SUSTAINABILITY OF CORN SOYA BLEND USE IN THE ORANGE FARMS SCHOOL FEEDING PROGRAMME

MUMSY EVIDENCE CHIBE

BTECH FOOD SERVICE MANAGEMENT

20154461

Dissertation submitted in fulfilment of the requirements for the degree of

Magister Technologiae Food Service Management

Department of Hospitality and Tourism

Faculty of Human Sciences

Vaal University of Technology

Supervisor: **SS Duvenage (MTech)**

Co-Supervisor: **Prof WH Oldewage-Theron (PhD)**

September 2007

The financial assistance of the National Research Foundation (NRF) towards this research is hereby acknowledged. Opinions expressed and conclusions arrived at, are those of the author and are not necessarily to be attributed to the sponsor.

DECLARATION

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

Signed 

Date 11 September 2007

I hereby give consent for my dissertation, if accepted, to be available for photocopying and for interlibrary loans after expiry of a bar on access approved by the Vaal University of Technology.

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ACKNOWLEDGEMENTS

This dissertation is dedicated with sincere appreciation to those who contributed to my life:

Firstly I wish to thank God Almighty, the Creator, for providing me with the strength and courage to complete this study. This did not come easily; all is indebted to the grace of God.

My special gratitude goes to my friends, my loving and courageous mother, and my brother and sister Stanley and Marble for their patience and for having faith in me.

Special thanks go to Mrs SS Duvenage, for acting not only as my master's study supervisor, but as my mentor on the road to educational success who always encouraged me to walk the extra mile if I wanted to achieve my goal in life, and to Prof WH Oldewage-Theron, my co-supervisor, for all the inputs and support throughout this study.

I also want to extend my thanks to the staff of Joint Aid Management (Mr A Boros) and Hope Nutrition Business Consultancy (Mrs E Zulu) for assistance and support provided.

I express my gratitude to the NRF for their financial support and the Vaal University of Technology for facilitating my educational journey towards the completion of this study.

Last but not least I would like to thank everyone who contributed to this project and encouraged me, especially Dr A Egal (Post Doctorial fellow), Mrs V Nolan (statistician), my best friends who assisted me both spiritually and personally (particularly Tolu Adeua and Tshinakaho Nyathela), and all those who supported me with prayers and words of wisdom throughout my life.

DEDICATION

To my late brother and sister Ephraim and Diana Qibi

With all my love

ABSTRACT

Most of the world's children between 5 and 15 years of age attend school, though many do so under difficult circumstances. A large percentage of school children is underfed and poorly nourished (Engelbrecht 2005:1; Worsley 2005:135; DoE 2004:1). The aim of the Joint Aid Management (JAM) school-feeding programme was to reduce malnutrition by providing a mid-morning snack to alleviate short-term hunger, support nutrient intake, enhance active learning capacities and improve school attendance (JAM 2004:4). The equivalent of 100g raw corn-soya blend (CSB) was to be provided to the children on a daily basis. The main objective of this study was to determine the sustainability of CSB porridge use in the Orange Farms school-feeding programme. Regulatory compliance and product acceptability over time was addressed. Adjustments to the ratio of ingredients and portion size (83g) of the porridge served were calculated within practical limitations.

The South African school feeding guidelines indicated that 25 percent of the energy needs for the 7-10 year olds, and 20 percent for the 11-14 year olds should be provided; while JAM indicated that 70 percent of the RDA recommendations (according to UNICEF 2002) should be provided by the product. A comparison between the applicable RDA for gender and age against daily dietary intake (habitual intake plus CSB porridge) revealed that the needs for vitamin A, riboflavin, niacin, folate, iron and zinc have been met, while calcium could not be provided in full. The needs for vitamins C and B12 were provided for in full through the CSB intake. Overall, the CSB intake made a substantial contribution to nutritive intake. Both the perceptions for taste (Reitumetse 75-80% and Sinqobile 88-83%) and texture (Reitumetse 74-82% and Sinqobile 71-78%) increased over time. As several learners (25%) consumed second servings twice (34%) but up to five times a week (21%), it can be assumed that the additional nutrient intake benefited the neediest children the most. It is recommended that CSB porridge should be introduced in areas where the dietary intake is compromised.

Keywords: food security, school-feeding programme in South Africa, food compliance and acceptability.

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LIST OF ABBREVIATIONS AND ACRONYMS

AAFC	Agriculture and Agri-Food Canada
AI	Adequate intake
AIDS	Acquired Immune Deficiency Syndrome
CBD	Central Business District
CSB	Corn-Soya Blend
DoA	Department of Agriculture
DoE	Department of Education
DoH	Department of Health
EER	Estimated Energy Requirements
ERS	Economic Research Service
FAO	Food and Agriculture Organisation
FIFO	First In First Out
FRAC	Food Research and Action Centre
GAIN	Global Alliance for Improved Nutrition
HIV	Human Immunodeficiency Virus
IDA	International Association
IFIC	International Food Information Council
IFPRI	International Food Policy Research Institute
JAM	Joint Aid Management
JR	Junior
JRF	Joseph Rowntree Foundation
MFAJ	Ministry of Foreign Affairs of Japan
Ms	Miss
MTech	Magister Technologiae (Masters Degree)
NEPAD	New Partnership for Africa's Development
NFCS	National Food Consumption Survey
NGO	Non Government Organisation
NICUS	Nutritional Information Centre University of Stellenbosch
NRF	National Research Foundation

NSNP	National School Nutrition Programme
PEM	Protein and Energy Malnutrition
PM	Afternoon
Prof	Professor
PSNP	Primary School Nutrition Programme
PSNP	Primary School Nutrition Programme
RDA	Recommended Dietary Intake
RDP	Reconstruction and Development Programme
RNA	Deoxyribonucleic Acid
S.A.	South Africa
SAHR	South African Health Review
SARPN	South African Regional Poverty Network
SD	Standard Deviation
SFP	Schools Feeding Projects
SNP	School Nutrition Programme
SPSS	Statistical Package for Social Science
SSA	Sub Saharan Africa
TVP	Texture Vegetable Protein
UK	United Kingdom
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNICEF	United Nations Children's Fund
UP	University of Pretoria
USA	United States of America
VUT	Vaal University of Technology
WFP	World Food Programme
WHO	World Health Organization

SYMBOLS

%	Percent
♀	Female
♂	Male
g	gram
h	hour
IU	International Unit
kcal	kilocalorie
kg	kilogram
kJ	kiloJoules
km	kilometre
ℓ	Litre
mg	milligram
ml	millilitre
mm	millimetre
n	number
pH	Potential of Hydrogen
R	Rand
®	Registered Trademark
RE	Retinol Equivalent
µg	microgram

DEFINITION OF TERMS

Poverty

Poverty is a situation which is characterised by an inability of individuals, households or communities to command sufficient resources to satisfy a socially acceptable minimum standard of living (Budlende, May, Mokate, Rogerson & Stavrou 1998:1); it can also be defined as the denial of opportunities and choices most basic to human development to lead a long, healthy, creative life and to enjoy a decent standard of living, freedom, dignity, self-esteem and respect from others (Hirschowitz, Orkin & Alberts 2000:54).

Corn

Corn is an international term that describes maize.

A dry corn (maize) -soya blend (CSB)

A product consisting of a mix of 65 percent maize, 25 percent soya and 10 percent sugar, which is fortified with vitamins A, D, E, and minerals, calcium and iron, and used by Joint Aid Management (JAM) for school feeding at Orange Farms (JAM 2004:4).

Food security

Food security exists when all people, at all times, have access to sufficient, safe and nutritious food to meet dietary needs and food preferences for an active and healthy life. In essence it refers to the fundamental needs basic to all human needs and the organisation of social life (FAO 1996:1-36; Devereux & Maxwell 2003:18).

Food insecurity

This situation exists when people are undernourished as a result of the physical unavailability of food, lack of social and economic access to adequate food, and/or inadequate food utilisation. This concept refers only to the consequence of inadequate consumption of nutritious food, considering the physiological utilisation of food by the body as it manifests itself within the domain of nutrition and health (Verduijn 2005:13).

Food insecure people

This concept refers to those individuals whose food intake falls below the minimum energy requirements, as well as to those who exhibit physical symptoms caused by energy and nutrient deficiencies resulting from an inadequate or unbalanced diet, or from the body's inability to use food effectively because of infection or disease (Verduijn 2005:14).

Household food security

This depends on an adequate and stable food supply which is accessible to all household members and meets nutritional needs (Steyn, Labadarios & Huskisson 1999:30-31).

Food accessibility

Food accessibility is influenced by the availability of food in the markets, its physical accessibility and affordability, which in turn affects the household's dietary intake amongst the poor households in urban areas (Latham 1997:7; Sswewanyana 2003:11; Webb & Rogers 2003:4).

Recommended Dietary Allowance (RDA)

RDA is the intake that meets the nutrient needs of almost all (97%-98%) individuals of a particular gender at the given life stage. It is important to recognise that the RDA applies to individuals and not to groups, and is the goal for dietary intake by the individual (According to the Institute of Medicine, Food and Nutrition Board as quoted by NICUS 2003:8; Bowley 2001:9).

Energy Requirements (ER) of an individual

This refers to the level of energy intake that will balance energy expenditure when the individual has a body size and composition, and a level of physical activity, consistent with long-term good health (Dulloo & Schutz 2005:95).

Estimated Energy Requirements (EER)

According to the Institute of Medicine, Food and Nutrition Board as quoted by NICUS 2003, EER is the average dietary energy intake that is predicted to maintain energy balance

in a healthy adult of a given age, gender, weight, height and level of physical activity, consistent with good health (NICUS 2003:15).

Macronutrients

The nutrients which are needed by the body in relatively large amounts, including water, carbohydrates, lipids and protein (NICUS 2003:13; Grosvenor & Smolin 2006:4).

Micronutrients

A group of organic compounds needed by the body in relatively small amounts for the normal metabolism of other nutrients such as protein and carbohydrates, vitamins and mineral elements. These nutrients are readily obtained from foods, although the content varies from food to food (Lutz & Przytulski 1997:90; Grosvenor & Smolin 2006:34).

Malnutrition

Malnutrition is a broad term commonly used as an alternative to undernutrition, but technically also refers to overnutrition. People are malnourished if a diet does not provide adequate kJ and protein for growth and maintenance, or if individuals are unable to fully utilise the food eaten due to illness (undernutrition). Malnutrition can also be caused by consuming too many kJ (overnutrition) (UNICEF 2006:1).

Food fortification

The above refers to the addition of specific micronutrients (vitamins and minerals) to specific foods. The type and amount of micronutrients are determined by the nutritional status and therefore nutritional needs of the population, while the food/s to be fortified depend on the eating habits of the population. The food/s to be fortified are generally called the "food vehicle". Both the micronutrients added and food vehicles selected must have a sound scientific basis if the population is to truly benefit (DoH 2003:2).

Food regulatory compliance

This refers to the extent to which a person's behaviour in terms of medication, following diets or executing lifestyle changes, coincides with medical or health advice (Haynes as quoted by Darko 2001:57-64).

Sensory evaluation

This is a scientific discipline used to evoke, measure, analyse and interpret those reactions to characteristics of food and materials as they are perceived through the sense of sight, smell, taste, touch and hearing (De Kok, Minnaar & Kinnear 2005: 5).

Acceptance

Acceptance is the experience or feature of experience, characterised by positive attitude towards the food, and/ or actual utilisation (such as purchase or eating) of food by consumers (University of Pretoria 2005:12).

Food acceptability

The above is referred to by such terms as palatability, hedonic tone, liking/disliking, food preference and pleasantness/unpleasantness. It is treated as a perceptual evaluative construct. It is a phenomenological experience, best categorised as a feeling, emotion or mood with a defining pleasant or unpleasant character (Cardello 1996:12).

Texture

Texture is the attribute of a substance resulting from a combination of physical properties and perceived by the senses of touch (including kinaesthesia and mouth feel), sight and hearing. Physical properties may include size, shape, number, nature and conformation of constituent structural elements (Carpenter, Lyon & Hasdell 2000:22).

1

RESEARCH PROBLEM AND SETTING

1.1 INTRODUCTION

For many children, the reality of childhood is difficult because of hunger (Klugman 2002:2) as short-term hunger is common in most poor households. School children are particularly vulnerable to short-term hunger, especially where diets inadequate in both quantity and quality are consumed (JAM 2004:5).

1.2 BACKGROUND TO THE PROBLEM

The national household survey (n = 4 000) of health inequalities among ethnic groups in South Africa indicates that 57 percent of the population lived in poverty, whereas 39 percent was vulnerable to food insecurity, while only 25 percent of the households were food-secure (Sayed 2002:11). The South African National Food Consumption Survey (NFCS) reported that although food security is not a national problem, household food security is (Labadarios, Steyn, Maunder, MacIntyre, Swart, Gericke, Huskisson, Dannhauser, Vorster & Nesamvuni 2000:492).

Poverty is the situation which is characterised by the inability of individuals, households or communities to command sufficient resources to satisfy a socially acceptable minimum standard of living. Poverty is perceived by poor South Africans to include alienation from the community, food insecurity, crowded homes, usage of unsafe and inefficient forms of energy, lack of jobs that are adequately paid and/or secure and fragmentation of families (Budlende, May, Mokate, Rogerson & Stavrou 1998:1).

The nutritional status of children in poor countries is frequently documented and the impact of malnutrition on survival and development are repeatedly highlighted. It is well accepted that nutritional status, especially in young children, serves as a general indicator of development, social uplifting and access to resources within communities (Conradie 2004:4). The nutritional status of children also has an immediate effect on growth (Ahmed 2001:1).

Although not severe according to the World Health Organisation guidelines, high levels of under-nutrition were found in South Africa. The findings of the South African Food Consumption Survey of 1999 indicate that more than one in five children aged one to nine years were stunted and one out of ten was underweight. The great majority of children consumed a diet deficient in energy and of poor nutrient density that can not meet their micronutrient requirements (Labadarios, Steyn, Maunder, MacIntyre, Swart, Gericke, Huskisson, Dannhauser, Voster & Nesamvuni, 2006:2).

For South African children as a whole, the dietary intake of the following nutrients was less than two-thirds of the recommended intake for age: energy, vitamin A, vitamin B6, riboflavin, selenium, folic acid, vitamin C, vitamin D, iron, calcium, zinc, vitamin E and niacin (Labadarios, Steyn, Maunder, MacIntyre, Swart, Gericke, Huskisson, Dannhauser, Voster & Nesamvuni, 2006:2). The major health conditions which also show effects on school attendance and performance include, *inter alia*, nutritional deficiencies, which are mainly reflected as protein energy malnutrition (PEM), vitamin A deficiencies, iodine deficiency disorders and infectious diseases (JAM 2004:4). For the purpose of this study vitamin A, vitamin B12, riboflavin, niacin, folate, thiamine, vitamin C, iron, calcium and zinc are deemed important.

According to Statistics South Africa about 35 percent of the total population (amounting to 14.3 million South Africans) was vulnerable to food insecurity. Among these, women, children and the elderly are particularly vulnerable (DoA 2002:22). Food insecurity is a major determinant of under-nutrition. There is general agreement that South Africa has national food security but not household food security (Kulman 2002:11-14).

At school level, nutritional and health statuses are powerful influences on a child's learning performance. Children who lack certain nutrients in their diet (particularly iron and iodine) or who suffer from PEM, hunger, parasitic infections or other diseases, do not have the same potential for learning as healthy and well-nourished children have. Poor health and nutrition among school-age children diminish their cognitive development either through physiological changes or by reducing their ability to participate in learning experiences or both (Del Ross 1999:6). Children with diminished cognitive abilities and sensory impairments perform less well and are more likely to repeat grades and drop out of school than children who are not impaired in this way. They also enrol in school at a later age, if at all, and finish with fewer years of schooling (Kulman 2002:7).

Even temporary hunger, common in children who are not fed before going to school, can have an adverse effect on learning. Those who are hungry have more difficulty concentrating and performing complex tasks, even if otherwise well nourished. Research and programme experience shows that improved nutrition and health can lead to better performance, fewer repeated grades, and reduced drop-out rates (Kulman 2002:7).

School feeding programmes throughout the world have successfully attracted poor children to school and retained them by offering what they would probably not get elsewhere: hot food or nourishing snacks. The primary objective of a school feeding programme is therefore to provide meals or snacks to alleviate short-term hunger, enabling children to learn. School based feeding programmes have proven effective in encouraging enrolment, increasing attention spans, and improving attendance at school (Ahmed 2004:1-60).

1.3 RATIONALE AND MOTIVATION

Joint Aid Management (JAM), the South African founded non-profit, Christian humanitarian relief and development organisation of 22 years experience in sustainable development, contacted the Vaal University of Technology in order to undertake research on their behalf concerning the impact of a school feeding programme on the nutritional

status of primary school children in Orange Farms. Orange Farms is a township just 45 kilometres south of Johannesburg and home to approximately 500 000 people which are recognised to be amongst the "poorest of the poor" (Naidoo 2003:2).

The JAM feeding programme was designed primarily to distribute nutritious food to children between the ages of three and fourteen years. The intention was to reduce PEM by providing an energy and protein rich early morning or mid-morning snack or meal so as to alleviate short-term hunger in the classroom, support nutrient intake, enhance active learning capacities and improve school attendance and punctuality (JAM 2004:4). School feeding seeks to address the effects of short-term hunger on active learning capacity and school attendance.

The fortified dry corn (maize) soya blend (CSB) utilised in the JAM school feeding programme at Orange Farms consisted of a mixture of 65 percent maize, 25 percent soya and 10 percent sugar (JAM 2004:4). The product provided carbohydrates, proteins, fats, vitamins A, D, E, and the minerals calcium and iron. Guidelines indicate that each child should receive a serving equivalent to 100g of dry CSB mixture once a day (JAM 2004:6).

According to the South African Health Review (SAHR 2002:5), food options or a combination of selections should provide a balance of nutrients not less than 25 percent of the Recommended Daily Allowance (RDA) for energy for the 7 to 10 year old group and not less than 20 percent of the RDA for energy for the 11 to 14 year old group in South Africa schools. These parameters have been applied for product regulatory compliance in this study. Menu options should make use of already available food products that are culturally acceptable, commonly consumed and fit in with the local eating habits. As maize meal is one of the major staple foods in South Africa (Nel & Steyn 2002:136-142), it was deemed that CSB as a maize based product (65%), would be accepted.

1.4 MAIN OBJECTIVE OF THE STUDY

The main objective of this investigation was to determine the sustainability of CSB porridge use in the Orange Farms JAM school-feeding programme in terms of regulatory compliance and sustainability of product acceptance, in order to facilitate nutrient intake through a school feeding product to address compromised nutrient supply in primary school children between six and fourteen years of age.

1.4.1 Sub-objectives of the study

The first sub-objective was to determine the sustainability of CSB porridge use in terms of regulatory compliance, in order to verify product preparation specifications and portion sizes to best meet the recommended nutrition guidelines.

The second sub-objective was to determine the sustainability of CSB porridge use in terms of the sustainability of product acceptance, in order to evaluate the feasibility for long term product utilisation.

1.5 DELIMITATIONS OF THE STUDY

1.5.1 Inclusion criteria

- JAM school feeding programme.
- Reitumetse and Sinqobile Primary Schools in Orange Farms as selected by JAM.
- All girls and boys between the ages of six to fourteen years already voluntarily participating in the JAM school feeding programme at that stage.
- Compliance of the CSB porridge to the nutritional content regulatory guidelines as required by JAM and the SA school feeding project; for primary schools as indicated for six to fourteen years olds.
- Sustainability of CSB porridge acceptance over time.

1.5.2 Exclusion criteria

- Children younger than six and older than fourteen.
- Other school feeding products.
- Assessment of nutrient status.

1.6 SUMMARY

The purpose of this study was to determine the sustainability of CSB porridge use in the Orange Farms JAM school-feeding programme in terms of regulatory compliance and sustainability of the product acceptance in the two primary schools Reitumetse and Sinqobile in Orange Farms, South of Johannesburg. A two phased approach was followed in order to achieve the goal of this study namely to facilitate nutrient intake through a school feeding product.

2

LITERATURE SYNTHESIS

2.1 INTRODUCTION

The purpose of this study was to determine the sustainability of CSB use as porridge in the Orange Farms JAM school-feeding programme. Focus was placed on product regulatory compliance and product acceptance in order to facilitate nutrient intake through a school feeding product to address compromised nutrient supply in school children.

To create a better understanding of the problem, this chapter present a theoretical literature synthesis to integrate the aspects of poverty, food security and insecurity, food consumption patterns, micronutrients requirements as supplied by the CSB product, initiatives of preventing and controlling malnutrition (food fortification, supplementation and the school feeding programmes), food compliance and product acceptability in to the context of this study.

Studies by the Food and Agriculture Organisation (FAO), United Nations Educational, Scientific and Cultural Organization (UNESCO) and World Health Organisation (WHO) showed that hunger, nutrition and poverty were strongly correlated. The same studies noted that in the world as a whole, hunger impacts negatively on Millennium Development Goals, namely universal primary education, gender equality, child mortality, maternal health, management of Human Immunodeficiency Virus / Acquired Immuno-deficiency Syndrome (HIV/AIDS), Tuberculosis (TB), malaria, and environment stability (DoE 2004:1).

According to the findings of the International Food Policy Research Institute (IFPRI 2005:2-4) about 300 million children around the world are hungry and 100 million of them, mostly girls, do not attend school (Engelbrecht 2005:1). Worsley also (2005:135) indicated that most of the world's children between five to fifteen years of age attend schools, although many do so under difficult circumstances and many cease schooling before the end of high school. Hunger has been shown specifically to contribute to reduced school attendance, impaired cognitive capacity and high child and maternal death rates. The Department of Education of South Africa indicates that a large group of children are underfed, poorly nourished, and exposed to a range of parasitic and infectious diseases (Worsley 2005:135; DoE 2004:1).

2.2 POVERTY

Poverty in the midst of plenty is one of the central challenges in today's global economy and society. Fighting poverty is both a moral imperative and a necessity for a stable world (Ministry of Foreign Affairs of Japan: MFAJ 2000:2). Poverty is indicated as the "inability of individuals, households or communities to command sufficient resources to satisfy a socially acceptable minimum standard of living". It includes a lack of opportunity, lack of access to assets and credit, as well as social exclusion (SARPN 2006:2; MFAJ 2000:4-5). In Africa poverty is increasing, and mortality rates are deteriorating due to the HIV/AIDS epidemic (MFAJ 2000: 2).

The Committee of Inquiry into a Comprehensive Social Security System (2002) indicates that poverty, unemployment and inequality are increasing in South Africa (SA). At least 45 percent of the population lives in absolute poverty, and many households still have unsatisfactory access to clean water, energy, health care and education (SARPN 2006:2).

The unemployment rates have risen from 33 percent in 1996 to 37 percent in 2001. The rising of inflation rates have caused escalating food prices, which impact directly on the well-being of the poor. Children are particularly vulnerable in situations of poverty. According to estimation about 11 million children under 18 years were living on less than

R200 per month in SA during 2002 and were desperately in need of income support (SARPN 2006:2).

2.3 FOOD SECURITY AND INSECURITY

The concept of food security first gained international prominence with the World Food Conference of 1974 (Pelletier, Olson & Frongillo (jr) 2001: 704).

2.3.1 Components of food security

Food security is a broad concept, encompassing issues related to the nature, quality, and security of food supply as well as food access. The world has been facing a paradox of widespread food insecurity and malnutrition amid net food surpluses. Increased food supplies do not automatically enhance access to food by the poorer groups of society. Food security measures alone may have a limited effect on the nutritional well-being of individuals, unless the reinforcing detrimental linkages between food insecurity, disease, poor sanitation and inadequate education are addressed (Iram & Butt 2004:753-766).

The production availability of adequate nutritionally safe food, and the access to or capacity to acquire nutritional food, are the major components of food security (AAFC 2003:1).

2.3.2 Global situation of food security

Worldwide, some 1 billion people in 70 lower income countries are hungry, and the situation could grow worse in the poorest countries. Ironically, most of these people live in rural areas where food is produced (ERS 2005:1; AAFC 2003: 1-2).

Food systems around the world are also changing; this is resulting in potential for greater availability of food as well as diversity of food choices within the global market. In developing countries competition for the market share of food purchases is arising from the entry system of new players such as large multi-national fast food and supermarket chains (FAO 2005a:1).

These changes to the food systems are having a substantial impact on the food and nutritional security of both producers and consumers. This impact is being felt on the availability and access to food, through changes to food production, procurement and distribution systems, the food trade environment, and overall food culture (FAO 2005a:1). For more details see Figure 1.

Global household and individual food security

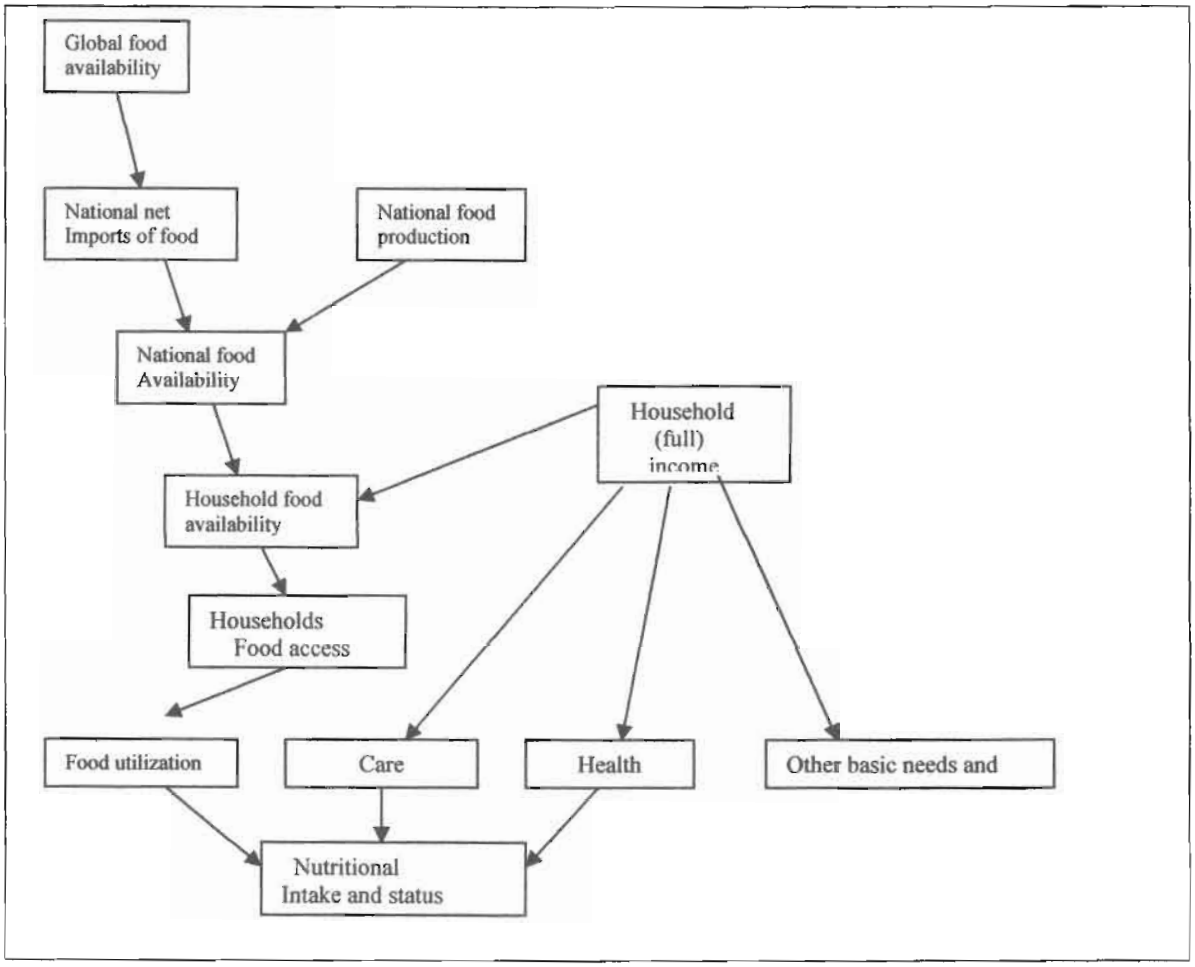


Figure 1 Organogram indicating the link between global, national, household and individual food security (Pelletier, Olson & Frongillo (junior) 2001: 704)

2.3.3 Food security in Africa and Sub-Saharan Africa

In Africa, population growth, poverty and agricultural production capabilities are critical factors when considering food security. Food production is growing more slowly than population, and in contrast to every other region of the world, per capita food production has declined since the 1970's. It is estimated that 50 percent of the total population of Sub-Saharan Africa (SSA) are hungry (FAO 1998:1). Although population growth rates are slowing down globally, the populations of SSA are still expanding by about three percent a year, enough to double the number of people in one generation.

There are a number of factors which contribute to African poverty. International factors such as unfavourable terms of trade and large external debt burdens have negatively affected economic performance. Domestic constraints have also played a role. Civil wars and political instability have seriously affected economic development, and have taken a direct toll on food production by driving farmers off their lands. There has also been inadequate public investment in agricultural research, training and infrastructure (FAO 1998:3).

The NEPAD (New Partnership for Africa's Development) is designed to address the current challenges facing the African continent. Issues such as the escalating poverty levels, underdevelopment and the continued marginalisation of Africa needed a new radical intervention spearheaded by African leaders to develop a new vision that would guarantee Africa's Renewal. Through NEPAD numerous programmes around water, energy, telecommunication and transport infrastructure, and human resources development are addressed. Other initiatives including work on expanding access to education, especially for rural communities, to improved the health infrastructure on the continent with special attention to communicable diseases such as TB, Malaria, HIV and AIDS and the mobilizing for affordable drugs (Mbeki 2005:2).

An important part of NEPAD is the issue of food security and the improvement of the agricultural sector, ensuring better capacity and efficiency and improved investment.

Related to this, is the critical matter of market access to the markets of the developed nations (Mbeki 2005:2).

2.3.4 Food security in South Africa

Food security is a part of section 27 of the Constitutional rights of South African (SARPN 2001:1). The Reconstruction and Development Programme (RDP), which was introduce in 1994 by President Nelson Mandela, identified food security as a priority policy objective. As a result, the Government reprioritised public spending to focus on improving the food security conditions of historically disadvantaged people (SARPN 2002:1).

Sound nutrition is the basic human right which is also guaranteed by the South Africa's Constitution, through the Bill of Rights. The Department of Health has an obligation to ensure that nutrition security is respected, protected, facilitated and provided to the all people (Kloka 2003:1). In addition, the rights to basic nutrition and sufficient food and the right to education are recognised concept, mandating the state in ensuring that all children do not go hungry or remain chronically malnourished (Kalman 2005:6). In *per capita* terms, South Africa is an upper-middle-income country, but despite this relative wealth, the experience of most South African households is of outright poverty or of continuing vulnerability to being poor (Budlende *et al* 1998: 1).

At national level, one out of two households in South Africa experienced hunger, one out of four were at risk of hunger and only one out of four households appeared food secure (NICUS 2005:4). The implication is that 35 percent of the South Africa population is vulnerable to food insecurity, and may be notably higher for some geographic regions (DoH 2004:4). Development indicator figures reported that as much as 43 percent of the SA population were surviving on less that R 250/month (Marais 2007:3).

While starvation seldom occurs in South Africa, children and adults do go hungry and chronic mild undernutrition does occur when financial resources are low. The mental and

physical changes that accompany inadequate food intakes can have harmful effects on learning, development, productivity, physical and psychological health, and family life (FRAC 2005:1). Literature on the economic status of households that the predominantly provinces rural and those with a high incidence of commercial farms, are most at risk of food insecurity (DoH 2004:4).

2.3.5 Household food security and insecurity

Household food security exists only when all people, at all times, have physical and economic access to sufficient, safe and nutritional food in order to meet dietary needs and food preferences for an active and healthy life (Coutsoudis, Maunder, Ross, Ntuli, Taylor, Marcus, Dladla, & Coovadia 2000:1).

According to the FAO (2005b:1), nutritional status of each member of the household depends on several conditions achieved. The food available to the household should be shared according to individual needs; the food must be of sufficient variety, quality and safety; and each family member must have good health status in order to benefit from the food consumed (FAO 2005b:1).

2.3.6 Food security and urbanisation

Urbanisation is the process in which the number of people living in cities increases compared with the number of people in the rural areas. A country is considered to be urbanised when more than 50 percent of its population lives in urban areas (Collins 2001:1). In South Africa the rate of urbanisation has been very rapid since the 1950s.

Currently 57 percent (or 21 million) of South Africans are living in towns and cities, an average level of urbanisation for a third world country. According to expectations 73 percent of the population will be urbanised (43.7 million) by 2010. Rapid urbanisation brings with it many problems as it places huge demands on land, water, housing, transport and employment (Collins 2001:1) as well as severe challenges to food and nutrition security (FAO 2005c:1).

2.4 INITIATIVES TO PREVENT AND CONTROL MALNUTRITION

Malnutrition is a general term for the medical condition in a person caused by an unbalanced diet containing either too little or too much food or a diet missing one or more important nutrients (Wikipedia 2006:1). Malnutrition is both a medical and a social disorder, often rooted in poverty. Combined with poverty, malnutrition contributes to a downward spiral fuelled by an increased burden of disease, stunted development and reduced ability to work (WHO 2006:2).

Poverty, low levels of education, and poor access to health services are major contributors to childhood malnutrition. The United Nations Children's Fund (UNICEF) estimates that malnutrition and diseases claim the lives of nearly 212 000 children every week at the rate of one every three seconds (UNICEF 2005:2; Boyle 2003:376).

There are strategies of preventing, controlling and overcoming malnutrition through dietary improvement namely food fortification and supplementation. These approaches are not only preventing micronutrient deficiency problems but also contribute to general malnutrition prevention (FAO 1997:3).

2.4.1 Food fortification

Fortification means to strengthen food with vitamins, minerals and other nutrients (DoH 2003:1). The food fortification vehicle can be either a staple food, or a more-processed commercially available food (Darnton-Hill & Nalubala 2002:231). Fortification of food with micronutrients is perceived as a valid technology within a food-based approach where existing food supplies and limited access fail to provide adequate levels of the respective nutrients in the diet (Nantel, Tontisirin, Nantel, Bhattacharjee 2002:247).

2.4.1.1 Requirements for a food vehicle for fortification

A food which is commonly consumed by the target population should be fortified. The constant consumption pattern with a low risk of excess consumption is of importance as

well as good stability during storage. Foods which are of relatively low cost, that are centrally processed with minimal stratification of the fortificant and with no interaction between the fortificant and the carrier food, need to be chosen. A suitable food vehicle for fortification are those foods that are contained in most meals, with availability unrelated to socioeconomic status and are linked to energy intake (Darnton-Hill & Nalubala 2002:232).

2.4.1.2 Advantages and disadvantages of food fortification

The advantages of food fortification are a support link to sustainable long-term dietary changes in a population (Nantel *et al* 2002:247). It requires relatively less change in consumer behaviours and food habits than the other interventions (Darnton-Hill & Nalubala 2002:231,247). The disadvantage of fortification frequently target same populations, particularly those located far from urban areas, do not have access to centrally-processed fortified foods.

2.4.2 Food Supplementation

Supplementary programmes are a 'safe-net' for those families that cannot cope and are not sustained by the general ration (Golden 2000:509 – 511). Supplementation is the distribution of food to supplement energy and other nutrients missing from the diet of those who have special nutritional requirements. The most common purpose of supplementary feeding is to prevent or alleviate malnutrition through reducing the nutrient gap between an individual's actual consumption and his/her requirement. Supplementary feeding is therefore one of the strategies of providing food or making it more accessible to certain population groups (World Bank 2006:4-12).

2.4.2.1 Basic types of supplements

Vitamins, minerals, herbs and other supplements offer a powerful resource for personal health and wellbeing. Supplements, even if they derived from plants and other natural

sources, are chemical substances, which can sometimes have marked side effects, and if used unwisely, can be toxic. Dietary supplements encompass a wide array of vitamins, minerals and herbs, as well as other compounds that have been extracted or created from natural sources (Readers Digest 1999:9-10).

2.4.2.2 Advantages and disadvantage of supplementation

The advantages of food supplementation relate to the rapid improvement in the nutritional situation of a target group (Shrimpton & Schultink 2002: 224) and can be used for specific treatment and prevention. Storage and transportation is less problematic than for foodstuffs and provides a politically-visible form of assistance (Prinzo & De Benoist 2002:255)

The disadvantage of supplementation is that the recipients usually required the intake in a regulated manner (Shrimpton & Schultink 2002: 224). The major problem is the regular mass distribution and non-compliance of the product. Procurement is difficult because of insufficient quantities and the short-term measure. The iron and vitamin A supplementation need to be carefully monitored to prevent a problem of possible toxicity (Prinzo & De Benoist 2002:255).

2.5 AVAILABILITY AND ACCESS TO FOOD IN LOW-INCOME HOUSEHOLDS

Food accessibility is influenced by the availability of food in the markets, its physical accessibility and affordability, which in turns affects household's dietary intake amongst the poor households in urban areas. The main determination of food accessibility at the household level includes prices, income and access to food by the urban poor households. Access to food depends upon whether or not the household has enough income to purchase food at prevailing prices. Income may exhibit a seasonal aspect since many of the urban poor tend to be employed in the informal sectors (Latham 1997:7; Sswewanyana 2003:11; Webb & Rogers 2003:4).

Poor households spend 60 to 80 percent of their income on food. Households are vulnerable to higher food prices due to either transport costs or monopolistic practices by powerful traders, which leave the households with little choice of where to buy, consequently increasing the risks of consuming poor quality food (FAO 2005b:1).

According to the Joseph Rowntree Foundation (JRF), low-income families had changed their food-buying habits in an attempt to economise. The cost of food took precedence over issues of taste, cultural acceptability and healthy eating (JRF 2005:2). Achieving good nutrition can be a challenge for anyone, but is especially challenging in low-income communities. When forced to stretch limited resources to cover all basic needs, it is not always possible to afford adequate food for oneself and one's family, let alone adequate nutritious food (FAO 2005c:2).

Food access can be another major hurdle. Low-income areas often have disproportionately fewer supermarkets than more affluent areas, sometimes resulting in "food deserts." In supermarkets or food stores that do exist, patrons are often facing with limited selection and poor food quality. Furthermore, the unhealthiest food choices are often the cheapest and the most heavily marketed in low-income areas. Even when healthy foods are accessible, lack of familiarity with certain foods and lack of food preparation skills can be additional barriers to achieving good nutrition (FAO 2005c:2).

2.6 FOOD CONSUMPTION

Over the years food consumption will continue to rise, moving from an average per person of 10987 kilojoules (kJ) (2626 kilocalories (kcal)) in the 1990s to nearly 12552kJ (3000 kcal) in 2015. The daily average consumption rates in developing countries are expected to exceed 12552kJ (3000 kcal) by 2030. Reports also predict that more people will be living in countries with medium to high levels of individual food consumption. This rising level of consumption usually leads to a diversification in the diet and subsequent improved nutrition (Union of Concerned Scientists 2005:2).

It was estimated that by the year 2015, six percent of the world population (412 million people) will still live in countries with very low food consumption levels under 5258kJ (2200 kcal). High rates of undernourishment will be most pronounced in Sub-Saharan Africa where 12 of the 17 countries with individual food consumption rates under 5258kJ (2200 kcal) will be located (UCS 2005:3), indicating a serious problem in the region.

2.6.1 Commonly consumed foods in South Africa

The national Food Consumption Survey conducted in SA identified the five most commonly consumed foods as maize, white sugar, tea, whole milk and brown bread (Institute of Medicine, Food and Nutrition Board as quoted by NICUS 2005:2).

2.6.2 Food consumption at SA schools

According to Meldrum (2005:1) the majority of South Africa's schools are not serving meals at all. Classes at those schools end at about 1.30 *post meridiem* (p.m.) afternoon and learners leave to get their own lunches. Some learners bring their own lunches from home, which usually consist of sandwiches. Most of the township schools have local vendors who sell snacks to learners.

Corn curls and crisps are the items often sold. Some of the township schools have led a way towards better nutrition through vegetable gardens which are funded by the government and supported by parents. Schools with vegetable gardens provided lunches of pap, a stiff maize porridge that is South Africa's staple food, supplemented by vegetable stew, usually made from cabbage, onions, beans, carrots and tomatoes (Meldrum 2005:1).

2.6.3 Meal patterns for children

According to the International Food Information Council (IFIC) (2005:6) to meet energy needs of children and teens, at least three meals a day should be provided, beginning with breakfast (IFIC 2005:6).

Snacks also form an integral part of meal patterns for children and teens. Young children generally cannot eat large quantities of food at one sitting and get hungry long before the next regular mealtime. Mid-morning and mid-afternoon snacks are generally advisable for young children. Fast-growing, active teens may have tremendous energy needs. Even though their regular meals can be substantial, snacks may still be needed to supply energy between meals and to meet daily nutrient needs (IFIC 2005:6).

2.7 SCHOOL FEEDING PROGRAMMES IN SOUTH AFRICA

According to Steyn, Hanekom, Nesamvuni, Oosthuizen and Laubsher (1996:131-136) the school feeding scheme programme was introduced in South Africa for the first time in 1944.

The school feeding programme was once again introduced at national level by President Mandela in the year 1994 as a lead project of the Reconstruction and Development Programme (RDP). The main aims were to contribute to the improvement of educational quality of primary school pupils by enhancing active learning capacity, school attendance and punctuality, to contribute to general health development by alleviating temporary short-term hunger, to educate pupils on nutrition and also improve nutritional status through micronutrient supplementation and parasite eradication where indicated and to develop the nutrition component of the general curriculum (Wentzel-Viljoen 2003:224).

Since July 1995 the programme was co-managed by the Department of Health and the Department of Education (Wentzel-Viljoen 2003:137). In April 2004 the primary school nutrition programme was transferred to the Department of Education (Van Stuijvenburg

2005:S214). Five million primary school children per year, on average, received food through this initiative during the last ten years (Engelbrecht 2005:2; Wentzel-Viljoen 2003: 205).

School feeding is one of the strategic objectives for addressing household food security in South Africa (Steyn & Labadarios 2002:333). Learners participating in school feeding programmes receive meals or snacks at school, with the purpose of reducing short-term hunger and improve nutritional status for better concentration, understanding and academic performance. These meals benefit more than just the children whom are fed at school. Feeding children at school benefits the community and society as a whole. This is known in economical terms as a "positive external effect" (Engelbrecht 2005:1).

2.7.1 Department of Education (DoE) and Joint Aid Management school feeding programme

School feeding programme guidelines for nutritional compliance are indicated by the Department of Health and UNICEF. The later are recommended by JAM. Both these sets of guidelines were applied to guide calculations for nutritional compliance in this research. See Table 1.

2.7.2 Primary aim of designing a school feeding programme

2.7.2.1 Aims of Department of Education School feeding programme

Proponents of school feeding programmes point to a variety of logistical, empirical and moral factors that suggest the need for school feeding. The following examples indicate the aims for school feeding programme:

- To provide nutritious supplement meals to learners so as to deal with temporary hunger.

- To improve learners active learning capacity and therefore increase school achievement, attendance and punctuality.
- To encourage sustainable food production towards job creation and economic improvement (DoE 2006: 2).

Table 1 Guidelines for nutrient intake

Department of Education (DoE) (South African Health Review 2002:5).	Joint Aid Management (JAM) (JAM 2005:1).
• The food option or combination of options selected should provide a balance of nutrients and not less than 25 percent of the RDA for energy for the 7 and 10 year old target group and not less than 20 percent of the RDA for energy for the 11-14 year old target group.	• JAM recommends the provisioning of the equivalent of a 100g dry CSB mix per child a day. The nutritional guidelines provided aim to reach at least 70 percent of the RDA as recommended by UNICEF.
• Menu options should make use of already available food product, that are culturally acceptable, commonly consumed and that fit in with the local eating habits. School feeding seeks to address the effects of short-term hunger on active learning capacity and school attendance. Energy-rich food served preferably before 09:00 (South African Health Review 2002:5).	

2.7.2.2 Aim of the Joint Aid Management (JAM) feeding programme

Nutritional feeding is at the core of creating environments for sustainable development within communities by:

- Reduce protein and energy malnutrition (PEM) by providing an energy and protein rich "early morning" or "mid morning" snack.
- Alleviate "short term hunger" in the classroom.
- Address micronutrient deficiencies such as vitamins, iron and calcium.

- Enhance active learning capacities of school children.
- Improve school attendance and punctuality (JAM 2007:1; JAM 2004:4).

The Orange Farms School feeding programme included the consumption of corn soya blend mixture which consists of extruded whole white/yellow maize 65 percent extruded whole soya 25 percent and sugar 10 percent (JAM: 2006:1)

2.8 SPECIFICATIONS OF THE CSB PRODUCT

2.8.1 Nutrient content specification

JAM indicates the following specifications for the CSB mix (JAM 2006:1-3):

Table 2 Nutrient content of the corn soya blend (JAM 2006:1-3).

Nutrient	Specification	Basis
Moisture	10% max	
Urease activity pH difference	0.05-0.2 pH units	As recommended
Crude Protein N x 6.25	15% min	Dry matter
Crude Fat – Acid Hydrolysis	6% min	Dry matter
Crude Fibre	5% max	Dry matter
Energy	350kcal/100g min (1464.4kJ/100g)	Dry matter

Micronutrient Fortification of corn soya blend (CSB) per 100g finished product

Nutrient	Unit	Specifications: Fortified CSB
Vitamin A	[1]I.U. / µg [2]RE	1664 / 998.4
Thiamine	[3]mg	0.128
Riboflavin	mg	0.448
Niacin	mg	4.8
Folate	[4]µg	60
Vitamin C	mg	48
Vitamin B12	µg	1.2
Iron ++	mg (ferrous fumarate)	8
Calcium ++	mg (calcium carbonate)	100
Zinc ++	mg (zinc sulphate)	5

[1]I.U International Unit
[2]RE Retinol Equivalents
[3]mg milligram
[4]µg microgram

2.8.2 Raw material specification

Raw materials for the production of the mix should be of good quality, free from foreign materials, substances hazardous to health, excessive moisture, insect damage, and fungal contamination. The raw materials should comply with all relevant national food laws and standards, and should be stored under dry, ventilated, and hygienic conditions. Use only insecticides that would not contaminate foods. The variation of the final product with respect to contents of moisture, fibre, protein, fat and micronutrients should not exceed five percent of the original value using standard analytical techniques (JAM 2006:1-3).

The product should be sound, fair and merchantable, free from abnormal smell, and live pests, of a colour proper to this product and a uniform fine texture with the following particle size: 100 percent passing through a 1.0 millimetre (mm) sieve and minimum of 95 percent passing through a 0.6 mm sieve. Shelf life must be a minimum of six months subject to proper transport and storage conditions (JAM 2006:1-3).

2.8.3 Corn or maize

Grain contain about the same amount of protein as other cereal grains (8-10%). However much of it is in the form of zein, a poor quality protein containing only small amounts of lysine and tryptophan. Maize forms the staple diet of many countries in the world, and it also used for the manufacture of starch, syrup and sugar, ready-to-eat cereals (corn flakes), meal, flour and industrial spirit (Kent & Ever 1994:22; Latham 1997:258).

2.8.4 Soya

The soya bean is the seed of the soya plant. Soya foods made from the bean include textured vegetable protein (TVP), tofu, tempeh, miso, and margarine, and soya, dairy alternatives like soya milk and soya yoghurt (Rutherford 2005:1).

Soya-based products provide an alternative source of protein, with the added benefit of containing fibre, vitamins and minerals. Soya is a source of energy and also provide

antioxidant protection against oxidative stress and are low in fat and high in phyto-oestrogens and isoflavones, which convey disease-preventing properties (Rutherford 2005:1).

Figure 2 Soya (Rutherford 2005:1)

2.9 NUTRITIONAL COMPLIANCE

For the purpose of this study nutritional compliance of the CSB porridge for energy, vitamin A, thiamine, riboflavin, niacin, folate, vitamin C, vitamin B12, iron, calcium and zinc was of importance as stipulated by Department of Health (2003:1-18) and JAM (2004:1) in terms of the RDA guidelines for the specific gender and age group. See Table I.

Recommended Dietary Allowance (RDA) is the average daily dietary nutrient intake level that is sufficient to meet the nutrient requirements of nearly all (97 to 98 %) individuals in the specified life stage and gender group. The RDA applies to individuals, not a group, and serves as a goal for dietary intake by individuals (Boyle 2003: 91).

2.9.1 Estimations of energy requirement

The World Health Organisation (WHO) defines the energy requirements of the individual as the level of energy intake that will balance energy expenditure when the

individual has a body size and composition, and a level of physical activity, consistent with long-term good health (Dulloo & Schutz 2005:94).

Energy is essential for life. It is needed for all basic physiological functioning of the body, particularly at cellular level in active transport, but also more apparent functions such as breathing, digestion and excretion. The most energy-demanding organ is the brain. In addition, muscles require energy for functioning, the heart for circulating blood to all the tissues, and human skeletal muscles to maintain posture, balance and mobility. For any activity, whether for occupation, leisure or sports, more energy supplied and sleep, energy is utilized, same applied to learners for active learning they need energy (Barasi 1997:115).

In children, pregnant, lactating women and adult the estimated energy requirement (EER) includes the needs associated with the deposition of tissues or the secretion of milk at rates consistent with good health (Institute of Medicine, Food and Nutrition Board as quoted by NICUS 2003:15).

2.9.2 Micronutrient requirements for children

Based on the publication by FAO (1998:9) vitamins and minerals, called micronutrients, are needed in the human body in smaller amounts than protein, fat and carbohydrates. Vitamins and minerals assist with all the body functions and forms part of the tissues. For the purpose of this study energy, vitamin A, thiamine, riboflavin, niacin, folate, vitamin C, vitamin B12, iron, calcium and zinc intake, which were identified as crucial by the JAM feeding programme, were addressed.

2.9.2.1 Vitamin A

Vitamin A deficiency is associated with inadequate levels of vitamin A in the body (Barasi 2003:162). The function of Vitamin A is building and maintaining healthy tissues, particularly eyes, skin, bones and tissues of the respiratory and digestive tracks. It is also important for effective function of the immune system. The deficiency in vitamin

A can lead to poor night vision, severe eye lesions and in severe cases permanent blindness (FAO 1998:9).

Good animal sources of vitamin A are eggs, butter, milk and milk products, and liver and fish or fish oil. Plant foods contain carotenoids, which are red or yellow pigments found in many fruits and vegetables. Red palm oil, used in parts of Africa, is rich in alpha-carotenes. Rich sources of carotenoids include carrots, dark green leafy vegetables, broccoli, red peppers and tomatoes. Fruits such as apricots, peaches and mango are also good sources of vitamin A (Barasi 2003:162).

RDA of vitamin A for children differs between the age groups namely 400mg for both male and female per day when aged between four to eight, 600mg for both genders between nine to thirteen years of age and 900mg per day for females and 700mg for males between fourteen to eighteen years old (Stanfield 1997: 6-7).

These guidelines were of importance in this study.

2.9.2.2 Vitamin B complex

The B vitamins are classified as vitamin B complex, including vitamin B1 (thiamine), B2 (riboflavin), B3 (niacin), B6 and B12. The B vitamins assist with converting carbohydrates, protein and fat into energy, and the building and repairing of the body tissues. The deficiencies of these vitamins can lead to serious effects including muscular weakness, paralysis, mental confusion, nervous system disorders, digestive problems, cracked and scaly skin, severe anaemia and heart failure (FAO 1998:9).

Vitamin B1 (thiamine) available from pork and enriched grain, seeds, nuts and legumes; vitamin B2 (riboflavin) from dairy products, whole and enriched grains, leafy green vegetables and meat; vitamin B3 (niacin) from beef, chicken, fish, peanuts, legumes, whole and enriched grains, vitamin B6 from meat, fish, poultry, legumes, whole grains,

nuts and seeds; and vitamin B12 from Animal products (Grosvenor & Smolin 2006:239-240).

The RDA of all the vitamin B for the children of the following age groups in South Africa is 1.2mg for both male and female of age between four to eight,1.8mg male and female of age between nine to thirteen and 2.4mg for both males and female's age between fourteen to eighteen per day (Institute of Medicine, Food and Nutrition Board as quoted by NICUS 2003: 76-90).

2.9.2.3 Folate

Folate is a water-soluble vitamin essential for new cell production and growth. It helps in the production of without DNA and ribonucleic acid (RNA) and mature red blood cells, which ultimately prevent anaemia (Economos & Clay 1998:4).

Folate is considered significant not only for the prevention of macrocytic anaemia, but also for normal foetal development, and the maintenance of cardiovascular health and cognitive function in the elderly. Staple diets largely consist of cereal grains and tubers that are very low in folate but can be improved by the addition of legumes or green leafy vegetables. For example, a regular portion of cooked lentils (95g) added to a rice-based diet can provide an amount of folate sufficient to meet the desirable nutrient density for this vitamin (FAO 2002: 43).

Other legumes such as beans and peas are also good sources of this vitamin, but larger portions are needed for folate sufficiency (100g beans and 170g peas). Cluster bean and colacasia leaves are excellent folate sources used in the Indian diet. Another good source of folate is chicken liver; only one portion (20-25g) is sufficient to meet the desirable nutrient density for folate and vitamin A simultaneously. The best sources of folate are organ meats, green leafy vegetables, and sprouts. However, 50 percent or more of food folate is destroyed during cooking. Prolonged heating in large volumes of water should

be avoided, and it is advisable to consume the water used in the cooking of vegetables (FAO 2002: 44).

The RDA of folate for children is 200mg for males and females age between four to eight, 300mg for males and females of age between nine to thirteen and 400mg for both males and female's of ages between fourteen to eighteen (Bender 2002:160-166).

2.9.2.4 Vitamin C

Vitamin C is needed to increase absorption of dietary iron, to make collagen (connective tissue) which binds the body cells together, and to serve as an antioxidant. According to the FAO (1998:9) and Stanfield (1997:84), prolonged vitamin C deficiency can lead to scurvy, failure of children to thrive and low resistance to infection. The symptoms of scurvy are bleeding gums and sore, swollen joints and it can lead to death. Vitamin C assists in bone and teeth formation. Most dietary vitamin C are supplied by fruits and vegetables; only a very small amount comes from animal sources, mostly from milk, although the level may be reduced by pasteurisation and other processing (Barasi 2003:187 -188; Napier 2001:31).

Among the fruits, the richest sources are blackcurrants and rosehips. For the general population, oranges (and orange juice) probably provide the most vitamin C. Other sources are mangoes, papayas and strawberries. Vegetable sources include green peppers, broccoli, cauliflower and brussels sprouts. Potatoes have a varying content of vitamin C: new potatoes are rich in the vitamin, but content declines as the storage time increases. Vitamin C can also be obtained by consuming 52 percent of fruits which half will be from fruits juice, 34 percent of vegetables, nine percent from potatoes and seven percent of milk (Barasi 2003:188-189).

The RDA of vitamin C for children of certain age groups in South Africa is 25mg for both males and females of age between four to eight, 45mg for male and females of age

between nine to thirteen and 75mg for females and 65mg males between fourteen to eighteen years of age (Napier 2001: 30-35; Bender 2002:169-170).

2.9.2.5 Vitamin D

Vitamin D is also called 'the sun vitamin' because the skin produces vitamin D when the sun shines on it. The body stores vitamin D in the liver and fat. Vitamin D is important in maintaining blood calcium and phosphorus levels for normal bone calcification. Sources of vitamin D are butter, cheese, animal ghee, milk, fatty fish, eggs and liver (King, Shames & Woodhouse 2000:6). According to the FAO (1998:9) a lack in vitamin D can lead to rickets, a disease that cause soft and deformed bones in young children (Ensminger, Ensminger, Konande & Robson 1994:398).

The RDA of vitamin D for the children of different age groups in South Africa is 400mg for both males and females of age between four to eight, 600mg male and female of age between nine to thirteen and 900mg females and 700mg males both age between fourteen to eighteen (King, Shames & Woodhouse 2000:8).

2.9.2.6 Iron

Iron deficiency anaemia (IDA) is the most prevalent nutritional disorder worldwide. The World Health Organization estimated that IDA affects approximately 50 percent of children, 42 percent of women and 26 percent of men in the developing countries. IDA can impair cognitive development, lowers work capacity, and reduces resistance to disease (Sustain 2002:2).

Iron is part of the haemoglobin molecule in blood. According to the FAO (1998:9) and WHO (2000:20) iron deficiency is the most prevalent in children and also in women of childbearing age. The deficiency can leads to lethargy (low work capacity), learning difficulties, poor growth and development and increased morbidity (illness) and maternal mortality, especially at child birth. In infants and young children, the functional

consequences of insufficient iron include impaired psychomotor development, coordination and scholastic achievement and decreased physical activity levels (WHO 2000:20).

The major sources of iron include meat, poultry, liver and other organs. Other sources are legumes, dark green leafy vegetables and dried fruits. Vitamin C should be included with iron containing foods to assist with absorption (Stanfield 1997:106).

The RDA of iron for the children of certain age groups in South Africa it indicates 10mg for both male and female of age between four to eight, 8.0mg male and 8.0 for female age between nine to thirteen and 11mg females and 15ªmg males both age between fourteen to eighteen per day (Stanfield 1997:106).

2.9.2.7 Calcium

Calcium and phosphorus are used for building bones and teeth. Most of the body's calcium and phosphorus is found in the bones and teeth, giving rigidity to the structures. Bone is being built every day, with new bone being formed and old bone being taken apart. Calcium also circulates in the blood where a constant level is maintained ensuring availability for use. Calcium helps blood to clot, muscles to contract (including the heart muscles), nerves to transmit impulses and to maintain normal blood pressure. A child who is growing rapidly absorbs a greater proportion of the calcium in the diet than an adult who simply needs to maintain the level of calcium in the bones and soft tissue (Drummond & Brefere 2001:228-229; Moore 1993:369, Stainfield 1997:101; Ensminger *et al* 1994:398).

The major sources of calcium are dairy products such as milk and milk products. Dairy products provide more than half of the calcium in the typical diet (Insel, Turner & Ross 2002:423). The RDA of calcium per day for children in South Africa is 800mg for both males and females between four to eight years of age and 1300mg for males and females

aged nine to eighteen years (Moore 1993:369, Stainfield 1997:101; Ensminger *et al* 1994:398).

2.9.2.8 Zinc

Children need zinc to grow and develop normally and both children and adults need zinc to heal wounds and to fight infections. Usually a lack of zinc in the body is due to a generally poor diet. Zinc deficiency cause slow growth or failure to grow, diarrhoea, immune deficiencies, skin changes and eye lesions, delay sexual maturation, and aggravate night blindness, behavioural changes, and poor appetite and slow wound healing. Zinc supplementation of malnourished infants and growth-retarded young children resulted in improved growth (WHO 2000:27).

The most important sources of zinc include animal and plant foods that are good sources of protein such as organ meats, muscle meat, poultry, wholegrain breads, cereals, legumes, peanuts and peanut butter (King, Shames & Woodhouse 2000:6).

The RDA of zinc per day is 5.0mg for both males and females between four to eight years old, 8.0mg for males and females of ages between nine to thirteen and 11mg females and 9.0mg for males between fourteen to eighteen years of age (Stanfield 1997:110).

2.10 PRODUCT ACCEPTABILITY

Food acceptability by consumers is being referred to by such terms as palatability, hedonic tone, liking or disliking, food preferences and pleasantness or unpleasantness (Cardello1996:2).

2.10.1 Influence of food acceptance on children

The food acceptance by a child is influenced by the example set by parents and familiar adults, siblings in the home and peers. In addition, the number of exposures to unfamiliar foods influences the child's likes and dislikes (Carruth & Skinner 2000:771-780).

2.10.2 Sensory perception of the products

There are two methods of determining sensory perception namely preference acceptance testing and consumer acceptance testing. For the purpose of this study consumer acceptance testing was used. This type of sensory analysis is of key importance in the food industry.

2.10.2.1 Taste

The sensation of taste is a result of the effect of water-soluble molecules interacting with receptors on the tongue and in the oral cavity. These receptors contain taste buds that are renewed every six to eight days. Taste substances are received onto the membranes of those cells containing taste buds, which then transmit an impulse to the brain (Carpenter, Lyon & Hasdell 2000:19).

For the purpose of this study, only one product acceptability method, namely consumer acceptance testing, was utilised in order to keep the procedure as easy as possible for the school children to understand.

2.10.2.2 Texture

Texture is the attribute of a substance resulting from a combination of physical properties and perceived by the senses of touch (including kinaesthesia and mouth feel), sight and hearing. Physical properties may include size, shape, number, nature and conformation of constituent structural elements (Carpenter *et al* 2000:22).

Texture involves more than just initial biting force. The terms for describing solid oral texture are divided into seven general categories that follow, in chronological order, the events comprising mouth feel/texture - from initial lip contact up through swallowing. Depending on the features of a particular product, these sensation categories can be expanded or eliminated depending on what factors are applicable (Hegenbart 1998:3).

Surface texture is how the product's surface feels to the lips and tongue. It includes surface geometry, such as the overall degree of roughness and whether the rough sensation is large and bumpy or fine and grainy. Also included is the amount of wetness or oiliness on the surface (Hegenbart 1998:3).

2.10.3 Hedonic rating tests

Oregon State University (OSU) indicates that the rating scale method measures the level of the liking of foods, or any other product where an affective tone is necessary. Hedonic tests rely on people's ability to communicate their feelings of like or dislike. Hedonic testing is popular because it may be used with untrained people as well as with experienced panel members. A minimum amount of verbal ability is necessary for reliable results in hedonic testing. Samples are presented in succession and the subject is told to decide how much he likes or dislikes the product and to mark the scales accordingly. The nature of this test is its relative simplicity (OSU 1998:1), and was therefore sustainable for this study.

According to Guinard facial hedonic scales are appropriate for use with children or groups with limited literacy level (Guinard 2001 as quoted by University of Pretoria 2005: 17-18). In this situation a rating scale is used to reflect consumers' perceptions or opinions about acceptance, liking or disliking of specific products and specific attributes of products (UP 2005:14).

The hedonic scale is the most commonly used scale to index likings and consumer acceptance of food, which include the rating scale with the points of value for the rating

of like extremely (9), like very much (8), like moderately (7), like slightly (6), neither like nor dislike (5), dislike slightly (4), dislike moderately (3), dislike very much (2), dislike extremely (1) (Moskowitz 1991:260).

This scale was also utilised to assess the acceptability of the CSB porridge by the school children. For this study, a three point hedonic scale was utilised including good, average and bad (Annexure A) though facial expressions. For this study assessment took place during the daily school feeding programme. The hedonic ratings were converted to scores and treated by rank analysis or analysis of variance (OSU 1998:1).

2.10.4 Evaluation of samples

During sample preparation and presentation the following should be considered

- Amount of the product to be utilised, measured by weight or volume, using precise equipment e.g. scale.
- Serving equipment to be used.
- Preparation process, regulation of time and temperature.
- Holding time (minimum and maximum time after preparation that a product is served).
- Information about the samples: as little as possible information must be provided to panellists to prevent expectation errors (UP 2005:32-33).

2.11 SUMMARY

Poverty, food insecurity and malnutrition are still obstacles to human rights, quality of life and human dignity. Today about 50 percent of the urban population in SSA live in poverty. Therefore, improving food security is essential for attaining a safer and more stable social climate in developing countries (FAO 2001:2).

Food fortification and supplementation of which the CSB and the school feeding programme are an example can be used as the strategic objectives for addressing

household food security in South Africa (Steyn & Labadarios 2002:333). Learners receive meals or snacks at school, with the purpose of reducing short-term hunger and improve nutritional status for better concentration, understanding and academic performance. These meals benefit more than just the children whom are fed at school, but the community and society as a whole also benefit (Engelbrecht 2005:1).

JAM is one of the non-government organizations (NGO's) providing meals (CSB porridge) to schools in South Africa. The next chapter is presenting the strategies undertaken in order to successfully feed the learners and to achieve the programme goal. The latter aimed to provide children with a meal which will contribute 70 percent of the RDA, as recommended by the UNICEF guidelines (as advocated by JAM), as well as with not less than 25 percent of the RDA for energy for the seven to ten year old group and not less than 20 percent of the RDA for energy for the eleven to fourteen year old group as recommended by the Department of Health.

3

METHODOLOGY

3.1 INTRODUCTION

This study on the sustainability of corn soya blend porridge use in the JAM Orange Farm schools feeding programme focused on regulatory compliance and sustainability of food product acceptance.

3.2 ADMINISTRATION

3.2.1 Obtaining permission

Permission was obtained from the principals of the Reitumetse and Sinqobile Primary Schools to undertake this research project. A public meeting with parents, school head masters, teachers, Vaal University of Technology representatives (Professor WH Oldewage-Theron and Masters Degree (MTech students) and Joint Aid Management (JAM) representatives were held before the feeding programme could commence. The MTech students were introduced to the attendees at the meeting. It was indicated that these students will conduct individual research projects as part of the main study.

During the meeting two letters which included all the details of the project, requirements and expectations, were distributed to the parents. Parents were asked to complete these letters in order to approve scholars' participation in the study and provide consent. The whole process was conducted under leadership of Prof WH Oldewage-Theron, as part of the main study, to determine the nutritional status of the school children in Orange Farms (Annexure B).

3.2.2 Ethical consideration

In the main study approval for the larger project was obtained from the Human Research Ethics Committee at the University of the Witwatersrand (R14/49) (Annexure C). It was indicated to the respondents, in the letters of consent, that the dissemination of information will take place in a responsible and professional manner and that all information and findings will be treated with respect and confidentiality. Anonymity was promised with regard to personal and sensitive information by providing participants with project numbers. The participation of the scholars in this study was voluntarily.

3.2.3 Dissemination of information and intellectual property rights

The information generated in this study is reported for the purpose of an MTech qualification. A reporting article will also be submitted for publication to an accredited scientific journal, indicating JAM as collaborator. Copyright of all data and related information (whether ideas or written matter) remained the intellectual property of Vaal University of Technology (VUT).

3.3 STUDY POPULATION

3.3.1 Basis for selection of schools in Orange Farms

Orange Farms was recognised to be amongst the 'poorest of the poor' communities in the Gauteng province. Joint Aid Management requested the councillors from the Orange Farms local municipality to identify schools with a high level of poverty. Five schools, which included three secondary schools (Isikhumbuzo, Siyaphambili and Tshebetso) and two primary schools namely Reitumetse and Sinqobile, were identified for inclusion in the main project. For the purpose of this study, only the two primary schools were sampled.

The corn soya blend product and soya stew was provided by the Joint Aid Management (JAM) to the five schools for voluntary consumption. The secondary school learners were consuming CSB stiff porridge and soya stew whereas the primary school children were consuming CSB soft porridge.

3.3.2 Basis for selections of respondents

School children between six and fourteen years of age from different grades participated voluntarily in this research study at the indicated primary schools. Sinqobile Primary School presented classes from grade zero to grade nine whereas Reitumetse Primary School presented classes from grade zero to grade seven. For comparative purposes in this study, voluntary participants from grade one to seven from both schools were included. Grade zero was excluded to avoid bias as some of the young children were unable to understand and respond to the questions.

3.3.3 Population size

The study population was not determined through specific selection but opportunity sampling was applied. Over the four occasions of data gathering seven hundred and fifty nine (760) assessments were completed by five hundred and thirty eight (538) respondents from Reitumetsi Primary School and two hundred and twenty two (222) respondents from Sinqobile Primary School. Over the four occasions 272 males and 266 females participated from the Reitumetse Primary School and 122 males and 100 females from Sinqobile Primary School.

3.3.4 Geographical demarcation

This research was conducted in the urban informal settlement of Orange Farms District Eleven (D11) of the greater Johannesburg Metropolitan Municipality in Gauteng Province, South Africa. Orange Farms is situated to the south of the Johannesburg central

business district between Lenasia and Evaton (Emfuleni Municipality) District Seven (D7) and Eight (D8) (See Figure 2).

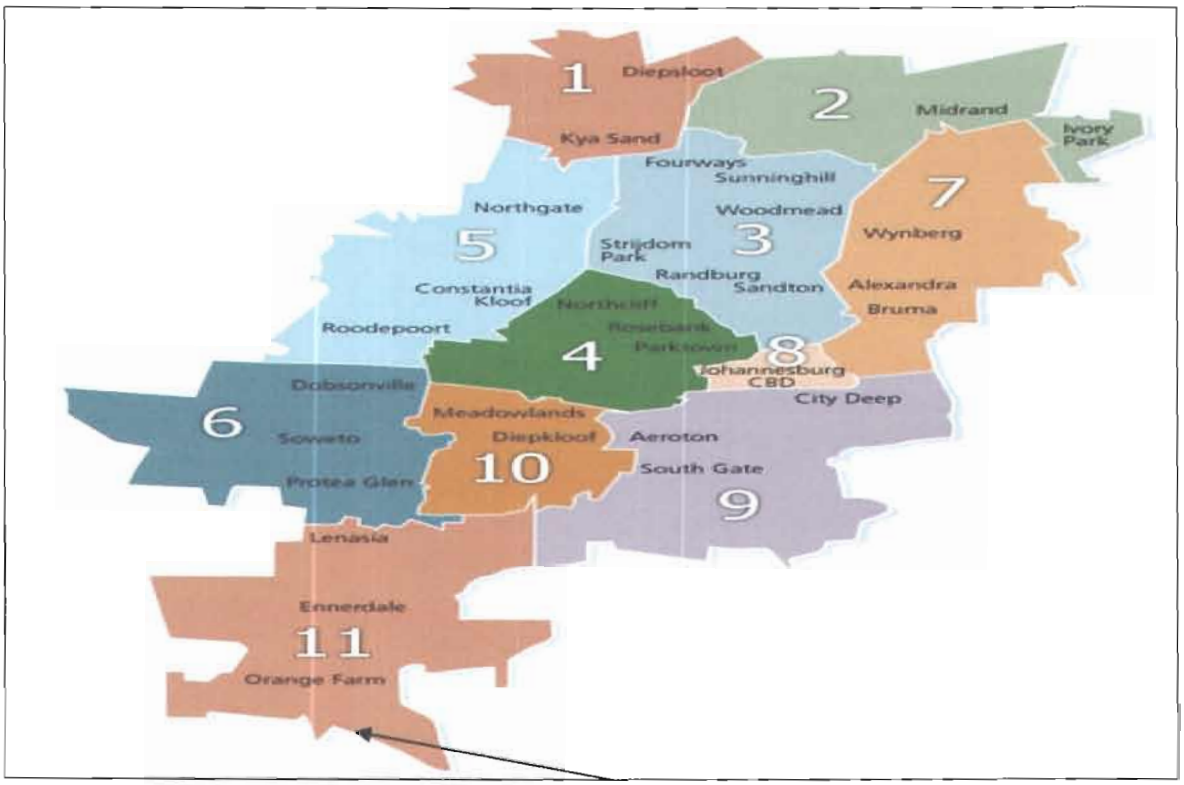


Figure 3 Location of the Orange Farms informal settlement (Wikipedia 2005:1)

3.4 RESEARCH DESIGN

A comparative research approach was followed.

3.5 OPERATIONALISATION

This research project was conducted in two phases, namely:

(1) the standardisation of the CSB porridge preparation procedures, ingredient ratios and serving sizes in order to ensure compliance with the regulatory goals for nutrient supply as stipulated by JAM and the Department of Health of South Africa for school feeding, and

(2) the testing of the sustainability of porridge acceptance over a two-month period by the participations respondents from the Reitumetsi and Sinqobile Primary Schools.

3.5.1 Phase 1: Product regulatory compliance

3.5.1.1 Assessment of situation

The Reitumetse and Sinqobile Primary Schools were visited on 21st February 2005. The main purpose of the visit was to meet the volunteers that prepare the CSB porridge and to assess the preparation (kitchen) and storage areas.

3.5.1.2 Treatment of corn soya blend (CSB)

The CSB product was delivered to both the Reitumetse and Sinqobile Primary Schools by JAM with the company vehicle. The individual schools provided the storerooms for CSB storage.

3.5.1.3 CSB porridge preparation procedures

The CSB porridge preparation method was observed, including the preparation and cooking method as well as the ratio of the ingredients on three different occasions. The quantity of water (measured) and the amount of raw CSB (weighed) were reported as well as the serving method. Seven samples of servings for each of the grades were randomly collect to estimate average portion sizes.

3.5.1.4 Adjustments of CSB porridge preparation procedures to ensure regulatory compliance

The recommended guidelines provided by the school feeding policy in South Africa (Steyn & Labadarios 2002:335) and the Joint Aid Management (JAM 2004:5) were compared for both boys and girls to determine the requirements to be met accordingly.

The amount and the ratio of the ingredients (CSB mix and water) was adjusted to meet the regulatory guidelines prescribing the nutrient requirements of the school children and to provide for the amount of servings to be prepared. After the adjustments were made the amount of portions served, gender and grade of the respondents were reported over the two month trial period for sensory acceptance.

3.5.1.5 Training of the staff

The volunteering women were trained to use the corrected procedures when preparing the CSB porridge. A group training method, using demonstrations, were applied as part of the training procedures to reduce training time and costs as several employees were to be taught to fulfil the same task (Forrest 1996: 115-116).

The training tools used included a note book, measuring jugs, buckets, raw CSB and water to ensure comprehension as most of the volunteers were illiterate. On three follow-up occasions the CSB preparation procedures were monitored to ensure compliance to the developed guidelines.

3.5.2 Phase 2: Product acceptance testing

3.5.2.1 Development of assessment sheets

After the implementation of the recommendations for compliance, sensory testing was conducted for product acceptability. Development of the sensory assessment sheet occurred after certain aspects have been taken into consideration. These aspects included the comprehension level of the school children and the information needed from the respondents. A three tiered hedonic scale and open ended question format was applied.

The assessment sheet was tested with twenty learners from both the Reitumetse and Sinqobile Primary Schools for the different grades. The learners were randomly selected. The assessment sheet was then adjusted to ensure maximum comprehension.

3.5.2.2 Recruitment of fieldworkers

Two BTech students from the Department of Hospitality and Tourism, Vaal University of Technology with experience as fieldworkers, were recruited. The recruited fieldworkers were people who knew and understand the indigenous languages of the area.

3.5.2.3 Training of fieldworkers

The fieldworkers were trained by two researchers and experienced research fieldworkers (Miss ME Chibe and T Nyathela), on the method to be applied when completing the questionnaire, which included method of completion of the questionnaire, assistance to be provide to the younger children and handling the children.

3.5.2.4 Data collection

Data was gathered on four occasions, equally distributed throughout the two month trial period. Personal interviews were conducted with the children in order to complete the sensory assessment sheet. The rules were explained to the children before completion of the assessment sheet on each occasion. The assessment sheets were completed on behalf of the younger children by the field workers, based on their responses.

3.6 TREATMENT OF DATA

3.6.1 Phase 1: Product compliance

The collected data was screened, captured on the Excel® 2003 spreadsheets of Microsoft Word Office 2003 and analysed. The results were reported through the use of tables and discussions in order to convey understanding to readers.

3.6.2 Phase 2: Sustainability of CSB porridge acceptance over time

The collected data was screened and captured on an Excel® spread sheet. The data were later transferred for further analysis to the Statistical Package for Social Sciences (SPSS)® for Windows, version 14 and statistically analysed by applying cross tabulation techniques in order to indicate the measure of association. The sustainability of product acceptability over the assessment period was indicated. The results were reported through the use of tables and graphs as well as discussions in order to convey understanding.

3.7 SUMMARY

This chapter presented the two phases through which this study was conducted complying with all the school feeding guidelines and the acceptability over time for the use of CSB porridge. The phases were individual outlined as well as the method through which data was collected and reported. Phase one: on compliance focus was placed mainly on observations of the porridge preparation methods, whereas Phase two: product acceptability assessment sheet was completed and analyse and results were reported. The next chapter is presenting the results of the study.

4

RESULTS AND DISCUSSIONS

4.1 INTRODUCTION

Chapter four presents the results of this study to determine the sustainability of CSB porridge use in the Orange Farms JAM school feeding project and are reported for product compliance (Phase 1) and sustainability of product acceptance (Phase 2).

The main findings of this empirical study are presented and reported as undertaken at the Reitumetse and Sinqobile Primary Schools in the Orange Farms informal settlement. Learners of between six to fourteen years old from grade one to seven from both schools were included as part of this study.

The data for this study was collected and presented in two phases, namely:

Phase 1: Regulatory compliance of the CSB porridge

The objective of this phase was to verify the product preparation specifications and serving sizes to meet the recommended guidelines for school feeding as indicated by JAM and the Department of Health. Results reported for the analysis of the situation included the provisioning and storage of the dry CSB mix and the observation of the preparation and cooking methods (when and how) of the CSB porridge. Adjustment of the ratio of the porridge ingredients were implemented and serving sizes were calculated to meet the recommended nutrition regulatory guidelines. The volunteers who did the usual porridge preparation were trained prior to implementation and then monitored for sustainability of practice.

Phase 2: Sustainability of CSB porridge acceptance for long term utilisation

The objective of this phase was to determine the sustainability of product acceptance and CSB utilisation for primary school children. Results reported the profile of the respondents (percentage of participants, age, gender and frequency of CSB porridge intake), sensory acceptance (texture and taste) and consumer perceptions (availability and benefit of consumption) over time.

4.2 PHASE 1: PRODUCT COMPLIANCE

Focus was placed on the analysis of the situation and nutrient compliance with the South Africa school feeding regulatory guidelines.

4.2.1 Analysis of the situation

The analysis of the situation included the observation of the situation at both primary schools (Reitumetse and Sinqobile), the treatment of the CSB product (when and how the porridge was prepared), serving and portioning of porridge, how learners responded towards the CSB porridge, and adjustment of the porridge preparation, serving and portioning.

4.2.1.1 Deliveries to the schools

The stock inventory, frequency of deliveries, method of delivery and amount of the bags of CSB mix delivered to the Reitumetse and Sinqobile Primary Schools was reported in Table 3:

Table 3 Food provisioning to the schools

Delivery process	Reitumetse Primary School	Sinqobile Primary School
Stock inventory	The JAM Orange Farms project facilitator conducted the stock inventory on a weekly basis.	
Frequency of deliveries	The deliveries depended on the quantity still available when conducting the weekly inventory (first in first out (FIFO) method). Extra CSB stock for one week was allowed for flexibility. On average deliveries were made every two weeks.	
Deliveries	With company (JAM) vans.	
Amount delivered	About eight (8) bags of 25kg dry CSB product, or 200kg.	About twelve (12) bags of 25kg dry CSB product, or 300kg.

4.2.1.2 Storage facilities at the schools

Only a dry storage facility was required as the raw CSB product was delivered to both the primary schools on a regular basis. The findings for the Reitumetse and Sinqobile Primary School storage facilities are reported in Table 4:

Table 4 Storage at schools

Storage of CSB mix	Reitumetse Primary School	Sinqobile Primary School
Storage facility	General storeroom was used for the bags containing the dry CSB mix and other school equipment.	The room was used as a cooking area and storage room.
Storage space	CSB mix was neatly packed on the carpeted floor to the side of the room.	Steel cupboards were used to store the bags containing the dry CSB mix.
Condition for storage	The storeroom was very clean. Bags with CSB mix and other equipment neatly stacked but separately.	The room was clean and the CSB mix was neatly packed inside the cupboards.

4.2.1.3 Preparation and cooking methods applied for CSB porridge

Different methods were applied for the preparation of the CSB porridge by both schools. Over three different occasions the CSB porridge preparation procedures was observed in order to identify the amount of porridge prepared, including the amount of raw CSB mix and water used and the quality of servings provided to learners.

Table 5 reports the results of the data collected over the three days of observation:

Table 5 Preparation and cooking methods for CSB porridge

Steps of CSB preparation	Reitumetse Primary School	Sinqobile Primary School
Step 1	50 litres water in 100 litres pot heated on gas stove to boiling point.	71 litres of water in a 100 litre pot, heated on gas stove till boiling point.
Step 2	Preparation of paste: 17 litres of water and 11kg raw CSB.	Gradually stir in 15kg raw CSB powder in to the boiling water using a wooden spoon and whisk alternatively.
Step 3	Stir the CSB paste in to the boiling water until all the lumps disappeared.	Stir the porridge until all the lumps disappeared.
Step 4	Cover the porridge with a lid and leave to simmer 10 minutes.	Cover the porridge with a lid. Leave the porridge to simmer 5 to 10 minutes. Open the porridge and stir. Cover and leave to simmer.
Step 5	Stir the porridge after 5 to 10 minutes until it becomes thick, cover pot and leave to simmer.	After simmering and thick, switch off the stove and porridge was allowed to cool.
Step 6	Total minutes of porridge preparation were 1h45 minutes. Serving of the porridge to learners during the short break time (09:30 – 10:00).	Total minutes of porridge preparation were 2h10 minutes. Porridge was served to the learners during the short break time (10:00-10:30).

4.2.1.4 Weight and size of the CSB porridge servings

During the three occasions of observation at both the Reitumetse and Sinqobile Primary Schools, seven samples of servings as served to each of the grades were randomly collected and weighted to estimate average portion sizes collected. A total of 84 samples (7 × 3 × 4 groups of servings) were collected at each of the schools.

The findings indicated that an average serving size of 234 ± 36g was served to grade 0 and 1; 408 ± 43.1g to grade 2 and 3; 447 ± 62g to grade 4 and 5; and 571 ± 48g to grade 6 and 7 at the Reitumetse Primary School. At the Sinqobile Primary School an average serving size of 287 ±59g was served to the grade 0 - 3, 471.4 ±45g to 4 and 5 whereas the grade 6 and 7 received an average of 599 ±53.8g as indicated in Table 6:

From the results it is clear that no standardised guidelines were applied to regulate the provisioning of CSB to the learners.

Table 6 Amount and average weight of CSB porridge servings

Age	Grade	Reitumetse Primary School		Sinqobile Primary School	
		Amount of servings	Weight of servings (g) Ave ±SD	Amount of servings	Weight of servings (g) Ave ±SD
6-11	0-1	40	234±36	43	287±59
8-15	2-3	36	408±43	69	287±59
9-13	4-5	39	447±62	56	471±45
11-14	6-7	49	571 ±48	37	599±54
Total number of learners served		**164**	**234 ±47 Mean weight SD**	**205**	**400 ±8.5 Mean weight ±SD**

4.2.1.5 Average ratio of ingredients for the preparation of the CSB porridge

At the Reitumetse Primary School an average of 67 ±5 litres of water was used with 11 ±3kg dry CSB mix for the preparation of 78 ±7 litres of porridge, At the Sinqobile Primary School an average of 71 ±13 litres of water with 15 ±2.5kg of dry CSB was used to prepare 88 ±15 litres of porridge during the seven days of sample collection. This implied that a ratio of 100g of dry CSB mix with 609millilitre of water was used at the Reitumetse and with 473 ml of water at the Sinqobile Primary Schools respectively as there was no left over in the pot.

At Reitumetsi Primary School as 164 servings was supplied, an average of 475ml porridge was provided/ serving, providing the equivalent of 67g dry CSB mix/ average serving consumed. For the Sinqobile Primary School as 205 servings was supplied, an average of 429ml porridge was provided/ serving, providing the equivalent of 73g dry CSB mix/ average serving consumed.

4.2.2 Nutrient compliance

4.2.2.1 Adjustment of ingredient ratio to ensure compliance to recommended guidelines

For the purpose of standardisation of the preparation method and optimal utilisation of the existing 100 litres cooking pot available at each of the schools and to ensure comparability of results for the sensory evaluation of the CSB porridge (in phase 2), it was decided to make use of the highest ratio of CSB dry mix to water practiced at the two schools (100g dry CSB mix + 473ml water/ serving) at the Sinqobile Primary School.

Although this ratio of ingredients resulted in a more stiff porridge for the learners at Reitumetsi Primary School, the learners at the Sinqobile Primary School were already adjusted to it. To keep the texture similar for the two schools and prepare the maximum amount of porridge, the ratio of 81ℓ water plus 17kg dry CSB mix were calculated to prepare 100ℓ porridge which can serve 205 servings of ± 488ml/ day. Accordingly 92.5ℓ

of porridge was prepared at Reitumetse Primary School utilizing 78ℓ water and 14.5kg dry CSB mix to provide 164 servings of 490ml each. For each of these servings of 490ml porridge eaten, the equivalent of 83g of dry CSB mix will be consumed.

4.2.2.2 Training of the volunteers on measurement procedures

Follow up action of the trainees (volunteers) for the preparation and serving method of the CSB porridge were conducted and proved satisfactory. Calendars, on which the amount of water, dry CSB mix and number of servings were reported (see Table 6) were collected on a monthly basis.

4.2.2.3 Compliance with the recommended guidelines

JAM recommends that the equivalent of 100g dry CSB mix should be provided per child for each school day in an attempt meet 70 percent of the recommended daily allowance as stipulated by UNICEF. However it was not possible due to preparation limitations in the schools. Only the equivalent of 83g dry CSB mix could be provided per child/ serving of porridge consumed from the 490ml of porridge eaten.

The South African guidelines for school feeding (Department of Health) indicates that the food option or combination of options selected should provide a balance of nutrients and not less than 25 percent of the RDA for energy for the seven to ten year old target group and not less than 20 percent of the RDA for energy for the eleven to fourteen year old target group. In Table 6 a comparison is presented between the energy intakes with the recommended guidelines.

4.2.3 Comparison of recommended energy intakes for boys and girls

As the equivalent of a 100g of dry CSB mix provided 1464kJ of energy (JAM 2006:1), it followed that the equivalent of 83g of the mixture would provide 1215kJ which compared more than favourably with the energy requirements stipulated by the DoH for

school feeding but do not fully meet the requirements as stipulated by UNICEF, especially for the older boys age 11 to 14 years. See Table 7.

However, when the average daily intake for energy (7046 ±2910 kJ) (Nyathela 2007:1) in combination with the intake from the CSB (83g CSB provides 1215 kJ) were calculated (8261 kJ) it became clear that the total intake did meet the EER of all the respondents.

Table 7 Comparison of recommended energy intakes for boys and girls

AGE	CSB	EER[1] for SA (NICUS)[2] kJ+		EER PAL[3] kJ		WHO[4]/ UNICEF[5] (100%[6]) kJ		WHO/ UNICEF (70%[7]) kJ	
	83g (kJ)	♂[8] 100%	♀[9] 100%	♂ 25%[10]	♀ 25%	♂	♀	♂	♀
Meeting requirements				√	√			√/ x	√
7	1215	1 820	1 699	455	424.75	8242	7280	5770	5096
8	1215	1 911	1 790	477.75	447.5	8242	7280	5770	5096
9	1215	2 018	1 865	504.5	466.25	8242	7280	5770	5096
10	1215	2 124	1 947	531	486.75	8242	7280	5770	5096
				20%[11]	20%				
11	1215	2 254	2 046	450.8	409.2	9288	7719	6502	5404
12	1215	2 403	2 158	480.6	431.6	9288	7719	6502	5404
13	1215	2 593	2 256	518.6	451.2	9288	7719	6502	5404
14	1215	2 804	2 309	560.8	461.8	9288	7719	6502	5404

1 EER Estimated Energy Requirement for South African children (Institute of Medicine, Food and Nutrition Board as quoted by NICUS 2003 1-120)

2 NICUS Nutrition Information Centre University of Stellenbosch

3 PAL Physical Activity Level – Active (NICUS 2003:1-120)

4 WHO World Health Organization (Rolph 2000:852-863)

5 UNICEF United Nation Children's Fund (Rolph 2000:852-863)

6 100 percent Nutritional Guidelines for children as determined by UNICEF (Rolph 2000:852-863)

7 70 percent UNICEF Recommendations as required by JAM to be meet during CSB intake by children

8 ♂ male

9 ♀ female

10 25 percent total energy requirement as recommended by Department of Health of South African for school children between the age 7 to 10 (Van Stuijvenberg 2005 s214).

11 20 percent total energy requirement as recommended by Department of Health of South African for school children between the age 11 to 14 (Van Stuijvenberg 2005.s214).

4.2.4 Comparison of nutrient intakes for boys and girls

To obtain an overview of the situation, Table 8 presents a comparison of the average daily nutrient intake of the learners at both the Reitumetse and Sinqobile Primary Schools (Nyathela 2007), the nutrients provided by the intake of the equivalent of 83g dry CSB mix, and 70 percent of the UNICEF recommendations for boys and girls of the stipulated age groups as recommended by JAM.

According to the fortification legislation regulating the fortification of certain food stuffs (DoH 2003:1-18), of the staples namely maize meal, flour and bread flour should be fortified with vitamin A, thiamine, riboflavin, folic acid, nicotinamide, iron and zinc (DoH 2003:1-18) in prescribed quantities. For the purpose of this study, those nutrients were also deemed as important.

According to the study by Amuli (2006:111) and South Africa Food Consumption Survey (Labadarios *et al* 2000:39-40), maize meal is the staple food purchased in the highest quantity, the low income households of the urbanised area and are therefore benefiting from the fortification for the staple foods with vitamin A, thiamine, riboflavin, folic acid, nicotinamide, iron and zinc .

In Table 8 a comparison is presented between the nutrient intakes of respondents (average daily intake in combination with the nutrients provided by the equivalent of 83g of CSB mix) and the prescribed guidelines.

In is clear from Table 8 that the recommended intakes for Vitamin A could be amply obtained from the supplied serving of 490ml CSB porridge by both age categories for boys and girls, supporting the huge shortfall indicated by the average daily intake (182 ±17µg RE). For thiamine content, the serving of porridge could not meet the recommendations in the least (0.11 mg), but the average daily intake was more than sufficient (0.91 ±0.5mg), probably due to the fortification of the staple food, maize meal, that is the stanle food mostly consumed by the learners at home.

A similar situation is observed for riboflavin, but the combined average daily intake (0.81 ±0.8mg) and the contribution made by the CSB porridge (0.37mg) will meet the requirements adequately for all age groups and genders. The contribution made by the CSB porridge prevented a shortfall in intake for all respondents.

For niacin (15 ±8mg) and folate (155 ±107µg) the average daily intakes wanted have sufficed, care of the fortification legislation. For both nutrients, the intake from the CSB porridge would not nearly have been sufficient but would have made a good contribution. The vitamin C (39.8mg) and vitamin B12 (1µg) content of the 83g CSB serving would have been more than sufficient to meet the needs of both age categories and genders.

For both boy and girls aged seven to ten, iron was fully provided (6.64mg) by the equivalent of 83g CSB mix. The children for which the recommended intake was not met, it could be provided by the total intake (13.64mg) calculated from the meals consumed at home (7.05 ±3.95mg) and the CSB intake (6.64mg) (Nyathela 2007).

For calcium, 83mg was provided by the consumption of the equivalent of 83g of CSB mix with could not meet the UNICEF guidelines. The sample indicated that learners from both the schools have an average intake of 246 ±17.7mg of calcium/day. The combined intakes could therefore not meet the requirements for the different groups, but a valuable contribution was made (Nyathela 2007).

Regarding zinc, it was indicated that only female learners between the ages of seven to ten satisfy the intake requirements for zinc when including the nutrients obtained from the equivalent of 83g of the CSB mix. This indicate that most of the learners age eleven to fourteen were lacking zinc in their average diet, but including the provisioning of the CSB mix, intake was more than adequate.

Table 8 Comparison of nutrient intakes and needs for boys and girls

		[4]Average daily intake	Average daily intake		WHO/UNICEF 100%				WHO/UNICEF 70%			
			Dry CSB Mix		7-10 years		11-14 years		7-10 years		11 -14 years	
Nutrients	**Units**	**Ave ± min**	**100g[5]**	**83[6]g**	♂	♀	♂	♀	♂	♀	♂	♀
Vitamin A	µg RE	182 ± 17	998.4	828.67	400	400	400	500	280	280	280	350
Thiamine	mg	0.91 ±0.5	0.13	0.11	0.9	0.9	1.2	1.0	0.63	0.63	0.84	0.7
Riboflavin	mg	0.81 ±0.8	0.45	0.37	1.3	1.3	1.7	1.5	0.91	0.91	1.19	1.05
Niacin	mg	15 ±8	4.8	3.98	14.5	14.5	19.1	16.4	10.15	10.15	13.37	11.48
Folate	µg	155 ±107	60	49.8	102	102	170	170	71.4	71.4	119	119
Vitamin C	mg	47.59 ±9	48	39.8	20	20	30	30	14	14	21	21
Vitamin B12	µg	1.7 ±0.2	1.2	1	1	1	1	1	0.7	0.7	0.7	0.7
Iron	mg	7.05 ± 4	8	6.64	9.5	9.0	15.0	16.0	6.65	6.3	10.5	11.2
Calcium	mg	246 ± 17.7	100	83	500	500	600-700	600-700	350	350	420-490	420-490
Zinc	mg	7 ±4.7	5	4.15	7.5	7.5	12.1	10.3	5.25	5.25	8.47	7.21

[1] RDA Recommended Dietary Allowance

[2] AI Adequate Intake

[3] CSB Corn Soya Blend

[4] Baseline study on nutritional status of primary school children (24 h recall) (Nyathela 2007)

[5] 100g Nutrients found in a dry CSB mix package

[6] 83g Nutrients which children were able to obtain

4.3 PHASE 2: SUSTAINABILITY OF CSB PORRIDGE ACCEPTANCE FOR LONG TERM UTILISATION

The objective of this phase was to determine the sustainability of product acceptance and CSB utilisation for primary school children. This was a phase which was based on the analysis of the learners' acceptance and perception of the corn soya blend porridge. A validated questionnaire which was tested at the Reitumetse and Siqobile Primary Schools was utilised to complete this phase. The main objective of this phase was to determine whether the acceptance of CSB porridge will be sustainable for long term use.

4.3.1 Profile of the respondents at the Reitumetse and Sinqobile Primary Schools

This section presents the socio-demographic results (grade, age and gender) of the respondents at both schools that voluntarily participated in this study.

4.3.1.1 Participation by each grade (%)

Table 9 indicates the participation of both the Reitumetse and Sinqobile Primary School participants for each grade over time for four occasions mean % ±SD.

Table 9 Participation by each grade (mean % ±SD)

	Reitumetse Primary School		Sinqobile Primary School	
Grades	n	Mean % ±SD	n	Mean % ± SD
1	25	18.2 ± (0.9)	13	24.5 ± (9.8)
2	14	9.8 ± (2.7)	7	11.6 ± (4.1)
3	20	14.7 ± (1.9)	10	15.1 ± (5.3)
4	24	18.0 ± (1.1)	8	14.4 ± (2.3)
5	11	8.4 ± (0.7)	7	13.6 ± (6.2)
6	20	14.8 ± (1.7)	7	12.3 ± (3.4)
7	22	16.1 ± (1.65)	5	8.5 ± (2.9)
Total	**136**	**100**	**57**	**100**

The findings in Table 9 clearly indicate that the most prominent groups which participated in this school feeding project were learners in grade one (24.5 ± 9.8 % at Sinqobile primary school and 18.2 ± 0.9 % at Reitumetse Primary School), and 3 and 4 (15.1± 5.3 % of grade 3 and 14.4 ± 2.3 % of grade 4 at Sinqobile and 14.7 ± 1.9 % grade 3 and 18.0 ± 1.1 % grade 4 at Reitumetse Primary School).

The reason for these similar, but total independent, findings has not been investigated, as it was not part of this study. It is but nevertheless very interesting and supportive to the validity of this study.

4.3.1.2 Participation of age groups

The highest participation was from the seven year old age groups (14.4 ±2.3%) followed by the 11 year olds (11.97 ±2.7%) from Reitumetse Primary School, whereas at the Sinqobile Primary School, the 10 year olds participated the best (16.7 ±2.3%), followed by the 13 years olds (16.9 ±2.7%).

4.3.1.3 Participation of gender groups

The average participation by both males and females were about equal in both schools, namely 51 ± 3 percent males and 49 ±3 percent females from the Reitumetse Primary School and 55 ±9 percent males and 45 ±9 percent females from the Sinqobile Primary School respectively.

4.3.2 Consumption of CSB porridge over time

4.3.2.1 Frequency of CSB porridge consumption over time

It is clear from Figure 3 that most of the respondents from the Reitumetse Primary School consumed CSB porridge five times a week (70.6 -84.8%) as indicated that whereas only 0.8 -10.9 percent of the respondents consumed the porridge once a week.

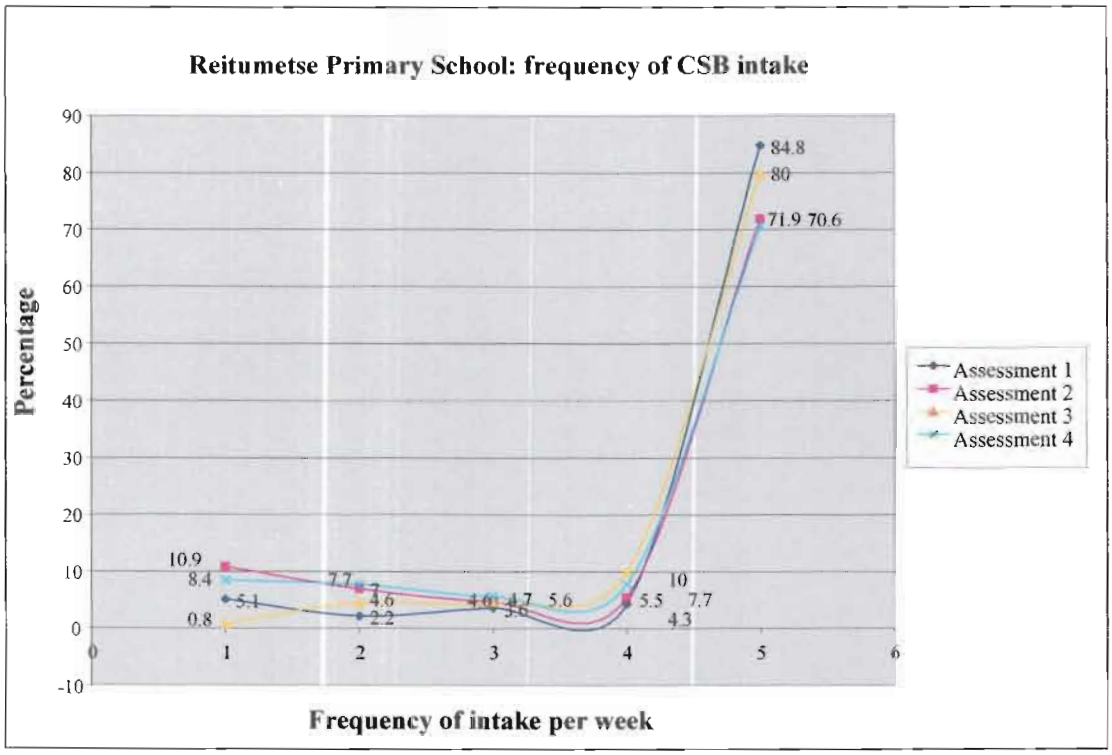


Figure 4 Frequency of CSB intake at the Reitumetse Primary School

Figure 5 reports the frequency of CSB porridge consumption by the respondents from the Sinqobile Primary School as between 41.1 and 75 percent for the respondents consuming of the porridge five times a week. Between 5 and 26.5 percent indicated consumption of the CSB porridge twice a week.

The reason for the spread in results has not been investigated but the lower intake co-insides with the inclusion of yellow maize in the production of the dry CSB mix. This change in production was not discussed before hand with the researcher and therefore has an unplanned influence on the findings.

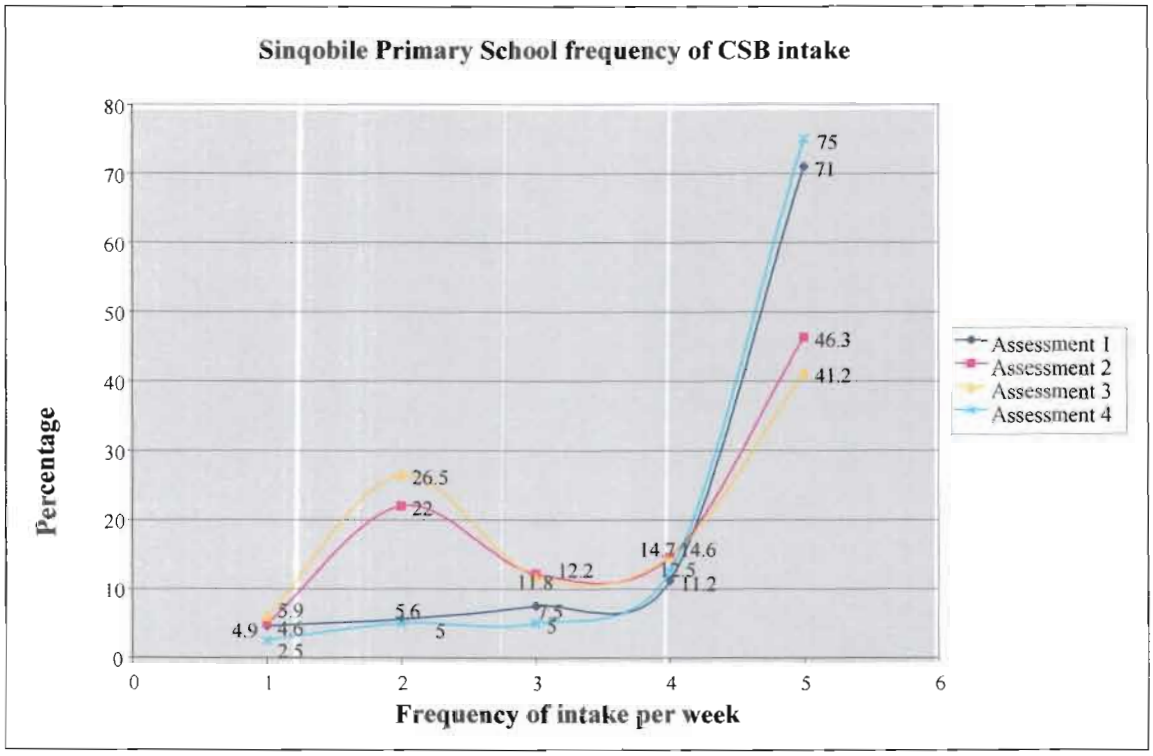


Figure 5 Frequency of CSB intake at the Sinqobile Primary School

4.3.3 Number of servings consumed daily

4.3.3.1 Percentage of respondents consuming second servings

Table 10 indicates the percentage of respondents from both schools who consumed more than one serving of the CSB porridge/day. Nearly half of the respondents (47 ±3.7%) at the Reitumetse Primary School went for second servings while 52 ± 2.6 percent went for second servings at the Sinqobile Primary School. The percentage of respondents that went for second servings at Reitumetse Primary School increased over time but not at Sinqobile Primary School. The reason for this has not been investigated.

Table 10 Learners consuming second servings

Assessments	Reitumetse Primary School			Sinqobile Primary School		
	n	Percentage	Mean ±SD	n	Percentage	Mean ±SD
Assessment 1	60	24	43.5	56	49	51.9
Assessment 2	59	23	46.1	21	18	51.2
Assessment 3	61	24	46.9	19	16	55.9
Assessment 4	75	29	52.4	20	17	50
Average	255	100	47	116	100	52
SD			± 3.7			± 2.6

4.3.3.2 Frequency of second serving consumption

Table 11 indicates that 27 percent of the respondents at the Reitumetse Primary School went for second servings once a week, and 34 percent twice a week whereas only 21 percent went for second serving five times a week. At the Sinqobile Primary School 21 percent of the respondents went for second servings once a week, 41 percent twice a week, whereas only 15 percent consumed second servings five times a week. At both the schools the highest incidence for second servings was twice a week.

Table 11 Average frequency for second servings at both schools

Frequency	Reitumetse Primary School			Sinqobile Primary School		
	n	Percentage	Mean ±SD	n	Percentage	Mean ±SD
Once	69	27	13±3.8	26	21	9.8 ±4.4
Twice	88	34	16 ± 2.2	49	41	26.9 ±11.9
Thrice	34	13	6 ±1.8	16	13	6.6 ±2.8
Four	14	5	3 ±1.4	12	10	4.5 ±2.5
Five	54	21	10±3.3	18	15	8 ±0.7
Total	259	100	10±1	121	100	16.6 ±4.1

4.3.4 Sensory perceptions regarding CSB porridge consumed over time

This section provides a detailed account of the sensory perception of the participating primary school learners at the Reitumetse and Sinqobile Primary Schools regarding the CSB porridge consumed.

4.3.4.1 Perception of texture over time

According to Figure 6 most of the respondents at the Reitumetsi Primary School perceived the CSB porridge texture to be good, with an increase indicated over time, from 74 to 82 percent.

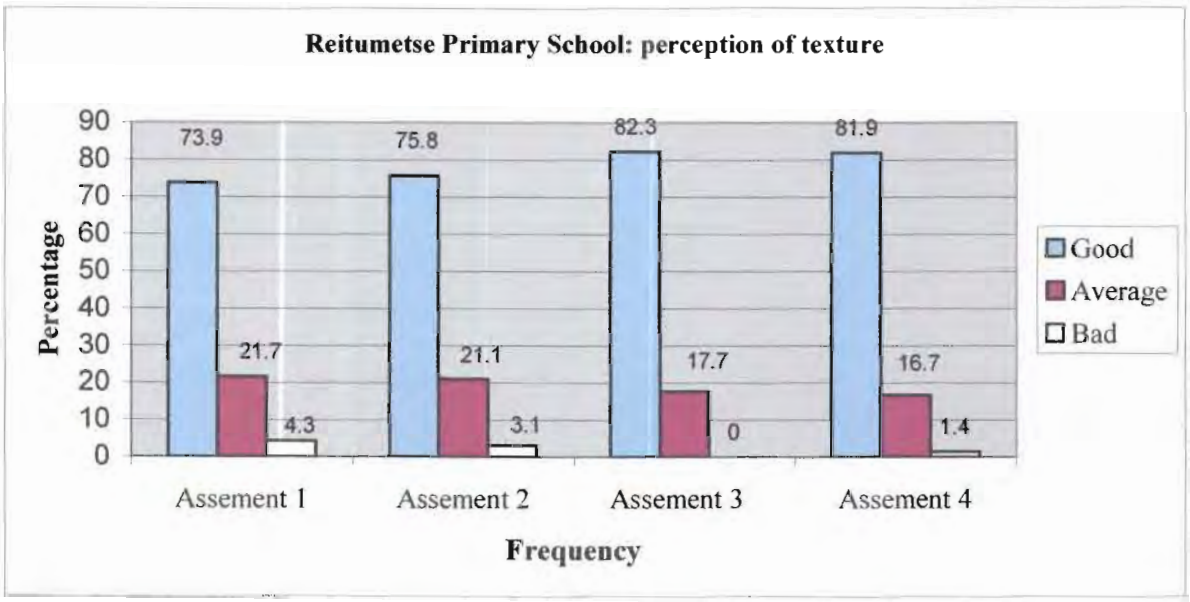


Figure 6 **Perceptions regarding texture of the CSB porridge at the Reitumetse Primary School**

Figure 7 indicates that most of the respondents at the Sinqobile Primary School (71.3 – 82.9%) perceived the CSB porridge texture as good, with a general increasing tendency indicated over time.

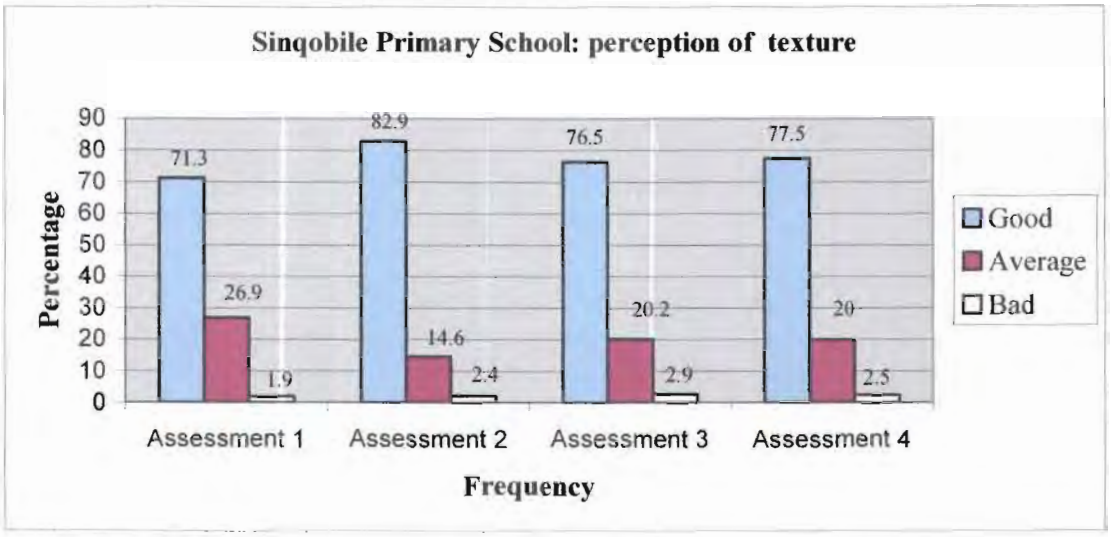


Figure 7 **Perceptions of texture of CSB porridge at the Sinqobile Primary School**

4.3.4.2 Perception of taste over time

Figure 8 shows that the respondents at the Reitumetse Primary School liked the taste of the porridge as most of them perceived the taste to be increasingly good over the four occasions of assessment (75– 80.4%).

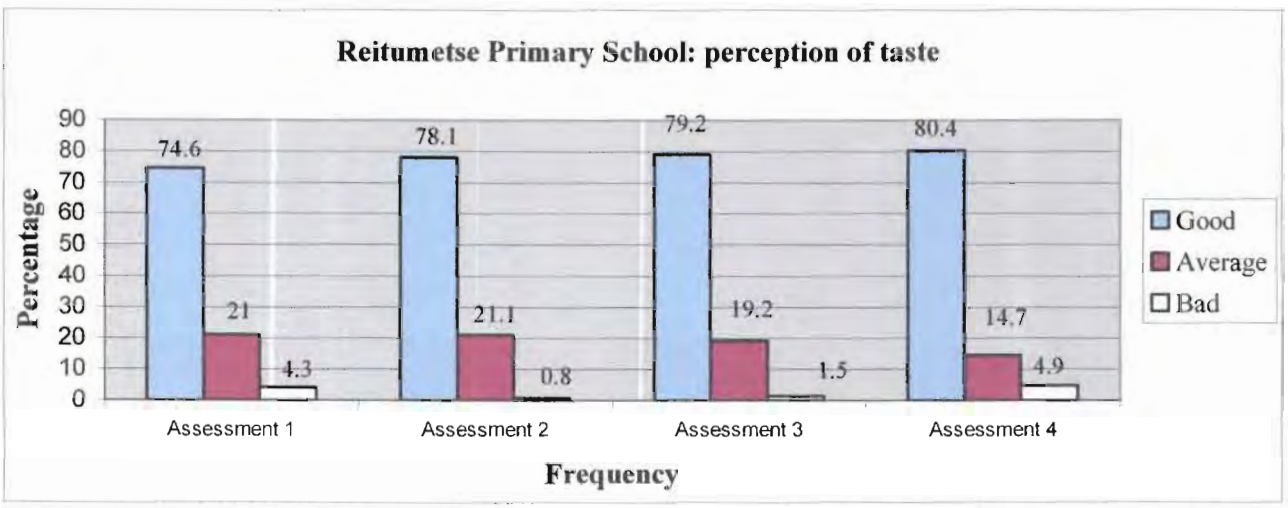


Figure 8 **Perceptions regarding taste of the CSB porridge at the Reitumetse Primary School**

From the four assessments conducted at the Sinqobile Primary School focusing on learners' taste perception of CSB porridge (Figure 9), it is clear that most of the respondents perceived the taste of the CSB porridge as good (88-82.5%). Despite the slight down ward trend of the perceptions (expectedly) due to the temporary inclusion of yellow maize in CSB formulation, the lowest point is still higher than the indicators for the Reitumetse Primary School. An overall positive perception is therefore reported.

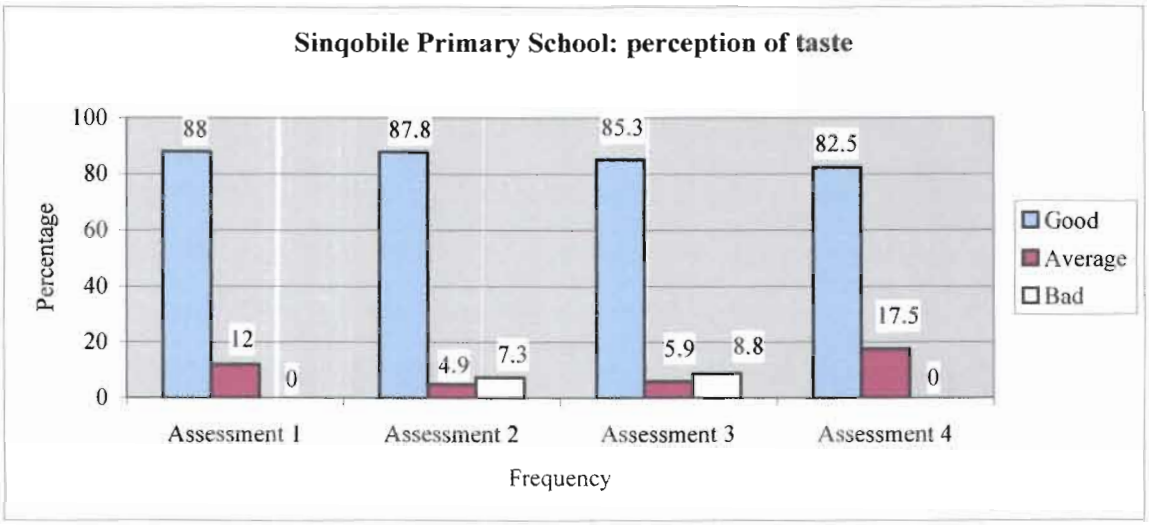


Figure 9 **Perceptions regarding taste of the CSB porridge at the Sinqobile Primary School**

4.3.5 Consumer perceptions of porridge over time

4.3.5.1 Availability of CSB porridge for school feeding

According to Figure 10 most of the respondents definitely want the porridge to be available at school over time as clearly indicated by the positive response by 96.1-99.2 percent of the participants at the Reitumetse Primary School and 94.9 – 100 percent at the participants of the Sinqobile Primary School respectively.

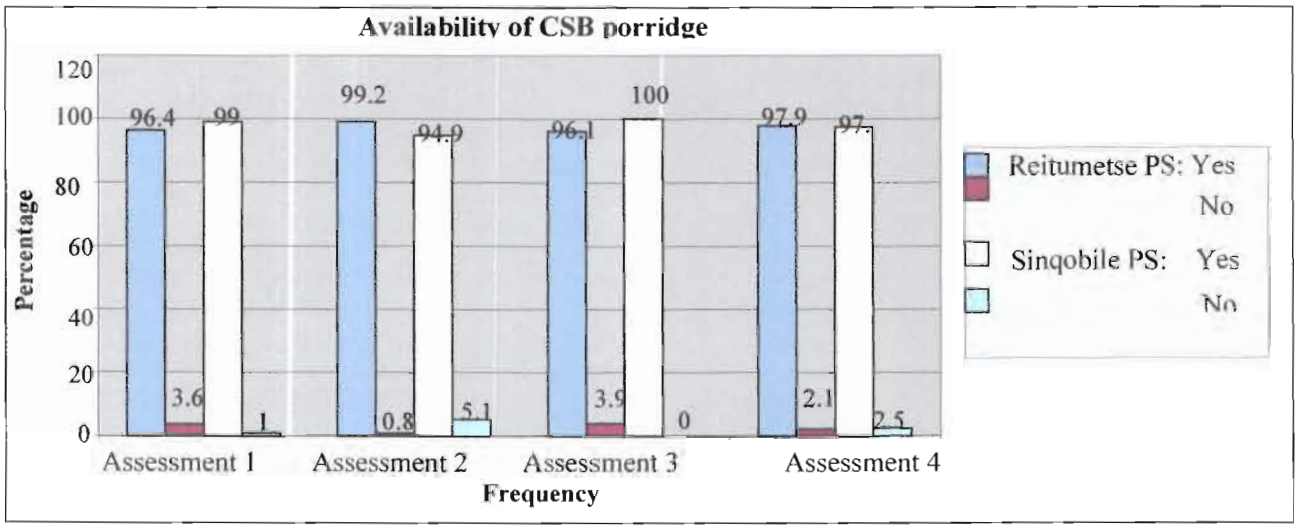


Figure 10 Availability of CSB porridge at school

4.3.5.2 Benefit of CSB porridge consumption as perceived by the respondents

This section was assessing the benefits perceived by respondents from the Reitumetse and Sinqobile Primary Schools from the consumption of the CSB porridge provided to them five days a week by the Joint Aid Management Organisation.

According to Table 12 the respondents from both the Reitumetse and Sinqobile Primary Schools indicated that the CSB porridge benefited them with energy (Reitumetsi 31% and 27% Sinqobile) as the most important benefit. At the Reitumetse Primary School the provisioning of nutrients were indicated as the second highest benefit, while the satisfaction of hunger was indicated in this position for the Sinqobile Primary School. Only one percent of the respondents indicated no benefit from consuming the porridge.

Table 12 Benefits of CSB porridge consumption perceived by respondents

Benefit of CSB porridge	Reitumetse Primary School			Sinqobile Primary School		
	n	Percentage	Mean ±SD	n	Percentage	Mean ±SD
Good health	77	14	14.4± 3.8	35	16	17.75 ±8.8
Give energy	171	31	31.9 ±13.9	60	27	26.9 ±8.5
Get nutrients	128	24	23.6 ±10.5	22	16	8.9 ±3
Satisfy hunger	35	7	6.5 ±1.6	53	24	22.7 ±6.0
Nothing	5	1	0.9 ±0.7	1	0	0.6 ±1.2
Don't know	122	23	7.4 ±2	51	23	43.8 ±36
Total	538	100	16.7±5.2	222	100	20.1±13

4.5 SUMMARY

In order to verify product preparation specifications for regulatory compliance, attention was given to the analysis of the situation, as well as to the adjustment of the ingredient ratio and serving sizes of the CSB porridge to ensure compliance with recommended nutrient guidelines. From the analysis of the situation it became clear that the frequent delivery of CSB to the Reitumetse and Sinqobile Primary School support availability of the product at the schools. Likewise storage facilities provided satisfactory for short term utilisation.

Results from the preparation procedures of the CSB porridge ratio of the ingredients and serving sizes indicated the meeting of regulatory guidelines for nutrient provided by the CSB porridge in the Orange Farms school feeding programme. Before implementation of the porridge adjustment, regulations for UNICEF and South Africa school feeding programme were compared with the amount of nutrients provided by the CSB porridge and adjustments were made in the ratio of the ingredients.

Due to the limitations of the situation where only one pot of 100ℓ capacity was available at each school, the maximum serving size that could be provided to each respondent was 490ml while maintaining similarity of texture of the porridge. This serving size represents the equivalent of 83g of dry CSB mix in comparison to the 100g prescribed by

JAM. Despite the diminished provisioning of CSB the requirements from both the DoH (25 percent EER for 7-10 and 20 percent for 11-14 year olds) and UNICEF (70 percent of RDA) could be met in most instances by the nutrient intake for the different age groups and genders when the average daily intake including the habitual intake as well as CSB porridge were incorporated. The shortfalls in the intake of 490ml CSB porridge were alleviated to a large extent.

To test the sustainability of the CSB porridge acceptability over time, focus was placed on the socio-demographic profile of the participating learners (grade, age, and gender), the frequency of CSB porridge consumption over time, and the sensory perceptions as well as consumer perception over time. The main objective of this study was therefore addressed. Conclusions for the results are presented in the next chapter.

5

CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

The main objective of this study was to investigate the sustainability of corn soya blend porridge use in the Orange Farms primary school feeding programme, focusing mainly on regulatory compliance of the CSB product and sustainability of product acceptance over time.

5.2 CONCLUSIONS

5.2.1 Regulatory compliance of the CSB porridge

In spite of the constraints of reality within which each serving of CSB porridge provided the equivalent of only 83g CSB dry mix in stead of the recommended 100g, it can be concluded that, within the household setting of limited average daily intake and support provided by the provisioning of the CSB porridge as school feeding product, it was possible to comply with the regulating guidelines as stipulated by JAM and the DoH. The CSB product therefore makes a substantial contribution to the nutritive intake of the learners.

If the fact is kept in mind that approximately 25 percent of the learners consumed second servings of CSB porridge (Table 10) mostly twice (34%) but up to five times a week (21%) (Table 11), it can be assumed that all major shortfalls for the nutrients addressed in the study might have been alleviated.

If the assumption is made that it were the children that were very hungry that went back most often for a second serving of CSB porridge, it can be inferred that the additional nutrient intake benefit the most needy children the most.

It can therefore be further inferred (as no measuring was conducted) that the consumption of the CSB porridge on a regular basis enhanced both cognitive and physical performance of the learners which supports more alertness in school and a better ability to learn and perform sports or other physical activities (IFIC 2005:6).

5.2.3 Acceptance of CSB porridge for long term utilisation

5.2.3.1 Perception for taste over time

The perception for taste increased over time at the Reitumetse (75-80%) (Figure 8) but diminished slightly over time at the Sinqobile Primary School (88 to 83%) (Figure 9), but was still higher than the perception for taste at the Reitumetse Primary School. It can therefore be argued and concluded that the acceptability of the CSB porridge taste will be sustainable over time to promote product utilisation.

5.2.3.2 Perception for texture over time

The sensory property of texture was perceived as good by most of the respondents from both the Schools (70 to 83 percent respectively) (Figures 6 and 7 respectively). The increasing tendency observed over time support sustainable product use over time.

5.2.3.3 Availability and benefits of CSB porridge for school feeding

The overwhelming positive response by both the Reitumetse (96-99%) and Sinqobile Primary Schools (94-100% respectively) further support the availability of CSB porridge at primary schools (Figure 10). Further evidence that the learners perceived the benefits

of energy and nutrient provisioning and hunger satisfaction from the product (Table 12), supports the sustainable acceptance of the product.

5.3 VALUE OF THE STUDY

A good working relationship between Vaal University of Technology (researchers), Joint Aid Management (school feeding management) and study supervisors was achieved. The Reitumetse and Sinqobile Primary Schools were interest in the feeding programme and the research project conducted. The co-operation and patience showed throughout the study was impressing.

By achieving the sub-objectives of this study to:

- verify product preparation specifications and serving sizes to best meet the recommended nutrition guidelines and to
- determine the sustainability of CSB porridge use in terms of the sustainability of product acceptance in order to evaluate the feasibility for long term product utilisation,

the achievement of the main objective of this investigation was obtained, namely to determine the sustainability of CSB porridge use in the Orange Farms JAM school-feeding programme to facilitate nutrient intake through a school feeding product to address compromised nutrient supply in primary school children between six and fourteen years of age.

5.4 RECOMMENDATIONS

- Bigger servings should be provided to older children in order to better meet the UNICEF guidelines.
- More research projects in the school feeding programme should be conducted in order to identify products which will sustain long term use complying with the South Africa regulatory guidelines for the school feeding programme.

- The JAM programme for School feeding can be expanded to include other primary schools in South Africa within a similar setting.
- Training and workshop with special monitoring on hygiene, preparation (how much to cook) and serving (how much to serve) should be provided to the volunteers on a regular basis.
- Ask assistance from industry to provide equipment and utensils such as bigger pots, weighing scales and measuring jugs.
- Further research on the impact of the school feeding product on the cognitive performance of school learners is recommended.

5.5 STUDY LIMITATIONS

- Only theoretical calculations of nutritional content were conducted. Chemical analysis can be conducted for verification purposes.
- Effect of cooking on nutritional value not assessed.
- Influence of seasonality on product consumption was not addressed.
- Inclusion of yellow maize in the production of the CSB mix influenced findings of the study.
- The influence of peer group pressure in CSB consumption was not accessed.

5.6 FINAL CONCLUSION

Overall, it can be concluded that the main objective of this study has been met.

BIBLIOGRAPHY

AAFC (Agriculture and Agric-Food Canada). 2003. About food security.[Online]. Available at: <http://www.agr.gc.ca/misb/fsb/fsb_bsa_e.php?page=index>. Access: 13/01/2006

AAFC (Agriculture and Agri-Food Canadian). 2006. Canada's fourth progress report on food security: in response to the world food summit plan of action. [Online]. Available at:<http://www.agr.gc.ca/m156/fsec-seca/pdf>. accessed: 20/11/2006

AHMED, F., 2001. *Public health nutrition: Nutrition and health of Europe's children.* London: Institute of Health.

AMULI, D.J. 2006. Purchasing patterns of major plants staples in low income households in the Vaal Triangle. MTech Dissertation. Vanderbijlpark: Vaal University of Technology.

BARASI, M.E. 1997. *Human nutrition: a health perspective*. UK: University of Wales Institute Cardiff.

BARASI, M.E. 2003. *Human nutrition: A health and perspective*. USA: Oxford University press Inc.

BENDER, D.A. 2002. The vitamins. *In* Gibney, M.J., Vorster, H.H. & Kok, F. eds. Introduction to Human Nutrition. USA: Blackwell Science Ltd. P125-176.

BOYLE, M.A. 2003. *Community Nutrition in Action: An Entrepreneurial Approach.* 3rd ed. USA: Wadsworth/Thomson Learning.

BUDLENDE, D., MAY, J. MOKATE, R., ROGERSON, C. & STAVROU, A. 1998. Poverty and Inequality in South Africa. .[Online]. Available at:

<http://www.polity.org.za/html/govdocs/reports/poverty.html?rebookmark=1#1>. Accessed: 21/04/2005.

CARDELLO. A.V. 1996. The role of the human senses in food acceptance. eds. *Food choice, acceptance and consumption.* UK: Blackie academic and professional.

CARRUTH, B.R. & SKINNER, J.D. 2000. Revisiting the picky Easter phenomenon: neophobic behaviors of young children. *Journal of American College of Nutrition.* 19 (6): 771-780.

CARPENTER, P.R., LYON D.H. & HASDELL, T.A. 2000. *Guidelines for sensory analysis in food product development and quality control.* 2nd ed. Gaithersburg. Aspen publishers.

COLLINS, J. 2001. Urbanisation. South Africa: University of Western Cape.[Online]. Available at: <http://www.botany. uwc.ac.za/envfacts/facts/urbanisation.htm>. Accessed:30/02/2007.

COUTSOUDIS, A., MOUNDER, E.M.W., ROSS, F., NTULI, S., TAYLOR, M., MARCUS, T., DLADLA, A.N. & COOVADIA, H.M. 2000. *Multicountry study on improving household food security and nutrition security for the vulnerable South Africa:* A qualitative study on food security and caring patterns of vulnerable young children. South Africa: WHO.

CONRADIE, J. 2004. The National Food Consumption Survey (NFCS) - Children aged 1 - 9 years. University of Stellenbosch and Tygerberg: c/o Department of Human Nutrition. .[Online]. Available at: <http://www.saspen.com/2001/natfoodsurvey.htm>. Accessed: 02/08/2005.

DARNTON-HILL, I. & NALUBALA, R. 2002. Fortification strategies to meet micronutrient needs: successes and failures. *Journal of the Nutrition Society.* 61(2): 231-241. May.

DEL ROSS, J.M. 1999. *School feeding programme: Improving effectiveness and increasing the benefit to education.* London: a guide for programme manager.

DoA (Department of Agriculture of South Africa). 2002. The integrated food security *strategy for South Africa.* Republic of South Africa: Department of Agriculture.[Online]. Available at: <http://www.info.gov.za/otherdocs/2002/foodpol.pdf>. Accessed: 25/05/2002.

DoE (Department of Education of South Africa). 2004. *National School Nutrition: Implementation, monitoring and reporting manual.* Republic of South Africa: Gauteng Province, Department of education.

DoE (Dpartment of Education of South Africa). 2006: *National School Nutrition Programme (NSNP) Training Manual for NSNP School Coordinators.* Gauteng Department of Education

DoH (Department of Health of Republic of South Africa). 2003. Government notice. No. R2003. *Regulations relating to the fortification of certain foodstuffs. Section 15(1) of the foodstuffs, Cosmetics and Disinfectants Act, No 54 of 1972.* Retrieved February 25, 2005: [Online]. Available at: <http:www.doh.gov.za/search/default.asp>. Accessed: 22/04/2007.

DoH (Department of Health of Republic of South Africa). 2004. Health sector strategic framework 1999-2004. [Online]. Available at: http://www.doh.gov.za/search/index.html. Accessed: 09/09/2007.

DRUMMOND, K.E & BREFERE, L.M. 2001. *Nutrition for foodservice and culinary professionals.* 4th ed. USA. John Wiles & Sons.

DULLOO, G.A & SCHUTZ, Y. 2005. Energy balance and body weight regulation. *In* Geissier, C. & Powers, H. eds. *Human Nutrition.* 7th ed. UK: Harcourt. 83-102.

ECONOMOS, C. & CLAY, W.D. 1998. Nutritional and health benefits of citrus fruits. FAO: Rome. [Online]. Available at: <http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/x2650t/x2650t03.htm>. Accessed: 25/06/2006.

ENGELBRECHT, O. 2005. Food for thought - School feeding programmes and positive external effects. [Online]. Available at: <http://www.saasta.ac.za/sciencewriters/winners/2005/engelbrecht_o.pdf>. Accessed: 03/02/2007.

ENSMINGER, A.H., ENSMINGER, M.E., KONANDE, J.E & ROBSON, J.R. 1994. *Food Nutrition Encyclopedia.* 2nd ed. Volume 1 A-H. USA. CRC Press.

ERS (Economic Research Services of United State Department of Agriculture). 2005. Global food security. USA: Washington, DC.[Online]. Available at: <http://www.ers.usda.gov/Briefing/GlobalFoodSecurity/>. Accessed: 06/05/2006

FAO (Food and Agriculture Organisation). 1997. Preventing micronutrients malnutrition approaches: Why policy makers should give priority to food-based strategies. [Online]. Available at: <http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/x0245e/x0245e00.htm>. Accessed: 04/02/2006.

FAO (Food and Agriculture Organisation). 1998. Map on food supply gap between rich and poor countries. Rome: Italy. [Online]. Available at: www.fao.org. accessed: 17/01/2006.

FAO (Food and Agriculture Organisation). 2002. FAO warns of increasing malnutrition among urban poor. Household food security and community nutrition.Press Release 01/36. [Online]. Available at: <http://www.fao.org/WAICENT/OIS/PRESSNE/PRESSENG/2001/pren0136.htm>.Accessed: 26/05/2007.

FAO (Food and Agriculture Organisation). 2005a. Globalization of Food Systems and Nutrition. Rome: Italy. [Online]. Available at: http://www.fao.org/es/esn/nutrition/urban_globalization_en.stm. Access: 15/ 01/2006

FAO (Food and Agriculture Organisation). 2005b. Italy: Rome. [Online]. Available at: <http://www.fao.org/es/esn/nutrition/household_en.stm>. Accessed: 15/01/2006

FAO (Food and Agriculture Organisation). 2005c. Food and Nutrition Security in Urban Environments. Rome: Italy. [Online]. Available at: <http://www.fao.org/es/esn/nutrition/urban_security_en.stm>. Accessed: 15/01/2006

FRAC (Food Research and Action Center). 2005. School breakfast score. [Online]. <Available at: hhtp:///www.frac.org/pdf/2—5-sbp.pdf>. Accessed: 20/11/2006.

FORREST, C.L(jr). 1996. Training for the Hospitality Industry. 2nd ed. USA: Educational Institute of the American Hotel and Motel Association.

G8 OKINAWA SUMMIT. 2000. Global poverty report. African Development Bank, Asian Development Bank, European Bank for Reconstruction and Development, Inter-American Development Bank, International Monetary Fund and World Bank: Okinawa Summit. July 2000. [Online]. Available at: <http://www.worldbank.org/html/extdr/extme/G8_poverty2000.pdf>. Accessed: 30/07/2006

GAIN (Global Alliance for Improved Nutrition). 2006. School feeding programmes. . [Online]. Available at: <http://www.gainhealth.org/gain/ch/enen/index.cfm?page=/gain/home/activities/special_programs/school_feeding>. Accessed: 04/02/2006.

GROSVENOR, M.B. & SMOLIN, L.A. 2006. Nutrition: everyday choices. USA: Von Hoffmann Press.

GOLDEN, M.H.N. 2000. *Famine relief. In* Garrow, J.S. James, W.P.T. & Ralph, A.eds. *Human nutrition and dietetics*.10th ed. United Kingdom: Harcourt publishers limited. 501-514.

GUINARD, J.X. 2001 Relation between PROP taster status and fat perception, touch and olfaction. Physiology & Behavior. *Journal of food science and technology*. 72(3):427-437.

HEGENBART, S.L. 1998. Food product design: making sensory tests instrumental. [Online]. Available at: http://www.foodproductdesign.com/articles >. accessed: 12/01/2007.

IFIC (International Food Information Council). 2005. Child and Adolescent nutrition. [Online]. Available at: <http://www.ific.org/nutrition/kids/index.cfm> Accessed: 28/01/2006.

IFPRI (International Food Policy Research Institute). 2001. Fight hunger and poverty: IFPRI releases comprehensive evaluation of innovative anti-poverty programme.[Online]. Available at: http://www.ifpri.org/pressrel/2001/062601.htm. Accessed: 05/11/2005

IRAM, U. & BUTT, M.S. 2004. Determinants of household food security: An empirical analysis for Pakistan. *International Journal of Social Economics.* [Online]. Ws 31(8): 753-766, Aug. Available at: <http://www.emeraldlibrary.com/Insight/viewContentItem.do?contentType=Article&contentId=847879>. Accessed: 11/01/2007.

INSEL, P., TURNER, R.E. & ROSS, D. 2002. *Nutrition.* USA: Jones and Bartlett.

JAM (Joint Aid Management). 2004. Nutritional Feeding throughout Africa. [Online]. Available: <http://www.jamsa.co.za/sub/childhelp/feeding/feeding.jsp>. Accessed: 15/04/2005.

JAM. 2006. CSB specification: communication with Mr A Boros, Orange Farms project manager. South Africa: Honeydew.

JRF (Joseph Rowntree Foundation). 2005. Life in the low income. [Online].Available at: <http://www.jrf.org.uk/KNOWLEDGE/FINDINGS/socialpolicy/SP97.asp>. Accessed: 30/07/2006.

KENT, N.L & EVER, A.D. 1994. *Technology of cereals: an introduction for students of Food and Science and Agriculture.* 4th ed. Great Britain: BPC Wheatons.

KLOKA, D. 2003. *Organizational Structure: Cluster; Maternal, Child, Women's Health and Nutrition.* [Online]. Available: <http://www.doh.gov.za/programmes/nutrition.html>. Accessed: 02/03/2006.

KLUGMAN, G., 2002. Addressing Malnutrition in South Africa. [Online]. Available at: <http://www.scienceinafrica.co.za/2002/january/food.htm#Top>. Accessed: 12/06/2005.

KING, C.J., SHAMES, D.M & WOODHOUSE, L.R. 2000. Supplement: zinc homeostisis in humans. *Journal of Nutrition*, 130 (5). 13605-13665.

LABADARIOS, D., STEYN, N., MAUNDER, E., MACINTYRE, U., SWART, R., GERICKE, G., HUSKISSON, J., DANNHAUSER, A., VOSTER, H.H. & NESAMVUNI, A.E. 2000. *The national food consumption survey (NFCS): Children aged 1-9 years.* Stellenbosch: NFCS.

LABADARIOS, D., STEYN, N., MAUNDER, E., MACINTYRE, U., SWART, R., GERICKE, G., HUSKISSON, J., DANNHAUSER. A., VOSTER, H.H., & NESAMVUNI, A.E. 2006. *The National Food Consumption Survey (NFCS): Children aged 1- 9 years, South Africa, 1999.* Stellenbosch:NFCS.

LATHAM, M.C., 1997. Human nutrition in the developing world. FAO Food and Nutrition Series No. 29, FAO, Rome. [Online]. Available at: <http://www.jceh.co.uk/journal/37_5.asp>. Accessed: 04/04/2005.

LUTZ, C.A. & PRZYTULSKI, K.R. 1997. *Nutrition and diet therapy.* 2nd ed. Philadelphia: F.A Davis.

MARAIS, J. 2007. ANC discussion document on social reform to be discussed at national conference in Polokwane. *Rapport newspaper*.24 June. P3.

MBEKI, T. 2005. Addressing. Pretoria: Presidency. Communications: Media Liaison. [Online]. Available at: http://www.dfa.gov.za/docs/speeches/2005/mbek0225.htm. Accessed: 04/04/2006.

MELDRUM, A. 2005. School meals around the world: South Africa. [Online]. Available at: <http://education.guardian.co.uk/schoolmeals/story/0,15643,1448386,00.html>. Accessed: 10/11/2005.

MFAJ (Ministry of Foreign Affairs of Japan). 2000. *Global Poverty Report: executive summary.* Japan: Tokyo.

MOORE, M.C. 1993. *Pocket guide: Nutrition dietary therapy*. 2nd. edition. USA. Mosby.

MOSCOWITZ, H.R. 1991. Food compatibility and menu planning. Journal of the institute of Canadian science and Technology Alimenta; 10 (4): 257-264.

NAIDOO, P. 2003. Orange Farm: the Struggle for water, the struggle for life. Johannesburg. Press release. [Online]. Available at:<http://www.joburg.org.za/2003/jan/jan31_garden.stm>. Accessed: 15/03/2005.

NANTEL, G. TONTISIRIN. K. NANTEL. G. & BHATTACHARJEE, L. 2002. Food-based strategies to meet the challenges of micronutrient malnutrition in the developing world. *Journal of the Nutrition Society*. 60 (2): 243-250, May. 12.

NAPIER, C. 2001. Nutritional status and food consumption patterns of children in the Vaal Triangle. MTech Dissertation. Vanderbijlpark: Vaal Triangle Technikon.

NEL, J.H. & STEYN, M. 2002. *Report on South African food consumption studies undertaken amongst different population groups (1983-2000): average intakes of foods most commonly consumed.* Pretoria. Directorate: Food Control, Department of Health.

NICUS (Nutrition Information Center of the University of Stellenbosch). 2003. *RDIs (Dietary Reference Intake)*. Stellenbosch: South Africa. [Online]. Available at: <www.sun.ac.za/nicus>. Accessed: 25/02/2005.

NICUS (Nutrition Information Centre University of Stellenbosch). 2005. *Nutrition.* [Online].Available at: <http://www.sahealthinfo.org/nutrition/depreciation.htm>. Accessed: 17/01/2006.

NANTEL, G., TONTISIRIN, K., NANTEL, G. & BHATTACHARJEE, L. 2002. Food-based strategies to meet the challenges of micronutrient malnutrition in the developing world. *Journal of the Nutrition Society*. 60 (2): 243-250, May. 12.

NYATHELA, T. 2007. Impact of CSB on nutritional status of primary school children in Orange Farm. Study in progress. MTech Dissertation. Vanderbijlpark: Vaal University of Technology.

OSU (Oregon State University). 1998. Sensory evaluation and the hedonic scale. [Online]. Available at: <http://food.oregonstate.edu/sensory/dena.html>. Accessed: 27/ 02/ 2006.

PILLETIER, D.L., OLSON, C.M. & FRONGILL, E.A(jr). 2001. Food security, hunger, and undernutrition. *In* Bowman, B.A. & Russell, R.M, eds. *Present knowledge in Nutrition.* 8th ed. Washington, DC: International Life sciences Institute.701-711.

PRINZO Z.W. & DE BENOIST, B. 2002. Meeting the challenges of micronutrient 251-257, May. 12.

READERS DIGEST. 1999. The healing power of vitamins, minerals and herbs: the South Africa A-Z guide to nutritional supplements that enhance your health and help you treat illness. South Africa: Readers digest Association.

ROLPH, A. 2000. Dietary reference value. *In* Garrow, J.S., James, W.P.T., & Rolph, A. Human nutrition and Dietatics. 10th ed. UK: Harcourt Publishers.

RUTHERFORD, T. 2005. Soya. [Online]. Available at: <http://www.amazon.co.uk/gp/help/customer/display>. Accessed: 27/05/2006.

SAHR (South African Health Review). 2002. Nutrition Policy Implementation. [Online]. Available at: <http://legacy.hst.org.za/sahr/2002/chapter17.htm>. Accessed: 02/08/2005.

SARPN (Southern African Regional Poverty Network). 2002. The integrated food security strategy for South Africa. [Online]. Available at: <http://www.sarpn.org.za/documents/d0000497/index.php>. Accessed: 28/01/2006

SARPN (South African Regional Poverty Network). 2006. Food security in South Africa: Key policy issues for the medium term. [Online]. Available at: <http://www.sarpn.org.za/documents/d0000685/page1.php>. Accessed: 15/01/2006.

SAYED, N. 2002. *Current information on national and household food security situation in South Africa.* Pietermaritzburg: University of Natal. Discipline of dietetics and human nutrition.

SHRIMPTON, R. & SCHULTINK, W. 2002. Achieving a balance diet in developing world: Strategies to meet micronutrient needs. Can supplements help meet the micronutrient needs of the developing world. *Journal of the Nutrition Society*. 61: 223-229, May.

SSWEWANYANA, S.N. 2003. *Food security and child nutrition status among urban poor households in Uganda: Impactions for poverty alleviation.* AERC Research Paper 130. Nairobi: African Economic Research Consortium.

STANFIELD, P.S. 1997. *Nutrition and diet therapy: self-instruction modules.* 3rd ed. USA: Jones and Bartlett.

STEYN, N.P., HANEKOM, S.M., NESAMVUNI, A.E., OOSTHUIZEN, W. & LAUBSHER, I. 1996. Analysis of perceptions of school children regarding the primary school nutrition programme in four provinces of South Africa. South Africa: University of Stellenbosch.

STEYN, N & LABADARIOS, D. 2002. *Nutrition Policy Implementation.* South Africa: University of Stellenbosch.

STEYN, N.P, LABADARIOS, D.L & HUSKISSON, J. 1999. *The National Food Consumption Survey (NFCS): Children aged 1-9 years, South Africa*, 1999. South Africa: University of Stellenbosch.

SUSTAIN. 2002. Micronutrient Fortification. [Online]. Available at: <http://www.sustaintech.org/technology/micro_fort.htm>. Accessed: 04/02/2006

UCS (Union of Concerned Scientists). 2005. Enough food in the future-without genetically engineered crops. [Online]. Available at: <http://www.ucsusa.org/food_and_environment/genetic_engineering/world-food supply.html.access>: 13/01/2006

UNICEF (United Nations Children's Fund). 1998. *The State of the World's Children, Panel2*, UNICEF. [Online]. Available at: <http://www.unicef.org/sowc98/panel2.htm>. Accessed: 04/02/ 2006.

UNICEF (United Nations Children's Fund). 2002. *Achieving Basic Education For All Nutrition Strategies for Schoolchildren.* UNICEF. New Yolk. [Online]. Available at: <http://www.unicef.org/lifeskills/files/NutritionStrategiesforSchoolDec2002.doc>. Accessed: 02/02/2006.

UNICEF (United Nations Children's Fund). 2005. *Nutrition.* [Online]. Available at: <http://www.unicef.org/india/nutrition.html>. Accessed: 17/01/2006

UNICEF (United Nations Children's Fund). 2006. *Malnutrition.* [Online]. Available at: <http://www.unicef.org/progressforchildren/2006n4/malnutritiondefinition.html>. Accessed: 21/04/2007.

UP (University of Pretoria). 2005. Consumer sensory evaluation: step by step. Pretoria: Sensory Research Division: Department of Food Science. 21-23 June.

VAN STUIJVENBERG, M.E. 2005. Using the school feeding system as a vehicle for micronutrient fortification: experience from South Africa. *Food and Nutrition Bulletin Journal*, 26 (2): S213-S219, June.

WEBB, P. & ROGERS, B. 2003. Addressing the "In" in food insecurity. Occasional Paper No.1. USAID Office of Food for Africa.

WENTZEL-VILJOEN, M.Sc. 2003. *Development of a model for the monitoring and evaluation of nutrition and nutrition-related programmes in South Africa.* PhD. Thesis. Potchefstroom: PU for CHE.

WHO (World Health Organisation). 2000. Foundation of nutrition well-being. [Online]. Available at: http://www.who.int/nut/. Accessed: 04/02/06.

WHO (World Health Organization) & FAO (Food and Agriculture Organization of the United Nations). 2002. *Human vitamin and mineral requirements*. Italy: Rome. [Online]. Available at: <http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/004/y2809e/y2809e00.htm>. Accessed: 25/06/2006

WHO (World Health Organization). 2006. Nutrition for Health and Development. [Online]. Available at: http://www.who.int/nutrition/en/. Accessed: 21/01/2006.

WIKIPEDIA. 2005. Image: *Johannesburg region map with names*. Jpg. Encyclopedia. (Online). Available at: http://en.wikipedia.org/wiki/Image:Johannesburg_region_map_with_names.jpg. Accessed: 30/11/2005

WIKIPEDIA. 2006. Malnutrition. [Online]. Available at: <http://en.wikipedia.org/wiki/malnutrition>.Accessed: 12/06/2006

WORLD BANK. 2006. Nutrition. USA: Washington. [Online]. Available at: <www.worldbank.org>.Accessed: 07/06/2006.

WORSLEY, A. 2005. Children's healthful eating: from research practice. *Food and Nutrition Bulletin Journal,* 26 (2): S135-143, June.

ANNEXURE A PRIMARY SCHOOL CHILDREN ASSESSMENT SHEET

DEPARTMENT OF HOSPITALITY AND TOURISM
VAAL UNIVERSITY OF TECHNOLOGY

PROJECT TITLE

Sustainability of corn soya blend use in the Orange Farms School-Feeding Programme

The purpose of this questionnaire

This questionnaire was developed with the aim of assessing learner acceptability of the CSB porridge after adjustment for compliance to JAM requirements. As a learner you are urged to complete all the questions.

NB: You are welcome to ask where you don't understand.

Learner personal details

AGE ..... DATE OF BIRTH...../.....19.....

GRADE ..... SCHOOL .....

ADDRESS.....

DATE ..... QUESTIONNAIRE NO: .....

For each of the questions, please tick the box, next to the option most appropriate for your choice

1. How often do you eat the CSB porridge per WEEK at school? Tick in the box next your answer.

Once	
Twice	
Thrice	
Four times	
Five Times	
None	

2. How much of the porridge do you usually eat?

All	
Most of it	
Half	
Little bit	
None	

3. Have you ever gone for a second serving?

Yes ☐ No ☐

If yes, how often do you go for a second serving per week?

Once	
Twice	
Thrice	
Four times	
Five times	
None	

4. How much do you like the texture of the porridge?

Good	Average	Bad

Explain.....

5. How much do you like the taste of the porridge?

Good	Average	Bad

Explain .....

6. Do you want the porridge to be always available at school?

Yes ☐ No ☐

Other .....

7. What benefit do you get from the CSB porridge school feeding programme? Give a brief explanation .....

.....

THANKS FOR YOUR TIME!!!!!!!!!!!

Vaal University of Technology
(Formerly Vaal Triangle Technikon)

ANNEXURE B

JAM
Joint Aid Management

PROJECT INFORMATION AND INFORMED CONSENT: ORANGE FARMS NUTRITION INTERVENTION PROGRAMME

Good day

My name is Wilna Oldewage-Theron and I am working at the Vaal University of Technology with Angel Malesa, a Masters student. We are doing a project to determine the nutritional status of school children in Orange Farms and need your assistance in getting the information for this project. I will explain the project to you and..... (fieldworker) will translate the project contents to you so that you will understand exactly what will be done, the reasons and what will be expected of you so that you can decide if you want your child to participate in this project. **Participation is voluntary** and should your child decide to participate, he/she may **withdraw at any stage** during the project.

WHAT IS THIS PROJECT?

The objectives of this project are to:

- Determine the prevalence, magnitude and underlying causes of malnutrition of school children in Orange Farms (March 2005).
- Evaluate the baseline survey report (March- June 2005)
- Implement a school feeding project in collaboration with Joint Aid Ministries to improve food, nutrition and health of the school children (March – December 2005).
- Evaluate the outcomes and impact of the projects (November/December 2005).
- Report on the findings to the study community, as well as the scientific community at large (ongoing).
- Develop appropriate nutrition education programmes to accompany each stage of the project (ongoing).

WHAT IS THE SCHOOL FEEDING PROJECT ABOUT?

Joint Aid Management (JAM), a South African NGO with 20 years of experience in feeding school children throughout Africa, in collaboration with the Vaal University of Technology (VUT), will be starting a School Feeding Programme in Orange Farm at Isikhumbuzo Secondary School, Siyaphambili Secondary School, Reitumetse Primary School, Tshebetso Secondary School and Sinqobile Intermediate School. Every student at these schools will be provided with a Corn Soya Blend (CSB) or rice and soy meal every school day during their first break.

The CSB meal is an instant porridge that will be mixed with water and prepared by trained and volunteer mothers consists of 65% corn, 25% soy, 0% sugar, fortified with a mineral and vitamin mix (Vitamin A, Iron, Iodine, Calcium, etc).

Secondary School students will receive 150g of CSB porridge and Primary School students will receive 100g of CSB porridge every school day. These proportions will provide 70-100% of daily recommended dietary allowance of micronutrients for all students, thus assisting them to concentrate and perform better at school.

WHY IS THIS PROJECT IMPORTANT?

Although dramatic progress has been made in some areas of nutrition in recent years, 790 million people in the developing world and 34 million in developed countries, are still undernourished and do not have enough to eat. Reducing hunger and malnutrition will continue to remain a challenge as the International Model for Policy Analysis of Commodities and Trade (IMPACT) projects that malnutrition will persist in 2020 and beyond (Flores, 2001:1; Pinstrup-Andersen & Babinard, 2001:11; Underwood, 2001:53). New information confirms an improved global nutrition situation, but the nutritional status is concurrently deteriorating in several countries, especially in Africa. Hunger and low intake of the major micronutrients, remains widespread despite rapidly declining world food prices during the past 20 years (Pinstrup-Andersen & Babinard, 2001:9).

JAM's School Feeding Programme is primarily designed to provide nutritious food to school children between the ages of 7and 18 years, in order to:

- Alleviate "short term hunger" in the classroom
- Address micronutrient deficiencies
- Enhance active learning capacities

PROCEDURE

The project will take place over a period of 10 months, from March to December 2005. You, as parents or caregivers of the children, will be requested to complete four questionnaires in an interview with the assistance of fieldworkers from VUT during March 2005.

Regarding the children, we will measure their height, weight and body fat composition (by means of electrodes). The children will also have to complete two food intake questionnaires with the assistance of the VUT fieldworkers. One small blood sample (two teaspoons of blood) will be drawn from a small sample (maximum 50) of the children at each school. You will be supplied with the exact dates when all of this will be taking place.

Before the feeding project will commence, all the children will be expected to take a de-worming tablet under the supervision of a trained nursing sister.

WHAT WILL BE MEASURED IN THE PROJECT?

- Eating and drinking habits
- Medical history
- Weight, height, body fat composition
- Clinical signs of malnutrition
- Blood sample (two teaspoons of blood): markers of nutritional status. PLEASE NOTE, **NO HIV OR AIDS** testing
- Blood pressure and body temperature

All these measurements will be done during March and November 2005, thus twice during the project. You will thus be requested to come to school one day during March and one day during November 2005. During these two days we will complete all the questionnaires for both you and your child, as well as take

all the measurements of your child. We will let you know at least one week in advance of the date and the time that we would like you to be present at the school. We will need you to be available for at least two hours to complete all the measurements and questionnaires.

WHO MAY PARTICIPATE?

All the children attending the mentioned schools in Orange Farms. People will be asked to participate and may refuse. Therefore, only **volunteers** will be asked to sign the informed consent form to participate in all the measurements. However, all the children will be able to get the instant porridge every school day, regardless of participating in the research project.

WHAT ARE THE BENEFITS FOR YOU?

Many healthy and nutritional status indicators of the children will be measured. You, both parents and children, will receive feedback during which a member of the investigation team will explain the health risks, if any, to you. You will receive dietary advice and will be referred to your clinic or doctor if necessary. A doctor will be supervising the research project and it involves a low risk.

The information collected will assist the investigation team in planning nutrition education programmes for the children to ensure that optimum nutrition is maintained for the children.

By receiving and eating the CSB every school day, the following benefits may occur:

- The project will improve the nutritional status of the students
- The food will provide students with sufficient energy to keep them alert in class
- The project may motivate students to attend school regularly

WHAT DO WE EXPECT OF YOU?

- Please bring your ID, we need to know your birth date.
- Please bring your children's birth certificates, we need to know their exact age.
- We will appreciate it if your child will report fasting on the day when the blood samples will be taken. It means that for 6-8 hours before the blood sample is taken, thus after 24H00 (12 pm) he/she must not eat or drink anything but pure water. We will start drawing blood at 06H00 and will request your child to be at the school at 06H00 on the day that we will draw blood (you will be advised one week in advance of the date).
- You will be asked to sign a form giving consent for your child/ren to participate in the project.
- We will ask you a number of questions regarding your health, age, income, family, smoking and drinking habits.
- Then you and your child/ren will receive a **reference number** for the project.
- Your child/ren will be weighed and measured.
- We will take your child's blood pressure to determine stroke risk.
- Your child's temperature will be taken orally.
- Your child will be questioned in detail about his/her eating habits. We would like the parent to be present at the time.
- Two teaspoons of blood will be taken from your child twice in the period of 10 months by a registered nursing sister. He/she may experience a little pain at the prick of the needle, but this will not be long lived.
- The child will receive journals to browse through while you wait.
- The child will receive a snack after the blood sample has been taken.

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

Thank you

Wilna Oldewage-Theron (Prof)
Activity leader: Orange Farms Nutrition Intervention Project

Tel: 016 950 9722
Fax: 016 950 9788

INFORMED CONSENT

I, ...(full name), the parent/legal guardian of _____(child/student), hereby give consent that he/she may participate in the school feeding programme to be administered by Joint Aid Management.

I hereby indemnify Joint Aid Management and VUT against any liability that may originate during his/her participation in the school feeding programme. I further undertake that I will not lay any claim against Joint Aid Management and VUT for damage or personal disadvantages that he/she may suffer as a result of the school feeding programme.

Signature .....

Relationship to child/student .....

Signed at ..... on .....

Address of parent/legal guardian:
.....
.....
.....

Telephone number: .....

ANNEXURE C ETHICAL CONSIDERATION

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Oldewage-Theron

CLEARANCE CERTIFICATE	PROTOCOL NUMBER M050250
PROJECT	*Impact of a Nutrition Intervention Programme on School Children in Orange Farm*
INVESTIGATORS	Prof W Oldewage-Theron
DEPARTMENT	Hospitality and Tourism
DATE CONSIDERED	05.02.25
DECISION OF THE COMMITTEE*	Approved unconditionally

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

DATE 05.04.20 CHAIRPERSON .....
(Professor PE Cleaton-Jones)

*Guidelines for written 'informed consent' attached where applicable

cc: Supervisor:

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10005, 10th Floor, Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. I agree to a completion of a yearly progress report.

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

ANNEXURE DECLARATION OF LANGUAGE EDITING

Dr. Zandra Bezuidenhout
Editor and Translator

7 Anesta Street

Stellenbosch 7600

Tel.: 021-8801543 / 073 9731953

Fax: 0866896492
E-mail: zbez@mweb.co.za
Member of the SA Translators' Institute

DECLARATION

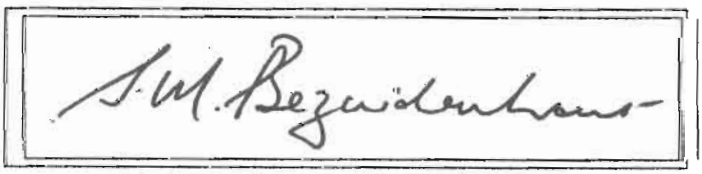
Language editing of dissertation:

Sustainability of corn-soya blend use
in the
Orange Farms Primary Schools Feeding Programme

by

Ms Mumsy Chibe

It is hereby declared that prior to publication, the above dissertation was language edited by Dr. Z. Bezuidenhout.



Stellenbosch
20 July 2007