

**SUPPLEMENTARY FEEDING OF SOUTH AFRICAN UNDERWEIGHT
CHILDREN BETWEEN 1 AND 10 YEARS OF AGE WITH
READY-TO-USE FOOD TO PROMOTE WEIGHT GAIN**

BY

KIRASHA MAHARAJ

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PIETERMARTIZBURG

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ABSTRACT

The aim of this study was to investigate whether *Sibusiso*, a Ready Food Supplement (SRFS), developed by the Gift of the Givers Foundation was able to promote weight gain among underweight children between 1 and 10 years of age. The study also aimed to train CAST community workers on how to assess and identify underweight children and to determine the number of underweight children aged 1-10 years who were currently on the CAST food aid program in Cato Manor and Chesterville in Durban, Kwa Zulu-Natal. This non-randomised intervention study was carried out on a total of 19 out of 20 subjects that initially qualified for inclusion into the study. A monitoring tool was used to collect data on anthropometrical measurements, symptoms experienced, disease conditions identified, level of appetite, meal consumption and energy for each subject for a period of three months. Study subjects were from families living in Cato Manor and Chesterville in Durban, Kwa Zulu-Natal, who were part of a food aid programme run by non-governmental organisation Church Alliance of Social Transformation (CAST). SRFS was compared to Recommended Energy Allowances (REA) and Recommended Daily Allowances (RDA) to determine the amount of energy and macronutrients that SRFS provided to subjects in their different age groups. The predominant health conditions and symptoms experienced by the subjects were assessed. General improvement in appetite, meal consumption and energy levels among subjects were monitored during the supplementation period

Out of 19 subjects who were supplemented with SRFS over the three month period, it was established that more children from Chesterville than Cato Manor were part of the CAST food parcel programme. SRFS was not able to meet 100% of the RDA and REA for subjects in their different age groups. However, SRFS was able to promote weight among subjects as

50% of subjects were able to achieve normal weight-for-age growth by the third month of supplementation. Human Immunodeficiency Virus (HIV) infection was the predominant disease condition experienced among subjects. A steady decline in the frequency of infection symptoms experienced among subjects was observed. Appetite, meal consumption and energy levels among subjects increased during the three month supplementation period.

In conclusion, SRFS was successful in promoting weight gain among underweight children and was able to improve the overall wellbeing of subjects by alleviating the burden of disease conditions and infection symptoms while improving appetite, meal consumption and energy levels. SRFS therefore was beneficially utilised in the CAST food aid programme. SRFS had beneficial effects on the health and nutritional status of the study subjects during the observed period of its use in the CAST food aid programme and its continued use is recommended.

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DEDICATION

This dissertation is dedicated to my late grandparents Mr Agbal Dhilip Singh and Mrs Manwanthie Singh.

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CHAPTER 1

INTRODUCTION, THE PROBLEM AND ITS SETTING

1.1 Importance of the study

Malnutrition remains one of the most important causes of infant and young child deaths and is estimated to be a contributing factor in over 50% of child deaths worldwide (Prudhon, Briend, Prinzo, Daelmons, Mason 2006; Zere, McIntyre 2003). If malnutrition was eliminated, it is estimated, child mortality and morbidity would decrease to one third (Prudhon *et al* 2006). In South Africa, the rates of stunting are the highest, followed by underweight and wasting. The highest rates of underweight children are among African and Coloured population and in terms of geographical area, higher rates of underweight exist in the rural areas. Underweight has been linked to socio-economic status as children of lower economic status have been found to bear a greater burden of malnutrition (Zere *et al* 2003). The most common clinical presentation of Human Immunodeficiency Virus (HIV) infection in children is malnutrition (Ndekha *et al* 2005). With HIV infected children it is important that optimal nutrition is provided to ensure the greatest opportunity for normal growth and development (Shaw, Lawson 2007, p 286).

In experimental situations, the nutritional status of moderately malnourished children can be improved by effective supplementary feeding (Sguassero, Onis, Carroli 2010). Traditionally, high protein, low fat cereal and legume mixtures made from blended flours have been used in food aid programmes (Maleta, Kuittinen, Duggan, Briend, Manary, Wales, Kulmala, Ashorn 2004). Results from studies conducted on these cereals supplemented to children with HIV infection in Sub-Saharan Africa have been disappointing. These supplements are usually low in energy density and a large intake is required in order for children to meet their energy requirements for catch-up growth. In addition, cereal legume supplements may simply replace other staple foods in the diet, thus failing to improve overall energy intake (Maleta *et al* 2004). Other disadvantages of using these supplements include high cost, inadequate levels of nutrients and poor compliance (Briend 2002).

According to Briend (2001), the use of a ‘highly fortified food’ presents a good solution to providing the “missing nutrients” needed in vulnerable groups. Of interest is a Ready-to-Use Therapeutic Food (RTUF) which is a solid, lipid based energy dense food, which has been found to be superior to the traditional cereal based mixes (Sandige *et al* 2004; Diop, Dossou Ndour, Briend, Wade 2003; Briend 2001). The benefits of RTUF include that the supplement requires no preparation before consumption, has excellent storage properties and is high in energy (Ndekha, Oosterhout, Zijlstra, Manary, Saloojee, Manary 2009; Maleta *et al* 2004; Briend 2001). In addition, RTUF is convenient and can be used safely at home in areas where poor hygienic conditions prevail without the risk of bacterial contamination (Diop *et al* 2003; Briend 2001). Lastly, RTUFs are adaptable and sustainable as the ingredients and technology used in the manufacturing process is simple (Diop *et al* 2003; Briend 2001).

There are numerous benefits to RTUF and taking into account that the rates of underweight children in South Africa are high, it posed beneficial to investigate the effectiveness of RTUF in a South African community setting. To date there have been no such studies conducted in South Africa. This study aimed to investigate whether supplementation with a RTUF (Sibusiso Ready Food Supplement) could promote weight gain in underweight children between 1 and 10 years of age living in Cato Manor and Chesterville in Durban, KwaZulu-Natal. Underweight children, who participated in this study, are part of household insecure families who are currently receiving food parcels supplied by the non-for-profit organisation Church Alliance for Social Transformation (CAST).

Supplementing underweight children identified from CAST with a Sibusiso Ready Food Supplement (SRFS) may help promote weight gain among these children, and as a result alleviate the burden of malnutrition and complications that are associated with the nutritional status. It should be noted that malnutrition is due to on-going nutritional ‘deprivation’ along with lack of emotional care by caregivers, which is due to poor understanding, poverty or family problems (World Health Organisation 1999). It was envisaged that the three month supplementation period would provide time for families to put into place poverty relief. According to Sguassero *et al* (2010) factors, such as housing, water supply and sanitation need to be improved in order to address the problem of malnutrition. In addition, projects such as starting and sustaining a vegetable garden would prove viable in order to sustain weight gain and prevent malnutrition.

1.2 Sibusiso Ready Food Supplement

Sibusiso Ready Food Supplement (SRFS) was developed in 2004 by a non-governmental organisation the Gift of the Givers Foundation (Appendix A). SRFS is a soya based high-energy protein food supplement, which looks and tastes like peanut butter. SRFS has an energy density of 23.5 KJ/g and a protein content of 16g/100g. SRFS is indicated for weight loss, muscle wasting, low energy levels, nutritional challenges, weakness, and decreased appetite. Advantages of SRFS include that the supplement requires no preparation, dilution or heating before consumption. SRFS can be eaten on its own, stirred into porridge or other foods, or used as a spread.

1.3 CAST Food Parcel Programme

The Church Alliance for Social Transformation (CAST) is a non-for-profit organisation based at Westville Baptist Church in Durban, Kwa Zulu-Natal. Among other projects, CAST distributes food parcels on a monthly basis to food insecure families in six communities in Kwa Zulu-Natal in order to assist with poverty relief. Criteria for receiving food parcels include that the breadwinner of the family is too sick to work, families are run by child headed households and lastly there is a household income of less than R500 per month. The contents of the food parcels include:

- 2.5 g mealie meal porridge
- 410 g peanut butter
- 500g sugar beans
- 2 kg samp
- 1 kg sugar
- 500g powdered milk
- 200g soya mince

Each food parcel lasts a family of four more or less ten days. These food parcels are distributed to families on the programme at different distribution sites in the areas targeted. CAST community workers assess eligible families in each area through home visits.

1.4 Statement of the problem

The purpose of this study was to determine whether supplementation for three months with Sibusiso Ready Food Supplement (SRFS) would promote weight gain among 20 underweight children between 1-10 years of age living in Cato Manor and Chesterville in Durban, KwaZulu-Natal.

1.5 Type of study

This was a non-randomised intervention study in which 20 underweight children aged 1-10 years living in Cato Manor and Chesterville in Durban, KwaZulu-Natal, were supplemented with SRFS for a period of three months.

1.6 Study objectives

The objectives of this study were to:

- 1.6.1 Determine whether supplementation for a period of three months with SRFS was able to promote weight gain among underweight children aged 1-10 years who are currently on the CAST food parcel program.
- 1.6.2 Determine the amount of energy and macronutrients SRFS provided to underweight children aged 1-10 years as compared to the Recommended Energy Allowances (REA) and Recommended Daily Allowances (RDA)
- 1.6.3 Determine the predominant disease conditions and symptoms experienced among underweight children aged 1-10 years who were currently on the CAST food parcel program.
- 1.6.2 To determine if there was an overall improvement in appetite, meal consumption and level of energy among underweight children aged 1-10 years of age who are currently on the CAST food parcel program.
- 1.6.3 To determine the number of underweight children 1-10 years of age who are currently on the CAST food parcel program in Cato Manor and Chesterville in Durban, Kwa Zulu-Natal.
- 1.6.4 To train community volunteers working for CAST on how to assess and identify underweight children

1.7 Study Constraints

- 1.7.2 The subjects included in this study were limited to children who were part of families currently on the CAST food parcel programme in Cato Manor and Chesterville in Durban, Kwa-Zulu-Natal. This was done in order to identify if SRFS was able to promote weight gain among these subjects within the three month supplementation period and thereby alleviating the burden of disease and providing time for families to put into place poverty relief solutions. This would also aid CAST in formulating more effective future food aid programs. Hence the age group of subjects in this study was broadened to 1 – 10 years of age in order to widen admission criteria and increase the number of subjects that could be included in this study.
- 1.7.3 Only twenty children were included in this study and for control purposes and compliance it was important that subjects attended each supplementation day for a period of three months. Contact details (cell phone number, home address, school attended) of the subjects were collected on the day of enrolment into this study so that caregivers could be contacted in the event that subjects did not attend the designated supplementation days and could be followed up at home if needed.
- 1.7.4 Poor attendance of subjects was an issue especially if a supplementation day fell on a pension/grant collection day or during a day of bad weather. In addition, some caregivers were working and they were not able to bring their children during the supplementation hours. To control for this, supplementation days were not held on pension/grant collection days and supplementation days were strategically planned on food parcel collection day to ensure optimal attendance of caregivers and subjects. During supplementation days of bad weather, transport was provided for subjects and caregivers by CAST community volunteers. Caregivers who were employed were told to have a family member (sibling, aunt) bring the subject to be assessed on the supplementation days.
- 1.7.5 Among the families receiving food parcels, only children who were identified as being underweight were supplemented with SRFS. This may have led to sharing of the SRFS with other children within the family and hence the underweight subject may not have received the recommended daily dose of SRFS, which could directly have impacted on weight gain. Caregivers were instructed on the amount of SRFS to provide the underweight children with and SRFS was prompted as a medicinal product, intended to be used exclusively for the underweight child and not as a general

food. This was done in order to discourage sharing of the product with other members of the family.

1.8 Study Parameters

All underweight children aged 1 -10 years who were part of families currently receiving food parcels from CAST in Cato Manor and Chesterville, Durban, Kwa Zulu-Natal, were included in this study.

1.9 Assumptions

In order for the hypotheses of this study to be tested successfully, it was assumed that:

- 1.9.1 Caregivers provided the recommended daily dose of SRFS to the subjects as instructed
- 1.9.2 SRFS was provided in addition to other meals and did not replace any of the meals in order to promote weight gain
- 1.9.3 SRFS was administered by a caregiver
- 1.9.4 Subjects did not have any other disease conditions or symptoms other than that identified in the monitoring tool during supplementation period

1.10 Definition of terms

Fever: Elevation above normal of body temperature. A fever may accompanied by symptoms such as shivering, headache, sweating, thirst, faster-than-normal breathing and a flushed face (Peters 2007, p228).

Gastroenteritis: Inflammation of the stomach and intestines, usually causing sudden upsets that last for two or three days. Appetite loss, nausea, vomiting and diarrhoea are the usual symptoms (Peters 2007, p246).

Jaundice: Yellowing of the skin and the whites of the eyes, caused by an accumulation of bilirubin in the blood. Is a chief sign of many disorders of the liver and biliary system. During kwashiorkor the liver often enlarges and in the more advanced stages are marked by jaundice (Peters 2007, p322).

Kwashiorkor: A severe form of malnutrition in young children that occurs principally in poor rural areas. Affected children have stunted growth and a puffy appearance due to oedema (Peters 2007, p331).

Macronutrients: For the purposes of this study, macronutrients refer to carbohydrate, fat, and protein.

Marasmus: A severe form of protein and calorie malnutrition that usually occurs in famine or semi-starvation conditions. The disorder causes stunted growth, emaciation and loose folds of skin on the limbs and buttocks due to loss of muscle and fat. Other signs include sparse brittle hair, diarrhoea and dehydration (Peters 2007, p355).

Nausea The sensation of needing to vomit (Peters 2007, 390).

Oral thrush: A fungal (candidia) infection that affects the mouth (Peters 2007, p549).

Ready-to-use-therapeutic food: A generic term including different types of foods, such as spreads or compressed. For the purposes of this study RTUF will refer to spreads only.

Recommended Energy Allowances: Represent the average needs of individuals.

Recommended Daily Allowance: The average dietary nutrient intake level that is sufficient to meet the nutrient requirements of nearly all (97%-98%) healthy individuals in particular life stage and gender group (Otten, Hellwig , Meyers 2006, p8).

Supplementary feeding: The provision of extra food to children or families beyond the normal ration of their home diets (Sguassero *et al* 2010)

Tuberculosis: An infectious notifiable disease commonly called TB, caused by the bacterium *Mycobacterium tuberculosis*. The primary infection is usually without symptoms. Progressive infection in lungs causes coughing (sometimes bringing up blood), chest pain, shortness of breath, fever, sweating, poor appetite and weight loss (Peters 2007, p563).

Underweight: A condition measured by weight-for-age, a condition that can also act as a composite measure of stunting and wasting (Cogill 2003 p58).

Weight-for-age: Low weight-for-age identifies the condition of being underweight for a specific age. The advantage of this index is that it reflects both past (chronic) and/or present (acute) under nutrition although it is unable to distinguish between the two (Cogill 2003, p11).

1.11 Abbreviations

AIDS:	Acquired Immunodeficiency Syndrome
ART:	Antiretroviral Treatment
CAST:	Church Alliance for Social Transformation
HIV:	Human Immunodeficiency Virus
LAZ:	Length-for-age z-score
REA:	Recommended energy allowances

RDA:	Recommended Daily Allowance
RTUF:	Ready-to-use Therapeutic Food
SD:	Standard Deviation
SRFS:	Sibusiso Ready Food Supplement
TB:	Tuberculosis
WAZ:	Weight-for-age Z-score
WHZ:	Weight-for-height Z score
WHO:	World Health Organisation

1.12 Summary

The rates of malnutrition in developing countries are high and impact greatly on child mortality and morbidity. Confounding the problem of malnutrition is HIV infection which is highly prevalent among children that further contributes to poor child survival. Appropriate nutrition interventions aimed at decreasing the rates of child malnutrition are required. Traditionally low energy, low protein blended flours have been used to supplement diets of malnourished children. However these supplements have been found inappropriate. RTUFs among other benefits, have found to have positive effects on weight gain among malnourished children. Hence, this study aimed to determine whether a RTUF produced by the Gift of the Givers Foundation would promote weight gain among underweight children aged 1-10 years of age. The subjects included in this study were from poverty stricken families who were part of a food parcel programme. By supplementing children for a period of three months, the RTUF could promote weight gain and thereby alleviate the burden of malnutrition.

1.13 Structure of the dissertation

The structure of the dissertation is as follows:

Chapter 2 is a literature survey, in which the most critical information needed to understand and interpret the hypothesis and the results of this study, is examined. Chapter 3 explains and gives the motivation behind experimental methods used during the intervention phase. The results of the intervention study are given in Chapter 4. In Chapter 5 the results of the study are discussed and compared to previous studies. Finally, in Chapter 6, the conclusions and recommendations are made based on the intervention study. The possible application of the findings to contribute to the lowering of cardiovascular disease is highlighted.

CHAPTER 2

LITERATURE REVIEW

Introduction

The millennium development goals set in 2005 aim “to eradicate extreme poverty and hunger” and “to reduce child mortality” by the year 2015 (Prudhon *et al* 2006). However, it is estimated that 170 million children in developing countries are underweight and as a result, over 3 million of these children die each year (Sguassero *et al* 2010). One of the leading underlying causes of childhood morbidity and mortality in developing countries is malnutrition (Sguassero *et al* 2010; Prudhon *et al* 2006).

Confounding to the problem of malnutrition is Human Immunodeficiency Virus (HIV) infection which has negative effects on child survival and significantly decreases life expectancy in Africa (Steenkamp, Dannhauser, Walsh, Joubert, Veldman, Van der Walt, Cox, Hendricks, Dippenaar 2009). It is estimated that 2.8 million children are affected by HIV infection in Sub-Saharan Africa (Ndekha, Manary, Ashorn, Briend 2005). In South Africa, approximately 20–30% of HIV infected children are underweight and more than 60% of HIV infected children have multiple micronutrient deficiencies. (Steenkamp *et al* 2009). According to Steenkamp *et al* (2009), factors such as impaired nutritional status, growth failure, weight loss and micronutrient deficiencies are linked to Acquired Immunodeficiency Syndrome (AIDS) in HIV infected children. These factors may lead to further worsening of an already comprised immune system, which ultimately contributes to “poor prognostic outcome” (Steenkamp *et al* 2009). Child malnutrition has detrimental effects on human performance, health and survival and the prevention of malnutrition remains a priority (Sguassero *et al* 2010).

Current programs aimed at preventing malnutrition remain “imperfect” especially in the poorest of countries and appropriate interventions aimed at the prevention and treatment of underweight children are needed (Sguassero *et al* 2010; Prudhon *et al* 2006). According to Manary (2006), Ready-to-use-Therapeutic Foods (RTUFs) may prove beneficial as a supplement in complementary feeding of children who at risk of malnutrition. RTUFs have been found to be successful in the treatment of severe malnutrition in numerous studies

(Prudhon *et al* 2006). Mortality rates were found to be low and rapid rates of recovery have been observed (Prudhon *et al* 2006).

The major benefits of RTUF are that the supplement is energy dense, is able to resist bacterial contamination, and requires no preparation before consumption (Manary 2006). Due to the high energy density of RTUF, a child that is severely malnourished can meet nutrient intakes that are sufficient to promote complete recovery (Manary 2006). The production of RTUF requires technology that is simple and has been successfully adapted in developing countries. RTUF is also practical to implement in resource poor settings (Manary 2006)

This literature review aims to examine RTUF, looking at how RTUF were developed, the benefits of RTUF, explore the use of RTUF as a supplement in nutritional programmes and in the context of HIV and lastly the sustainability of using RTUF in the prevention of malnutrition will be explored.

2.1 The development of Ready-to-use Therapeutic Food (RTUF)

In 1999, the World Health Organization (WHO) recommended the use of large amounts of a high energy, high protein milk feed with added vitamin and minerals known as WHO F100 in the treatment of severe malnutrition in children and was used during the rehabilitation phase of treatment to promote rapid weight gain (Briend 2001). However, WHO F100 posed challenging to implement as the milk based foods were an excellent medium for bacteria and had to be prepared before each meal which presented as a problem as close supervision, safe preparation methods and access to clean safe water was required (Briend 2002; Briend 2001; Briend, Lacsala, Prudhon, Mounier, Grellety, Golden 1999). Recovery of severely malnourished children usually took four weeks and health facilities were expensive, bed numbers were limited and outpatient management with WHO F100 was not advisable (Briend 2001; Briend *et al* 1999). In addition mothers needed to stay with their children in the rehabilitation phase, especially if their children were still being breast fed (Briend 2002). This was difficult to achieve particularly when the mother had other children at home or when her employment was necessary for the financial survival of the household (Diop, Dossou, Ndour, Briend, Wade 2003; Prudhon *et al* 2006). Lastly, WHO F100 resembled infant milk formulae and distribution by health workers would have undermined “efforts to discourage formulae feeding and promote breastfeeding” (Diop *et al* 2003). This lead to limited

coverage of nutritional rehabilitation programmes based on WHO recommendations (Briend 2001). Hence a community based approach was required to overcome these shortfalls (Prudhon *et al* 2006).

RTUF was shown to be “efficacious” in producing rapid weight gain and could be used in the community (Prudhon *et al* 2006). Due to the acceptability of RTUF, a second product was developed which was used as a supplement to local diets and in managing moderate malnutrition (Briend 2001). The second RTUF differed from WHO F100 in that WHO F100 was designed to be used as the sole form of nutrition in the nutritional rehabilitation phase of severe malnutrition and had in content a much higher vitamin and mineral content to supply all nutritional requirements of a malnourished child. The aim of the second RTUF was to supply a small amount of vitamins and minerals absent in the rehabilitation diet which was prepared with locally available foods thereby reducing the cost of the product (Briend 2001).

Plumpy-nut and Plumpy ‘doz produced by the company Nutriset in France are examples of RTUF currently available (Defourny *et al* 2009; Ciliberto, Sandige, Ndekha, Ashorn, Briend, Ciliberto, Manary 2005). Plumpy ‘doz was developed in 2006 and is indicated for children under the age of three years old (Defourny *et al* 2009). The composition of Plumpy ‘doz was based on the composition of WHO F100 and Plumpy-nut, but is fortified with higher levels of vitamins and minerals. Plumpy ‘doz was designed to be consumed in small amounts (47g or 3 tablespoons/day) as a supplement to the infant or toddlers daily diet of breast milk and family foods and not provide all of the child’s energy and nutrient requirements as with other therapeutic diets (Defourny *et al* 2009). In 2004, a locally produced RTUF manufactured in Malawi Sibusiso Ready Food Supplement (SRFS), was found to be as effective as imported RTUF thereby decreasing cost and increasing availability of the product (Maleta *et al* 2004; Briend 2001). While Plumpy-nut and Plumpy ‘doz have both shown to aid in continuously increasing capacity and coverage of programs aimed at the outpatient management of severe malnutrition (Defourny *et al* 2009), the health and nutritional effects of Sibusiso seem not to have been studied.

2.2 Advantages of RTUF

2.2.1 Increased energy density

The energy density and micronutrient content of traditional cereal and legume supplements were generally low, requiring the addition of oil, and micronutrients which presented as an additional cost (Maleta *et al* 2004). Without the addition of oil the energy content of cereal and legume supplements failed to increase total energy intake as they resulted in merely displacing other staple foods in the diet (Maleta *et al* 2004). RTUF poses beneficial as children are known to have a clear preference for foods that are of high energy density (Briend 2001). According to Briend (2002), children are generally hungry during the rehabilitation phase of severe malnutrition and it is suggested that malnourished children prefer foods that are fatty. This may offset the effect of viscosity as higher intake was observed with lower viscosity feeds among children when given isocaloric meals (Briend 2001; Bennet, Morales, Gonzalez, Peerson, Lopez de Roma, Brown 1999). The viscosity of RTUF is high and may limit increase in energy intake as compared to liquid WHO F100 (Briend 2001). However, in a study conducted by Rolls, Bell, Thorwart (1999), it was established that there was higher intake of energy among adult women volunteers who were provided with a meal in which water and food were served separately as opposed to the same meal mixed in water. The same phenomena may have occurred with malnourished children as RTUF was found to be more accepted than WHO F100 feeds (Briend 2001). This in part could explain the increase in energy intake observed with RTUF in the first acceptability study comparing RTUF to WHO F100 in the treatment of severe malnutrition (Briend 2001). This study was conducted in a therapeutic feeding centre in Mao, Chad on 20 severely malnourished children who did not have oedema and were over the age of one (Briend *et al* 1999). The subjects were included sequentially into the study once they were in the recovery phase and had been gaining weight rapidly for at least three days. The children first received six daily feeds of WHO F100 which was prepared locally. In order to test the acceptability of RTUF over WHO F100, RTUF was introduced by alternating WHO F100 feeds with RTUF feeds and energy intake per feed was compared. To avoid bias, the order of feeds was changed each day. One child was randomly selected daily to have their intake weighed before, during and after the meals. Children were fed by their mothers. Mothers were told to repeatedly offer food over one hour, not force-feed their children and to give plain water to quench thirst (Briend *et al* 1999).

The energy intake of RTUF was 40.2 kcal/kg/feed as compared to WHO F100 which had an energy intake of 20.2 kcal/kg/feed (Briend *et al* 1999). However the higher intake of RTUF compared with WHO F100 did not mean that the overall energy intake was higher as the average energy intake of WHO F100 before RTUF was introduced was 30kcal/feed, which is the same as what subjects received from the combined diets. This suggested that full replacement of all WHO F100 feeds by RTUF did not lead to a major increase in overall energy intake. Excessive energy intake may lead to complications such as heart failure and a major increase in energy intake is not desirable (Briend *et al* 1999; WHO 1999). Hence, Briend *et al* (1999) recommended that in order to avoid overfeeding and misuse of the product, RTUF should be issued in small quantities on regular intervals. Frequent contact with health facilities of caregivers and children are necessary in order to monitor progress of children supplemented (Briend *et al* 1999). Lastly, the energy supplied by fat should not exceed 55 percent of energy and hence a “limit can be set for the maximum quantity of each nutrient included in the RTUF” thus allowing for nutrients to remain within an acceptable range to promote a safe intake level (Briend 2001).

2.2.2 Increased nutrient content

Diets of children in developing countries are generally low in vegetable, fruit and animal products and contain large amounts of cereal and legumes (Briend 2002). Poor intake of animal products, fruit and vegetables lead to deficiencies of riboflavin, retinol and vitamin B12 (Briend 2002). In addition, cereals and legumes contain large amounts of phytate and other substances which are known to reduce metal absorption (Briend 2002, Briend 2001). This results in poor absorption of key nutrients such as calcium, zinc and iron and has led to zinc and iron deficiencies being among the most prevalent deficiencies in poor communities (Briend 2002; Briend 2001). High risk groups such as severely malnourished children, require very high levels of vitamins and minerals. RTUF allows for fortification with tasteless insoluble minerals as the viscosity of the RTUF “prevents sedimentation of minerals during storage” (Briend 2001). This allows for the addition of very high levels of insoluble salts without negatively affecting the acceptability of RTUF and lead to the fortification content of the second RTUF developed being much higher. In addition one of the ingredients used to prepare RTUF are groundnuts. Groundnuts contain lysine which is an essential amino acid. The addition of soy flour can further increase the amino acid profile of RTUF. But both groundnuts and soy flour contain phytates. However, the fortification levels of zinc are high

enough to ensure that the ratios of phytate: zinc and phytate: iron remains within acceptable levels (Briend 2001).

RTUF is a mixture of powder mixed with fat (Briend 2001). When in high concentrations, vitamins and minerals have an unpleasant taste especially in their in-soluble form - This has been well perceived in traditional liquid diets (Briend 2001). Fat is able to mask this unpleasant taste in RTUF, thus allowing unpleasant tasting soluble salts which are more easily absorbed than tasteless insoluble salts to be added (Briend 2001; Briend 2002). According to Briend (2001), the acceptability of RTUF over WHO F100 in the study conducted by Briend *et al* (1999) could have been due to RTUF having a better taste than WHO F100. In addition, this type of emulsion is beneficial when vitamins are added since the thick fat layer surrounding the vitamins provides protection against humidity and oxygen. Due to the low water content of RTUF, the shelf life of the RTUF is increased as soluble minerals are prevented from reacting with the vitamins (Briend 2001). Hence a fat supplement with high levels of vitamins and minerals may pose as a more acceptable solution to supplementary feeding programmes as compared to the high protein blended flours which are a great medium for bacteria and insects (Briend 2001).

2.2.3 Resistance to bacteria and insects

RTUF contains less than two percent water as compared to flour which has a water content of eight to twelve percent (Briend 2001). Simply put, bacteria need water to grow and are unable to grow in RTUF as compared to the liquid version of the same feed in which bacteria grow exponentially (Diop *et al* 2003; Briend 2001). The intake of liquid feeds in an unhygienic environment increases the risk of diarrhoea, but due to the low water content there is a decreased risk of children developing diarrhoea with RTUF (Diop *et al* 2003). This poses beneficial as problems such as diarrhoea and infectious diseases may undermine the positive effects of supplementary feeding (Sguassero *et al* 2010).

If eaten alone or put on a slice of bread or biscuit, RTUF is safe since like the bread or biscuit, the water content is low and hence does not support the growth of bacteria (Briend 2001). In a community where large amounts of bread are consumed, RTUF served on bread would prove to be a viable option for supplementary feeding programmes. In terms of storage, RTUF are much easier to store as they do not contain enough water to support insect and

bacteria growth (Briend 2001). RTUF that are locally produced without airtight packaging can be stored at high temperatures for three to four months (Manary 2006). The shelf life of RTUF can be increased further to twenty four months when packaged in airtight foil envelopes (Manary 2006).

Hence RTUF can be used safely in a home setting even under poor hygienic conditions “without the risk of proliferation of pathogenic bacteria” (Briend 2002; Briend *et al* 1999). RTUF could also pose useful in home-based therapy or in facilities that do not have a kitchen. Briend *et al* (1999) concluded that RTUF could be used to improve success and coverage of nutrition rehabilitation programmes. However, according to Briend (2001), using RTUF in nutritional programmes goes against the “design” of most programmes as usually a supplement that is high in protein and low in fat made from blended flours are used (Briend 2001).

2.3 Use of RTUF as a supplement in nutritional programmes

2.3.1 RTUF versus traditional liquid based diets

In a controlled comparative clinical effectiveness trial conducted by Ciliberto *et al* (2005), two different management strategies for the second phase of treatment of childhood malnutrition was examined. This study aimed to observe if home based therapy with RTUF would result in higher rates of recovery and lower rates of relapse or death, than would standard therapy in seven Malawian Nutritional Rehabilitation Units (NRUs) between the period of December 2002 and June 2003. Standard therapy of childhood malnutrition in NRUs in Malawi was in accordance with the WHO guidelines and consists of two phases. In phase one, in-patients were provided with a milk based liquid diet and antibiotics. When the patient’s clinical condition and appetite improved, they progressed to phase two of treatment which consisted of a high energy high protein milk-based liquid diet (WHO F100) which continued until the patient was no longer wasted (Weight for Height Z-score (WHZ) > -2). The second phase of treatment was continued at home where WHO F100 was replaced with a flour supplement consisting of cereal and legumes. Subjects included in this study were children (10 – 60 months) attending one of seven NRUs who presented with wasting (WHZ < -2), mild oedema or both and a good appetite. Apart from in-patients, children who were

brought by caregivers from surrounding areas were also included in this study (Ciliberto *et al* 2005).

Reassessments were conducted every two weeks at the NRUs. Measurements included weight, length and mid upper arm circumference (MUAC) (Ciliberto *et al* 2005). Information on the number of days of fever, cough and diarrhoea experienced by the children in the previous fortnight was collected from caregivers. Children in the standard therapy group either received feedings in hospital or additional cereal-legume supplements for use at home whereas children in the RTUF group received an additional two week supply of RTUF at each visit. Study participation lasted eight weeks after which children were discharged.

Children were discharged before eight weeks if they reached a WHZ > 0 based on their admission height, clinically relapsed requiring readmission to the NRU or died. All children who reached a WHZ > -2 were asked to return for follow-up anthropometric measurements six months after recovery to assess the rate of relapse after the intervention was complete. Primary outcomes included attainment of a WHZ > -2 while remaining free of oedema and relapse or death. Secondary outcomes included rate of growth in body weight, MUAC and length and the number of days of fever, cough and diarrhoea during the first two weeks of treatment (Ciliberto *et al* 2005).

Subjects included a total of 1178 children (Ciliberto *et al* 2005). In group one, 992 subjects received home based standard therapy with RTUF and in group two 826 subjects received standard therapy. The following observations were highlighted from the study:

- There were no adverse reactions experienced in the RTUF group.
- Subjects in group one were more likely to reach a WHZ > -2 than group two.
- Subjects in group one was less likely to relapse or die than subjects in group two.
- Subjects in group one gained weight, height and MUAC at a greater rate than did subjects in group two and had a lower prevalence of fever, cough and diarrhoea.
- Of the 869 subjects who recovered, 717 returned for a follow-up visit six months after completion of therapy. 24 of the 717 subjects had relapsed out of which 9 were from group two and 15 from group one (Ciliberto *et al* 2005).

Ciliberto *et al* (2005) highlighted that in comparison to standard therapy, RTUF was found to provide higher rates of recovery in malnourished children. RTUF was found to be acceptable to mothers. This was supported by health care professionals who preferred RTUF in a satisfaction survey conducted in 2003, by the college of medicine. In addition this study indicated that there was a lower risk of fever, cough and diarrhoea in the RTUF group as RTUF was administered at home. This was largely due to there being an increased risk of the spread of pathogens in the NRUs as ill children are placed in one large ward and hence home based therapy with RTUF was found to be superior. (Ciliberto *et al* 2005).

2.3.2 RTUF versus traditional maize/soy flour supplements in home based therapy

Maleta *et al* (2004) hypothesized that RTUF would promote better dietary intakes and better weight and height gain in children than maize/soy flour in home based therapy of malnutrition. This study was conducted between June 2000 and April 2001 in Lungwena, Malawi. Subjects with the lowest WHZ were selected from the Lungwena Child Survival Study cohort and were between the ages of 42 and 60 months. Children were malnourished ($WAZ < -2$) and stunted ($LAZ < -2$). The primary outcome was absolute weight gain and secondary outcomes were height gain and changes in dietary intake (Maleta *et al* 2004).

The parallel group intervention study consisted of three phases (Maleta *et al* 2004). In phase one, subjects did not receive food supplementation and baseline dietary intakes and weight and height gain were monitored in the first four weeks. In phase two, in the subsequent twelve weeks, subjects were provided with 92g/day of RTUF or 140g/day of maize/soy flour. Subjects were allocated into two study groups by computer generated random numbers obtained by one author who did not participate in the data collection. The third phase was a post supplementation observation period after the 12 weeks of supplementation. During phase one and two, subjects were examined and weights and heights were measured at four week intervals, as well as at the end of the twelve week follow-up. In addition, 24 hour dietary recall was assessed fortnightly from enrolment to the end of the supplementation phase (Maleta *et al* 2004).

The maize/soy flour required preparation as opposed to RTUF which required no additional preparation (Maleta *et al* 2004). Both supplements were intended to provide additional macronutrients and micronutrients if the entire supplement was consumed and supplied approximately 500 kcal/day of energy. Likuni Phala (maize/soy flour) produced in Malawi

and Plumpy-Nut (RTUF) were both industrially prepared. The energy density of Likuni Phala when prepared as porridge was found to be one sixth the energy density of RTUF. To ensure that subjects would receive their full rations, a similar ration was given to all underweight children younger than five years of age in the household who were not included in the study. Caregivers were advised to provide the supplement in 3 to 4 rations each day in addition to the family meals. Empty RTUF sachets were collected at each assessment visit to monitor consumption (Maleta *et al* 2004).

A total of 61 subjects were included in this study with 30 subjects receiving RTUF and 31 subjects receiving maize/soy flour (Maleta *et al* 2004). At baseline, anthropometrical indices and dietary intakes were similar in both groups and no adverse reactions to the RTUF were reported. In the supplementation phase, mean energy and nutrient intakes in the RTUF group increased markedly compared with baseline observations whereas no significant changes were observed in nutrient intake in the group receiving maize/soy flour. In addition a larger proportion of subjects in the RTUF group achieved the Recommended Daily Allowances (RDA) for energy, calcium, zinc and vitamin A as compared to the maize/soy flour group in which only vitamin A intake was significantly affected. An increase in weight gain in both groups was observed however weight increased slightly but not significantly higher among RTUF group.

During supplementation, intake of staple foods decreased in the maize/soy flour group leading to a decline in energy intake of 614Kj/day. RTUF was superior due to its smaller volume and ready-to-use form which had little effect on the family diet and was more likely to result in an increase in total energy intake as compared to the traditional cereal based mixes. Poor access to fuel, wood and labour involved in food preparation, resulted in fewer frequent maize/soy flour meals being prepared as compared to RTUF which merely had to be added to family meals as a supplement by caregivers (Maleta *et al* 2004).

Post supplementation subjects in the RTUF group gained significantly more weight than subjects in the maize/soy flour group and hence weight gain was sustained only in the RTUF group (Maleta *et al* 2004). However, the sustainability of weight gain among subjects in the RTUF group after the intervention period could be attributed to seasonally available foods which may have positively affected micronutrient status leading to a change in growth rate without an effect on energy intake. Correction of micronutrient deficiencies leads to

improved appetite and may explain the sustained growth promoting effect of the micronutrient rich RTUF, even after stopping of supplementation (Maleta *et al* 2004).

Hence Maleta *et al* (2004) was able to demonstrate the positive effect of RTUF on the growth of moderately underweight and stunted children in their home environment. RTUF was able to improve energy and nutrient intakes to facilitate a higher proportion of subjects' intakes met the RDA. This effect was found to be less in the group that received the maize/soy flour.

Results observed by Maleta *et al* (2004) were similar to results observed in a study conducted by Manary *et al* (2004). Manary *et al* (2004) compared three dietary regimens in home based therapy for severely malnourished children in Malawi. The study was conducted at a Nutritional Rehabilitation Unit (NRU) at Queen Elizabeth Central Hospital in Blantyre, Malawi during January 2001 and October 2001. Eligible subjects included all children who were discharged from the NRU during January 2001 and October 2001, aged greater than twelve months. In-patient management of subjects included treatment for acute bacterial infections, feedings (provided 420KJ/kg/day energy and 1.2g/kg/day protein) and supportive care for acute metabolic complications. Subjects had regained their appetite and all infectious and metabolic complications were resolved and were able to receive home based therapy (Manary *et al* 2004).

Demographical information and anthropometrical measurements (weights, length and MUAC) were collected upon enrolment (Manary *et al* 2004). HIV testing was also done. Results of HIV positive children were not included in this study as malnourished children with HIV in Malawi are likely to have a different pathophysiology and worse prognosis than HIV negative children. During hospitalization, children were tested for peanut allergies using RTUF. Based on the subjects enrolment stature, a graduation weight was determined which corresponded to a WHZ of 0. The primary outcome was reaching 100% of graduation weight. Secondary outcomes included rate of weight gain, rate of height gain, rate of growth in MUAC, prevalence of infectious symptoms and lastly anthropometric indices six months after graduation (Manary *et al* 2004). Subjects were systematically allocated to three diet regimens based on their day of discharge (Manary *et al* 2004). The dietary regimens were chosen to examine the result of providing varied quantities and energy densities of macronutrients in home based therapy. It should be noted that all three groups, received

sufficient quantities of vitamins and other micronutrients for recovery (Manary *et al* 2004). Table 1 highlights the three diet regimens.

Table 1: Three diet regimens (Manary *et al* 2004)

	Dietary Group 1	Dietary Group 2	Dietary Group 3
Type of food given	RTUF in a quantity sufficient to meet nutrient requirements for full catch up growth	Multivitamin/mineral fortified RTUF supplement	Received a quantity of maize/soy flour to feed the entire nuclear family. The subject received a quantity sufficient for full catch up growth and a separate multivitamin/mineral supplement.
Energy provided	733Kj/kg/day (175kcal/kg/day)	2090 Kj/day Supplied about 33% of the daily energy requirements	Sufficient for catch-up growth
Energy provided (KJ/g)	23	26	4
Average quantity received by subjects	Received on average 276g/day	Received on average 92g/day	2400g/day of dry food stuffs

The RTUF was produced in France, it was an energy dense mixture of peanut butter, milk powder, oil, sugar and micronutrients with an energy density 23 kJ/g (Manary *et al* 2004). The RTUF supplement was a similar mixture to the RTUF but with an energy density of 26 kJ/g. The RTUF supplement was used to determine if adding a limited amount of an energy dense, micronutrient rich food to the subject's usual diet would promote full catch up growth as this would be helpful when considering large scale interventions. The maize/soy flour (80% maize and 20% soy) provided 4kJ/g when prepared as the traditional Malawian cooked soft dough. The maize/soy flour dietary group were given sufficient amounts of healthy, low energy dense traditional foods which is typically the approach of supplementary feeding programmes in Africa. On average, a malnourished child needed an intake of 1500g/day of cooked maize/soy to receive 733 kJ/kg/day (Manary *et al* 2004).

Caregivers in the RTUF and RTUF supplement groups were instructed to feed the entire quantity of RTUF prescribed over the course of the day, by feeding small amounts at frequent intervals (Manary *et al* 2004). Caregivers were instructed to feed their children the maize/soy blend seven times a day and to save portions of porridge and cooked dough for feedings between family meals. Caregivers brought their children to the clinic every 14 days for anthropometrical measurements and health assessments. Caregivers were asked about the

health status of the subject for the previous 14 days and the number of days fever, cough or diarrhoea was present. Subjects were discharged from the study when they reached their graduation weight for height or relapsed (requiring readmission to the NRU or died), and lastly if subjects failed to reach a WHZ of > 0 after 16 weeks. Subjects who reached their WHZ returned for a follow-up visit after 6 months in order to have their nutritional status assessed (Manary *et al* 2004).

Out of 452 eligible subjects identified, 282 HIV negative subjects were enrolled in the study. (Manary *et al* 2004). No differences in the demographical or nutritional characteristics of subjects among the three dietary groups were observed. No allergies were observed when test feeding with RTUF was conducted and no allergies were observed in group 1 or group 2 during the study period. There were no reports of subjects not able to or willing to take the RTUF due to taste or acceptability. There were no differences observed in the incidences of cough and fever by dietary group (Manary *et al* 2004). Results obtained from the study are reflected in Table 2.

Table 2: Results obtained from study conducted by Manary *et al* (2004)

	Dietary Group 1 (RTUF Supplement) N=96		Dietary Group 2 (RTUF) N=69		Dietary Group 3 (Maize/Soy) N=117	
	n	%	N	%	n	%
Reached graduation WHZ	59	61	59	86	80	68
Drop outs < 6 weeks	17	25	6	9	8	7
Drop outs > 6 weeks	8	8	1	1	7	6
Died or relapse	12	12	3	4	22	19
Diarrhoea reported days		5.6		3.8		2.3

Subjects in the RTUF group gained weight, height and MUAC at a faster rate than subjects in RTUF supplement or maize/soy flour groups (Manary *et al* 2004). As shown in Table 2, more subjects receiving RTUF reached their graduation weight than those receiving RTUF supplement or maize/soy flour (86% versus 61%). RTUF was found superior to RTUF supplement since during rapid catch-up growth children need a diet that is energy dense and not a snack that is energy dense. There was a greater prevalence of diarrhoea observed in both RTUF and RTUF supplement groups but was possibly due to the change in the stools

observed by mothers due to an increase in dietary fat rather than gastroenteritis (Manary *et al* 2004).

The energy density of the maize/soy blend was similar to many of the cereal legume combinations commonly used as “healthy foods for undernourished children in developing countries”. The maize/soy flour blend group had a slower rate of weight gain but subjects did not pass away more of fever, cough or diarrhoea (Manary *et al* 2004). Hence the low rate of weight gain is due to lower energy intakes and not of infectious episodes. The energy of RTUF was five times higher than the energy of maize/soy which could have contributed to the higher rates of growth. A modest amount of maize/soy were provided to mothers but due to factors such as additional cooking time and resources needed to prepare 5 to 7 feeds per day in a rural African setting where cooking is mainly done outside over a fire, the number of feeds were not achieved. In addition maize/soy flour blend contains milk powder which is derived from animals. It is believed that diets which are entirely plant based may lack components needed for optimal growth (Manary *et al* 2004).

However, the growth rate of 5.1g/kg/day was less than the predicted rate of 20g/kg/day in RTUF group (Manary *et al* 2004). The predicted growth rate was based on hypothetical considerations. The lower growth rate could have been due to RTUF being shared at home with other family members or an increase in energy expenditure among subjects due to physical activity in the rural home setting. Out of 16 subjects lost to follow-up after 16 weeks, 15 subjects were receiving maize/soy flour blend. The rate of drop out could have been attributed to the fact that mothers may have thought that follow-up visits were of no benefit due to slow progress in the first few weeks of supplementation (Manary *et al* 2004).

Forty seven subjects (16%) were lost to follow-up during the intervention phase. 66% of these subjects either did not return after enrolment or returned just once. Poor attendance could have been due to unexpected problems at home or difficulties with travel. 131 children (66 %) who reached graduation weight returned for follow-up after an average of 5.9 months. Out of the 131 subjects, 5 were wasted (WHZ < -2), 18 had lost more than 1 WHZ from graduation which was largely due to the subjects mother being deceased rather than any particular dietary intervention. Manary *et al* (2004) recommended the provision of more follow-up visits for children in these high risk circumstances which could improve nutritional status after recovery (Manary *et al* 2004).

Manary *et al* (2004) were able to demonstrate the superiority of RTUF as compared to other dietary regimens when considering energy density and weight gain. Factors such as poor access to fuel, wood and labour involved in food preparation contributed to the futility of using cereal based mixes as a supplementary food and highlights the sustainability of RTUF' in home based therapy (Maleta *et al* 2004; Manary *et al* 2004). In addition, RTUF would prove beneficial in South Africa, as 46 percent of the South African population are rural and only 47.4 percent of the population have access to electricity for cooking (Zere *et al* 2003). Lastly, it was concluded that RTUF could be useful in preventing malnutrition and appropriate intervention trials among younger children need to be considered especially in the context of HIV (Manary *et al* 2004).

2.4 RTUF in the context of HIV infection

Manary *et al* (2004) were able to demonstrate the benefits of RTUF in home based therapy of HIV negative severely malnourished children as full anthropometric recovery was achieved in up to 95% of children after the acute phase of their illness. However, as stated earlier, results of HIV infected children were not included as malnourished children with HIV in Malawi were likely to have a different pathophysiology and worse outcome than HIV negative children (Manary *et al* 2004). According to Steenkamp *et al* (2009), factors that may contribute to growth failure in HIV infected children include decreased energy intake, a lower fat free mass and micronutrient deficiencies which may result in poorer outcomes. In order to reverse growth failure in HIV infected children, the provision of ART and aggressive nutrition support with energy dense nutritional supplements to supplement balanced meals is required (Steenkamp *et al* 2009).

Ndekha *et al* (2005) hypothesized that more frequent anthropometric recovery is associated with home based therapy with RTUF than with other home based regimens in severely malnourished HIV infected Malawian children. Subjects were between one and five years of age who were discharged from Queen Elizabeth Central Hospital in Blantyre, Malawi. Subjects were enrolled during a study of home based therapy comparing three dietary regimens for malnourished children during January 2001 and September 2001.

Subjects were prospectively systematically allocated to receive RTUF, RTUF supplement or maize/soy flour based on their week of discharge from the hospital. The dietary regimens

were the same as the regimens used by Manary *et al* (2004) (Table 1). The primary outcome was reaching 100% weight for height. Secondary outcomes included rate of weight gain, rate height gain, rate of growth in MUAC, prevalence of infectious symptoms and anthropometric indices 6 months after reaching 100% weight for height (Ndekha *et al* 2005).

93 HIV infected subjects were included into the study. Results showed that 52 (56%) of the subjects discharged from hospital achieved complete anthropometric recovery with home based therapy with RTUF and 11 subjects died (Ndekha *et al* 2005). RTUF was associated with reaching 100% of WHZ more frequently and with more rapid weight gain when compared to RTUF supplement or maize/soy flour. However a limitation that should be noted was that there were differences in severity of malnutrition between the three dietary groups. The RTUF supplement group had subjects who were more wasted than the other two groups. This limitation in conjunction with a small sample size limited the ability to make meaningful comparisons on the secondary outcomes between the three dietary groups. A lower initial weight WHZ was associated with a poorer outcome and receiving RTUF was associated with a good outcome and greater rates of weight gain. Anthropometric recovery was likely to be a significant benefit to these subjects as i quality and longetivity of their lives were improved. The dietary group was not found to be a significant determinant of statural growth, MUAC growth or prevalence of fever, cough or diarrhoea. After 6 months, 31 subjects who had reached 100% weight for height, returned for follow-up. Only 5 subjects out of the 31 were found to be wasted which indicated a relapse (Ndekha *et al* 2005).

Table 3: Comparison of HIV infected and HIV uninfected Subjects (Ndekha *et al* 2005).

	HIV infected Subjects	HIV uninfected Subjects
Reached 100% WHZ	56 %	84%
Mean recovery time among subjects who reached 100% WHZ	86 days	35 days

The results of the study conducted by Ndekha *et al* (2005) are in agreement with Manary *et al* (2004). In both studies home based therapy with RTUF was found to be superior to RTUF supplement and maize/soy flour. HIV infected subjects had more fever, cough and diarrhoea during their recovery than HIV uninfected subjects. As seen in Table 3, the outcome of HIV infected subjects were worse and mean time to recovery was longer than with HIV uninfected subjects. Ndekha *et al* (2005) recommended that home based nutritional programs serving

HIV infected children in sub-Saharan Africa must be prepared to treat children for four months to achieve a good outcome for some these children.

Similar results were observed by Sandige *et al* (2004) who aimed to examine the outcome of malnourished Malawian children who were treated with either locally produced or imported RTUF. This study was conducted between April 2002 and August 2002 for a period of 14 weeks. All children between of 1 and 5 years of age, who were discharged from the NRU at Queen Elizabeth Central Hospital in Blantyre, Malawi, were eligible for home based therapy. In addition children referred from the outpatients department for treatment of malnutrition with either oedema or a WHZ <-2 were also included. The primary outcome was successful recovery and children reaching WHZ > -0.5 by 14 weeks of therapy. Secondary outcomes were rate of weight gain, statural growth, growth in MUAC, anthropometric status six months after discharge from home based therapy and the prevalence of fever cough and diarrhoea during the first two weeks of therapy (Sandige *et al* 2004).

Children received either imported or locally produced RTUF (Sandige *et al* 2004). Both supplements was fortified with vitamins and minerals and provided 733 kJ/kg/day (175 kcal/kg/day) and 5.3 g/kg/day of protein. The amount of RTUF prescribed provided the total diet for catch-up growth, replacing the subjects' normal diet. Mothers were asked to feed RTUF in small quantities (few spoonfuls) seven to ten times a day. The imported RTUF was Plumpy-Nut produced by the company Nutriset. RTUF locally produced consisted of a mixture of 30% full fat milk powder, 28% icing sugar, 15% cotton seed oil, 25% salt free peanut butter and 1.6% of a mineral and vitamin mixture. All ingredients with the exception of the vitamin and mineral mix used in preparation of the locally produced RTUF were purchased locally. There were no differences in the consistency between the RTUF, however the locally produced RTUF was sweeter as sucrose was used in preparation rather than dextromaltose. The study was not blinded as packaging's of the RTUF were different. The imported RTUF was distributed in 92g disposable foil sachets whereas the locally produced RTUF was distributed in 275g clear plastic jars with screw on lids (Sandige *et al* 2004).

Information collected upon enrolment included history of illness, family demographics and socioeconomic status from interviews with caregivers and from in-patient hospital charts (Sandige *et al* 2004). Children were tested for adverse reactions to RTUF and to ensure acceptability. Anthropometrical measurements taken were weight, height and MUAC.

Counselling on HIV was provided and status was determined. If tests were positive, a second test was performed. Each child was assigned a target graduation weight corresponding to their WHZ > -0.5 based on their enrolment stature. Children were systematically assigned to either receive locally produced or imported RTUF according to order of entry into the study. Subjects were reassessed every second week during the duration of the study. Weights were measured every second week and lengths and MUAC measurements were measured every 4 weeks. Information was collected from caregivers on the occurrence of fever, cough and diarrhoea in the previous fortnight. A two week supply of RTUF was distributed during these visits. Children were discharged from the study when they reached their graduation weight, experienced a clinical relapse requiring admission to the NRU, failed to reach WHZ > -0.5 after 16 weeks or died. The nutritional status of children who reached their target weight or completed the 16 weeks of therapy was reassessed at a six month follow up visit (Sandige *et al* 2004).

The safety of the locally produced RTUF was assessed by an independent food technologist (Sandige *et al* 2004). Bacterial cultures were taken from samples of the locally produced RTUF before and after contamination with a dirty child's hand. Results showed that no coliforms, *Salmonella species*, *Staphylococcus aureus* or yeasts were found. In addition < 1000 colonies/g of mesophilic aerobes were present. Aflatoxin levels were found to be below the most "stringent of safety standards" (Sandige *et al* 2004).

In total, 260 subjects were recruited into the study (227 = inpatient unit; 33 = outpatient department). No differences in baseline demographic or nutritional characteristics were found between both groups. Rates of weight, length and MUAC gain were similar for HIV uninfected subjects in both groups (Sandige *et al* 2004). 30% of subjects were HIV infected. The rate of weight gain for HIV infected subjects was less than that for uninfected subjects. This was to be expected as HIV infected subjects had more severe wasting and poorer outcomes compared to uninfected subjects. Forty six HIV infected children reached WHZ > -0.5 , 9 dropped out of the study, 9 experienced a relapse and were readmitted to hospital, 7 died and 7 subjects did not gain enough weight to achieve WHZ > -0.5 . The rate of weight gain for HIV infected subjects was less than uninfected subjects. In addition, the average time among HIV infected subjects who did recover was found to be longer than uninfected subjects. However, it was still remarkable that so many HIV infected subjects were able to achieve catch up growth even if the period of supplementation was prolonged. A total of

160 children who reached a WHZ >-0.5 (73%), returned for follow-up after an average of 5.8 months. It was found that 14 (9%), were wasted indicating a relapse. The mean WHZ on 6 month follow-up was -0.6 compared with -0.2 on completion of home therapy (Sandige *et al* 2004).

The results reflected in this study are in line with results from similar studies that were conducted in Malawi and Ethiopia and the recovery rates were similar to that of other studies in HIV negative children (Sandige *et al* 2004). This highlights that out-patient therapeutic feeding of locally produced RTUF in malnourished children with HIV can improve nutritional status (Sandige *et al* 2004). However further, studies are needed to determine what role home based therapy and RTUF have in the care of HIV infected children. This is needed in the context of therapeutic programs for HIV infected children on ART that are being implemented in sub-Saharan Africa (Ndekha *et al* 2009).

2.5 Sustainability of RTUF

2.5.1 Adaptability of RTUF

RTUF can be adapted to different situations or respond to specific nutritional requirements (Briend 2001). In nutritional programmes, nutrient fortification levels and fatty acid content can be adjusted to meet specific needs according to the most common nutrient deficiencies. Ingredients can be changed to make use of locally available products. Where peanut allergies are present, ground nuts can be substituted with other sources of proteins or with ingredients that are readily available. RTUF can be eaten with other foods or as a condiment to the family diet as long as appropriate flavours are added (Briend 2001). The technology used in production of RTUF is simple and can be implemented easily in most developing countries allowing sustainability (Defourny *et al* 2009; Briend 2001). In addition, RTUF have been successfully produced in Malawi, Niger and Congo (Manary 2006).

In the study conducted by Sandige *et al* (2004), it was found that 202 (78%) of subjects had reached WHZ >-0.5 (108 (78%) locally produced RTUF; 94 (75%) imported RTUF. Rates of growth were found to be similar in both groups and a 5 % difference in recovery rate was observed between locally produced RTUF as compared to the imported RTUF. A 95 % successful outcome for both groups was observed among HIV uninfected subjects (Table 4).

Table 4: Comparison of locally produced RTUF and Imported RTUF of HIV negative Children (Sandige *et al* 2004)

N=260	Locally produced RTUF (n=97)		Imported RTUF (n=83)	
	n	%	n	%
Graduates (WHZ>-0.5)	94	95	79	95
Median days to reach WHZ>-0.5	43 days		43 days	
Death/Relapse/Failure	3	3	2	2.5
Dropouts	2	2	2	2.5
Diarrhoea	198 days	3.7 (days)	180 days	4.3(days)
Fever		5.1(days)		5.1(days)

Children were able to attain similar rates of anthropometric growth in both groups. Locally produced and imported RTUF were found to be similar in the efficacy of treatment of malnutrition (Sandige *et al* 2004). Locally produced RTUF was likely to be at least 96% effective as imported RTUF. The solute load was higher in the locally produced RTUF than the imported RTUF as disaccharide sucrose rather than the polysaccharide dextromaltose was used in the locally produced RTUF. A large solute load could lead to malabsorption and diarrhoea. However, diarrhoea rates were found to be low, was not reported more in the locally produced RTUF group and growth rates were similar. This could be explained due to the lipid paste dissolving slowly in the gut thereby releasing the osmotic load over a period of a few hours as observed with RTUF' *in vitro* (Sandige *et al* 2004).

After 6 months only 9% of the children experienced a relapse. After home based therapy, the children presumably resumed a diet of maize and beans. This suggests that normal growth can be maintained on the family diet once catch up growth have been achieved. Taking into account that in Sub-Saharan Africa, recovery rates from severe malnutrition remain consistently low, this study highlights that 'home based therapy with RTUF could increase recovery rates while lessening the burden on poorly resourced inpatient facilities' (Sandige *et al* 2004). In addition, Sandige *et al* (2004) concluded that locally produced RTUF was as effective as imported RTUF in the treatment of severe malnutrition thereby reducing the cost of the intervention.

2.5.2 Cost

Initially, RTUF were designed to be used safely at home and to reduce the duration and cost of hospital treatment and not for high weight gain (Diop, Dossou, Ndour, Briend, Wade 2003). RTUFs have been found successful in home-based therapy and decrease the cost of treatment as compared to treating a malnourished child as an in-patient (Manary 2006). According to Ciliberto *et al* (2005), RTUF was cheaper to “administer” as it required smaller amounts of personnel and modest facilities. However, according to Manary *et al* (2004), in order to improve intake of RTUF and rate of weight gain of subjects, greater supervision or home visits by health care workers would need to be provided. This would pose an additional cost and would be impractical in most Sub-Saharan African areas (Manary *et al* 2004).

The primary cost of RTUF is related to the ingredients used (Manary 2006). According to Manary (2006), the cost of RTUF is still high for poor families where malnutrition is rife and programs that are using RTUF can only be sustainable when RTUF is “purchased by social welfare programs supported by governmental or non-governmental organisations”. A solution would be to have the ingredients donated in order to decrease cost thus making RTUF more sustainable in welfare programmes. In Malawi, the United Nations Organisation donates the ingredients used for the production of RTUF (Manary 2006). To further decrease cost, milk can be replaced with other ingredients. A soy-based RTUF was found to be as effective and acceptable in the prevention of anaemia and stunting in children aged three to six years of age in Saharawi (Manary 2006).

In the study conducted by Ndekha *et al* (2005), HIV infected subjects who reached 100% of WHZ would have each consumed on average 22kg of RTUF. However taking into account that more than half of HIV infected children are malnourished and HIV uninfected malnourished children, might anthropometrically recover and benefit from RTUF, the cost of such feedings maybe within budgets of the many palliative care programs targeted at malnourished children throughout Sub-Saharan Africa (Ndekha *et al* 2005).

2.6 Prevention better than cure

In order to achieve the millennium development goals aimed at eradicating extreme poverty and hunger and reducing child mortality, preventative strategies are needed over and beyond treatment (Defourny *et al* 2009, Prudhon *et al* 2006). In a study conducted by Defourny *et al* (2009), the feasibility and effectiveness of blanket coverage with nutritional supplements which could prevent the development of stunting and malnutrition was explored. An organisation known as the Médecins sans frontières in joint efforts with the Niger ministry of health implemented a strategy with the intention of preventing the seasonal rise of severe malnutrition while improving the nutritional status of an entire population of high risk children in the Marandi region in 2007. A blanket distribution of a fortified RTUF to 60000 children aged 6 to 36 months was undertaken. Children with a height of between 60 – 25cm were registered for distribution as age was usually unknown. A minimum height of 60cm was used to ensure that children with a lower height for age were not missed in the preventative distribution due to the high prevalence of stunting. At each distribution centre, children were also screened for severe malnutrition and referred for therapeutic treatment if indicated (Defourny *et al* 2009).

A monthly distribution of four pots of RTUF (325g/pot) was administered to each child between May and October 2007 (Defourny *et al* 2009). One pot would last a month as caregivers were instructed to feed three tablespoons of RTUF each day. RTUF was presented as a supplement in addition to the foods young children typically ate and not a replacement for breastfeeding. Each caregiver was given a booklet during registration which contained tear-out tickets, reflecting one for each month's distribution (Defourny *et al* 2009).

A total of 62922 beneficiaries attended the first RTUF distribution (Defourny *et al* 2009). Data between 2002 and 2005 reflected that the fewest amount of children were admitted in February for severe malnutrition with the number of admissions at its highest in October and then steadily declined to February of the next year. In comparison in 2007, the prevalence of children with a MUAC of <110cm between May and August decreased by half, rising slightly in September and October. The prevalence of severe malnutrition fell and remained extremely low. The proportion of complicated cases of malnutrition requiring intensive care was lower among children registered for the RTUF distribution (7.85%) than those not registered (9.9%). Cure rate was also found higher in the RTUF group (92.3%) and the

default rate lower as compared to children not receiving any preventive distribution (cure rate 90.1%, default rate 6%) (Defourny *et al* 2009).

In a large population the distribution of milk based fortified RTUF targeted at children of 60-85cm length was found to reduce the prevalence and incidence of severe malnutrition (Defourny *et al* 2009). In addition subjects admitted into the programme with non-complicated malnutrition were less likely to require hospitalization and exhibited better outcomes. The blanket program was able to flatten out the usual seasonal rise in admissions of severe malnutrition as the individualized treatment of almost 60000 children with moderate wasting within an intensive therapeutic program. Also highlighted in this study is that the number of subjects coming to the monthly distributions remained consistently high during the six month distribution. It highlights that caregivers and children were prepared to walk 14km to receive a product which they regarded as an “investment of their time and energy”. This highlights the “clear endorsement by the community” and the large scale distribution of RTUF is one effective way to improve food aid and nutritional programming of high risk groups (Defourny *et al* 2009).

In terms of budget the programme was beyond the usual budget dedicated to the treatment of underweight young children. The study highlighted that further information is needed in the feasibility and cost effectiveness of such a distribution as RTUF are still more expensive than existing fortified flours. Research is needed to determine the precise dose of minimum RTUF required as reductions in dose may reduce costs significantly, thereby leading to a more affordable sustainable programme (Defourny *et al* 2009).

CONCLUSION

Malnutrition in children poses as a major problem in Sub-Saharan Africa and is worsened by HIV infection. Effective supplementary programmes are needed in order to decrease the incidences of malnutrition in children and in addition provide adequate levels of energy and nutrients to promote growth in HIV infected children. Inexpensive cereals are generally used as supplementary foods in food aid programmes in Africa. Results from studies done on these cereals which were supplemented to malnourished children in Sub-Saharan Africa have been disappointing. The use of RTUF in the treatment of severe malnutrition and moderate malnutrition have been highly recommended as RTUF have been associated with better outcomes in therapeutic feeding and supplementary feeding of malnourished children with and without HIV infection.

RTUF was initially designed to replace problematic WHO F100 feeds in the rehabilitation phase of treatment of severe malnutrition. However due to the popularity of RTUF, other products have since been produced. RTUF have found superior to the traditional cereal based mixes that are commonly used as supplementary foods in Africa. This is largely to the energy density of the RTUF which promotes weight gain. They are convenient and safe as they require no additional preparation, no addition of water and can be used safely in rural settings without the risk of bacterial contamination. RTUF have been found beneficial in contributing to an increase in weight in HIV infected malnourished children, thereby aiding in better prognosis and increasing the quality of life of such individuals. RTUF are adaptable and sustainable as the ingredients and technology used to manufacture these spreads are simple. Locally produced RTUF have been found as effective as imported RTUF thereby reducing the cost of these supplements. In addition positive outcomes of RTUF in prevention of malnutrition have been observed. However the cost of RTUF poses an issue and further investigation is required on the cost effectiveness of RTUF based interventions.

In conclusion it can be seen that RTUF has proved beneficial in the treatment of severely and moderately malnourished children. However further studies are needed to investigate the effectiveness of RTUF and that of its locally produced equivalents such as Sibusiso Reday Food Supplement, especially in the South African community setting.

CHAPTER 3

METHODOLOGY

3.1 Research Design

The purpose of this intervention study was to determine whether SRFS was able to promote weight gain among underweight children aged 1-10 years and the level of energy and macronutrients SRFS provided to these children in their different age groups as compared to the Recommended Energy Allowance (REA) and Recommended Daily Allowances (RDA). In addition, the study aimed to determine the predominant disease conditions and symptoms experienced and if there was a general improvement of appetite, meal consumption and energy levels among subjects. Lastly, the study aimed to train CAST community workers on how to assess and identify underweight children and to determine the number of underweight children aged 1-10 years who were currently on the CAST food parcel program in Cato Manor and Chesterville in Durban, Kwa Zulu-Natal.

According to Sguassero *et al* (2010) a randomized controlled intervention would be the most acceptable method of evaluation as bias is eliminated and allows for more reliable trial conclusions than other methods of treatment allocation. However this study was not randomised as it would have been unethical to randomly select a few underweight children to receive SRFS taking into account that these children come from poverty stricken homes. In addition, due to ethical considerations, a control group was not included in the design, as it would also be unethical to exclude some of the children from food aid.

3.2 Population and sample selection

All children from families receiving food parcels from CAST in Cato Manor who were identified as underweight were initially invited to participate in this study. A screening day was held in April 2011 where caregivers were invited to bring their children to be assessed for eligibility into this study. In Cato Manor, the screening day took place at a CAST volunteer workers home, which also serves as the distribution site for food parcels to families living in this area. The researcher who is a registered dietician was present to assess the children. The aim was to weigh all children and plot their weights in correlation to their ages on the WHO

weight-for-age (WAZ) growth charts. Children whose weights were found to be below WAZ < -1 were identified as being underweight.

CAST community workers were available during these screening days to aid with translation from English to the Zulu language. The rate of attendance was poor since no families attended the screening day. This was due to the screening day being held during the Easter School vacations in April 2011 and most of the families were away from their homes. A second screening day was held on 4th of May 2011, a week after the initial screening day. In order to ensure high rates of attendance, CAST community workers distributed invitations to all families receiving food parcels in Cato Manor and Chesterville inviting caregivers to bring their children for screening. However attendance was poor as caregivers were either at work and were unable to bring their children to be screened or caregivers did not see the relevance of attending the screening day.

Due to the disappointing rates of attendance of the screening days it was decided by the researcher, CAST team and Gift of the Givers representatives, that in order to recruit children to participate in this study, home visits to families on the food parcel would need to be done. CAST community workers were trained by the researcher on how to assess and identify underweight children using WHO growth references. After being trained, CAST community workers proceeded with home visits for a period of a week, the visits were targeted at families receiving food parcels in Cato Manor. Caregivers who had children identified as being underweight were informed what the study was about and asked to attend an enrolment day which was held on the same day as food parcel collection in Cato Manor. In Cato Manor, out of 42 families who were on the CAST food parcel program, 10 children met the criteria to participate in this study.

Due to the relatively small number of children identified as underweight in Cato Manor, the area of supplementation was expanded to the neighbouring community of Chesterville, where CAST also distributed food parcels to household insecure families. In Chesterville, food parcels were distributed at Chesterville Community clinic in which CAST has a park home from which the CAST social worker and community workers work from. CAST community workers working in Chesterville were also trained on how to identify underweight children and home visits were performed in duration of a week. In Chesterville, there were 27 families receiving food parcels and 10 children met the entry criteria into this study.

Hence the criteria for entry into this study were:

- Children had to be from families on the CAST food parcel programme in Cato Manor and Chesterville,
- Children had to be between 1 and 10 years of age
- Children had to be underweight (WAZ < - 1).

All 20 children identified as underweight in Cato Manor and Chesterville were invited to participate in this study. A control group was not included due to the relatively small number of children recruited. In addition, it would be unethical to exclude these underweight children from receiving SRFS taking into account that the children were from households that were food insecure.

3.3 Survey methods and materials

3.3.1 Monitoring tool

A monitoring tool was used to collect data on background information, anthropometrical measurements, symptoms experienced, disease conditions identified, level of appetite, meal consumption and energy for each subject (see Appendix B). Background information obtained from subjects included the resources that were available at home and, the source of the milk the subjects were predominantly receiving. A food frequency table was used to determine what foods were most frequently consumed at home. Information on age, gender, caregiver, number of people living in the household and number of children under the age of 13 years living in the household was also obtained.

3.3.2 Weight

Weights of subjects were measured on each day of supplementation for a period of three months. A portable electronic scale was used to weigh subjects. The scale was calibrated by using a 2 kg weight. The scale was placed on a firm level surface to ensure accurate readings.

The procedure for weighing subjects was as follows:

- The scale was turned on and the researcher waited until it read 0.00kg
- The caregiver was asked to remove clothing such as shoes, socks and any additional clothing that could contribute to extra weight gain
- The subject was asked to stand in the middle of the scale with the body weight distributed equally on both feet and subjects hands were to the side
- The weight of the subject was read off the scale
- If the subject was crying and refusing to stand on the scale, a weight of the caregiver holding the subject and a weight of the caregiver without the subject was taken. The two weights were subtracted to obtain the weight of the subject.
- Weights were recorded to 2 decimal places in kilograms
- Three weight measurements of each subject were taken. An average value of the 3 measurements was calculated and used as the final weight.

3.3.3 Length/height

A length board was used if a subject was under the age of two years old to measure recumbent length. The procedure for taking a length was as follows:

- The board was placed on a hard flat surface.
- The caregiver was asked to remove the subjects' shoes and socks and undo braids or remove hair ornaments that could interfere with the measurement of length.
- The subject was asked to lay on the mat on his/her back with his/her head placed against the fixed headboard, compressing the hair.
- The subjects head was placed against the board so that the child looked straight up. The subject had to lie flat on the board with shins and knees placed firmly against the board.
- The subject's legs were held down with one hand and the foot board was moved with the other. The board was pulled against the subject's feet. The soles of the feet were flat against the foot board with the toes pointing upwards.
- Lengths were recorded to 1 decimal place in centimetres.
- Three length measurements were taken for each subject. An average value of the 3 measurements was calculated and used as the final length.

If the subject was above the age of two years old, a Seca height stick was used to obtain recumbent height as follows:

- The height stick was placed on a hard flat surface against a wall.
- The caregiver was asked to remove the subjects' shoes and socks and undo braids or remove hair ornaments that could interfere with the measurement of height.
- The subject's feet were placed flat and together in the centre of and against the wall.
- Subject was asked to look straight ahead with shoulders level, hands to the side and head, shoulders and buttocks against the wall
- The head piece was lowered on top of the subjects head applying adequate pressure to compress the hair.
- Heights were recorded to 2 decimal places, in metres.
- Three height measurements were taken for each subject. An average value of the 3 measurements was calculated and used as the final length.

3.3.4 Procedure on day of data collection

Data was collected from Cato Manor and Chesterville from June 2011 until August 2011. Data was collected on two consecutive days held at Cato Manor and Chesterville, respectively. Data collection days were strategically planned on the same day as food parcel collection day in order to ensure a high rate of attendance.

On the first day of supplementation, caregivers brought their children who had been identified as being underweight by the CAST community workers when home visits were performed as well as other children aged 1-10 years living in the same household. All children were reassessed to ensure that all underweight children were included in this study. It was explained to the caregivers what this study was about, the purpose of such a study and what was required of subjects. Caregivers preferred to be communicated to in English but a CAST community worker was available to act as a translator if needed to translate from English to Zulu. Consent forms were signed and a letter that contained information on what this study was about, what was expected of subjects and contact details of the researcher and research supervisors were provided to each of the caregivers (Appendix C).

Each subject was issued with two tubs of SRFS at each visit. Table 5 highlights the dosage of SRFS that caregivers were told to administer to the subjects as per group.

Table 5: Dosage of SRFS as per age group of subjects

Age Group(years)	Dosage of SRFS (Heaped Teaspoons)
1 – 2	2
2- 5	3
5-10	4

Caregivers were told to provide the SRFS as small frequent servings as could be eaten alone, served on a slice of bread or mixed with milk.

3.4 Pilot Study

The purpose of the pilot study was to test whether the monitoring tool to be used in this study was appropriate and that the objectives of the study could be met. Any terms that appeared in the monitoring tool had to be defined in order to avoid ambiguity when collecting and analysing data. The monitoring tool used in this study was formulated by representatives of the Gift of the Givers Foundation. The aim of this monitoring was to have a standardized instrument that could be used to assess the effectiveness of SRFS in the treatment of severe malnutrition in children under 5 years old.

The monitoring tool was tested on the screening day held in April 2011 in Cato Manor on a family living in Cato Manor. The caregiver of the children assessed was known to the CAST community worker residing in Cato Manor and provided assistance to the CAST community worker but was not part of the CAST food parcel program. Out of the two children who were assessed by the researcher, it was found that one child presented with a WAZ < -1. The researcher interviewed the caregiver using the monitoring tool.

3.4.1 Findings of the pilot study

From the assessment of subject, using the monitoring tool, the following data was obtained (Appendix D):

- The subject was an African male aged one year seven months old
- The caregiver of the subject was the mother
- There were 5 people living in the same household as the subject, of which 2 children were under 13 years of age.
- Resources available at home included electricity, running water and a stove. The family did not have access to a vegetable garden, indoor flushing toilet or a fridge. The subject was receiving formula milk as the predominant milk source.
- In terms of food frequency, meat/chicken/fish, milk and vegetables were consumed on a monthly basis. Eggs, fruit, bread/potatoes/phutu and porridge were consumed on a weekly basis. Only water was consumed on a daily basis.
- The weight of the subject was 9 kg, which was below a WAZ of -1. The length of the subject was 64cm and was identified as having a normal LAZ.
- Disease symptoms that the subject had experienced in the past month were diarrhoea and vomiting. However in terms of disease, the subject had not experienced diarrhoea in the past two weeks, and did not present with dehydration, mouth sores, oral thrush, kwashiorkor, marasmus or gastroenteritis. The subject did not present with Tuberculosis (TB) but was HIV infected and receiving ART.
- The appetite of the subject was rated as good, and was consuming a full bowl of food at most meals. Energy levels were rated as fine.
- The subject was receiving multivitamin and no porridge or formula milk from a clinic.

The monitoring tool was able to provide relevant information in a systematic format. From the subject interviewed it could be seen that the subject was possibly underweight due to not consuming nutrient rich meals as foods such as meat/chicken/fish, milk, vegetables eggs, fruit, bread/potatoes/phutu and porridge were only consumed on a monthly or weekly basis. Since the subject was HIV infected, receiving ART, the energy requirements of the subject to promote adequate weight gain were much higher than a healthy subject. In addition the subject had experienced diarrhoea and vomiting in the past month, which are factors that could have contributed to inadequate weight gain or weight loss.

Although the monitoring tool was originally designed to be used in severely malnourished children under the age of five years, it was not changed for the following reasons:

- The tool was able to provide insightful and relevant information as to possible reasons as to why the subjects were underweight or not gaining weight.
- The inclusion criteria for subjects into this study were between 1 and 10 years of age and children between 1 and 5 years fell into this age group and if these children had presented with severe malnutrition (kwashiorkor, marasmus), it was important that this was taken into account as this could have had negative effects on the overall weight gain among children observed in this study.
- It would also provide broader insight to CAST as to what were the most prevalent symptoms, health conditions being experienced in the Cato Manor and Chesterville community and would provide insight as to factors that hinder future supplementation programmes in these communities.

3.5 Variables included in the study

3.5.1 Weight gain or loss

The weight of the subjects was measured at each supplementation day. A gain in weight was observed if there was an increase or decrease in weight from the previous weight taken.

3.5.3 Length

The length of subjects was measured using a height stick or a length mat (depending on the age of the subject).

3.5.4 Symptoms of disease

Caregivers were asked if subjects presented with symptoms as per the monitoring tool. Symptoms included nausea, diarrhoea, jaundice or vomiting. Caregivers had to answer yes or no to these questions. It was important to identify if the subjects had experienced any of these symptoms as this could affect nutritional intake of the subject and ultimately weight gain.

3.5.5 Diseases

Gastroenteritis: A subject was identified as having gastroenteritis, if they presented with symptoms of appetite loss, nausea, vomiting and diarrhoea.

Dehydrated: A subject was identified as being dehydrated if they presented with symptoms such as extreme thirst, dry lips and tongue, an increase in heart rate and breathing rate, dizziness, confusion, lethargy or if the subjects' skin looked dry with no elasticity

Mouth Sores: The researcher assessed for mouth sores by inspecting the mouth of subjects.

Oral thrush: The researcher assessed for oral thrush by inspecting the mouth of subjects.

Kwashiorkor: Was identified as a subject having a LAZ < -3 and puffy in appearance due to oedema

Marasmus: Was identified by a LAZ < -3 and if a subject presented with loose folds of skin on the limbs and buttocks, sparse brittle hair, diarrhoea and dehydration

HIV: Caregivers were asked if the subjects HIV status was known. Status was classified as HIV infected, HIV un-infected or unknown.

TB: Caregivers were asked if the subject had been tested for TB.

3.5.6 Appetite

Caregivers were questioned about the appetite of subjects. Appetite was rated as either being poor or good.

3.5.7 Meal consumption

Meal consumption was measured by asking caregivers how much food the subjects were consuming on average at each meal. Using a 240 ml bowl as a reference (Appendix E), caregivers were asked to rate the amount of food consumed as ¼, ½ or a full bowl of food.

3.5.8 Energy levels

Parents were asked to rate the level of energy of subjects at each visit. Energy levels were classified as being very weak, weak, fine or full of energy.

3.5.9 Other supplements

Caregivers were asked on the first day of supplementation if subjects were receiving a multivitamin, porridge from a clinic or formula milk from a clinic.

3.5.10 Other medication

If a subject was HIV infected or found to have TB, caregivers were asked if the subjects were receiving TB treatment or ARV treatment.

3.5.11 Resources available at home

Information on facilities available at home was collected on the first day of supplementation. Caregivers were asked if the following was available at home: vegetable garden, electricity, fridge, indoor flushing toilet, running water and stove.

3.5.12 Milk source

Information on milk source was obtained by asking caregivers if subjects were receiving breast milk, formula milk, cows' milk or goats' milk.

3.5.13 Food frequency

A food frequency was obtained from caregivers on the first day of supplementation. Caregivers were asked to rate how often foods such as meat/chicken/fish, eggs, milk, vegetables, fruit, bread/potatoes/phutu, porridge and water were consumed. Consumption levels were rated as daily, monthly or weekly.

3.5.14 Age

The precise age of the subject was needed in order to aid in plotting the weights of each subject accurately on the WHO growth charts. The ages of subjects were expressed in years and months. The date of birth of the subject was used to calculate age. Caregivers were asked to bring the subjects birth certificate or road to health card or documentation that provided details of the age of the subject on the day of enrolment into the study in order to ensure that an accurate age was obtained.

3.5.15 Gender

The gender of each subject was needed in order to use the correct growth charts to assess weight. Subjects were classified as male or female

3.5.16 Caregiver

The adult who brought the subject to attend the supplementation days was asked who the primary caregiver of the subject was. This would be the person by whom the subject was taken care of. Subjects were rated as having both parents, mother, grandmother or relative.

3.5.17 Number of people in the household

The caregiver was asked to state the number of people living in the same household as the subject.

3.5.18 Number of children under 13 years in the household

The caregiver was asked to state the number of children under the age of 13 were living in the same household as the subject.

3.6 Data Analysis

3.6.1 To determine whether supplementation for a period of three months with SRFS was able to promote weight gain among underweight children between 1 and 10 years of age who were on a food program.

Anthropometric data between different visits for each patient was analysed using the software, SPSS (Statistical Software for Social Sciences) version 18. Comparisons were made between visit 1 (before any supplementation was given), and subsequent visits, for each patient individually, for the group as a whole. Basic descriptive statistics (means \pm standard deviations) were used to describe the characteristics of the volunteers at each visit. Paired t-tests were used to measure within group differences between the different visits. A p-value of less than or equal to 0.05 was considered significant.

3.6.2 To analyse the amount of energy and macronutrients SRFS provided to subjects in their different age groups as compared to the Recommended energy allowances (REA) and recommended daily allowances (RDA)

In order to compare the amount of energy and macronutrients SRFS was able to provide to subjects in relation to REA and RDAs, the dosage of SRFS provided to subjects in each age group had to be expressed in grammes. A heaped teaspoon of peanut butter weighs 12g (Langenhoven, Paulina, Wolmarans, Faber 1991, p 89). The number of teaspoons of SRFS recommended for subjects in each age group was multiplied by 12 to calculate the dosage in grammes (Table 6).

Table 6: SRFS calculated in grams according to the subjects age groups

Age Group(years)	Dosage of SRFS (heaped teaspoons)	Dosage of SRFS(g)
1 – 2	2	24
2- 10	2-4	48

The nutritional breakdown of SRFS (energy and macronutrients) was obtained from the SRFS information leaflet (Appendix A). Macronutrients refer to carbohydrate (CHO), fat and protein content found in SRFS. The energy and macronutrient content of SRFS was expressed as per 100g servings in the information leaflet. In order to obtain the amount of energy and each macronutrient that subjects had received from SRFS according to their

different age groups, the dosage of SRFS in grammes had to be multiplied by the energy and macronutrient (per 100g) and divided by 100g.

$$\text{Amount of Macronutrient} = \frac{\text{Dosage of SRFS in grams} \times \text{macronutrient per 100g}}{100}$$

Table 7 highlights the energy and macronutrient content per 100g serving of SRFS and the amount of macronutrients that SRFS provided to subjects in their different age groups. Energy was compared to the Recommended Energy Allowances (REA) for light to moderate activity levels (USAID 2000). The content of macronutrients provided by SRFS was compared to the RDA for each age group and the percentage RDA met by SRFS for each macronutrient was calculated (Otten *et al* 2006, p 536). A recommended daily allowance for fat has not yet been determined. However, according to the acceptable macronutrient distribution ranges (AMDR), the percentage of energy supplied by fat should be between 30 – 40% in children of 1-3 years old and 25-35% in children aged 4-18 years (Otten *et al* 2006, p 537).

Table 7: Macronutrient content SRFS provided to subjects in their different age groups

Macronutrient	SRFS per 100g	1 – 2 years old			2-3 years old			4-8 years old			9-13 years old		
		SRFS	RDA	REA	SRFS	RDA	REA	SRFS	RDA	REA	SRFS	RDA	REA
Energy (kJ)	2352	564.48	*ND	5439.2	1128.96	ND	5439.2	1128.96	ND	7531.2	1128.96	*ND	8368
Protein (g)	16	3.84	13	*ND	7.68	13	*ND	7.68	19	*ND	7.68	34	*ND
CHO (g)	48	11.52	130	*ND	23.04	130	*ND	23.04	130	*ND	23.04	130	*ND
Fat (g)	35	8.4	*ND	*ND	16.8	*ND	*ND	16.8	*ND	*ND	16.8	ND	*ND

* Not Determinable

3.6.3 To determine the predominant diseases that were experienced among underweight children aged 1-10 years who were on the CAST food parcel program.

At each supplementation day, data was collected on the diseases which were being experienced by subjects in this study. Disease conditions were diarrhoea (past 2 weeks), dehydrated, mouth sores, oral thrush, kwashiorkor, marasmus, gastroenteritis, TB and HIV. The frequencies of these conditions were calculated by adding the number of diseases that subjects presented at each data collection day. The disease condition that the subjects presented throughout the period of data collection was identified as being the predominant disease condition experienced among participants.

3.6.4 To determine if there was an overall improvement in appetite, meal consumption and level of energy among underweight children aged 1-10 years of age who were on the CAST food parcel program.

At each supplementation day, data was collected on the level of appetite, meal consumption levels and energy levels of subjects observed in the previous month by caregivers. At the end of the three month supplementation period, data collected was analysed to identify whether there was an overall improvement in appetite, meal consumption and energy levels.

3.6.5 To train CAST community workers on how to assess and identify underweight children

One CAST community worker in Cato Manor and four CAST community workers in Chesterville were trained by the researcher on how to assess and identify underweight children. CAST community workers were provided with training manuals that covered what this study was about, what the role of the CAST community workers were and lastly how to weigh children. Demonstrations were performed by the researcher on how to weigh children and plotting of weights of children on the WHO growth charts. The CAST community workers were provided with case studies and were asked to plot the weights of the case study subjects on the WHO weight-for-age growth charts and establish whether the case study subject was underweight or of normal weight. If the CAST community workers were able to

perform this task successfully, the CAST community workers were than equipped with the knowledge to assess and identify underweight children.

3.6.6 To determine the number of families with underweight children aged 1- 10 years who were on the food program

In Cato Manor and Chesterville, 42 and 27 families, respectively, were receiving food parcels from CAST. Taking into account that the criteria for receiving food parcels included that the breadwinner of the family was too sick to work, families were run by child headed households and lastly there was a household income of less than R500 per month it was interesting to learn how many of these families had children that were underweight. This information would be useful for CAST when designing future nutrition interventions.

The number of underweight children was determined by the CAST community workers who performed home visits to assess all children from these families and by inviting the families that were on the food parcel programme to bring their children to be assessed during the enrolment day into the study.

3.7 Ethical Considerations

Ethical approval for the study was obtained from the Human and Social Ethics Committee of the Faculty of Science and Agriculture of the University of Kwa Zulu-Natal (Appendix F).

Consent was obtained from caregivers to allow their children to participate in this study. It was explained to the caregivers were explained what this study was about and what was being investigated on the day of enrolment into this study. In addition, caregivers received a formal document that contained information on what the study was about, what their children were expected to do and lastly, the contact details of the researcher and research supervisor (Appendix C). CAST community volunteers were available to aid in translation if needed.

3.8 Summary

In this non-randomised intervention study, 20 children from families on the CAST food parcel programme were identified as being underweight and were recruited to participate in this study. CAST community workers were trained on how to assess and identify underweight children and performed home visits to all families receiving food parcels in Cato Manor and Chesterville to assess for eligible children to be recruited into this study. Consent was obtained from caregivers of subjects and the subjects were supplemented with SRFS from July 2011 to September 2011. A monitoring tool was used to obtain data and anthropometrical measurements were performed at each of the three supplementation days. The data was then analysed to determine whether subjects had gained weight during the three month supplementation period, to determine what were the most predominant diseases and symptoms of diseases experienced by the subjects and to observe if there was an overall improvement in appetite, meal consumption and energy levels among subjects. This study also aimed to train CAST community workers on how to assess and identify underweight children and to determine the amount of underweight children aged 1-10 years that were on the CAST food parcel programme.

CHAPTER 4

RESULTS

4.1 Sample Characteristics

Twenty african underweight children aged 1 -10 of years in Cato Manor and Chesterville were recruited to participate in this study. One subject was excluded from the study as the subject and family relocated to another area in Durban, Kwa-Zulu-Natal, and did not attend supplementation days after enrolment into the study. A total of 19 underweight African children were supplemented for a period of three months with SRFS. No control group was used in this study. Table 8 shows that the mean age of the subjects was 4.8 years. On average there were 7 people living in the household with the subject and an average of 3 children who were less than 13 years of age. 11 (57.9 %) of the subjects were male and 8 (42.1%) were female.

Table 8 Sample characteristics of study subjects

Sample characteristics	Mean
Age/ years	± 4.8
Mean household size/ number	$6.47 \approx 7$
Mean number of children under 13 years in household	$3.05 \approx 3$

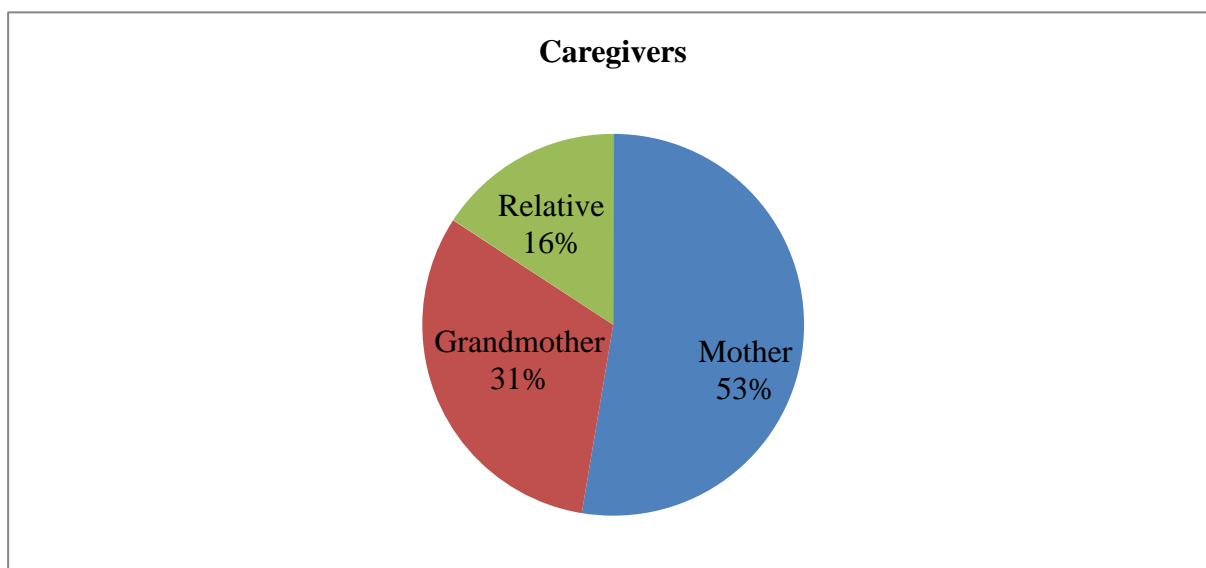


Figure 1 Caregivers of Subjects

Figure 1 shows that the primary caregiver of the majority of subjects was the mother (53%), followed by the grandmother (31%) and relative (16%).

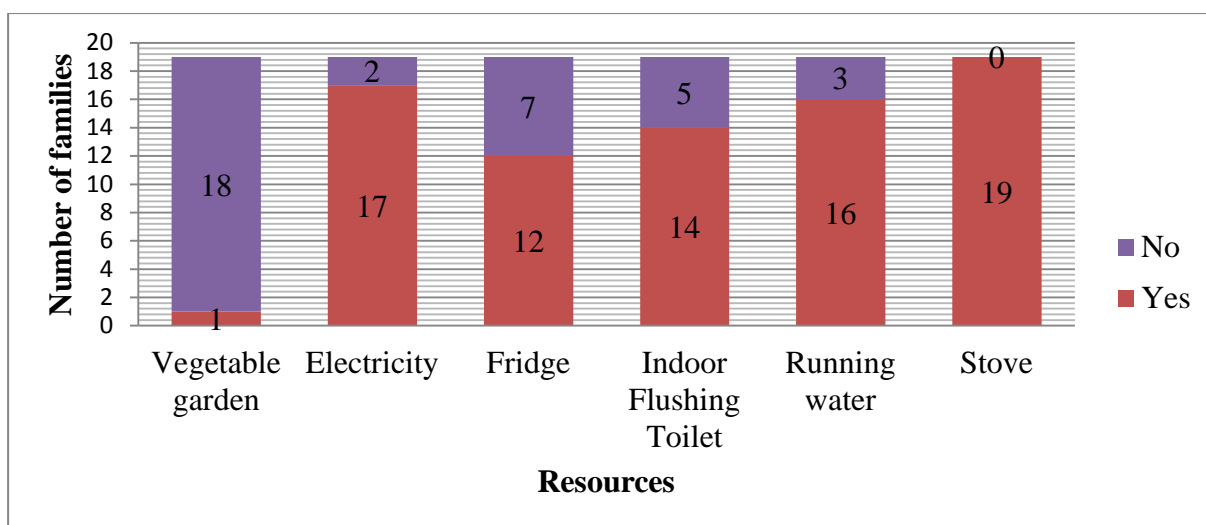


Figure 2 Resources available at home

Figure 2 shows the resources that the subjects and families had access to at home. All 19 (100%) of families had access to a stove, 16 (84.2%) had access to running water, 14 (73.7%) had access to indoor flushing toilets, 12 (63.2%) had access to a fridge and 17 (89.5 %) had access to electricity. Out of the 19 subjects, only one family had a vegetable garden at home.

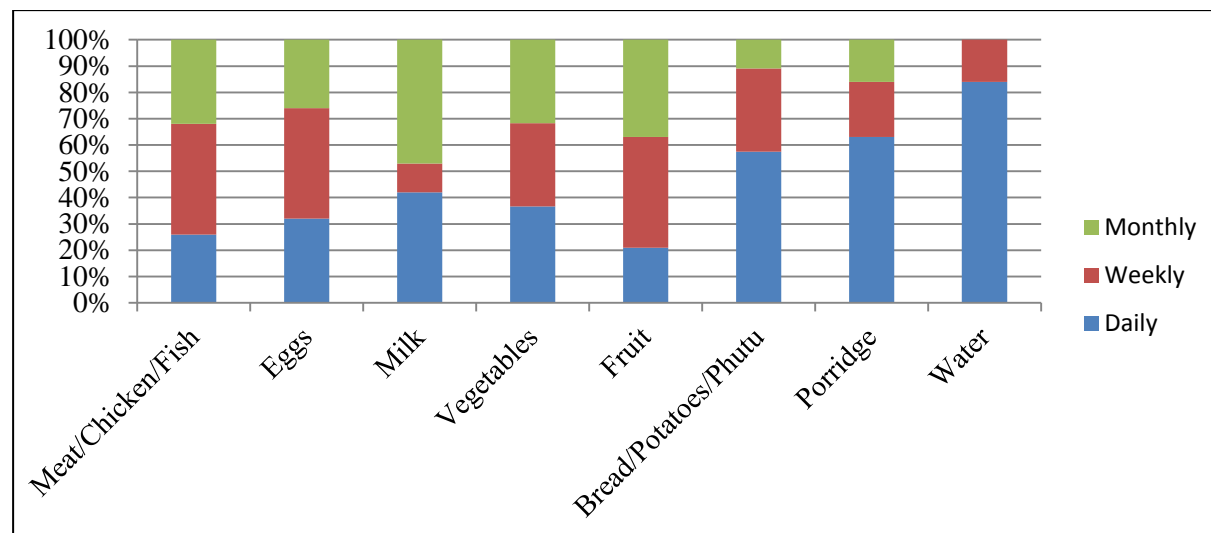


Figure 3 Frequency of foods consumed by subjects

Figure 3 shows the frequency of foods consumed at home by subjects. Foods such as meat/chicken/fish, eggs and fruit was found to be consumed on a weekly basis. Water, porridge, bread/potatoes/phutu and vegetables were consumed on a daily basis. Milk was consumed on a monthly basis. In terms of milk source, the majority of the subjects were fed formula milk (68 %), followed by breastmilk (5 %). None of the subjects recieved goat milk and 27% of the subjects were cows milk. In addition, 4 (21.1 %) of subjects were receiving formula milk and 2 (10.5 %) of the subjects were receiving porridge from a clinic. 10 (52.6%) of subjects were receiving a multivitamins.

4.2 Effects of supplementing with SRFS on the nutritional and health status of the study subjects

4.2.1 To determine whether supplementation for a period of three months with SRFS was able to promote weight gain among underweight children aged 1-10 years were currently on the CAST food parcel program.

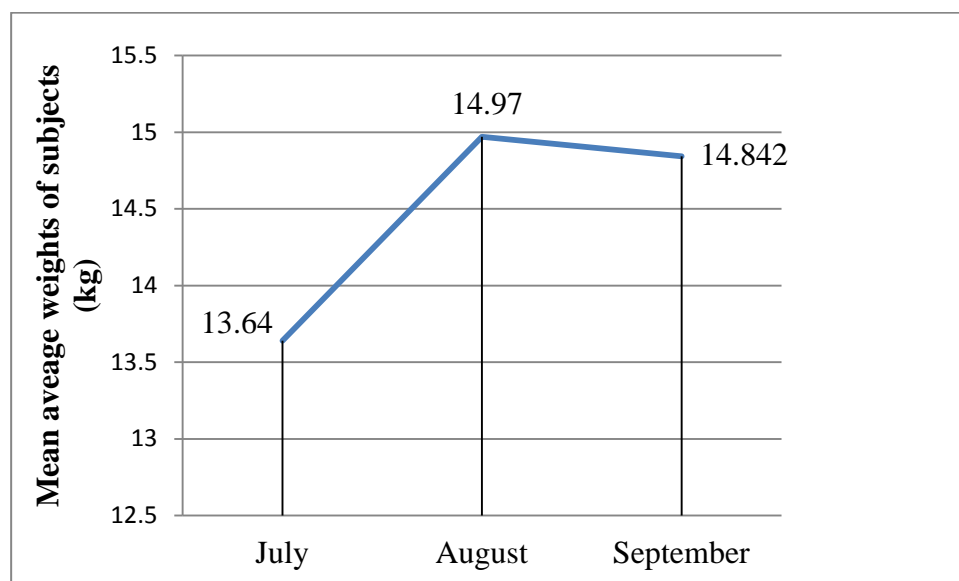


Figure 4 Mean weights of subjects during three month supplementation with SRFS

There was an increase in the mean weight of subjects from July 2011 to August 2011. A slight decrease in weight was noted among subjects between August 2011 and September 2011. According to the paired-sample-t-test, it was found that between July 2011 and August 2011, a significant gain in weight was noted ($SD = 0.00$, $p < 0.05$). Between August 2011 and September 2011, a loss of weight was noted but was found to be non-significant ($SD = 0.570$, $p > 0.05$). However, when comparing the initial weight of the subjects to their final weight, a significant gain in weight was noted ($SD = 0.00$, $p < 0.05$). Hence although weight loss was observed between August 2011 and September 2011, the subjects were still able to gain a significant amount of weight during the supplementation period of three months.

In addition, out of the 19 subjects who were supplemented with SRFS for a period of three months, 8 (50%) of the subjects were able to reach a WAZ of > 1 , indicating that these subjects had attained normal weight for age and were no longer underweight. With regard to

the 11 children who did not reach their normal weight for age, they were found to be gaining weight but at a low rate.

4.2.2 To determine the amount of energy and macronutrients SRFS provided to underweight children aged 1-10 years as compared to the Recommended Energy Allowances (REA) and Recommended Daily Allowances (RDA)

From Table 9, it can be seen that the highest percentage of REA that SRFS was able to meet was 20.76% in the 2-3 year age category, followed by 14.99 % in the 4 -8 year age category.

Table 9: Percentage of REA met by SRFS for energy among subjects in their different age groups

Age group	1-2 year old	2-3 year old	4-8 year old	9-13 year old
% of REA met by SRFS	10.38	20.76	14.99	13.49

As shown in Table 9, the highest percentage of the RDA met by SRFS for protein was in the 2-3 year old group followed by the 4 -8 year old group. With regard to CHO, the percentage RDA met was the lowest among subjects aged 1 -2 years and the same for children aged 2 – 10 years.

Table 10: Percentage RDA met by SRFS for macronutrients among subjects in their different age groups

Age group	1-2 year old	2-3 year old	4-8 year old	9-13 year old
Protein	29.53	59.08	41.37	23
CHO	8.86	17.72	17.72	17.72
Fat	ND	ND	ND	ND

4.2.3 To determine the predominant diseases and symptoms of diseases experienced by underweight children aged 1-10 years who were on the CAST food parcel program.

Table 11 Diseases among subjects during the three month supplementation period with SRFS

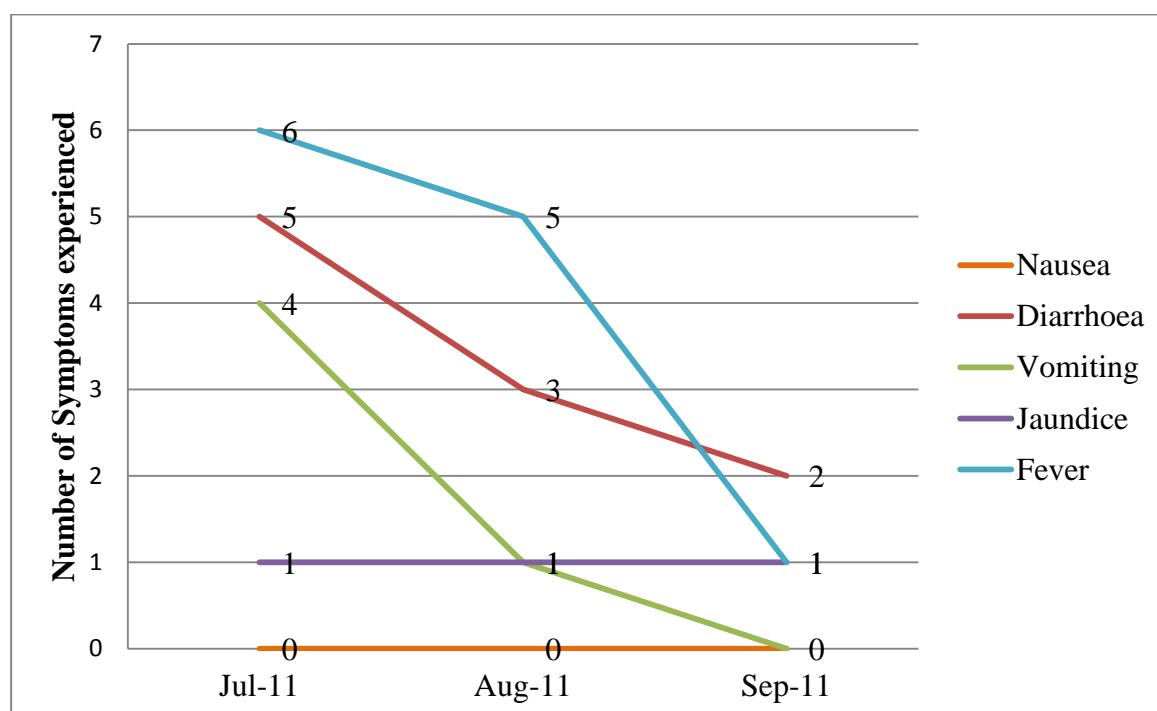
Disease Conditions	July 2011	August 2011	September 2011
Diarrhoea (past 2 weeks)	1	1	0
Dehydrated	0	0	0
Mouth Sores	3	0	0
Oral thrush	1	2	0
Kwashiorkor	0	0	0
Marasmus	0	0	0
Gastroenteritis	0	0	0
TB	0	0	0
HIV positive	6	7	7
No Disease Conditions	8	9	12
Total of Subjects	19	19	19

Table 11 shows that with regard to diseases experienced, none of the subjects presented with dehydration, kwashiorkor, marasmus, gastroenteritis or TB during the three month supplementation period with SRFS. The number of subjects with no disease increased from 8 subjects in July 2011 to 12 subjects in September 2011, indicating that by the end of the supplementation period, 63% of the subjects were experiencing no disease as compared to 42% in the initial month of supplementation. In addition, there was a general increase in the number of subjects that did not experience disease conditions during the supplementation period. By the third month of supplementation, incidences of mouth sores, oral thrush or diarrhoea (past two weeks) was noted. HIV infection was found to be the predominant disease experienced by the subjects.

Table 12 HIV status of subjects

	July 2011	August 2011	September 2011
HIV Positive	6	7	7
HIV Negative	4	4	5
Status Unknown	9	8	7
Total	19	19	19

Table 12 shows that at the start of study, 6 subjects were HIV positive, 4 HIV negative and the status of 9 subjects was not known. However, by the end of the supplementation period, two of the subjects had had their status tested and the number of subjects who did know their HIV status declined to 7 subjects. Hence by the end of the three month supplementation period, 36.8% of the subject HIV status unknown. In addition, at the start of the study, 6 subjects were receiving ART and by month three of supplementation 7 subjects were receiving ART.

**Figure 5 Frequency of symptoms of disease experienced by subjects**

As shown in Figure 5, from July 2011 to September 2011, there was a steady decline of symptoms such as fever, diarrhoea and vomiting experienced by subjects. The symptom with the highest prevalence at the start of supplementation was fever, followed by diarrhoea. However, by the third month of supplementation these symptoms were still being experienced

but the frequency of these symptoms had declined. Only 1 subject was found to have jaundice and there was no incidences of nausea.

4.2.4 To determine if there was an overall improvement in appetite, meal consumption and level of energy among underweight children aged 1-10 years of age who were on the CAST food parcel program.

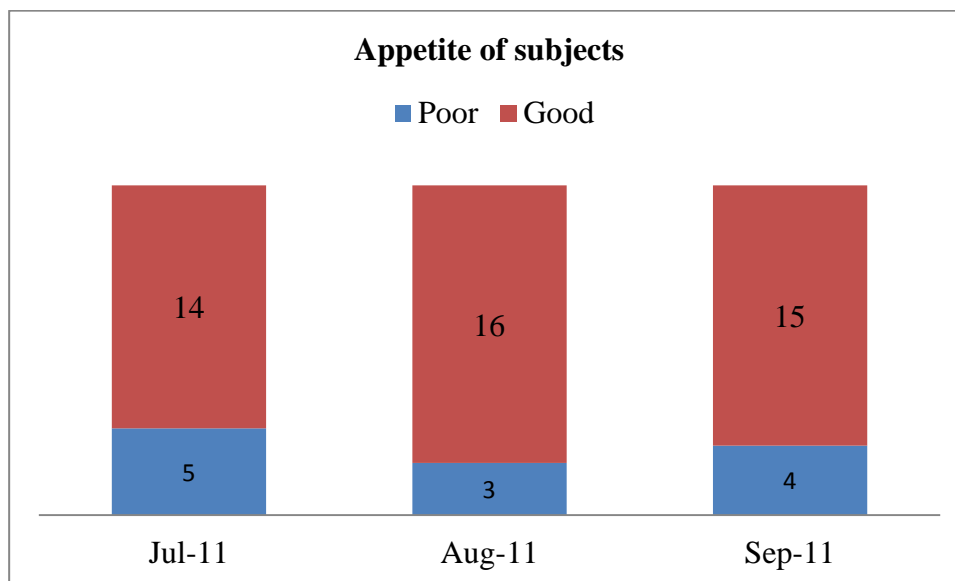


Figure 6 Level of appetite experienced by subjects

An increase in appetite was observed among subjects from July 2011 to August 2011 (Figure 6). However, a decline in appetite among subjects between August 2011 and September 2011 was noted. Looking at overall appetite levels of subjects, a general improvement was noted between July 2011 and September 2011.

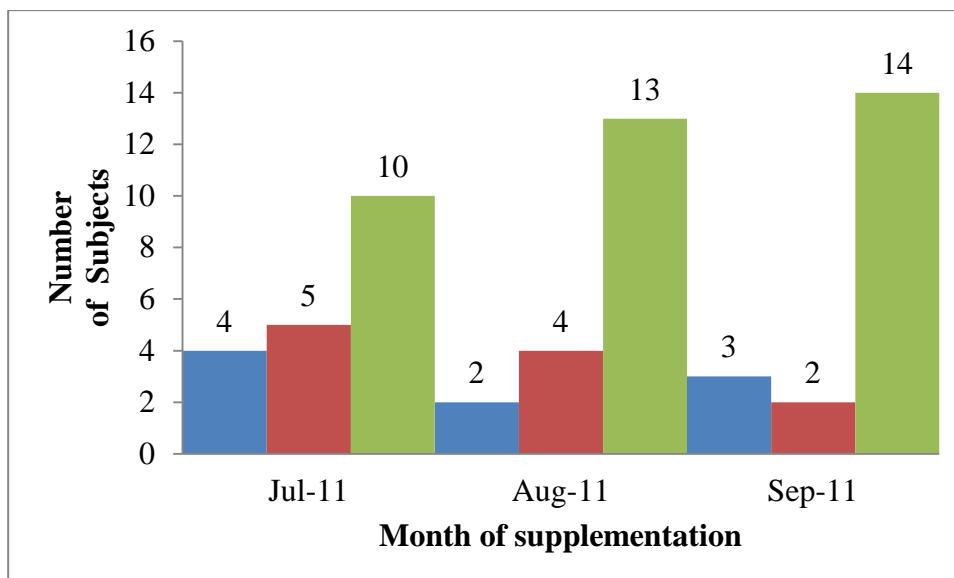


Figure 7 Meal consumption by the subjects

There was a general improvement in meal consumption by the subjects (Figure 7). In July 2011, caregivers had indicated that 52.6% (10) subjects were consuming a full bowl of food at most meals. However, by September 2011, 73.7% (14) of subjects were reported to consume a full bowl of food. The number of subjects consuming $\frac{1}{2}$ a bowl of food or a $\frac{1}{4}$ bowl of foods had decreased.

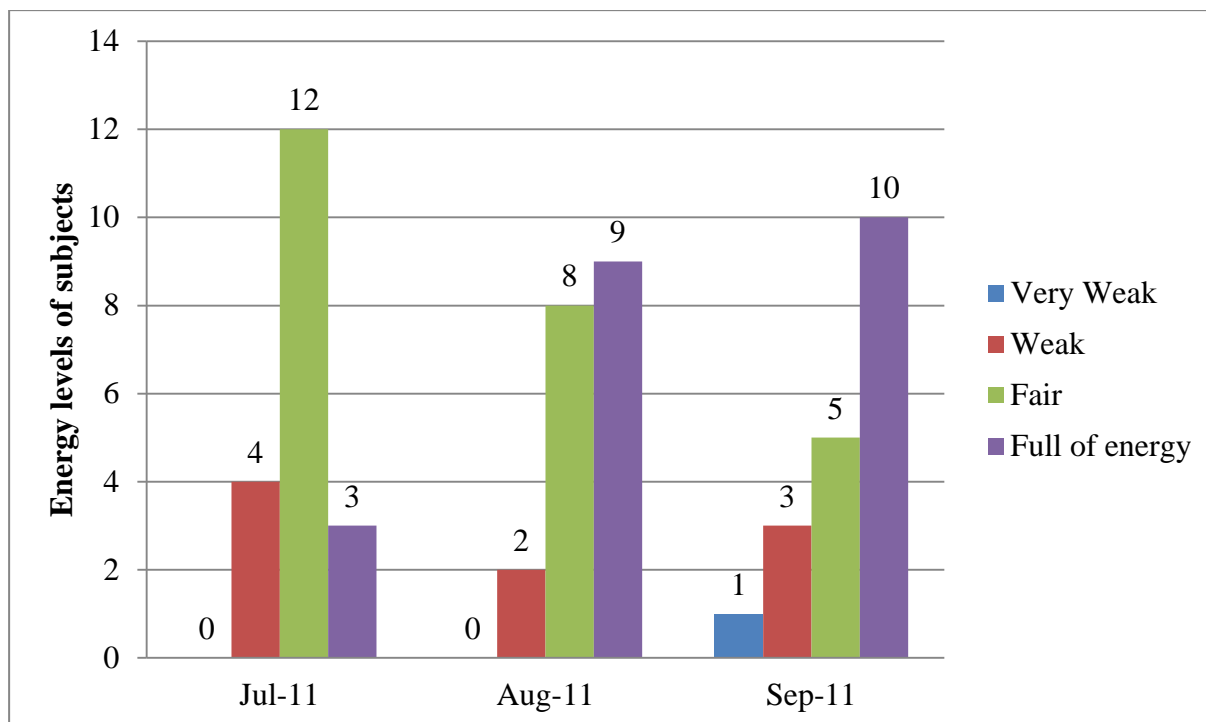


Figure 8 Energy levels of Subjects

From Figure 8 it can be seen that there was a general improvement in energy levels of the study subjects. 52.63% subjects were rated as being full of energy and 26.3 % had a fair amount of energy by the end of the study.

4.2.5 To determine the number of underweight children 1-10 years of age who were on the CAST food parcel program in Cato Manor and Chesterville in Durban, Kwa Zulu-Natal.

A higher number of underweight children were observed among families receiving food parcels in Chesterville than in Cato Manor. In Cato Manor, two children from one family were identified as being underweight. Looking at both communities combined, 27.5 % of children were found underweight among families receiving food parcels.

Table 13 Number of families with underweight children in Cato Manor and Chesterville

	Cato Manor	Chesterville
Number of families receiving food parcels	42	27
Number families identified as having underweight children	8	10
Total number of underweight children	9	10
Percentage underweight children in these families	47.4	52.6

4.2.6 To train community volunteers working for CAST on how to assess and identify underweight children

CAST community workers were able to successfully perform home visits and assess and identify children who were underweight, among families receiving food parcels. On the day of enrolment, these children were reassessed by the researcher, and it was found that the CAST community workers had accurately assessed all the children.

4.3 SUMMARY

Out of the 19 underweight children who were supplemented with SRFS over the three month period it was found that more children from Chesterville than from Cato Manor were part of the CAST food parcel programme. SRFS was not able to meet 100% of the RDA and REA for subjects in their different age groups, but was able to promote weight gain among the underweight subjects as 50% of the subjects were able to achieve normal weight for age by the third month of supplementation. A noticeable decline in the number of diseases experienced by the subjects was observed, however HIV infection was found to be the most predominant disease condition experienced. A steady decline in the frequency of symptoms experienced among subjects was noted. The level of appetite and meal consumption among subjects increased during the three month supplementation period. Lastly, the energy levels among subjects were found to increase during the supplementation period and by the third month majority of the subjects were reported full of energy. The objective of training community volunteers working for CAST on how to assess and identify underweight children was achieved as all volunteers were able to successfully assess subjects.

CHAPTER 5

DISCUSSION

A total of 19 underweight African children who were part of families on the CAST food parcel programme were included in this study. The mean age of the subjects was 4.8 years. There was not a big difference in gender among subjects as 57.9% were male and 42.1% female. On average there were 7 people living in the same household as the subject with an average of 3 children under the age of 13 years. The majority of the subjects were taken care of by their mothers (53 %) followed by their grandmothers or relatives. More than 50% of the families had access to facilities such as a stove (100%), running water (84.2%), indoor flushing toilets (73.7%), fridge (63.25%) and electricity (89.5 %). Out of the 19 subjects, only one family had a vegetable garden at home. It was found that staple foods such as porridge, bread/potatoes/phutu and other foods such as vegetables and water was consumed on a daily basis by subjects. Protein foods such as meat/chicken/fish and eggs were consumed on a weekly basis. Full cream milk was consumed on a monthly basis. However, this was probably due to the fact that the majority of subjects were receiving formula milk (68%) from clinics.

5.1 Significant Findings

5.1.1 To determine whether supplementation for a period of three months with SRFS was able to promote weight gain among underweight children aged 1-10 years who were on the CAST food parcel program.

When looking at the initial weight of subjects as compared to their final weight at the end of the supplementation period with SRFS, an overall significant gain in weight was noted. Hence, SRFS was able to promote weight gain among underweight subjects aged 1-10 years of age. This is in line with findings from studies conducted by Maleta *et al* (2004) and Manary *et al* (2004), who demonstrated that RTUF provided a positive effect on growth of moderately malnourished children in their home environment. In addition, 52.6 % of the subjects in this study attained WAZ > 1 indicating that these subjects had reached their normal weight for age during the three month supplementation period and were no longer underweight by the end of the supplementation period. The findings are similar to the study

conducted by Manary *et al* (2004), in which 61 % of subjects supplemented with RTUF had reached normal weight for age.

Among the 47.4 % of subjects that did not attain normal weight for age, it was observed that there was an increase in weight among these subjects although the rate of weight gain was found to be slower. The slower rate of weight gain among these subjects could be attributed to the SRFS being shared with other members of the family as pointed out by Manary *et al* (2004). Only the underweight children were supplemented with SRFS and not all children in the family. This could have led to the sharing of the product with other children in the household when the caregiver observed that SRFS was promoting weight gain in the underweight child. In addition the slower rate of weight gain could have been due to the fact that some of these subjects were HIV infected and hence a longer supplementation period was required to meet normal weight for age. This will be discussed later on in this chapter.

5.1.2 To determine the amount of energy and macronutrients SRFS provided to underweight children aged 1-10 years as compared to the Recommended Energy Allowances (REA) and Recommended Daily Allowances (RDA)

SRFS was not able to provide 100% of the REA and RDA for the subjects' in their different age groups. However, the age group in which the highest percentage of REA and RDA for energy and protein was achieved was in the 2-3 year old group followed by subjects in the 4-8 age group. In the 2-3 year age group, 59 % of the RDA for protein was met by SRFS. Taking into account that the mean age of the subjects was 4.8 years, it can be seen that SRFS was able to provide higher percentage energy and protein content to the average subject in this study.

In addition, according to Otten *et al* (2006), the RDA is an estimate of the average dietary nutrient intake level that is sufficient to meet the nutrient requirements of nearly all (97%-98%) healthy individuals in particular life stage but exceeds the requirements of nearly all individuals of the group. Hence because RDA falls above the requirements of most people, intakes below the RDA cannot be assessed as being inadequate.

The overall weight gain observed among subjects during the three month supplementation period could have been due to the fact that SRFS had produced an increase in the total energy

intake among subjects since as mentioned by Maleta *et al* (2004); RTUF does not promote the decline of staple food intake as it is simply added to the food. Maleta *et al* (2004) reported that RTUF did not achieve the RDAs, but could have improved energy and nutrient intake to facilitate a higher proportion of subjects' intake meeting the RDAs. In addition, the micronutrient composition of SRFS was not analysed. Maleta *et al* (2004) found that the micronutrient content of RTUF could have improved micronutrient status among subjects and thereby correcting micronutrient deficiencies and increasing appetite which in turn increased the intake of foods and promoted weight gain. The same phenomena could have occurred in this study.

5.1.3 To determine what the predominant diseases and symptoms of disease experienced by underweight children aged 1-10 years who were on the CAST food parcel program.

Looking firstly at disease conditions experienced, the most predominant disease condition experienced among subjects was HIV infection. There was an overall decrease in disease conditions such as diarrhoea (in the past two weeks), mouth sores and oral thrush. In addition, the number of subjects with no disease conditions increased from 8 subjects in July 2011 to 12 subjects in September 2011 indicating that by the end of the supplementation period 63% of the subjects were experiencing no disease conditions as compared to 42% in the initial month of supplementation. Hence SRFS was possibly able to improve disease conditions among subjects supplemented for a period of three months.

A proportion of 36.8% of the subjects reported to be HIV infected. Two subjects were tested for HIV infection during the study, of which one subject was found to be HIV infected. According to Steenkamp *et al* (2009), factors that may contribute to growth failure in HIV infected children include decreased energy intake, a lower fat free mass and micronutrient deficiencies which may result in poorer outcomes. According to Ciliberto *et al* (2005), HIV infection may represent a pathophysiology that could cause patients to respond differently to certain intervention strategies, compared to healthy individuals. Hence, among 47.4 % of the subjects who gained weight at a slower rate, HIV infection could have played a significant role in mediating such an outcome. It is suggested that a longer supplementation period is required for these children to reach normal weight-for-age. Yet, it is also highly probable that HIV-infected children would not gain all their lost weight again. Ndekha *et al* (2005) showed

that the mean recovery time for HIV infected children supplemented with RTUF was much longer compared to that of HIV uninfected children. In addition, Ndekha *et al* (2005) recommended a four month supplementation period with RTUF in order for HIV infected children to reach normal weight for age. A prerequisite, however, would be that the children be on ART. Steenkamp *et al* (2009) confirms that in order to reverse growth failure in HIV infected children, the provision of ART and aggressive nutrition support with energy dense nutritional supplements to supplement meals is required. In this study, at the end of the three month supplementation period with SRFS, only 36.8% of subjects reported to be HIV positive and receiving ART, and the status of 36.8% of subjects were still unknown.

Looking at symptoms experienced, only one subject was found to have jaundice and no incidences of nausea was noted. A steady decline of symptoms such as fever, diarrhoea and vomiting experienced by subjects was observed from the beginning to the end of the study. The symptom with the highest prevalence at the start of supplementation was fever, followed by diarrhoea and vomiting. By the third month of supplementation these symptoms were still experienced, but the frequency of these symptoms had declined. It should be noted that diarrhoea and infectious diseases may undermine the positive effects of supplementary feeding. A higher prevalence of fever and diarrhoea were reported by HIV infected subjects, as opposed to HIV uninfected subjects. However, according to Diop *et al* (2003), there is a decreased risk of developing diarrhoea with RTUF due to the low water content of the product and hence the risk of bacterial proliferation is decreased. A decrease in fever and diarrhoea during the three month supplementation period with SRFS, is in keeping with findings from Ciliberto *et al* (2005) who also reported that there was a lower prevalence of fever and diarrhoea among subjects receiving RTUF in the home environment.

5.1.4 To determine if there was an overall improvement in appetite, meal consumption and level of energy among underweight children aged 1-10 years of age who were on the CAST food parcel program.

An increase in appetite was reported among subjects, from July 2011 to September 2011. However, a small decline in appetite among subjects was observed between August 2011 and September 2011. In addition, during month three, the mean body weight of the group of subjects as a whole dropped slightly. Hence, the slight decrease in weight during the August

2011 to September 2011 could have been attributed to a decrease in appetite reported for this same period of supplementation.

A general improvement in meal consumption was reported by subjects. In July 2011, caregivers had indicated that 52.6 % (10) subjects were consuming a full bowl of food at most meals. By September 2011, 73.7 % (14) of the subjects were consuming a full bowl of food. The number of subjects that were consuming $\frac{1}{2}$ a bowl of food or a $\frac{1}{4}$ bowl of food had decreased during the same time. According to Maleta *et al* (2004), an increase in appetite leads to an increase in food intake. Hence, it is hypothesised that the decrease in appetite observed between August 2011 and September 2011 in this study could not have contributed to the decrease in body weight noted during this period of time, as meal consumption had consistently increased during the three month supplementation period. Looking at overall appetite levels of subjects, a general improvement was noted between July 2011 and September 2011. In addition, a general concomitant improvement in energy levels among subjects was observed during the three supplementation periods. A 52.63% subjects rated themselves as being full of energy and 26.3 % reported a fair amount of energy by the end of the study. Briend (2002) reports that an increase in energy levels contributes to weight loss due to raised physical activity, which provides a reasonable explanation for what happened in this study.

5.1.5 To determine the number of underweight children 1-10 years of age who were on the CAST food parcel program in Cato Manor and Chesterville in Durban, Kwa Zulu-Natal.

A higher percentage of underweight children were observed among families receiving food parcels in Chesterville (52.6 %), compared to those that lived in Cato Manor (47.4%). Looking at both communities combined, 27.5 % of children from the 69 families were found to be underweight. According to Zere *et al* (2003), children of lower socio-economic status are at risk of malnutrition. The criteria for families entering into the CAST food parcel programme included that the breadwinner of the family was too sick to work, families were run by child headed households and lastly, that the household income should be less than R500 per month. Hence, the families studied were of a low socio-economic status and it would be expected that a large number of the children would be underweight.

5.1.6 To train community volunteers working for CAST on how to assess and identify underweight children

The CAST community workers had to perform house visits to families on the CAST food parcel programme in order to identify underweight children that could be recruited to participate in this study. The CAST community workers were successfully able to assess and identify underweight children in Cato Manor and Chesterville. According to Briend *et al* (1999), in order to avoid overfeeding and misuse of the RTUF, frequent contact with health facilities of caregivers and children are necessary in order to monitor progress of children during some form of health intervention (Briend *et al* 1999). In addition, Manary *et al* (2004) states that greater supervision or home visits by health care workers would need to be provided to secure a positive outcome of such an intervention. Hence, the training of CAST community workers should benefit the community. The training of CAST community workers has now equipped them with the necessary skills to identify underweight children and aid these children in seeking proper care.

5.2 Recommendations for improvement of the study

- A follow up visit of subjects 6 months after the cessation of supplementation with SRFS should be conducted to observe the long-term effects on weight gain, and whether the gain was sustainable;
- The micronutrient content of SRFS should have been analysed, as well as the energy and macronutrient content, in order to identify the extent to which SRFS meets the RDAs for these nutrients;
- Empty bottles of SRFs could have been collected at each data collection day to measure the compliance of the subjects to the SRF supplementation;
- HIV testing should have been done at the beginning of the study in order to identify those children infected with HIV. HIV infected children may respond differently to supplementation and that could have confounded the results of this study;
- Other children in family who were not underweight but under the age of 10 years old should have been supplemented with SRFS in order to ensure that the product was not shared and that underweight subjects were getting the recommended daily dose of SRFS;

- A 24 diet recall should have been obtained from caregivers. The average energy intake and nutrient content of participants could be used to establish the extra energy nutrient content that SRFS had provided to subjects.

5.3 Implications for further research

- This study focused on short-term changes in body weight of supplemented children. A long-term study would add value to the results of this study;
- Future studies should aim to monitor baseline dietary intakes of subjects and the increase of overall energy that supplementation with SRFS provided in order to identify if an overall energy intake and weight gain was achieved;
- The impact of SRFS on HIV infected children, especially those from a low socio-economic background, should be investigated in the South African setting;
- The impact of providing SRFS to underweight children in rural areas in South Africa should be investigated;
- In this study, home based care with supplementation of SRFS was found to be beneficial in the promotion of weight gain. However, future studies should assess the provision of SRFS in in-patient management of malnutrition.

CHAPTER 6

CONCLUSION

- 6.1 RTUF has consistently shown to improve weight gain among severely and moderately malnourished children in developing countries. The major benefits of RTUF include that they are energy dense, can be used safely in environments of poor hygienic conditions and does not require any preparation before consumption. Taking into account that the prevalence of underweight children in South Africa is high, it posed beneficial to investigate the use of RTUF in this setting.
- 6.2 In this study it was found that SRFS was able to promote weight gain in underweight children aged 1-10 years living in Cato Manor and Chesterville. More than half of the 19 subjects included in this study were able to reach normal weight for age after a three month supplementation period. In terms of the children who did not reach their normal weight for age, it was still observed that these children gained weight, albeit at a slower rate. Reasons for this is not clear, but it is suspected that HIV infection could have potentially played a role. The most predominate disease condition experienced among these subjects was HIV infection. Yet, testing for HIV was not included as part of the protocol for this study.
- 6.3 Other disease conditions such as mouth sores, oral thrush and diarrhoea were present at the beginning of supplementation, but had steadily improved by the third month of supplementation. In addition, a steady decline in infectious symptoms such as diarrhoea, vomiting and fever that could provide negative effects on supplementary feeding of children was observed. This was in keeping with results from other studies. In addition, SRFS supplementation in this study was also found to exert a beneficial effect on appetite, meal consumption and energy levels of subjects. Although there was a decline in appetite noted between the second and third month of supplementation with SRFS, meal consumption was not affected.
- 6.4 SRFS was unable to meet full REA and RDA requirements for energy and macronutrients. However, based on the fact that the subjects managed to significantly gain weight during the three month supplementation period, it can be concluded that

the SRFS increased the overall energy intake among subjects. In this study the micronutrient content of SRFS was not analysed and compared to the RDAs. However, weight gain could have been attributed to the fact that SRFS was able to provide additional micronutrients which helped to alleviate micronutrient deficiencies, thereby increasing appetite and meal consumption and ultimately overall energy intake.

- 6.5 This study did not only benefit the participants directly, but also other individuals in the community suffering from malnutrition. CAST community workers were trained to assess and identify underweight children. Taking into consideration that these community workers are in constant contact with the community, these workers are now equipped with skills and tools to identify underweight children in the community and aid children and families finding appropriate support.
- 6.6 Hence, in conclusion, SRFS in this study was not only successful in promoting weight gain among children, but was also able to improve the overall wellbeing of subjects by alleviating the burden of disease conditions and infectious symptoms while improving appetite, meal consumption and energy levels. SRFS, therefore, is beneficially utilised in the CAST food parcel programme, and other similar programmes should be made aware of these results. Eventually, SRFS can be utilised in other like communities, to the benefit of underweight children. Taking into consideration that in South Africa the under-5 mortality rate is on the increase, it is hypothesised that a product such as SRFS can play a leading role in bringing a country such as South Africa back on track in achieving the Millennium Development Goals, which its Government has made a commitment towards. Goal 4 of the Millennium Development Goals states that: “As a country, we should have reduced by two-thirds, between 1990 and 2015, the under-five mortality rate. At this stage this Goal is impossible to achieve.”

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APPENDIX A: Sibusiso Ready Food Supplement Information leaflet



sibusiso
NUTRITIONALLY
ADVANCING AFRICA'S
DEVELOPMENT

for
HEALTH
PROFESSION

nourish
energisi

brilliantly natural

For more information,
comments / clarifications / trade enquiries kindly contact:

Sibusiso Products (Pty) Ltd
PO Box 505
Hyper By The Sea
Durban, 4053
South Africa
Toll: +27 31 566 6679
Fax: +27 31 566 6682
Toll Free Number: 0800 566 786
Email: sibusiso@sibusiso.net
Web: www.sibusiso.net

Rab Processors Ltd
PO Box 5338
Limbe
Malawi
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+265 1 641 498 - Blantyre
+265 1 710 118 - Lilongwe
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0800 566 786**

Endorsed by



www.giftofthegivers.co.za

Does not require water to mix

Does not require refrigeration

Does not require cooking or heating

1 STEP
Spoon from container

2 STEP
See suggested serving

3 STEP
Ready to eat



Sibusiso READY FOOD SUPPLEMENT

High Energy & Protein

What are the qualities of this product?

- This product is READY to eat; it does not require cooking, heating or dilution;
- Sibusiso Ready Food can be used as a stand alone product directly from the bottle, as a spread, or added to porridge;
- This energy and nutrient dense product has a sweet nutty flavour, which is quite different to flavours of other food supplements;
- High energy – 100g SRFS 2352kJ;
- Protein – SRFS 16 g / 100g;
- It is free of lactose, wheat and gluten.

When is this product indicated?

- Sibusiso Ready Food Supplement is indicated for people who have high energy needs (for example, due to infection), but who find it difficult to meet these needs through a mixed diet.
- Sibusiso Ready Food Supplement is additionally indicated for people who have decreased appetite and who battle to eat enough to meet their nutritional requirements.



What are some of the results of this product to date?

Some of the testimonials of people who have used Sibusiso Ready Food to supplement their diets are as follows:

"Having carried out independent laboratory tests and obtained feedback on a range of people utilizing the product, the Gift of the Givers Foundation is satisfied that Sibusiso Ready Food Supplement has shown substantial promise in the provision of energy, weight gain and improved nutritional status".
Dr Indira Sooliman MB, Ch.B. – Chairman, Gift of the Givers Foundation.

Testimonials of Sibusiso Ready Food Supplement's Success

"...After taking Sibusiso Ready Food Supplement, there has been a marked improvement in his health and he has gained weight. He is now taking an active interest in life once again..." – **Ms C. Shaw, (referring to an acquaintance who is living with HIV and AIDS).**

"...Sibusiso Ready Food Supplement has really helped my son. He was only 39kgs before I gave him the supplement and we could see the difference after a week. Please keep up the good work for the sake of all those who need it..."
Mrs Withers.

"...Before taking Sibusiso Ready Food Supplement, I weighed only 32 kgs. After taking the supplement, I had gained 6.5kgs within the first month and my appetite and health had improved. I now weigh 40kgs. My four year old daughter also takes the supplement and her appetite has improved..."
Michelle Kennedy.

**Losing Weight!
 Poor Appetite!
 Muscle Wasting!
 Low Energy Levels!
 Weakness and illness!
 Nutritionally Challenged!**

The Solution is



www.sibusiso.net

NUTRITIONAL INFORMATION

Nutrients	Per 100g	Per 50g daily serving	% RDA per 5 daily sers
Energy	- kJ	2352	1176
Protein	- g	16	8
Carbohydrate	- g	48	24
Fat	- g	35	17.5
Fibre	- g	1.9	0.95
Vitamin A	- mcg RE	1200	600
Vitamin D	- mcg	10	5
Vitamin E	- mg	30	15
Vitamin K	- mcg	50	25
Vitamin C	- mg	150	75
Vitamin B1	- mg	2.2	1.1
Vitamin B2	- mg	2.2	1.1
Vitamin B3	- mg	20	10
Vitamin B6	- mg	2.6	1.3
Folic acid	- mcg	600	300
Vitamin B12	- mcg	3.6	1.8
Biotin	- mcg	60	30
Pantothenic acid	- mg	8	4
Calcium	- mg	2000	1000
Phosphorus	- mg	1400	700
Iron	- mg	28	14
Magnesium	- mg	160	80
Zinc	- mg	10	5
Iodine	- mcg	300	150
Selenium	- mcg	110	55
Sodium	- mg	< 580	< 290
Potassium	- mg	1150	575
Copper	- mcg	1400	700

Percentage Recommended Dietary Allowance Adults and Children older than 10 years

APPENDIX B: Monitoring tool

Nutritional Assessment of Patient receiving Sibusiso Ready Food Supplement (SRFS)


I2CM

Patient Details:

Name: _____ Patient no.: _____

Age: _____ years _____ months Sex(m/f): _____ No. of people in household: _____

Caregiver(both parents/mother/grandmother/relative): _____ No. of children under 13 yrs in household: _____



Background Information:
Please tick the applicable answer

	Yes	No
Vegetable garden		
Electricity		
Fridge		
Indoor flushing toilet		
Running water		
Stove		

	Food Frequency		
	Daily	Weekly	Monthly
Meat/chicken/fish			
Eggs			
Milk			
Vegetables			
Fruit			
Bread/potatoes/phutu			
Porridge			
Water			

Milk source: Breastmilk Formula Cows Goats

Nutritional Information:
Please fill in necessary details and tick correct column

		VISIT 1	VISIT 2	VISIT 3	VISIT 4	VISIT 5	VISIT 6	VISIT 7	VISIT 8
Date									
Weight (kg)									
WT Gained (kg)									
WT Lost (kg)									
Length (cm)									
Symptoms	Nausea								
	Diarrhoea								
	Jaundice								
	Fever								
	Vomiting								
	Diarrhoea (past 2 wks)								
Disease Conditions	Dehydrated								
	Mouth sores								
	Oral thrush								
	Kwashiorkor								
	Marasmus								
	Gastro								
	TB								
	HIV +								
Appetite	Poor								
	Good								
Meal consumption	1/2 bowl								
	1/2 bowl								
	Full bowl								
Energy levels	Very weak								
	Weak								
	Fine								
	Full of energy								

Other Supplements:
Please tick the applicable answer

Other supplements	Yes	No
Multivitamin		
Porridge		
Formula		

Other Medication:
Please tick the applicable answer

Other medication	Yes	No
TB		
ARV		

This form was compiled by: Dietitian Nurse Other (specify)

Remember: At first visit: Fill in all patient details, background information and food frequency and other supplements received
At every visit: Fill in weight, height/length and tick appropriate boxes for weight gained or lost, symptoms of disease, disease conditions, appetite, food consumption and energy levels

Issue every child with 2 tubs of Sibusiso at each visit
Every child must have 2-3 heaped teaspoons of Sibusiso daily

Many thanks for the time and effort taken to fill in this form. Philippa Barnard and Angie Steyn- Consulting Dietitians for Sibusiso Products (Pty) Ltd

APPENDIX C: Consent Forms**PARENT / GUARDIAN OF CHILD**

Dear Sir / Madam

RE: REQUEST FOR PERMISSION TO SUPPLEMENT YOUR CHILD WITH SIBUSISO (READY TO USE FOOD)

I am a student of the Discipline of Dietetics and Human Nutrition at the University of KwaZulu-Natal, Pietermaritzburg. I am studying towards a masters degree and my research topic is entitled "Supplementary feeding of South African underweight children between 1 and 10 years of age with Ready to Use Food to promote weight gain". This study aims to investigate whether the Sibusiso product will help your child to gain weight if given for a period of three months as your child has been identified as being underweight.

I am hereby requesting permission to provide the Sibusiso product to your child and to assess and monitor your child's progress on the supplement on a monthly basis for a period of three months. A months supply of Sibusiso will be issued on the same day as the collection of food parcels in Cato Manor. If you are unable to bring your child to be assessed for what ever reason, one of your community volunteers will do a home visit to assess your child and monitor your child's progress. Any information collected about your child will remain strictly confidential and on a voluntary basis. Your child may withdraw from participating in my study at any point should they wish. They will not face any negative or undesirable consequences should they choose to withdraw.

Should you have any queries regarding my research, please feel free to contact me on 076 850 8857.

I would be most grateful if you could sign the attached form and return it to me as soon as possible.

Yours Sincerely

Kirasha Maharaj
Masters Student

Professor Frederick Velman
Masters Supervisor

INFORMED CONSENT FROM PARENT / GUARDIAN

1. I hereby confirm that I have been informed by UKZN Masters student Kirasha Maharaj about the nature of her study "Supplementary feeding of South African underweight children between 1 and 10 years of age with Ready to Use Food to promote weight gain" which investigates whether the Sibusiso product will help your child to gain weight if given for a period of three months.
2. I have also received, read and understood the written information in the letter requesting permission for my child to participate in this study.
3. I understand that I may contact Ms Maharaj (076 850 8857) at any time if I have any questions about the research.
4. I understand that my any information collected about my child will remain strictly confidential and on a voluntary basis. I also understand that my child may withdraw from participating in this study at any point should they wish, without fear of any negative or undesirable consequences.

I hereby consent for my child to participate YES:___ NO:___

Name: _____

Signature: _____

Childs Name: _____

Date: _____

APPENDIX D: Completed monitoring tool (pilot study)

Nutritional Assessment of Patient receiving Sibusiso Ready Food Supplement (SRFS)


1141

Patient Details:

Name: _____ Patient no: _____

Age: 1 years 7 months Sex(m/f): M No. of people in household: 5

Caregiver (both parents/mother/grandmother/relative): Mother No. of children under 13 yrs in household: 2



Background Information:
Please tick the applicable answer

	Yes	No
Vegetable garden		<input checked="" type="checkbox"/>
Electricity	<input checked="" type="checkbox"/>	
Fridge		<input checked="" type="checkbox"/>
Indoor flushing toilet		<input checked="" type="checkbox"/>
Running water	<input checked="" type="checkbox"/>	
Stove	<input checked="" type="checkbox"/>	

	Food Frequency		
	Daily	Weekly	Monthly
Meat/chicken/fish			<input checked="" type="checkbox"/>
Eggs		<input checked="" type="checkbox"/>	
Milk			<input checked="" type="checkbox"/>
Vegetables		<input checked="" type="checkbox"/>	
Fruit		<input checked="" type="checkbox"/>	
Bread/potatoes/phutu		<input checked="" type="checkbox"/>	
Porridge		<input checked="" type="checkbox"/>	
Water	<input checked="" type="checkbox"/>		

Milk source: Breastmilk Formula Cows Goats

Nutritional Information:
Please fill in necessary details and tick correct column

		VISIT 1	VISIT 2	VISIT 3	VISIT 4	VISIT 5	VISIT 6	VISIT 7	VISIT 8
Date		<u>04/08/11</u>							
Weight (kg)		<u>9 kg</u>							
WT Gained (kg)									
WT Lost (kg)									
Length (cm)		<u>61.0</u>							
Symptoms	Nausea								
	Diarrhoea	<input checked="" type="checkbox"/>							
	Jaundice								
	Fever								
	Vomiting	<input checked="" type="checkbox"/>							
Disease Conditions	Diarrhoea (past 2 wks)								
	Dehydrated								
	Mouth sores								
	Oral thrush								
	Kwashiorkor								
	Marasmus								
	Gastro								
	TB								
	HIV+								
	Podri	<input checked="" type="checkbox"/>							
Appetite	Good	<input checked="" type="checkbox"/>							
	1/2 bowl								
	1/2 bowl								
Meal consumption	Full bowl	<input checked="" type="checkbox"/>							
	Very weak								
	Weak								
Energy levels	Fine	<input checked="" type="checkbox"/>							
	Full of energy								

Other Supplements:
Please tick the applicable answer

Other supplements	Yes	No
Multivitamin	<input checked="" type="checkbox"/>	
Porridge		<input checked="" type="checkbox"/>
Formula		<input checked="" type="checkbox"/>

Other Medication:
Please tick the applicable answer

Other medication	Yes	No
TB		<input checked="" type="checkbox"/>
ARV	<input checked="" type="checkbox"/>	

This form was compiled by: Dietitian Nurse Other (specify)

Remember: At first visit: Fill in all patient details, background information and food frequency and other supplements received

At every visit: Fill in weight, height/length and tick appropriate boxes for weight gained or lost, symptoms of disease, disease conditions, appetite, food consumption and energy levels

Issue every child with 2 tubs of Sibusiso at each visit
Every child must have 2-3 heaped teaspoons of Sibusiso daily

Many thanks for the time and effort taken to fill in this form. Philippa Barnard and Anja Steyn-Consulting Dietitians for Sibusiso Products (Pty) Ltd

APPENDIX E: Picture of Bowl Used to measure meal consumption (250ml)



APPENDIX F: Ethics Forms



UNIVERSITY OF
KWAZULU-NATAL
INYUVESI
YAKWAZULU-NATALI

Research Office, Govan Mbeki Centre
Westville Campus
Private Bag x54001
DURBAN, 4000
Tel No: +27 31 260 3587
Fax No: +27 31 260 4609
mohunp@ukzn.ac.za

27 June 2011

Miss K Maharaj (205522265)
School of Dietetics & Human Nutrition
Faculty of Science & Agriculture
Pietermaritzburg Campus

Dear Miss Maharaj

PROTOCOL REFERENCE NUMBER: HSS/0373/011M
PROJECT TITLE: Supplementary feeding of South African underweight children between 1 and 10 years of age with Ready to use food to promote weight gain

In response to your application dated 21 June 2011, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol has been granted **FULL APPROVAL**.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment /modification prior to its implementation. In case you have further queries, please quote the above reference number.

PLEASE NOTE: Research data should be securely stored in the school/department for a period of 5 years.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

.....
Professor Steven Collings (Chair)
HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS COMMITTEE

cc. Supervisors: Prof F Veldman & Ms C Biggs
cc. Ms M Francis

 1910 - 2010 
100 YEARS OF ACADEMIC EXCELLENCE

Founding Campuses: Edgewood Howard College Medical School Pietermaritzburg Westville