6** | **98** | **95.7** | **97** | **97.6** | **92** | **95.2** | **95.8** | **95.2** | **96.9** | **97** | **94** |

(24thFebruary to 4th June 2005)

Table 4.1 show the school attendance of the learners from the control school. The actual school attendance ranged from 92% (week 9) to 99% (week 1). The school attendance at the control school was in general regarded as good.

**Table 4.2: School attendance at the experimental school from week 1 to 15**

| WEEKS | 1 | 2 | 3 | 4 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Week 1-4 n=70 Week 7-15 n-67 | Days n=5 | Days n=5 | Days n=5 | Days n=5 | Days n=5 | Days n=5 | Days n=5 | Days n=4 | Days n=4 | Days n=5 | Days n=5 | Days n=5 | Days n=5 |
| Possible School Attendance | 350 | 350 | 350 | 350 | 335 | 335 | 335 | 268 | 268 | 335 | 335 | 335 | 335 |
| Actual School Attendance | 281 | 278 | 316 | 276 | 274 | 253 | 259 | 206 | 206 | 286 | 274 | 287 | 280 |
| Percentage | **80.2** | **79.4** | **90.2** | **78.8** | **81.8** | **75.5** | **77.3** | **76.9** | **76.9** | **85.4** | **81.8** | **85.7** | **83.5** |

(24thFebruary to 4th June 2005)

Table 4.2 show the school attendance of the learners registered at the experimental school. Attendance had the lowest percentage of 75.5 (week 8) and the highest of 90.2 (week 3). Three learners left school during the school holidays (weeks 5 and 6). One learner was from Grade 6 and the other two were from Grade 7.

### 4.1.2 Anthropometric measurements

The calculated Z-scores for BMI for age, weight for age and height for age for the children in both schools are given in Tables 4.3 to 4.6.

**Table 4.3: Mean Z-scores for children from the control and experimental schools at baseline (Week 1)**

| | Control school n = 42 | | Experimental school n = 67 | |
|---|---|---|---|---|
| **Variable** | **Mean Z-score** | **SD** | **Mean Z-score** | **SD** |
| Height | -0.99 a | 1.3 | -1.55 a | 1.2 |
| Weight | -1.37 b | 0.9 | -1.86 b | 1.3 |
| BMI | -1.37 | 2.5 | -1.20 | 1.0 |

Means with the same symbol differ significantly from each other ($p<0.05$)

Table 4.3 indicates that the Z-score for the height for age of the children in the control school at baseline (-0.99) differed statistically significantly from those in the experimental school (-1.55) ($p=0.03$), this was of low practical significance ($d=0.43$). The Z-score for weight for age of the children in the control school (-1.37) also differed statistically from those in the experimental school (-1.86) ($p=0.04$), this was also regarded as of low practical significance ($d=0.53$). The Z-score for BMI for age of the learners in the control school (-1.37) also differed from those in the experimental school. However these differences were of neither statistical ($p=0.61$) or practical ($d=0.07$) significance.

**Table 4.4: Mean Z-scores for children from the control and experimental schools at week 15 (baseline adjusted)**

| | Control school n=42 | Experimental school n=67 | |
|---|---|---|---|
| **Variable** | **Mean Z-score** | **Mean Z-score** | **Root MSE** |
| Height | -1.31 | -1.48 | 0.78 |
| Weight | -1.44 a | -1.65 a | 0.48 |
| BMI | -0.78 b | -1.12 b | 0.88 |

Means with the same symbol differ significantly from each other ($p<0.05$)

The results in Table 4.4 above show the mean Z-score for learners of the control school and the experimental school at week 15 for height for age, weight for age and BMI for age. The Z-score for weight for age of learners attending the control school indicate a difference of (-1.44)

(Root MSE=0.48) from the weight for age of learners attending the experimental school (-1.65), and this was regarded as a statistically significant difference. These differences were also of practical significance ($d$=0.78). The Z-score for BMI for age of the learners in the control school (-0.78) differed significantly from that of the learners in the experimental school (-1.12) (Root MSE=0.78). However, this was of low practical significance ($d$=0.49).

**Table 4.5: Mean Z-scores for children from the control school at baseline and at week 15**

| | Baseline: week 1 n=42 | | End: week 15 ** n=42 | |
|---|---|---|---|---|
| **Variable** | **Mean Z-score** | **SD** | **Mean Z-score** | **Root MSE** |
| Height | -0.99 | 1.3 | -1.31 | 0.78 |
| Weight | -1.37 a | 0.9 | -1.44 a | 0.48 |
| BMI | -1.37 | 2.5 | -0.78 | 0.88 |

Means with the same symbol differ significantly from each other ($p$<0.05)
** Means adjusted for baseline

Table 4.5 indicates the results of the control school at baseline and at the end (week 15) of the study for the three variables (height, weight and BMI). The Z-score for weight for age at baseline was -1.37 and in the end it was -1.44. These differences in height and weight at baseline were of statistical significance (Root MSE=0.48), but of low practical significance ($d$<0.05). For BMI for age the Z-score at baseline was -1.37 and in the end it was -0.78. These differences were of no significance due to large individual differences (Root MSE=0.88).

**Table 4.6: Mean Z-scores for children from the experimental school at baseline and at week 15 after the feeding intervention**

| | Baseline: week 1 n=67 | | End: week 15 n=67 | |
|---|---|---|---|---|
| **Variable** | **Mean Z-score** | **SD** | **Mean Z-score** | **Root MSE** |
| Height | -1.55 | 1.2 | -1.48 | 0.78 |
| Weight | -1.86 | 1.3 | -1.65 | 0.48 |
| BMI | -1.20 | 1.0 | -1.12 | 0.88 |

Means with the same symbol differ significantly from each other ($p$<0.05)
** Means adjusted for baseline

Table 4.6 illustrates the results of the Z-scores at baseline and the end of week 15. The figures applied to the learners of the experimental school for the three variables, height for age, weight for age and BMI for age. No statistical or practical significance were found.

### 4.1.3 Clinical examination of infections

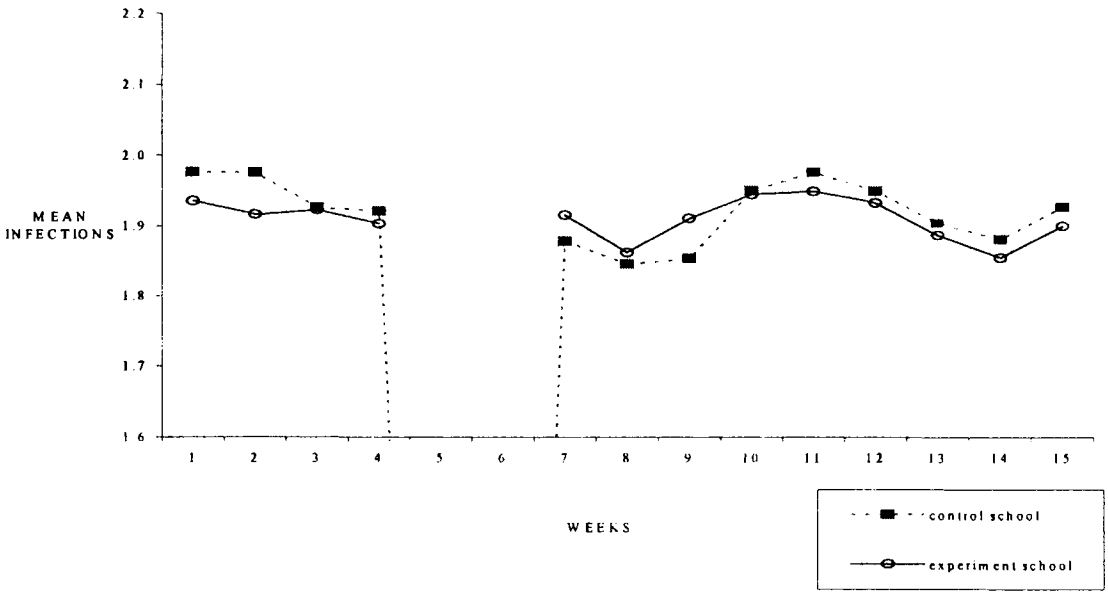


**Figure 5: Mean infection level for control and experimental schools**

Figure 5 show the infection levels of the two schools from week 1 to week 15. The indicators for infections used in the study were cold, flu, running nose and a cough. At baseline (week 1), there was no significant difference in the infection levels between the two schools ($p$=0.63). At week 15 (end of study), there was also no statistical significant difference between the two schools ($p$=0.63). Between week 1 and 15, the mean infection level in both schools, showed no statistically significant changes ($p$=0.32). There was, however, a statistically significant difference for the experimental school, although the difference was of no practical significance ($d$=0.13). Overall, throughout the 15-week period, the control school had a higher

infection level than the experimental school.

### 4.1.4 Clinical examination of skin sores

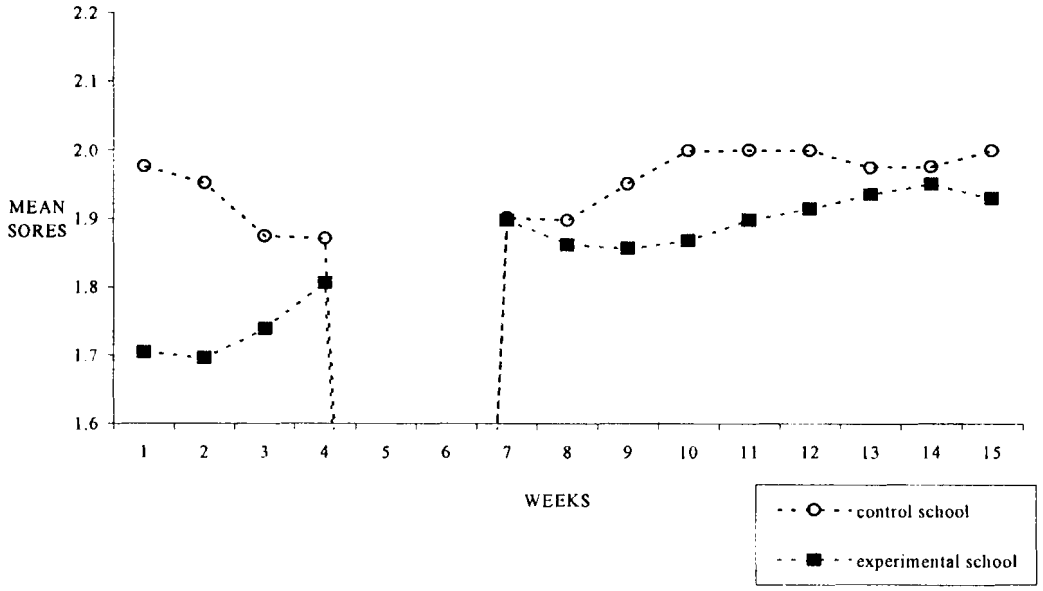


**Figure 6: Mean sore level for control and experimental schools**

At baseline (week 1) there was a statistically significant difference in the occurrence of sores between the two schools ($p$=0.00<0.05). A mean value was calculated with the number 1 indicating sores and number 2 indicating no sores. At baseline the mean value for the control school was 1.90 and for the experimental school it was 1.70. At week 15 there was no statistical difference between the two schools ($p$=0.42). Over the 15 week period the experimental school improved from a mean value of 1.70 at baseline to a mean value of 1.94 at week 15 which was regarded as highly significant ($p$=0.00).

### 4.1.5 Structured face-to-face interviews with learners

The following are the results of the face-to-face interviews at both the control and the experimental schools. Only Grades 4 to 7 learners participated in the interviews, the reason being that they were able to express themselves better than the younger learners in grades 1 to 3. The interviews were aimed at getting the learners' perceptions and views with regard to a vegetable meal and the garden as well.

**Table 4.7: Learners' perceptions towards vegetables**

| Question | Possible answer | Control school n=21 | % | Experimental school n=23 | % |
|---|---|---|---|---|---|
| **1.** Which vegetable grown in the school garden do you like the most? | Cabbage | 7 | 33.3 | 1 | 4.3 |
| | Spinach | 2 | 9.5 | 5 | 21.8 |
| | Tomatoes | 1 | 4.8 | 8 | 34.8 |
| | Carrots | 9 | 42.9 | 9 | 39.1 |
| | Beetroot | 2 | 9.5 | 0 | |
| | Other specify | | 0 | 0 | |
| **2.** How do you like to eat the carrots? | Raw | 13 | 61.9 | 15 | 65.2 |
| | Cooked | 8 | 38.1 | 8 | 34.8 |
| **3.** Do you like the way the vegetables are cooked at school? | Yes | 20 | 95.2 | 23 | 100 |
| | No | 1 | 4.8 | | |
| **4.** How often would you like to eat vegetables at school? | Every day | 7 | 33 | 9 | 39.1 |
| | Once a week | 4 | 19.0 | 2 | 8.7 |
| | Twice a week | 4 | 19.0 | 9 | 39.1 |
| | Thrice a week | 4 | 19.0 | 3 | 13.0 |
| | Four times | 2 | 9.52 | 0 | |
| | None | 0 | 0 | 0 | |

In both the control and experimental schools the learners liked carrots most and at both schools the learners preferred to eat the carrots raw rather than cooked. The majority of learners in the control school liked the way the vegetables were cooked at school (95.23%) and only 4.76% did not like the way the vegetables were cooked. In the experimental school all learners liked the way the vegetables were cooked at school. The majority of learners at the control school would like to eat vegetables at school every day (61.9%) and the same tendency could be detected in the experimental school (65.2%).

**Table 4.8: Observation of own body changes by the learners**

| Question | Possible answers | Experimental school n=23 | % |
|---|---|---|---|
| **5.** Have you noticed any changes in your body ever since the introduction of vegetables in the diet? | Yes<br>No | 7<br>16 | 30.4<br>69.6 |

The learners in the experimental school claimed to have noticed changes in their own bodies (30.4%), such as feeling healthy and that their sores have been healing since the introduction of a vegetable meal and in the experimental school 69.6% of the learners said they did not notice any changes in their bodies.

**Table 4.9: A vegetable meal and school attendance**

| Question | Possible answers | Control school n=21 | % | Experimental school n= 23 | % |
|---|---|---|---|---|---|
| **6.** If vegetables were to be stopped/excluded in the school-feeding programme, would you continue coming to school? | Yes<br>No | 21 | 10<br>0 | 23 | 10<br>0 |

All the children in both schools said they would come to school even if the vegetable meal would be excluded, since they came to school to study and not for food.

**Table 4.10: Views on the vegetable garden**

| Question | Possible answers | Control school n=21 | % | Experimental school n= 23 | % |
|---|---|---|---|---|---|
| 7. Do you like helping in the school garden? | Yes | 19 | 90.5 | 23 | 100 |
| | No | 2 | 9.5 | | |
| 8. Are you prepared to produce more vegetables in the school garden and sell, so to assist in the school with money? | Yes | 19 | 90.5 | 23 | 100 |
| | No | 2 | 9.5 | | |
| 9. Would you like to have a vegetable garden at home? | Yes | 19 | 90.5 | 22 | 95.7 |
| | No | 2 | 9.5 | 1 | 4.4 |

All the learners (100%) in the experimental school concluded that they liked helping in the school garden, while 90.5% of the children in the control school said they liked helping in the garden. To the question of whether they were prepared to produce more vegetables in the school garden, the majority in the control school (90.5%) said they were prepared to produce more vegetables in the school garden and all children in the experimental school responded positively. This clearly indicated that children were prepared to work or help in the school garden. The majority of children in both schools would like to have a vegetable garden at home.

### 4.1.6 Questionnaires with teachers

The following are the results of the questionnaire given to teachers. The aim of the questionnaire was to find out what the effects of adding vegetables to the school-feeding programme might be with regard to the school attendance, the prevalence of infections in the children as well as to determine the teachers' views about the programme.

**Table 4.11: Students views towards vegetables as observed by the teachers**

| Question | Possible answers | Control school n=2 | % | Experimental school n= 2 | % |
|---|---|---|---|---|---|
| **1.** How did the students respond to the introduction of vegetables in the school-feeding programme? | Positive<br>Negative | 2<br>0 | 100 | 2<br>0 | 100 |
| **2.** In your opinion do the students like vegetables in their meal? | Yes<br>No<br>Some | 1<br>0<br>1 | 50<br><br>50 | 0<br>0<br>2 | <br><br>100 |
| **5.** Do you think the students are aware of the importance or the nutritive value of vegetables? | Yes<br>No<br>Partly | 2<br>0<br>0 | 100 | 1<br>0<br>1 | 50<br><br>50 |
| **3.** Do the students like the way vegetables are prepared in the school? | Yes<br>No | 2<br>0 | 100 | 2<br>0 | 100 |

All teachers in both the control and intervention schools said the students responded positively to the introduction of vegetables in the school feeding programme. For the second question regarding whether the students were in favour of the vegetable meal, one teacher of the control school said the students liked vegetables in their meal, another teacher who teaches the lower grades (Grade 1-3) said only some liked the vegetables in their meal. Those who did not like vegetables were sometimes seen throwing them away. In the intervention school both teachers said the learners certainly seemed to appreciate and enjoy the vegetables, as was proved by the way they all ate what was presented to them. All the teachers of both the control and the experimental schools said the learners seemed to be satisfied with the way the vegetables were being prepared, by the way the learners ate (finished) the food during feeding time. Both the teachers of the control school remarked that the learners were aware of the importance or nutritional value of vegetables and pointed out that making them aware was part of the school curriculum. From the experimental school, one teacher said the students

were aware of the importance or nutritional value of vegetables. The other teacher who teaches the upper grades (Grade 4-7) said only some students was aware of the importance or nutritional value of vegetables.

**Table 4.12: School attendance as observed by the teachers**

| Question | Possible answers | Control school n=2 | % | Experimental school n= 2 | % |
|---|---|---|---|---|---|
| **4.** Has the introduction of vegetables affected the following? | | | | | |
| i) School attendance | Positively | 1 | 50 | 2 | 100 |
| | Not really | 1 | 50 | | |
| | Negatively | | | | |
| ii) Students' health conditions? | Positively | 1 | 50 | 2 | 100 |
| | Not really | 1 | 50 | | |
| | Negatively | | | | |

The results regarding whether the introduction of vegetables had positively affected the school attendance revealed the following: one teacher (Grades 1-3) of the control school was of the opinion that it had positively affected the school attendance while the other said it had not really affected the school attendance. In the experimental school both teachers agreed that the introduction of the vegetables had affected the school attendance positively. The issue of student health, whether the vegetables had an effect or not, revealed the following: in the control school one teacher (Grades 4-7) agreed that the vegetables had a positive effect, while the other said it had not really had an effect. Both teachers of the experimental school agreed that the learners' health had improved since the introduction of the vegetables in the school feeding programme.

**Table 4.13: Perception of students towards the school garden as viewed by the teachers**

| Question | Possible answers | Control school n=2 | % | Experimental school n= 2 | % |
|---|---|---|---|---|---|
| **6.** Are the students willing to help in the school garden? | Yes<br>No<br>Some | 2<br>0<br>0 | 100 | 1<br>0<br>1 | 50<br><br>50 |
| **7.** What are your feelings about the production of vegetables in the school? | Positive<br>Negative | 2<br>0 | 100 | 2<br>0 | 100 |
| **8.** Are you willing to assist and motivate the students in order to improve the income of the school? | Yes<br>No | 2<br>0 | 100 | 2<br>0 | 100 |

The results according to Table 4.13 showed that both teachers of the control school regarded the learner as willing to help in the school garden. In the experimental school one teacher (upper grades) said some students were willing to help in the garden and some were not willing to help in the garden. The teacher who teaches the lower grades (Grade 1–3) said all students in her classes, were willing to help in the garden. The results on the teachers' feelings about the production of vegetables and their willingness to motivate and encourage the learners to commit themselves to the growing of vegetables in a school garden, showed that all the teachers of both schools (control and experimental) were in favour of the production of vegetables in the school garden and that they were willing to assist and motivate the learners in order to improve the income of the school.

# CHAPTER 5: DISCUSSION

## 5.1 INTRODUCTION

In this chapter the results will be discussed, interpreted and compared to relevant literature. The main objectives of the study were to investigate the influence that a vegetable-enriched diet, as made possible by a gardening project at school, might exercise on school attendance, the prevalence of infections and the occurrence of sores in the school-attending learners of both the experimental and the control schools. The investigation was aided by a structured interview with the learners and a questionnaire to be completed by the teachers. The results will be discussed accordingly.

### 5.1.1 School attendance

The control school had a better school attendance than the experimental school throughout the five-month period. This was probably due to the fact that most of the learners attending the control school lived next to or quite near the school premises. The experimental school's attendance percentage was lower, ranging from 78.5% to 85.5%. Most of the learners attending the experimental school live some distance from the school and many of them travel to school by bicycle, as the number of bicycles at the school indicated.

The majority of learners who were absent from school, e.g. the experimental school, in most of the cases proved to be from the lower grades (Grades 1-3). Some reasons for being absent included ill health, weather conditions (like raining that caused the river to be too dangerous to cross) and attending funerals. In many cases no reasons were recorded. In some African societies, attending funerals would mean being at the deceased's place of residence until the traditional funeral ceremonies had been completed and this would usually take up to a

week. In the upper grades (Grades 4-7) the reasons provided by absentees also included the weather conditions and most did not offer any particular reasons for being absent.

One of the factors contributing to learners being absent from school, and this was confirmed by the learners themselves, was the long distance they had to travel to school. Anon (2004) states that farm schools are often quite a distance away from the homes of many of the learners attending them. Some learners stay on the farm where the school is located and some come from neighbouring farms. The lack of services in rural areas results in public transport not being ordinarily available for school children to use. Lack of transport has an impact on truancy, non-attendance and dropout rates.

The absence from school can also be caused by other factors, e.g. circumstances at home or at school. In some cases pupils themselves lack the necessary enthusiasm and motivation. The home situation may be that parents display an attitude of indifference as far as schooling is concerned, where parents do not value education. In some home situations children are required to assume certain responsibilities which might interfere with their school-related activities. Cases of reluctance to go to school because of the presence of bullies at school have also been reported. It would serve a good purpose for schools to find out more about the causes and reasons for absence so that these existing problems can be addressed.

According to several authors (Hall *et al.*, 2001; London *et al.*, 1998) farm workers are said to have the lowest rates of literacy and that one of the reasons why many black South Africans work on the farms, is that most of them have never received formal basic education. The absence of learners from school could be due to some parents who do not value the essence or importance of education, thus are less concerned about

whether their children attend school or not.

The Department of Education would prefer, and justifiably so, that school attendance be as good as possible. The communities themselves could render a valuable contribution in this respect, especially by means of a sound integrated association consisting of teachers and parents or caretakers.

Another reason given for being absent was ill health. The anthropometric results had shown that the learners from both the experimental school and the control school were below the reference groups. During a study conducted in Nepal by Mooke & Leslie (1986), they found that the probability of children attending school was 5% for stunted children versus 27% for children of normal status. Learners of subnormal physical development might be more susceptible to ill health, which would naturally result in less regular school attendance.

From literature, it is recognised that regular school attendance is a key factor in raising pupil attainments and improving future life opportunities for young learners. Learners who are persistently absent from school tend to do poorly in examinations and are consequently less likely to secure regular employment and more likely to fall victim to anti-social behaviour and crime (Del Rosso, 1999). According to Hulet & Galal (2003), undernourished children have lower school attendance, shorter attention span, lower performance scores and more health-related problems than the well-nourished children. From the results in this study, children did not regard the vegetable meal at school the reason for their attendance. However, some of the teachers at both schools observed this meal to benefit school attendance.

### 5.1.2 Prevalence of infection

The Government, through the Department of Education, provided

certain foodstuffs to schools four times a week and allocated according to the number of learners attending a specific school, amounting to a total of R1.07 per learner per day. The school then would decide on the days that feeding would not take place (Annexure V). The control school had decided on a Friday and the experimental school on a Wednesday. Through conversation with teachers at the experimental school, it was noticed that some learners came to school on an empty stomach and it seemed that the only meal they got was the one provided by the school. The reason for choosing Wednesday as a non-feeding day was that it was a midweek day and that there was a possibility that some learners, during the weekends, had little or no food at home. The choice of a Wednesday will then shorten the time without food.

The results at baseline for both control and experimental schools showed that the Z-scores for all three of the anthropometric values indicated that the learners were undernourished. The experimental school's Z-scores for height for age indicated -1.55, weight for age -1.86 and the BMI for age was -1.20. At the control school the Z-score for height for age was -0.99, weight for age -1.37 and the BMI for age was -1.37. These scores indicate that the children at the experimental school were more undernourished than those at the control school.

Farm communities in general have been characterised by poverty, poor living conditions, inadequate housing, poor sanitation, poor health and inadequate water supply (London *et al.*, 1998). These characteristics could have contributed to the learners being malnourished and not having enough food. It has been found in a number of studies that the farm workers living on and working on farms have been identified as the poorest and most vulnerable population groups of the South African society (Leonhauser *et al.*, 2003). Farm dwellers account for 45.8% of the population classified as rural (May, 1998).

The results for the both schools at the end of the study (week 15) indicated that there was no statistical significant difference in any of the variables (height, weight and BMI). At baseline in the control school, the mean Z-score for weight for age was -1.37 and after 15 weeks it was -1.44. The mean Z-score for height for age at baseline was -0.99 and after 15 weeks it was -1.31. At baseline the BMI for age mean Z-score was -1.37 and after 15 weeks it was -0.78 for the experimental school.

The experimental schools mean Z-score for height for age at baseline was -1.55 and after 15 weeks it was -1.48. The mean Z-score for weight for age at baseline was -1.86 and after 15 weeks it was -1.65. The BMI for age mean Z-score was -1.20 and after 15 weeks it was -1.12. It is important to note that the Z-scores for height for age and weight for age in the control school were more negative after 15 weeks, which indicated that the children were getting more undernourished and/or malnourished as they grew, while the opposite was observed in the experimental school. The study period lasted only for 15 weeks and after the study period a slight improvement with regard to the three variables could be detected in the experimental school. The possibility of increased improvement after a longer period of time cannot be excluded.

It can be concluded that the vegetable meal had an effect. Vegetables such as carrots (vitamin A) and dark green vegetables promote growth and protect against infection (Padbidri, 2002). The results on the occurrence of infections as observed in this study by the presence of colds, flu, cough or a running nose indicated the same tendency in both schools (Figure 5). However, the results on the occurrence of skin sores indicated a highly significant improvement in the occurrence hereof in the experimental school (Figure 6).

According to Gilespie & Mason (1991) malnutrition and infection result

from inadequate dietary intake, which is associated with weakened immunity systems and extended duration of disease. They also state that to control infectious disease, involves a number of things, such as improving the health environment, assuring access to adequate health services and good nutrition.

Since there is lack of health care in the area selected for this study, the farming communities have to travel to the main towns such as Ventersdorp, Carletonville and Potchefstroom for a number of things such as medical attention. According to Anderson *et al.* (2000) many black children do not receive some of the basic necessities they require to stay healthy. It is also noted that in South Africa the children's health status is often influenced by where they live and the amount of income their family earns. A lack of financial resources (low income) often results in malnutrition and poor health.

The learners in both schools have shown that they are malnourished by having a negative Z-score in relation to the reference values. It has been proved that dietary deficiency disease reduces the body's resistance to infections and adversely affects the immune system. Some of the normal defense mechanisms of the body are impaired and do not function well in malnourished people (Tomkins & Watson, 1989).

Inappropriate housing, overcrowding, contact with infected animals, poverty and limited access to treatment programmes in remote communities are some contributory factors to infection.

A study on health status among farm workers in the Western Cape, by London *et al.* (1998) concluded that farm workers appeared to be a closed community with a high disease burden. The health status of the farming communities, poses serious challenges to the health authorities. Vorster *et al.* (2000) found that children living on farms are more likely

to be stunted and underweight than any other children. It may be concluded that good nutritional status prevents infection by a number of mechanisms, notably through the immune system and maintaining the integrity of epithelial tissues.

### 5.1.3 Occurrence of sores

At the beginning of the study (week 1) learners attending the experimental school presented with more sores than those at the control school. After additional vegetable intake and especially as measured during week 4 the mean for the experimental school had lowered to 1.94. The inclusion of vegetables in the school meal had exercised a beneficial effect on the occurrence of sores.

### 5.1.4 Structured face-to-face interview with learners

Valuable, useful and relevant information was obtained by means of the interviews with the learners. It was, for example, possible to gain insight into their perceptions of the added vegetable feeding programme and the gardening project at their school. The information was, for example, very useful/helpful in deciding about the type of vegetables to grow, how to prepare/cook the vegetables and the times they wanted to eat. Without consultation with them one might end up being without consumers and thus without participants for launching a project and investigation of this kind. It would also serve a good purpose to keep them interested and involved in their gardening project. According to learners' responses as observed at both schools the favourite vegetable seemed to be carrots, e.g. at the control school (42.9%) and at the experimental school (39.1%). The majority of learners from the control school as well as the experimental school indicated that they would like to eat a vegetable meal every day, and this could lead one to conclude that they actually enjoyed eating vegetables.

The interviews with the learners also contributed positively to gaining

more information as to yet another aspect, *i.e.* bodily or physical changes following the introduction of additional vegetable intake as observed by the learners themselves. The interviews revealed that certain observations had indeed been made by them. The majority of learners (66.7%) claimed to have noticed the changes (being healthy and growth). Most of the learners indicated that they would like to help in the vegetable garden and were found to be enthusiastic about producing more vegetables in the garden. This also showed that the children were interested in the vocational type of work ("hand on"). This could help the less academic learners to be able to get knowledge in the field of vocational work in the long run.

### 5.1.5 Teachers' questionnaires

The views of teachers with regard to the vegetable garden project were obtained by means of a questionnaire that was handed to each of the teachers at both the experimental and control schools. All the teachers, without exception, confirmed that the vegetable garden project and the provision of additional vegetables to the learners certainly were welcomed by them as well as by the learners. The control school's teachers emphasised the possibility of having a full-time person appointed to look after the garden and guide them on the maintenance of it. This statement could explain why the vegetable garden at the control school was abandoned or neglected by the teachers. As to the question whether a vegetable meal had contributed to the school attendance, the teachers from the experimental school agreed that it had contributed to the increased school attendance by the learners.

# CHAPTER 6: RECOMMENDATION AND CONCLUSION

## 6.1 RECOMMENDATIONS

### 6.1.1 Integrated multidisciplinary approaches

In order for malnutrition to be reduced sustainably, actions and interventions are needed, especially to address the contributory causes. In this study, among the contributory factors, poverty and lack of health care among the farm communities could be listed as important. Several studies have pointed out the problem of underweight to be detected among children living in these communities.

Intergrated multidisciplinary approaches are often more effective than single-sectorial activities in reinforcing household food security, improving overall nutritional status and increasing family income, especially among the vulnerable communities, such as farm dwellers. The vegetable garden alone cannot alleviate the problem of undernutrition, the prevalence of infection or the occurrence of sores. What needs to be done encompasses a broader spectrum of assistance, e.g. to establish managed health care services, sound caring practices (which could include programmes of guidance and relevant education to learners, parents and teachers alike) and provision of transport to learners.

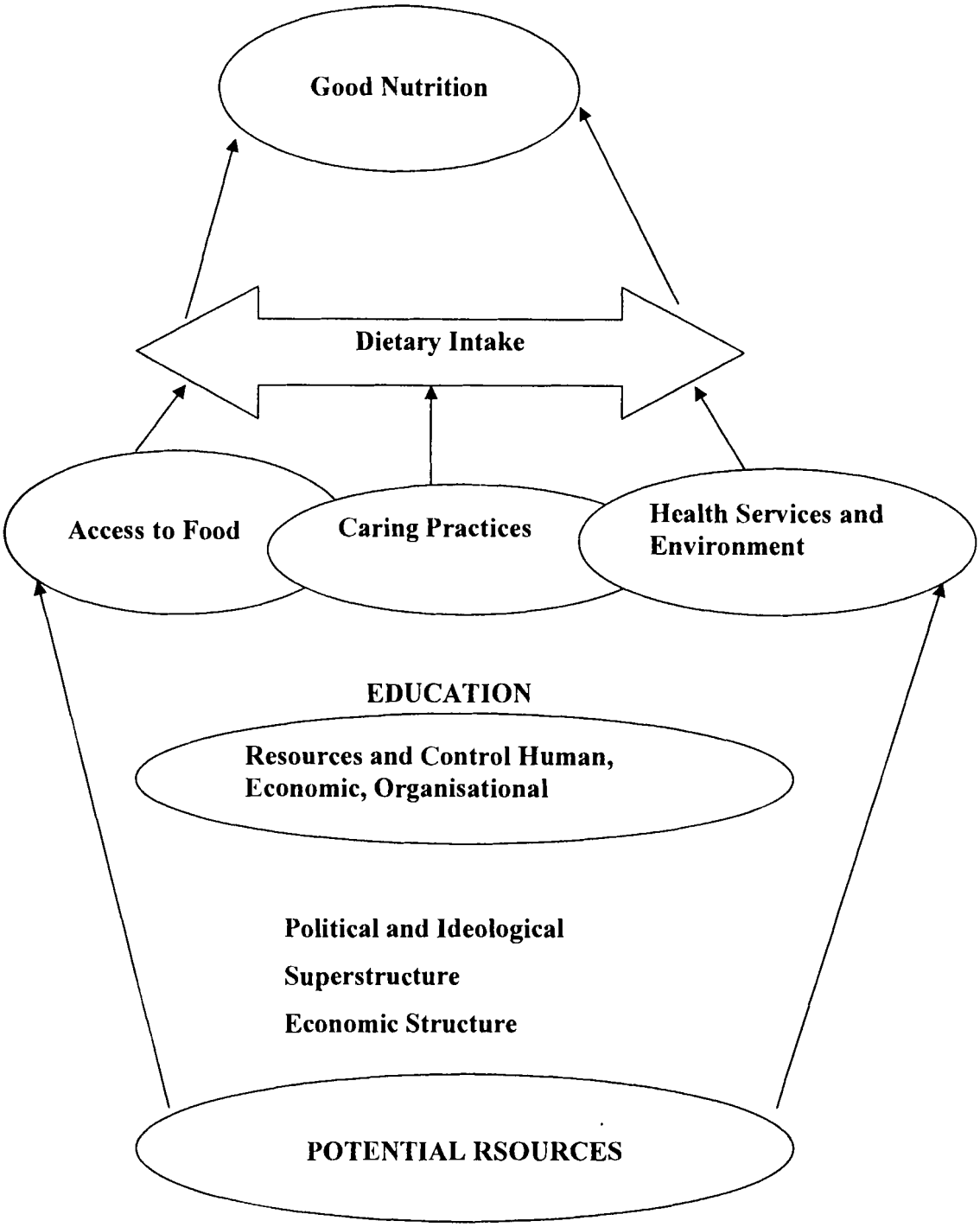


**Figure 7: Nutrition framework (Adopted from UNICEF, 1990)**

UNICEF (1990) developed a framework (Figure 7), which show the factors that contribute to good nutrition. This framework illustrates how health, food and care, particularly the feeding practices of young children, contribute to nutrition.

### 6.1.2 Increasing school feeding income

The government allocates R1.07 for feeding per learner per day (Anon, 2004). There is a need to increase the money to be able to provide a good nutritious meal. In rural areas, *i.e.* at rural schools, the Government, through the Department of Education, provides meals to learners only four times a week. These learners are among the people identified as vulnerable by a number of authors (Vorster *et al.,* 2000). The recommendation would be for the Government to provide the learners of rural schools with a meal five times a week and twice a day (provision of meals in the morning and afternoon). The provision of a meal twice daily would play a vital role in the nourishment of the body. The provision of a meal throughout the week and twice a day would help in a number of ways such as reducing absence from school, improving the nutritional status of the learners, curbing incidences of infection and reducing occurrence of sores.

### 6.1.3 Provision of health services

According to analyses of the results and observations of this study it became apparent that health care called for more attention and therefore improved health care counts among the recommendations presented here. Improved health care and health care services could include a clinic or a mobile clinic near the farm areas or near to the schools, so that the farming communities would be able to receive medical services at a point closer to them, instead of travelling to nearby towns such as Venterdorp, Carletonville and Potchefstroom which are situated approximately 40km or more away from the farm areas referred to in this study. Some of the infections and sores that had been observed would be paid more immediate attention, especially if one also takes into account that parents or caretakers do not always find it easy to undertake the trips to the towns because of problems with transport as well as with hours of being on duty at work.

Since the farm schools are located in the farm areas, and since the black farming communities have been identified as poor, one can understand that certain needs would emerge. Appropriate and practical efforts (in addition to what is already being done) could be intensified in order to address such needs. Such activities might be undertaken by the Department of Education in collaboration with other ministries such as Health and Social Services to establish programmes that would address and monitor the activities concerning the general welfare of the children living on the farms and attending schools there. Community involvement could also be encouraged and organised.

### 6.1.4 Provision of a kitchen and a trained cook

In the experimental school, the headmistress was responsible for the preparation of the meals for the learners and this took place at her own place of residence. The meals would be prepared after school hours and then brought to school the next day. In most cases the nutritional value of vegetables would be lost by the time the learners consumed the meals. This is also time-consuming for the headmistress. It is recommended here that the Government, through the Department of Education, provide a shelter (kitchen) for preparing the school meals, as well as a trained cook, who would assume responsibility for preparing a nutritious meal for the learners. The latter should be on the payroll of the Department concerned. Moore (1994) found that the schools that have canteens were associated with increased school enrollment, regular attendance, consistently lower repeater rates and higher success rates in national examinations, especially among girls.

### 6.1.5 Incorporating school gardens with the school curriculum

The "hands on" activities of cultivating and growing a vegetable garden at school seemed to be liked by most of the learners. According to the results the learners enjoyed working in the garden. The Department of Education needs to help schools to develop a curriculum that integrates

vocational work and academic work. Doing so could encourage learners to develop as many facets of their abilities and skills as possible in preparation for a demanding adult life. Matching the curriculum to the learners' aptitudes and aspiration is also likely to make the learners more willing to learn while at school. Agriculture as a subject, focusing on gardening at this school level phase, can include practical activities and the execution of such activities as well as progress made by learners could be assessed according to set scales and criteria. It is suggested that Grades 4 to 7 might benefit most if applied on primary school level. An accompanying recommendation is that there could be a gardening competition, whereby the learners can be grouped and then assigned to plots and the best plot could get an award. As these are farm communities, with little income, the Department of Education could see to it that sufficient money is provided for such projects.

### 6.1.6 Provision of a "shed" and pot planting

The study period lasted for too short a time to expect major changes or improvements. The study could be prolonged to a longer period of time, e.g. six to twelve months. In this way more than one season would also be included. The harsh and dry winter formed part of the period of study. What could be recommended with regard to winter conditions is to grow root vegetables and cover them with grass to protect them from frost. Another recommendation with regard to the vegetable garden project is the provision of a "shed" like a "green house" in order to protect the vegetable plants from extreme weather conditions. A "shed" would undoubtedly be quite useful in a number of ways, such as keeping pests under control, protecting vegetable plants, preventing the water from evaporation too fast and stabilising the atmosphere surrounding the plants. Another alternative or addition would be to introduce the planting of vegetable plants in flowerpots. . It would be possible to keep such containers with their plants in protected areas and to move them to different areas as changes might demand.

## 6.2 CONCLUSION

Malnutrition is an issue of concern across the world. Poverty, household food, nutrition insecurity and malnutrition, are said to be major causes of many deaths facing children and women in Africa. There are a number of factors that contribute to malnutrition, especially in developing countries. These factors are, *inter alia*, poverty, poor climate (drought and/or floods), unfertile land, wars, unskilled manpower and lack of knowledge.

Proper and adequate nutrition is a precondition for human and economic development. Malnutrition in children slows economic growth and development by increasing illness and mortality and reducing the productivity of tomorrow's labour force. Malnutrition may be economically costly especially when it occurs among children because the effects are cumulative over a lifetime. Nutrition deficiency is said to lead to child deaths, increased health costs to families and the Government, decreased mental capacity and lower future productivity, all of which hinder the economic development of a nation. Improved nutrition could increase human capacity and foster economic growth. Increased and balanced food intake and improved nutrition often is best achieved by raising the incomes of poor households. Generally malnutrition is both a cause and a consequence of poverty.

Regular school attendance is essential for the learners to make the most of their education. Children who do not attend school regularly are much more likely to leave school with inadequate or no qualifications and they are more likely to be drawn into crime and anti-social behaviour.

The farm dwellers, especially the children, have been identified in the THUSA study as the most vulnerable group because of their poor nutritional status (Vorster *et al.*, 2000). One of the first initiatives the new Government of South Africa launched in 1994 was to introduce the

Primary School Nutrition programme to encourage enrolment and school attendance in poor communities. It was considered one of the presidential land projects of the Reconstruction and Development Programme. The Department of Health is presently administering the feeding scheme. The Government aims to provide lunches to all learners attending the poorest schools by 2004 (Human Rights Watch, 2004).

The South African agricultural sector is one of the best-developed agricultural sectors in Africa. Exportation of products also takes place. Most of its products are exported throughout the world (Department of Agriculture, 2005). Surprisingly there are some groups in South Africa who are said to be vulnerable and malnourished. Among the groups are people living and working on the farms and that includes the children on farms.

It has been proved in numerous studies that vegetable gardens on the school premises have had a very positive impact on the children's learning, general growth, general health and school attendance (Love & Sayed, 2001). Similar outcomes were observed in the results of this study, but could be better confirmed by a longer period of study.

Gardening programmes on school premises can be regarded as an effective way to educate children and their parents about the nutritious advantages of fresh, locally grown food while at the same time helping children to get balanced meals, which they in some cases (perhaps far too often to be acceptable) do not get at home. Gardening programmes also provide excellent opportunities for teachers to teach more about sustainable agriculture and the plight of small farms around the country.

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# ANNEXURE I

# OBSERVATION FORM

## OBSERVATION FORM

**SCHOOL:** _____

**NAME:** _____

**AGE:** _____ **GENDER:** F M

| | WEEK 1 | WEEK 2 | WEEK 3 | WEEK 4 | WEEK 5 | WEEK 6 | WEEK 7 | WEEK 8 |
|---|---|---|---|---|---|---|---|---|
| YES =1<br>NO =2 | | | | | | | | |
| INFECTION | | | | | | | | |
| SORES | | | | | | | | |
| SCHOOL ATTENDANCE | | | | | | | | |

| | WEEK 9 | WEEK 10 | WEEK 11 | WEEK 12 | WEEK 13 | WEEK 14 | WEEK 15 |
|---|---|---|---|---|---|---|---|
| YES =1<br>NO =2 | | | | | | | |
| INFECTION | | | | | | | |
| SORES | | | | | | | |
| SCHOOL ATTENDANCE | | | | | | | |

# ANNEXURE II

# ANTHROPOMETRIC MEASURES

# ANTHROPOMETRIC MEASURES (MONTHLY)

| MONTH | FEBRUARY | MARCH | APRIL | MAY | JUNE |
|---|---|---|---|---|---|
| HEIGHT (M) | | | | | |
| WEIGHT(Kg) | | | | | |
| BMI | | | | | |

# ANNEXURE III

# LEARNER'S FACE-TO-FACE INTERVIEW

# INTERVIEW GUIDE

STUDENT FACE-TO-FACE INTERVIEW

**Introduction to students**

* Greeting to the students and explain the purpose of the interview (to get their views on the garden and vegetable) ensure the students are relaxed and make them comfortable.

**SECTION A: PERSONAL INFORMATION**

School: _____

Name: _____

Gender **(to circle)** Boy Girl

Grade **(to circle)** 4 5 6 7

Date of birth: _____ AGE: _____

**SECTION B:**

1. Which vegetables grown in the vegetable garden do you like most?
   **(to circle)**

   Cabbage

   Spinach

   Tomatoes

   Carrots

   Beetroot

   Other specify _____

2. How do you best like to eat the carrots?

   Raw

   Cooked

3. Do you like the way the vegetables are cooked at school?
   **(experimental school)**

   Yes:

   No: (give reason/s) _____

4. How often would you like to eat vegetables at school?
**(to circle)**

Everyday

Once a week

Twice a week

Thrice a week

Four times a week

None

5. Have you noticed any changes in your body ever since the introduction of vegetables in the diet?
**(Experimental school)**

Yes (mention the changes) _____

No

6. If vegetables were stopped/excluded in the school-feeding programme, would you continue coming to school? **(Give reason)**

Yes _____

No _____

7. Do you like helping in the school garden? (e.g. planting, cultivation, weeding, watering etc)

Yes

No (give reason/s)_____

8. Are you prepared to produce more vegetables in the school garden and sell them, so as to assist the school with money?

Yes:

No (give reason) _____

9. Would you like to have a vegetable at home at home? **(give reason)**

Yes _____

No _____

**THANK YOU SO MUCH FOR YOUR TIME**

# ANNEXURE IV

# TEACHER'S QUESTIONNAIRE

# TEACHER'S QUESTIONNAIRE

- **Please could you assist in completing the questionnaire below?**
- **Please note that the information will be treated confidently.**

The aim of the questionnaire is to find out your views regarding the school vegetable garden in the school and the effects of vegetables in the school-feeding programme regarding the school attendance and the prevalence of infection in the students.

## SECTION A: PERSONAL QUESTIONS

1. School: _____

2. Gender (circle) M F

3. Age (circle) 20 – 25

   26 – 30

   31 – 35

   < 35

4. Grades teaching (circle) 1 – 3

   4 – 7

**SECTION B:**

1. How did your students respond to the introduction of vegetables in the school- feeding programme?

_____

_____

2. In your opinion, do the students like vegetables? **(Give reason)**

Yes: _____

No: _____

3. Do the students like the way vegetables are prepared in the school? **(Give reason)**

Yes: _____

No: _____

4. How has the introduction of vegetables affected the following?

i) School attendance rate

Positively

Negatively

Not really

ii) Students' health conditions

Positively

Negatively

Not really

5. Do you think the students are aware of the importance or the nutritive value of vegetables? **(circle)**

Yes

No

Partly

6. Are the students willing to help in the school gardens?

Yes

No

Some

7. How are your feelings towards the production of vegetables in the school?

Positive

Negative

8. Are you willing to assist and motivate the students to produce more vegetables and sell them in order to improve generate money for the school?

Yes

No

9. Any other comments _____

**THANK YOU FOR YOUR TIME AND COOPERATION**
**IT HAS BEEN WOUNDERFUL WORKING WITH YOU**

# ANNEXURE V

# SCHOOL MENUS

# MENUS

## CONTROL SCHOOL

| MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY |
|---|---|---|---|---|
| Soya & pap or mealie-rice | Brown bread with peanut butter | Mabele,(sorghum or samp with beans | Fat cakes with soup | **NO FEEDING** |

## EXPERIMENTAL SCHOOL

| MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY |
|---|---|---|---|---|
| Rice & Soya+ vegetables | Samp & Beans | | Pap & milk | Rice & vegetable stew |
| Pap & vegetable soup | Rice & soya + vegetables (spinach or cabbage | **NO FEEDING** | Bread & milk & fruit | Samp & soya and vegetables |

# ANNEXURE VI

# VEGETABLES HARVESTED

# VEGETABLES HARVESTED (2005)

## EXPERIMENTAL SCHOOL

| Date | Crop | Amount of Harvest |
|---|---|---|
| 13/01/05 | Beetroot | 10kg |
| 27/1/05 | Cabbage | 10kg |
| 3/2/05 | Tomatoes | 6kg |
| 14/2/05 | Tomatoes | 5kg |
| 16/2/05 | Tomatoes | 2kg |
| 23/2/05 | Tomatoes | 3.6kg |
| 28/2/05 | Tomatoes | 2kg |
| 3/3/05 | Tomatoes | 3.6kg |
| 7/3/05 | Tomatoes | 1kg |
| 10/3/05 | Tomatoes | 500g |
| 11/3/05 | Tomatoes | 500g |
| 3/3/05 | Spinach | 5kg |
| 18/3/05 | Beetroot | 5kg |
| 6/4/05 | Carrots | 7kg |
| 8/4/05 | Spinach | 4kg |
| 5/4/05 | Spinach | 3kg |
| 12/4/05 | Tomatoes | 5.6kg |
| 14/4/05 | Tomatoes | 5.6kg |
| 14/5/05 | Spinach | 4kg |
| 23/5/05 | Spinach | 3kg |

## SUMMARY OF HARVEST

| Crops | Amount |
|---|---|
| Beetroot | 15kg |
| Cabbage | 10kg |
| Tomatoes | 34kg |
| Spinach | 19kg |
| Carrots | 7kg |
| **Total** | **96kg** |

## CONTROL SCHOOL

| Date | Crop | Amount of Harvest |
|---|---|---|
| 17/01/05 | Cabbage | 2.4kg |
| 18/01/05 | Cabbage | 2.9kg |
| 22/01/05 | Carrots | 13kg |

## SUMMARY OF HARVEST

| Crops | Amount |
|---|---|
| Cabbage | 5.3kg |
| Carrots | 13kg |
| **Total** | **18.3kg** |