AN ASSESSMENT OF THE QUALITY AND ACCEPTANCE OF A READY-TO-USE SUPPLEMENT, SIBUSISO®, BY HUMAN IMMUNODEFICIENCY VIRUS AND HUMAN IMMUNODEFICIENCY VIRUS/TUBERCULOSIS TREATED PATIENTS IN KWAZULU-NATAL

BY

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ABSTRACT

Introduction: Malnutrition is a health issue directly and indirectly contributing towards high rates of morbidity and mortality globally, particularly in developing countries. South Africa (SA) is faced with a double burden of diseases with a high prevalence of both under and over nutrition. The high prevalence of Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome (HIV/AIDS) in SA worsens undernutrition. HIV/AIDS increases nutrient requirements and inadequate food intake results in malnutrition. Nutrition support through food supplementation is important to combat the high prevalence of malnutrition in sub-Saharan African countries including South Africa. Thus, a groundnut-soya based supplementary paste, Sibusiso, has been produced. However, its nutritional composition and acceptability have not been studied.

Objectives: (i) To determine the nutritional composition and physical properties of a ready-to-use supplement, Sibusiso, (ii) To determine the sensory acceptability of Sibusiso among healthy subjects; and sensory acceptability and perceptions of Sibusiso by subjects treated for HIV and HIV/TB.

Materials and methods: The nutritional composition, colour and texture of Sibusiso and a commercial peanut butter (control) were analysed following standard procedures. A cross-sectional consumer acceptability test was done using a 5-point facial hedonic scale (healthy control group, n = 68; HIV, n = 88 and HIV-TB co-infection treated, n = 51). A total of six focus group discussion sessions (HIV subjects = 4 sessions and HIV/TB co-infected subjects = 2 sessions) were also conducted.

Results and discussions: The protein content of Sibusiso (16 g/100 g) was almost half that of the commercial peanut butter (control), (25 g/100 g). However, Sibusiso contained 1.4 times more ash (4 g/100 g) and almost twice as much carbohydrate (40 g/100 g) compared to the commercial peanut butter (22 g/100 g). The fat (40 g/100 g) and energy (2 624 kJ/ 100 g) content of Sibusiso was not substantially different from that of the commercial peanut butter which was 43 g/100 g and 2 852 kJ/100 g, respectively. The lysine content of Sibusiso (58 mg/g) was about 1.7 times higher than that of the commercial peanut butter. The methionine (11 mg/g) and histidine (35 mg/g) content of Sibusiso was almost twice that of the commercial peanut butter, respectively. The nutrient content of Sibusiso was either similar or slightly more than that of other ready-to-use

supplements such as *Plumpy'nut*®. Sibusiso met the FAO/WHO/UNU recommendations for essential amino acids. The consumption of 50 g of Sibusiso per day may provide approximately 35% of the Estimated Energy Requirements (EER) and 30% of the Recommended Dietary Allowance (RDA) for protein for adults. Sibusiso was brown in colour, similar to the commercial peanut butter. Its textural attributes were found similar to that of the commercial peanut butter but harder and stickier.

The acceptability of Sibusiso was significantly associated ($p \leq 0.05$) with the health status of consumers. Overall, Sibusiso was liked by 94% of HIV and HIV/TB individuals (mean score: 4) compared to 85% for the healthy group (control). More than 90% of the HIV/TB and HIV treated individuals liked the taste compared to the control group (86%, mean score: 4). The colour and mouthful were rated 'good' by more than 80% of the HIV and HIV/TB group, mean score: 3, with only 68% among the healthy group, mean score: 4.1.

Conclusion: Sibusiso is a good source of nutrients and was found to be acceptable to HIV and HIV/TB treated consumers. It may be effective in alleviating disease-related malnutrition among vulnerable individuals such as those infected by HIV and HIV/TB.

PREFACE

The work within this dissertation was conducted in the School of Agricultural, Earth and Environmental Sciences at the University of KwaZulu-Natal from February 2011 to September 2012. The supervisors were Dr Muthulisi Siwela, Dr Kirthee Pillay, Dr Eric O Amonsou and Professor Frederick J Veldman.

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DECLARATION [redacted]

[redacted] Prudence Bongekile Mabaso identity number [redacted] declare that the work in this dissertation submitted to the University of KwaZulu-Natal, School of Agricultural, Earth and Environmental Sciences is my own independent work, except where otherwise stated. The work in this dissertation has not been submitted for any degree before to any tertiary institution by me or any other person. Data from other sources used in this dissertation has been appropriately acknowledged and referenced.

Signed: _____ Date _____

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CHAPTER 1
INTRODUCTION, THE PROBLEM AND ITS SETTING

1.1 Importance of the study

Ready-to-use supplementary foods (RUSFs) were developed and consumed to prevent and alleviate malnutrition among children and adults [Scherbaum, Shapiro, Purwestri, Inayati, Novianty, Stütz, Yusran, Müller, Wirawan & Suryantan 2009; World Health Organization (WHO) 2007]. RUSFs have been produced in various forms such as compressed bars, biscuits and micronutrient powders, lipid-based nutrient supplements, and high-quality vegetable oil and pastes (de Pee & Bloem 2008) in response to the high level of malnutrition reported globally (Scherbaum *et al* 2009).

Malnutrition, including over and under nutrition, is a health issue directly and indirectly contributing towards high rates of morbidity and mortality globally, particularly in developing countries (Müller & Krawinkel 2005). Undernutrition, the focus of this study, is divided into micronutrient deficiencies and protein-energy malnutrition (PEM) (Grover & Ee 2009; Faber & Wenhold 2007). According to the Food and Agriculture Organization of the United Nations (FAO) and the United Nations World Food Programme (WFP), in 2010, 925 million people were chronically and severely undernourished (FAO 2012). The Food Insecurity and Vulnerability Information Mapping System (FIVIMS) further reported that 44% of these people were from the Central, Eastern and Southern Africa from which 40% of the population suffered from micronutrient deficiencies (WHO 2012; FIVIMS 2004). Globally, it was reported that approximately two billion people, particularly women and children were iron deficient and approximately 230 million children were vitamin A deficient (WHO 2012). Iron, vitamin A, zinc and iodine deficiencies were reported as the most common (Rosenberg 2007; Allen, de Benoist, Omar & Hurrell 2006).

South Africa is faced with a double burden of diseases with a high prevalence of both under and over nutrition (Vorster 2010). However, the effect of undernutrition is worsened by the high prevalence of Human Immunodeficiency Virus (HIV)/Acquired Immune Deficiency Syndrome (AIDS). HIV/AIDS increases nutrient requirements and inadequate food intake results in malnutrition (Labadarios 2005). PEM occasionally presents as a secondary condition in the

presence of energy demanding diseases and is common amongst poverty-stricken populations due to famine, drought, political unrest or social issues (MedlinePlus 2011). An inadequate intake of foods high in vitamins and minerals such as meat, fish, poultry, eggs, milk and dairy products, vegetables and fruits is also common among poor individuals. Access to these foods is affected by various factors (Allen *et al* 2006), amongst which is accessibility, affordability, availability and the lack of cold storage facilities (Shetty 2006). These factors particularly affect people with a low income who consume unhealthy diets (Duvenage & Schönfeldt 2007; Allen *et al* 2006). A finding that most developing countries were highly dependent on a monotonous diet based on cereals, roots and tubers has supported this (Tontisirin, Nantel & Bhattacharjee 2002). Such foods contain low micronutrients and protein therefore sole consumption of this food results in malnutrition (Allen *et al* 2006). In South Africa, the poor micronutrient containing foods that were reported to be commonly consumed were maize, samp, mealie rice or grits, white rice, dry beans and peanut butter (Duvenage & Schönfeldt 2007). This applied to both rural and urban areas for individuals over the age of 10 years (Nel & Steyn 2002).

Other factors that were reported to contribute to malnutrition were illnesses such as tuberculosis (TB) and HIV/AIDS, inadequate maternal and childcare practices, poverty and food insecurity, ignorance, social taboos and lifestyle choices (Mabaya, Jordaan, Malope, Monkhei & Jackson 2010). Intestinal infections such as diarrhoea enhance malabsorption thus resulting in malnutrition. According to Saunders, Smith & Stroud (2011) infections such as TB, malaria and HIV have the most drastic effect on malnutrition. Malnourished individuals often experience body fat loss, visceral organ wasting and muscle wasting (Shetty 2006), which can be masked in obese individuals (Saunders & Smith 2010). The extent to which an individual may suffer the consequences of malnutrition depends on factors such as age, gender, physical activity, the presence of infections, endocrine status and adequacy of the consumption of certain nutrients (Shetty 2006). Illnesses normally reduce appetite, which affects intake and utility of food by the body (Saunders *et al* 2011).

In order to alleviate malnutrition, the South African Department of Health developed the Integrated Nutrition Programme (INP) with short and long-term nutrition interventions [Department of Health (DOH) 1998]. The strategies or focus areas under the programme were the following: contribution to household food security; disease-specific nutrition support, treatment and counselling; growth monitoring and promotion; nutrition promotion, education and advocacy; promotion, protection and

support of breastfeeding; micronutrient malnutrition control; and food service management (Steyn & Labadarios 2002). Recent reports have highlighted limited success for the current strategies towards meeting nutritional needs of their target groups (Swart, Sanders & McLachlan 2008). The vitamin A supplementation programme under the micronutrient malnutrition control focus area was found to be unable to meet the needs of the most vulnerable children and post-partum women (Swart *et al* 2008). Fortification of maize meal and bread flour with vitamin A, thiamin, riboflavin, niacin, vitamin B_6, folic acid, iron and zinc was made compulsory in October 2003 in South Africa (Faber & Wenhold 2007; DOH 2002). Food fortification was reported more effective when combined with supplementation. However, recent data showed failure of the programme to meet anticipated results from the programme (Labadarios 2007). The inability of fortified foods to offer the desired amount of energy, protein, fats and other elements obtained from a good diet for optimal health was amongst other reasons why the programme failed. The programme might also not reach the targeted population especially the poorest part of the population due to affordability and access (Allen *et al* 2006). The dietary diversity strategy on the other hand aimed at encouraging an intake of a variety of foods from different food groups and within different groups (Faber & Wenhold 2007). However, the effectiveness of this strategy has been limited by poverty and the lack of access to appropriate foods (Mayer, Pfeiffer & Beyer 2008). These programmes and the rest of the INP focus areas seem to be particularly ineffective among vulnerable groups of people such as those infected with HIV and TB, who have higher nutritional needs.

As mentioned previously, people infected with HIV/AIDS or TB experience a drastic increase in micronutrient and macronutrient requirements. Physiological changes and the presence of opportunistic infections and side effects from the HIV/AIDS and TB medication are the reasons for the drastic increase [Regional Centre for Quality of Health Care (RCQHC) 2004]. As a result, in South Africa malnourished and wasted HIV or TB patients receive ready-to-use therapeutic foods together with medication during routine hospital or clinic visits (Oketch, Paterson, Maunder & Rollins 2011). Ready-to-use therapeutic foods have been proven effective in improving the nutritional status of HIV or TB treated patients in other African countries such as Malawi, Niger, Ethopia, the Democratic Republic of Congo and Mozambique (Prasad, Holla & Gupta 2009).

In 2004, a RUSF called Sibusiso was developed by the Gift of the Givers Foundation (GOTG). The GOTG is a South African non-governmental organisation (NGO) and Africa's largest humanitarian and disaster relief organisation. Sibusiso is produced in Malawi by a company called Rab Processors Ltd using locally grown groundnuts (Rab Processors Ltd 2011; GOTG 2009). It is a peanut and soya paste fortified with micronutrients and macronutrients. The addition of macronutrients and micronutrients to food products has a tendency to alter the sensory properties of food products. Sensory properties play a vital role in the eating and purchasing behaviour of consumers, which affects the acceptability of the product (Stone & Sidel 2004, pp13-15). According to Young, Blanco, Hernandez-Cordero, Pelto & Neufeld (2010), in order for a supplement to be effective it must first be acceptable to the target consumers and be regularly consumed. It was also suggested that no food or beverage should be produced, distributed or marketed without studying whether its sensory properties are acceptable or not to the public (Stone & Sidel 2004, pp13-15). There is a lack of data around the sensory acceptability of peanut-based RUSFs and the sensory acceptability of Sibusiso has not been studied in South Africa. In this study the sensory acceptability and perception of Sibusiso by consumers with different health conditions such as HIV/AIDS and TB was assessed. The physical properties of the product were also assessed to understand factors that may affect the acceptability of Sibusiso.

1.2 Summary of research focus

This study provided data on the nutritional composition of a RUSF, Sibusiso and the physical properties such as colour and texture of the product. In addition, the sensory acceptability and perception of Sibusiso by healthy consumers and consumers treated for HIV/AIDS and HIV/TB co-infection was determined. Participants in the study were healthy adults from Pietermaritzburg, KwaZulu-Natal (KZN), and adult patients from Northdale and Grey's hospital in KZN.

1.3 Purpose of the study

The purpose of the study was to determine the nutritional composition and physical properties of Sibusiso and to assess the sensory acceptability and perceptions of Sibusiso by healthy consumers and consumers treated for HIV/AIDS and HIV/TB co-infection.

1.4 Study objectives

The objectives of this study were:

1.4.1 To determine the nutritional composition of the ready-to-use supplementary food, Sibusiso.

1.4.2 To determine the physical properties of the ready-to-use supplementary food, Sibusiso, in terms of its colour and texture.

1.4.3 To determine the sensory acceptability and perceptions of the ready-to-use food supplement, Sibusiso, by healthy consumers and consumers treated for HIV/AIDS and HIV/TB co-infection.

1.5 Hypotheses

The hypotheses of this study were as follows:

1.5.1 The nutritional composition of the ready-to-use supplementary food, Sibusiso, is superior to that of a commercial peanut paste due to the addition of micro- and macronutrients to Sibusiso.

1.5.2 The colour and texture of the ready-to-use supplementary food, Sibusiso, is the same as that of a commercial peanut paste.

1.5.3 Healthy consumers associate the sensory properties, colour, smell, texture and taste, of the ready-to-use supplementary food, Sibusiso, with that of a commercial peanut paste.

1.5.4 Consumers treated for HIV/AIDS and HIV/TB co-infection associate the sensory properties, colour, smell, texture and taste, of the ready-to-use supplementary food, Sibusiso with that of a commercial peanut paste.

1.6 Study parameters and general assumptions

It was assumed that equipment used to analyse the nutritional composition, colour and texture of Sibusiso was accurate and reliable after calibration. The consumer acceptability study was conducted in the UMgungundlovu District Municipality, KwaZulu-Natal, South Africa. Consumers in the study were female and male adults between the ages of 18 - 55 years. HIV/AIDS and TB treated consumers had to be able to taste, smell and perceive the mouthfeel of a paste and not be

bedridden. It was assumed that consumers in the sensory evaluation understood the sensory properties assessed and were honest and objective when answering questionnaires. Consumers with a peanut allergy were excluded from the consumer acceptability study.

1.7 Abbreviations

AOAC	Association of Official Analytical Chemists International
ART	Antiretroviral therapy
ARV	Antiretroviral drugs
BMI	Body Mass Index
CDC	Centers for Disease Control and Prevention
DOTS	Directly Observed Treatment Short-course
EER	Estimated Energy Requirements
FAO	Food and Agriculture Organization
FIVIMS	Food Insecurity and Vulnerability Information Mapping System
GOTG	Gift of the Givers Foundation
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
HPLC	High-Performance Liquid Chromatography
INP	Integrated Nutrition Programme
KZN	KwaZulu-Natal
MUAC	Mid-upper arm circumference
NDF	Neutral Detergent Fibre
NGO	Non-Governmental Organisation
NPO	Non-Profit Organisation
PEM	Protein-Energy Malnutrition
PLWHA	People Living With Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
RCQHC	Regional Centre for Quality of Health Care
RDA	Recommended Dietary Allowance
RUSF	Ready-To-Use Supplementary Food
RUTF	Ready-To-Use Therapeutic Foods
SAVACG	South African Vitamin A Consultative Group

SCN	Standing Committee on Nutrition
SPSS	Statistical Package for Social Sciences
TB	Tuberculosis
UKZN	University of KwaZulu-Natal
UNICEF	The United Nations Children's Fund
USAID	United States Agency for International Development
WHO	World Health Organization
WFP	World Food Programme

1.8 Definitions

Antiretroviral drugs: Drugs that act against a retrovirus such as HIV, inhibiting its multiplication at different stages of its life cycle (Stedman 2008).

Healthy consumer: For the purpose of this study it was an individual who presented no signs or symptoms of illness and had not been diagnosed with or on treatment for any chronic diseases, including HIV or TB.

Malnutrition: Imbalance, excess or lack of proper nutrient consumption leading to overnutrition or undernutrition [World Food Programme (WFP) 2012].

Opportunistic infection: An infection that results when pathogens take advantage of a weakened immune system, especially in the presence of diseases such as HIV (AIDS.org 2012).

Quality: For the purpose of this study quality was assessed by assessing the nutritional composition, colour and texture of Sibusiso.

Ready-to-use supplementary food: High energy peanut based pastes fortified with high levels of nutrients during processing, higher than in the normal fortification process, it is used for the prevention of acute malnutrition or chronic malnutrition (Latham, Jonsson, Sterken & Kent 2011).

Ready-to-use therapeutic food: It is a high energy and nutrient-dense food or food product with a similar nutritional profile as that of the F-100 known to have special therapeutic benefits, generally used in emergency situations and produced for treatment of severe acute malnutrition (Latham *et al* 2011; Collins & Sadler 2002).

Side effects: Any reaction to or consequence of a medication or therapy. Usually, although not necessarily, the effect is undesirable and may manifest itself as nausea, dry mouth, dizziness, blurred vision, discolored urine or tinnitus (Anderson 2009).

Tuberculosis: A disease that results from an infection with an organism called mycobacterium tuberculosis, the tubercle bacillus, which can affect almost any tissue or organ of the body, it mostly affects lungs (Avert 2012).

1.9 Outline of the dissertation

The lay out of the dissertation is as follows:

Chapter 1: Introduction, the problem and its setting

Chapter 2: Literature review

Chapter 3: Methodology

Chapter 4: Results

Chapter 5: Discussion

Chapter 6: Conclusions and recommendations

This dissertation was referenced according to the guidelines used in the Discipline of Dietetics and Human Nutrition, University of KwaZulu-Natal, Pietermaritzburg.

CHAPTER 2
LITERATURE REVIEW

2.1 INTRODUCTION

In this chapter the prevalence of HIV and TB globally and in South Africa, its effect on food intake, the nutritional status of consumers and the nutritional needs of HIV/AIDS and TB infected consumers will be reviewed. Available interventions to alleviate malnutrition, HIV and HIV/TB co-infection and limitations of these interventions that led to the provision of ready-to-use supplements to HIV/AIDS and HIV/TB co-infection treated consumers during routine clinic visits will be reviewed. The effects of these supplements on the nutritional status and their acceptability to the targeted consumers will also be reviewed.

2.2 PREVALENCE OF HUMAN IMMUNODEFICIENCY VIRUS AND TUBERCULOSIS

Globally and specifically in SA, TB has been listed among the top ten causes of illnesses, death and disability and is the only infectious, curable disease accounting for the most deaths (Coovadia, Jewkes, Barron, Sanders & McIntyre 2009; Dye 2006; Davies 2003). Approximately 9.4 million TB cases were reported in 2009 globally, representing an annually increasing rate of 137 cases among every 100 000 persons reported (WHO 2010). Asia and Africa were reported to have the most new TB cases, with 55% and 30% cases, respectively. South Africa is the third leading country in the world with 0.40 - 0.59 million TB cases after India with 1.6 - 2.4 million and China with 1.1 - 1.5 million cases (WHO 2010). This is due to the high prevalence of HIV/AIDS which increases vulnerability to TB infection (Corbett, Watt, Walker, Maher, Williams, Raviglione & Dye 2003).

The mortality rate of HIV/TB co-infected individuals in Africa has been reported to be more than 20 times higher than in the rest of the world (WHO 2010). A person infected with HIV has a tenfold risk of developing TB compared to the uninfected (Sudarsanam, John, Kang, Mahendri, Gerrior, Franciosa, Gopal, John, Wanke & Muliyil 2011). HIV infected individuals have a

compromised immune system which exposes them to opportunistic infections such as TB (Lategan, Steenkamp, Joubert & Le Roux 2010).

It was reported that approximately 30 - 50% of HIV infected individuals will later develop active TB while among TB infected individuals, 75% is HIV positive (WHO 2011a; Frieden, Sterling, Munsiff, Watt & Dye 2003). There is difficulty and delay in diagnosing TB among HIV infected people and faster progression of TB in HIV infected individuals. Among the new TB cases reported in 2009 globally, 13% of 9.4 million were HIV positive. The WHO (2011a) reported that of 1.7 million death cases due to TB, 400 000 were HIV infected. The association between TB and HIV is serious as the high prevalence of people living with HIV presents a challenge in managing TB (WHO 2011a; WHO 2010).

The increasing prevalence of HIV/TB co-infection is notable in Africa where the number of TB infected people with HIV is more than 60% in Botswana, Zambia, Zimbabwe and South Africa (Frieden *et al* 2003). South Africa is the leading African country with the largest number of co-infected adults of 2 million, followed by Nigeria with 0.9 million adults (WHO 2011b; Frieden *et al* 2003). The HIV/TB co-infection pandemic coupled with malnutrition has become a serious health problem in South Africa referred to as "triple trouble" (Chaparro & Diene 2009). It was reported that individuals between the ages of 15 - 49 years were the most affected by the HIV/TB co-infection (Frieden *et al* 2003). KwaZulu-Natal, Gauteng and Mpumalanga in South Africa are the leading provinces with the number of co-infected individuals because of the fast-growing rate of the HIV infection (Fourie 2006). Previously, the Western Cape Province had the highest rates of TB but has now been replaced by KwaZulu-Natal due to the poor TB programme performance indicators (DOH 2007).

The high HIV and TB epidemic in South Africa is associated with the past oppressive era the country faced. Until 1994, the apartheid era created social, economic and environmental conditions favourable to the development of TB and HIV transmission (Sudarsanam *et al* 2011). Some of these conditions were overpopulation in shacks, migrant labour and dysfunctional health systems for the black population (Jinabhai, Coovadia & Abdool-Karim 1986). During the apartheid era, in the first half of the 20th century, the majority of black people migrated to big cities to work and were forced to live in overcrowded, poorly ventilated, single-sex hostels. These places had prostitutes

known as ‘town wives’ who provided their service to workers. The spread of TB and HIV transmission increased as workers habitually visited families and wives in rural areas (Kark 2003; Packard 1987). It is because of this history that South Africa is still facing the HIV and TB pandemic to date (Karim, Churchyard, Karim & Lawn 2009). HIV is commonly spread via heterosexual sex and through mother-to-child transmission (Avert 2011). As a strategy to fight the high HIV/TB co-infection pandemic, the South African National AIDS Council (SANAC) called for the integration of care for both diseases at one hospital or clinic visit (SANAC 2011). According to SANAC people living with HIV with a CD4 count of < 350 cells/mm or have severe HIV disease irrespective of the CD4 count qualify to receive the antiretroviral therapy (ART) [Kaiser Family Foundation (KFF) 2011].

2.3 NUTRITIONAL REQUIREMENTS IN HUMAN IMMUNODEFICIENCY VIRUS

Nutritional requirements of people living with HIV/AIDS (PLWHA) depend on the disease stage according to the WHO classification of HIV stages and on the presence or absence of symptoms and side effects. The protein, fat, micronutrient and energy requirements of infected individuals are reviewed in the next section.

2.3.1 Energy requirements

HIV patients have increased resting energy expenditure (REE) even when on treatment. This increases energy requirements due to an increased amount of energy used for HIV infection and opportunistic infections (Castleman, Seumo-Fosso & Cogill 2004; FANTA 2004; WHO 2003). It has been reported that energy requirements in people living with HIV at the asymptomatic stage (WHO stage 1) is 10% higher than that of healthy, uninfected individuals of the same age, gender and physical activity level. This energy requirement should be met to maintain the body weight of HIV infected patients without manifested HIV symptoms (WHO 2003). Furthermore, at the symptomatic stage (WHO stage 2 and above), energy requirements are further increased by 20% - 30% more than that of healthy, uninfected individuals of the same age, gender and physical activity level (Avert 2011; FANTA 2004). This is because of the increased energy demand due to opportunistic infections and diseases. Fawzi, Msamanga, Spiegelman & Hunter (2005) reported that opportunistic infections can increase energy requirements by 50 - 100%. However, such high requirements may not be attainable during the period of illnesses (WHO 2003). This may be due to

the lack of adequate and nutrient-rich food intake, unavailability of nutrient-rich foods and metabolic changes such as; nutrient malabsorption and loss due to damaged intestinal cells, and impaired transport, storage and utilization of some nutrients (Castleman *et al* 2004). Proteins, fats and carbohydrates provide the body with energy. Carbohydrates are the major source of energy for the brain and nervous system, sustaining the digestive system and maintaining lean muscles. Digestible carbohydrates combined with protein and fats add bulkiness to food and contribute the most to energy for the body. Indigestible carbohydrate such as fibre is important for other vital functions but provides little or no energy (Sizer & Whitney 2008, p104).

2.3.2 Protein Requirements

The WHO reported that there is inadequate data about increased protein requirements in people living with HIV/AIDS (WHO 2003). The protein needs of PLWHA are the same as that of healthy, uninfected individuals of the same age, gender and physical activity level (Avert 2011). This is so until further research is done to determine the optimal protein requirements during the course of the HIV disease.

2.3.3 Fat requirements

There is no data to suggest any difference in fat requirements between PLWHA and that of uninfected people (WHO 2003). However, antiretroviral (ARV) drugs positively and negatively interact with foods that are high in fat, which suggests the importance of understanding specific interactions and consequences of specific drugs. For example, an intake of foods high in energy, fat and protein may decrease the absorption of protease inhibitor (PI) drugs such as indinavir (Pronsky, Meyer & Fields-Gardner 2001). On the other hand, such foods may increase the bioavailability of non-nucleoside reverse transcriptase inhibitor (NNRTI) drugs such as tenofovir. Therefore, it is crucial to educate and advise patients about appropriate times to take specific drugs and fatty foods (FANTA 2004). This is important to aid better nutrient utilisation, metabolism, distribution or excretion and the effectiveness of specific drugs (Castleman *et al* 2004).

2.3.4 Micronutrient requirements

The micronutrient requirements of HIV infected adults are the same as that of healthy uninfected individuals of the same age, sex and physical activity level. Patients should preferably obtain sufficient micronutrients from an adequate diet (WHO 2003). However, pre-existing multiple micronutrient deficiencies of vitamins and minerals such as vitamin A, B-complex, C, E, selenium and zinc common in HIV infected individuals raises the need to consume multiple micronutrient supplements. Failure to meet the micronutrient requirements amongst other things increases the progression of HIV to AIDS (FANTA 2004). In order to meet the increased nutritional requirements it is vital to consume foods high in energy and micronutrients such as meat, fish, poultry, eggs, milk and dairy products, vegetables and fruits (Allen *et al* 2006). However, PLWHA from undeveloped areas fail to meet the increased nutrient needs because of poor diet consumption (Castleman *et al* 2004; FANTA 2004).

2.4 MALNUTRITION IN HIV AND TB INFECTION AND INTERVENTIONS TO ALLEVIATE MALNUTRITION

HIV, TB and malnutrition are inseparable, referred to as "triple trouble" (Chaparro & Diene 2009). Malnutrition, specifically undernutrition is common among HIV/AIDS and TB infected people because of physiological, socio-economic and psychosocial factors that accompany the infection. Reduction of food intake is the most important factor in disease-related malnutrition (Saunders & Smith 2010), because it weakens the immune system opening a gap for opportunistic infections. Infections such as TB affect appetite negatively due to changes in the secretion of cytokines, glucocorticoids, peptides, insulin and insulin-like growth factors which leads to decreased food intake (Avert 2011; Suttajit 2007). Malnutrition is also worsened by the reduction of nutrient absorption and efficiency of utilization due to the injured lining of the intestines and increased energy expenditure during illnesses (Avert 2011; Hsu, Pencharz, Macallan & Tomkins 2005).

2.4.1 Macronutrient deficiencies

There is an increase in energy use and need for an HIV infected individual. HIV infected individuals commonly experience extreme weight loss and muscle wasting especially in food

insecure sub-Saharan Africa where the diet taken is generally low in energy and has no diversity (Sztam, Fawzi & Duggan 2010). This accelerates disease progression, morbidity and mortality due to protein energy malnutrition (Hsu *et al* 2005). The resting metabolic rate (RMR) increases during illness and HIV infected adults lose approximately 10% or more calories at rest or even higher in the presence of other infections. Reduced protein and energy intake, physical activity, growth and diet-induced thermogenesis also contribute to weight loss and wasting (Hsu *et al* 2005). More than 10% weight loss is linked to a four-to-six fold higher risk of death for many HIV/AIDS infected patients. This may be even worse in cases of HIV/TB co-infection (Avert 2011; Colecraft 2008). The effect is worsened by poverty, poor environmental conditions and low economic productivity (Gillespie & Kadayila 2005).

2.4.2 Micronutrient deficiencies

Micronutrients are important for the maintenance and function of the immune system (Cunningham-Rundles, McNeeley & Moon 2005; Scrimshaw & SanGiovanni 1997); however, their deficiency is commonly notable at the advanced stage of the HIV disease which increases HIV progression, transmission and mortality (Kupka, Msamanga, Spiegelman, Morris, Mugusi, Hunter & Fawzi 2004). The lower serum concentration of micronutrients among HIV infected individuals may persist even during the intake of ART because of decreased food intake, increased nutrient needs, gastrointestinal malabsorption and body redistribution (Drain, Kupka, Mugusi & Fawzi 2007; Shevitz & Knox 2001). Deficiencies of thiamin, selenium, zinc, and vitamins A, B_3, B_6, B_{12}, C, D, and E have been reported among HIV infected individuals. There is an increase in micronutrient deficiencies among HIV and TB co-infected individuals which subsequently increases disease progression and wasting (van Lettow, Harries, Kumwenda, Zijlstra, Clark, Taha & Semba 2004). It has been reported that micronutrient deficiencies are common among HIV positive people even before the infection, which worsens malnutrition and disease progression (FANTA 2004).

There is a need to consume sufficient amounts of macronutrients and micronutrients by HIV infected individuals because of the negative effect the infection has on the nutritional status (Castleman *et al* 2004; FANTA 2004). The presence of opportunistic infections and side effects coupled with poor food intake leads to increased nutritional requirements (RCQHC 2004). Poor

diets consumed by PLWHA from undeveloped areas fail to meet the increased nutritional requirements thus promoting disease progression (Castleman *et al* 2004; FANTA 2004). According to FANTA (2004), nutritional support for PLWHA helps to manage HIV related complications, promotes good response to medical treatment and improves the quality of life (Castleman *et al* 2004). Suitable food supplements enriched with macro- and micronutrients to complement the diet are essential to improve the nutritional status of HIV and TB infected individuals (Lategan *et al* 2010). South Africa is faced with the challenge of identifying appropriate and affordable interventions to lower the prevalence of malnutrition among HIV infected individuals. Current malnutrition interventions are reviewed next.

2.4.3 Nutrition interventions to alleviate malnutrition in HIV and TB infection

In 1995, the South African Department of Health developed an Integrated Nutrition Programme (INP) aimed at ensuring optimal nutrition, thus preventing and alleviating malnutrition among the general public (DOH 1998). The INP has seven focus areas with different objectives to alleviate malnutrition. The following focus areas aim to eliminate malnutrition among adults in the general public: firstly, contribution to household food security; secondly, disease-specific nutrition support, treatment and counselling; and thirdly, micronutrient malnutrition control (DOH 2001).

The first focus area focuses on implementing any nutrition-related activities that may improve access to adequate food of good quality to meet dietary needs of the entire household at all times (DOH 2001). The second focus area, disease-specific nutrition support, treatment and counselling, aims at lowering the prevalence of low birth weight babies. It also aims at lowering underweight during pregnancy, malnutrition and the mortality rate of under 5 year olds and diseases of lifestyle associated with nutrition (Steyn & Labadarios 2002). Thirdly, the micronutrient malnutrition control strategy, aims at eliminating micronutrient deficiencies of nutrients by implementing supplementation programmes such as the vitamin A supplementation programme, food fortification and promotion of dietary diversification and education (DOH 2001).

The INP focus areas do not account for the increased nutrient needs of HIV and TB infected people. Therefore, the DOH, Social Development and Agriculture are collaborating in a programme that includes the National Emergency Food Programme (NEFP) and the Nutritional Supplementation Intervention strategy for TB and HIV-infected individuals (Anon 2003). Both programmes aim at

eradicating malnutrition and food insecurity by giving fortified food supplements and micronutrient supplements (pill or syrup form) to all people with TB, HIV and AIDS (Figure 2.1) (Anon 2003). A reduction in the impact of opportunistic infections and symptoms such as oral thrush, diarrhoea and fatigue has been reported due to the provision of supplements at clinics (Oketch *et al* 2011). Specialized highly fortified ready-to-use supplements have been proven effective in improving the nutritional status of consumers with severe chronic illnesses such as HIV/AIDS when concurrently given with the ART in other African countries (Ahoua, Umutoni, Huerga, Minetti, Szumilin, Balkan, Olson, Nicholas & Pujades-Rodríguez 2011; Ndekha, van Oosterhout, Saloojee, Pettifor & Manary 2009a; Ndekha, van Oosterhout, Zijlstra, Manary, Saloojee & Manary 2009b; Ndekha, Manary, Ashorn & Briend 2005).

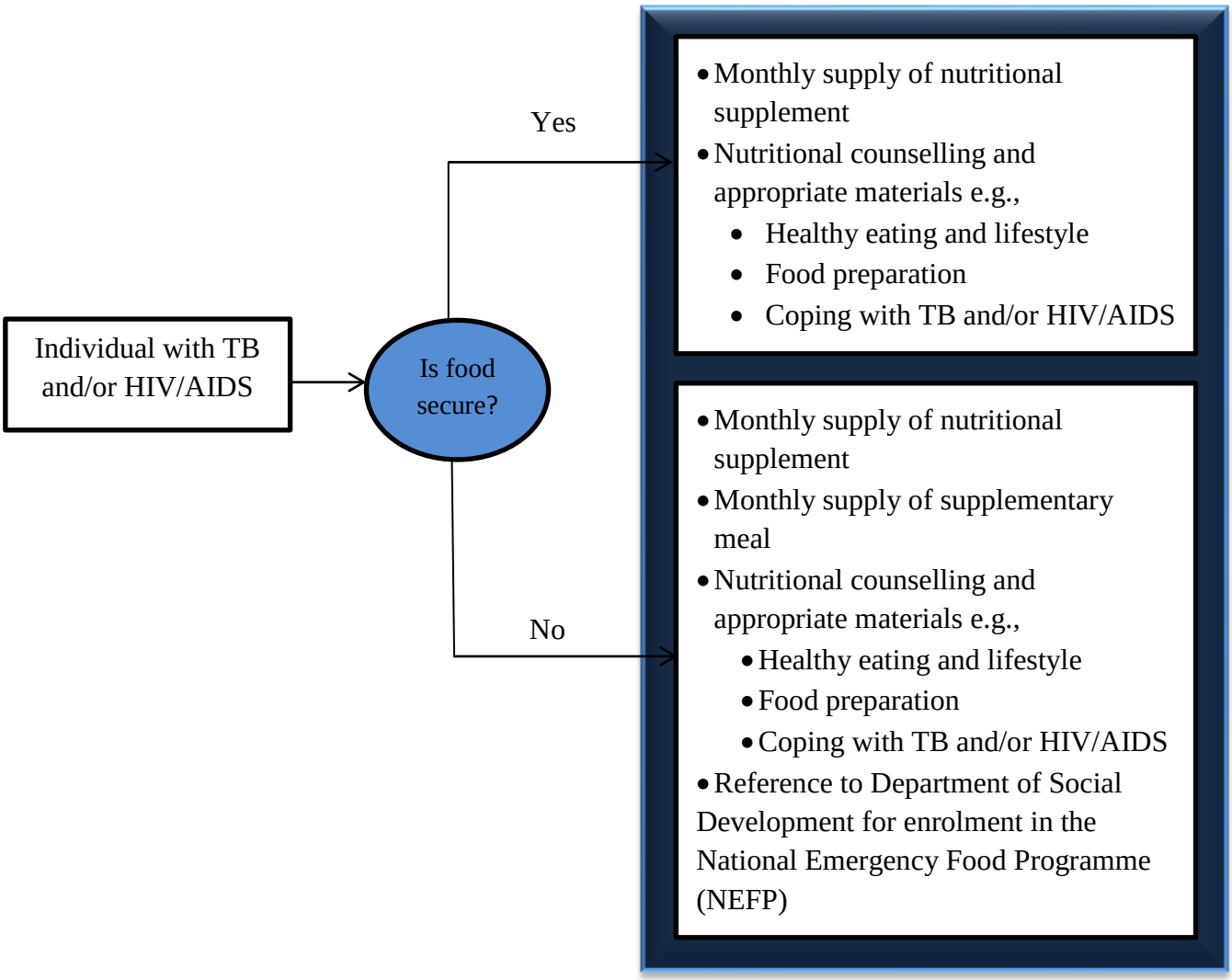

Figure 2.1: Nutritional response to malnutrition among HIV and AIDS (Anon 2003)

2.5 THE EFFECT OF HIV/AIDS AND TB TREATMENT ON NUTRITIONAL STATUS

A good combination of adequate nutrition and treatment for HIV/AIDS and TB is crucial to improve the nutritional status and revitalise the weakened immune system, thus lowering the likeliness of co-infections. It also manages opportunistic infections, and delays disease progression, thus improving the quality of life and survival (Chandra 1991). Furthermore, it is crucial for the improvement of adherence to treatment (Chandra 1991). However, Castleman *et al* (2004) reported that it is difficult to meet the nutritional requirements of HIV infected individuals because of metabolic changes such as; nutrient malabsorption and loss due to damaged intestinal cells, and impaired transport, storage and utilisation of some nutrients. These changes are accompanied by poor appetite, oral sores, rash, nausea, diarrhoea, fatigue, chills, fever, night sweats, loss of taste sensation, and weight loss (Avert 2011; Norman, Pichard, Lochs & Pirlich 2008). Such changes further affect the ability to meet nutritional requirements negatively especially because many PLWHA fail to acquire food with sufficient nutrients. In addition to physiological changes that take place in the body infected with HIV, the treatment also presents side effects that directly affect food intake and adherence to medical treatment (United States Agency for International Development (USAID) 2008; Castleman *et al* 2004; Macallan McNurlan, Kurpad, de Souza, Shetty, Calder & Griffin 1998). Common treatment side effects are rash, dizziness, anorexia, nausea, vomiting, diarrhoea, dyspepsia, abdominal pain, flatulence, dry mouth, loss of taste, constipation, stomatitis, anaemia, fever, and pancreatitis depending on the ARV drugs taken (Table 2.1). All of these changes have an influence, mostly negative, on the nutritional status as dietary needs are more increased (RCQHC 2004).

Table 2.1: Side effects of commonly used ARVs (RCQHC 2004)

ARV DRUG	SIDE EFFECTS
Zidovudine (ZDV)	Loss of appetite, anaemia, nausea, vomiting, fatigue, constipation, fever, headaches, changed taste, weight gain.
Nevirapine (NVP)	Nausea, vomiting, fever, weight loss.
Efavirenz (EFZ)	High blood fat levels, loss of appetite, nausea, vomiting, diarrhoea, flatulence, dizziness.
Lamivudine (3TC)	Nausea, vomiting, diarrhoea, anaemia, tiredness, abdominal pain, loss of appetite.
Stavudine (d4T)	Nausea, vomiting, diarrhoea, fever, loss of appetite, lipodystrophy, abdominal pain.

2.6 USE OF SIBUSISO, A READY-TO- USE SUPPLEMENTARY FOOD TO ALLEVIATE MALNUTRITION IN HIV AND TB PATIENTS

2.6.1 Background of the development of ready-to-use supplementary foods to alleviate malnutrition

In 1999, the WHO, WFP, United Nations Standing Committee on Nutrition (SCN) and the United Nations Children's Fund (UNICEF) modified their guidelines for the management of severe malnutrition (WHO 2007) by giving therapeutic milk to severely malnourished children between 6 - 36 months of age. The therapeutic milk was successful in alleviating malnutrition and was effectively employed in hospitals (Scherbaum *et al* 2009; Maleta, Kuittinen, Duggan, Briend, Manary, Wales, Kulmala & Ashorn 2004). However, problems were encountered with the reconstitution of this product. There was the need for clean safe water and supervision during reconstitution at the hospital and undesirable bacterial growth occurred when left unrefrigerated (Scherbaum *et al* 2009; WHO 2007). The product also targeted severely malnourished children only (Isanaka, Roederer, Djibo, Luquero, Nombela, Guerin & Grais 2010), provided excess nutrients for moderately malnourished children, was expensive to produce and had a limited production capacity (Michaelsen, Hoppe, Roos, Kæstel, Stougaard, Lauritzen, Mølgaard, Girma &

Friis 2009; Ashworth & Ferguson 2009; de Pee & Bloem 2008). These weaknesses led to the development of ready-to-use therapeutic foods (RUTFs) which have been proven to be acceptable to children and effective in alleviating malnutrition and from which ready-to-use supplementary foods (RUSFs) were developed (Isanaka *et al* 2010). RUSFs are low nutrient containing supplements developed to prevent and alleviate malnutrition among children aged 6 to 36 months (Scherbaum *et al* 2009; WHO 2007) and adults (Ndekha *et al* 2009a).

Ready-to-use supplementary foods are produced in various forms such as compressed bars, biscuits and pastes (de Pee & Bloem 2008). In this dissertation, the focus will be on pastes. RUSFs are made up of peanut or soya paste, milk or whey powder, vegetable oil, sugar and minerals and vitamins, providing 23 kJ/g or more of energy (Maleta *et al* 2004). The peanut based RUSFs have several advantages compared to other supplements. These include the low water activity in the product which inhibits bacterial growth even when accidentally exposed to contaminants (Briend 1997); the supplement can be kept unrefrigerated for a number of months (GOTG 2009). It also does not require any cooking which spare heat sensitive vitamins and does not require any labour, fuel and water when given to people thus appropriate for poor households. Moreover, it can also be issued at household level to people experiencing natural disasters and wars to meet the nutritional needs and prevent malnutrition in the affected area (Manary, Ndkeha, Ashorn, Maleta & Briend 2004).

Compared with therapeutic foods, RUSFs provide less energy when combined with the local diet in a small daily dose of the spread (Isanaka *et al* 2010). This justifies the use of the spread as a preventative measure instead of treatment (Isanaka *et al* 2010). According to Collins & Henry (2004) the process of producing this product is simple as local crops and basic technologies present in developing countries can be used. The production of RUSFs has been said to be less costly compared to the production of RUTFs which has led to an increased interest to use the product in nutrition programmes (Isanaka *et al* 2010).

2.6.2 Existing ready-to-use supplementary foods used to alleviate malnutrition in HIV and TB adult patients

The first ready-to-use therapeutic food, *Plumpy'nut*®, was developed in 1996 with the intention to treat severe acute malnutrition in children replacing the WHO F-100 (Troubé 2012; Nutriset 2010). This RUTF is a dark brown peanut based paste which targets children and adults. It is produced in 92 g sachets and comprises of a peanut paste, sugar, vegetable fat and skimmed milk powder, whey powder, maltodextrin, cocoa and lecithin enriched with vitamins and minerals. The paste provides 500 kcal (2093.4 kJ) of energy per 92 g (Nutriset 2010).

One of the ready-to-use therapeutic supplements produced in South Africa is *Imunut*®. It is enriched with protein, essential vitamins, minerals, energy and essential fatty acids and is targeted at children with acute malnutrition. It is creamy and brown in colour made up of milk powder, sucrose, vegetable oil, peanuts, emulsifier and glucose powder (Diva 2011). These supplements were produced according to the WHO/UNICEF/WFP/SCN specifications for RUTFs which state that a supplement should have a soft texture and should be crushable. Supplements should also taste good, be appropriate for children to eat and at least half of their protein should come from milk products (Anon 2012; WHO/WFP/SCN/UNICEF 2007). A peanut based ready-to-use supplementary food, *Plumpy' doz*®, was developed and produced in Normandy, France to alleviate acute malnutrition among children between 6 - 36 months of age (Nutriset 2010). This supplementary food was proven acceptable to children aged 6 to 36 months of age from Niger (Isanaka *et al* 2010).

2.6.3 The effect of ready-to-use supplements on malnutrition

The provision of a highly fortified ready-to-use food to malnourished children from Chad, Ethiopia, Senegal and Malawi resulted in an improved nutritional status (Isanaka *et al* 2010; Maleta *et al* 2004; Collins & Sadler 2002; Briend, Lacsala, Prudhon, Mounier, Grellety & Golden 1999). The positive effect of these highly fortified foods on children was associated with the fact that these were developed to suit children's preferences. The product, *Plumpy'nut*®, was later modified for adults and was also proven to improve the nutritional status of HIV infected adults in Malawi, Uganda and Kenya. The consumption of the supplement was associated with changes in the mid-upper arm circumference (MUAC), weight, body mass index (BMI), oedema, HIV clinical stage,

presence of diarrhoea and morbidity rate (Leyna, Mnyika, Mmbaga, Hussain, Klouman, Holm-Hansen & Klepp 2007; Wheeler 1999; Kotler 1994).

2.6.4 Acceptability of existing ready-to-use supplementary foods by patients

Even though RUTFs have been proven effective in improving the nutritional status of HIV malnourished children and adults (Ndekha *et al* 2009a; Ndekha *et al* 2009b; Ndekha *et al* 2005), there is limited data on the acceptability of this food especially among adults on treatment for HIV/AIDS and HIV/TB co-infection (Dibari, Bahwere, Le Gall, Guerrero, Mwaniki & Seal 2012).

In Kenya, a ready-to-use therapeutic food was given to HIV infected adults on ART to test its acceptability. The study was conducted in Nyanza Province which had the highest prevalence of HIV infected people (15.3%) in 2007. Fifty-six (56) HIV infected adults (28 HIV infected, 18 HIV/TB co-infected, 2 carers and 8 health staff), aged 15 years or older with a BMI of <17 kg/m^2 and/or a MUAC of <185mm were supplied with four sachets of *Plumpy'nut*®. The provision of the supplement was part of a food programme for HIV people by the Kenyan Minister of Health. In this study, three qualitative tools were used to collect data namely; the focus group discussions, semi-structured interviews and directly undisturbed observations of the distribution and consumption of the product in the HIV/TB ward (Dibari *et al* 2012). It was reported that participants perceived *Plumpy'nut*® to be medicinal due to its recovery effect and its ability to give energy, enabling patients to resume normal household duties rapidly. Recipients felt stigmatised as the food was given with HIV treatment and was thus considered a 'medical drug prescription' (Dibari *et al* 2012; Ndekha *et al* 2009).

The product was said to be unacceptably salty in taste which led to some patients mixing it with other foods which was against the instructions of taking the food. Patients also mixed the food with other foods because of its monotonous nature which was boring in their diet. This however compromised the efficacy of micro- and macronutrients and delayed nutrition rehabilitation. The product was reported to be too sweet by some patients who suggested the addition of lemon juice. Patients also had a problem with the thick texture and suggested an improvement to a smoother texture so that the supplement would be easily swallowed (Dibari *et al* 2012). The taste of the supplement was associated with vomiting and nausea by some patients. This was said to be due to

symptoms experienced by all patients on ARV treatment or maybe because the product was originally developed to meet preferences of severely malnourished children (Dibari *et al* 2012; FANTA 2004).

In addition, oral thrush experienced by HIV patients also negatively affected the acceptability of the supplement by one out of 40 interviewed patients. One of the recommendations received from the study was that the swallowing capacity of patients should be assessed and verified before supplements are given because hospitalised patients could not solely eat the RUTF. These patients had to mix the supplement with water or porridge because of its thick consistency. In addition, therapeutic foods traditionally developed for malnourished children should be improved to meet the palatability preferences expressed by adult patients (Dibari *et al* 2012; Koethe, Chi, Megazzini, Heimburger & Stringer 2009).

Another study was conducted in the central region of Malawi in 2005 among 63 wasted HIV/AIDS infected adults, aged 29 to 44 years. These participants were at stage 3 of HIV according to the WHO classification system of HIV, had a MUAC of <210mm, a BMI of <17 kg/m^2 and had bilateral pitting oedema in their feet or legs. More than 13.3% of the participants had started taking ARVs. The study was conducted to assess the acceptability of a novel chickpea and sesame seed ready-to-use spread among wasted ART patients. The supplement was given at the beginning of taking ARVs and continued for 14 weeks. On admission to the study, participants were experiencing symptoms such as fever, diarrhoea, oral thrush, nausea and dermatitis, which are known to affect food intake. Patients were given the supplement with a 960 mg daily dose of co-trimoxazole prophylaxis to treat minor opportunistic diseases. The acceptability of the RUTFs was assessed through discussions with patients and caregivers. People living with HIV/AIDS accepted the locally produced supplementary food. However, patients associated the supplement with minor gastrointestinal symptoms that did not affect the product intake as such symptoms were found common among HIV infected individuals. It was found that patients from the study continued taking the supplement because its benefits outweighed its negative effects (**v**an Oosterhout, Ndekha, Moore, Kumwenda, Zijlstra & Manary 2010; Bahwere, Sadler & Collins 2009).

No data was found on the consumer acceptability of ready-to-use supplementary or therapeutic foods in South Africa especially among consumers treated for HIV/AIDS and HIV/TB co-infection. It is important to assess product sensory characteristics to identify characteristics that may be unacceptable to consumers so that the product may be improved by the manufacturer. It is also important to investigate this to determine whether the targeted group will use the product or not and also to estimate the market strength of the product. In a study conducted in the United States, it was reported that the success rate of a new product in the market is 17%, which suggested an 83% failure rate if consumer research is not done (Sloan 1994).

2.6.5 Sibusiso, a ready-to-use food supplement

Sibusiso is a ready-to-use supplementary food that was produced by a South African NGO, Gift of the Givers foundation, to prevent malnutrition during illnesses and natural disasters. It is a groundnut-soya based paste which makes it different from the existing RUSFs (GOTG 2009). The use of soya improves protein quality in a product as soya beans are known to have the highest protein content among cereals and legumes (Yeh, Resurreccion, Phillips & Hung 2002). Sibusiso is also made with soya milk extract, soya protein, oil (soya oil), sugar, vanilla flavouring and a vitamin and mineral premix. Therefore, it is high in energy, protein and micronutrients. The product is suitable for children from 9 months old to the elderly. It has been used by the South African Department of Health as an effective nutrient supplement for individuals experiencing malnutrition, TB and HIV and AIDS (GOTG 2009). Although Sibusiso has the potential to improve the nutritional status of malnourished patients, especially HIV and TB patients its sensory acceptability among these patients has not been studied. The main ingredients used to make Sibusiso, such as peanuts and soya may influence consumer acceptability of the product. Physical properties such as colour and texture of Sibusiso which are influenced by the chemical composition or ingredients used may also influence consumer acceptability of a product (Costell, Tárrega & Bayarri 2010; Pohjanheimo 2010). It has been reported that consumers with HIV/AIDS and TB experience changes in sensory activities which negatively affects food perceptions and this is worsened by side effects from the medication (Saunders & Smith 2010). Therefore, it is important to assess the sensory properties of Sibusiso by HIV/AIDS and TB treated consumers.

In addition, it is important to assess the nutritional composition of Sibusiso in order to confirm whether the product meets the WHO/UNICEF/WFP/SCN specifications for ready-to-use supplementary foods. According to Elmadfa & Meyer (2010), it is important to know the nutritional composition of a product to identify how the product would meet specific requirements in the diet of the target group. Knowing the nutritional composition of the product also helps to understand how the product components may influence the planning of clinical and therapeutic diet (Elmadfa & Meyer 2010). Sibusiso is marketed as a high energy and protein containing product (16 g/100 g). However, its protein quality judged by the amino acid profile has not been reported, therefore, it is important to know the quality of the protein and other nutrients contained in Sibusiso. This is important as the product targets consumers with high nutritional needs. The knowledge of the nutritional composition of Sibusiso may also determine whether nutrition and health claims made about the product are valid (Gillespie, Kulkarni & Daly 1998). Factors that influence the acceptability of a food product are reviewed in the next section.

2.7 FACTORS AFFECTING FOOD ACCEPTABILITY

Acceptability of a food product by consumers depends on its intrinsic factors such as chemical and physical properties and extrinsic factors such as: culture; country of origin; price; store name; media; nutrition information and claims (Pohjanheimo 2010; Conner & Armitage 2002, p5). It also depends on sensory and psychological factors as shown in Figure 2.2 (Conner & Armitage 2002, p6). Extrinsic factors generate expectations that can influence consumer behaviour, perception of product quality, purchase intention or product selection (Deliza & MacFie 1996). Intrinsic factors conversely have been reported to have a greater effect on consumer's decision to like or dislike most food products than extrinsic factors. These factors influence the likelihood of consumers purchasing or eating a product (Cardello 1994, p254; Shepherd & Sparks 1994, p204). Common factors that affect the acceptability of ready-to-use supplements are addressed next and physical factors will be discussed first (Conner & Armitage 2002, p5).

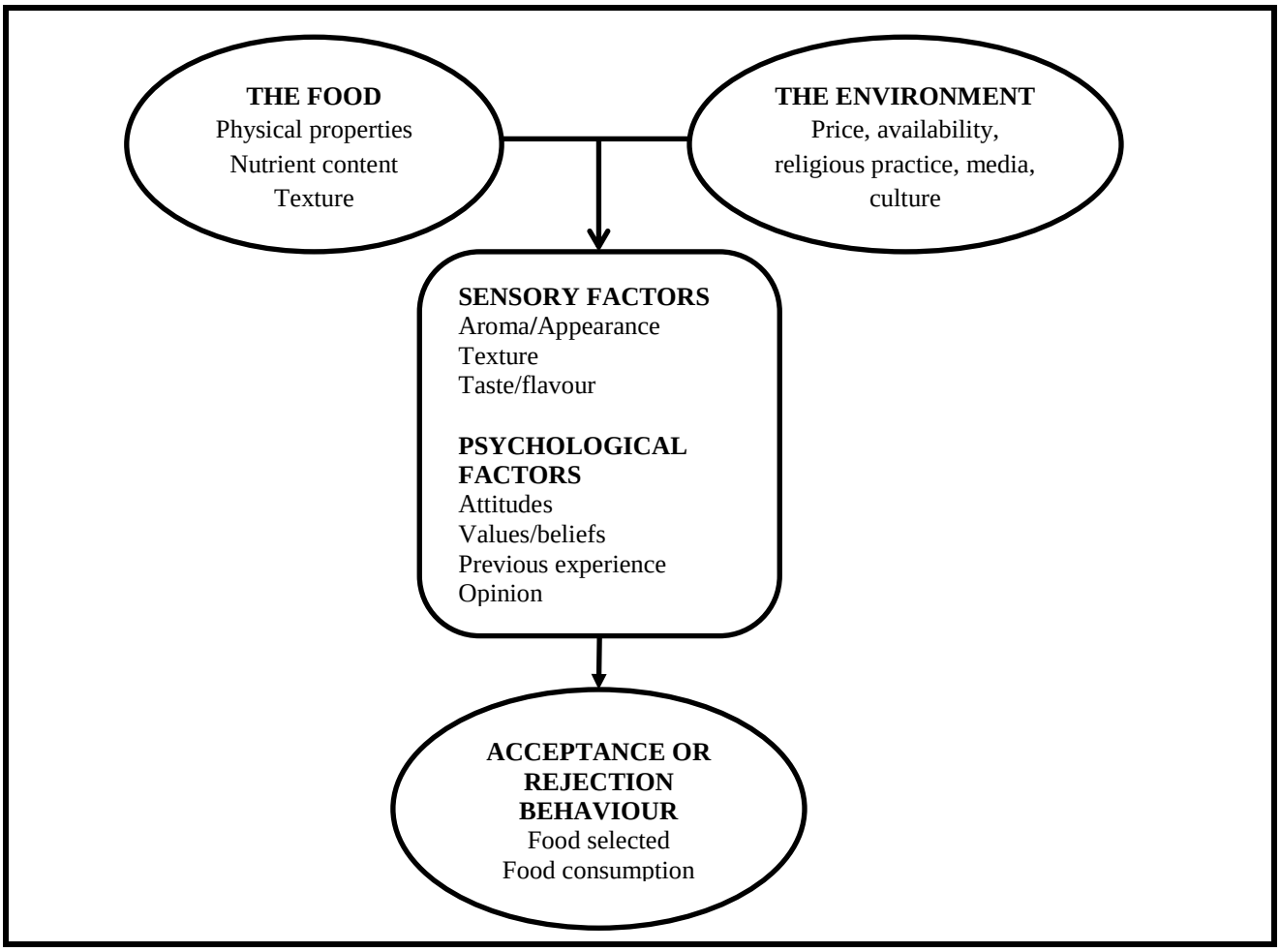

Figure 2.2: Factors that influencing food acceptability (adapted Conner & Armitage 2002, p6).

2.7.1 Physical properties of ready-to-use food supplements

Physical properties such as texture, consistency, colour and viscosity of spreads have to be appropriate for use and meet consumer expectations of how spreads should be. These properties are a manifestation of food chemical properties and composition that identifies a food product. The quality of these properties affects acceptability of food as consumers desire specific properties from specific foods. Generally, pastes such as the studied RUSF, Sibusiso, are solely eaten, used as spreads or added to watery foods which are commonly eaten by vulnerable groups (Briend 2001). These products have a high viscosity that allows the supplement to melt when added to these watery foods (Singh, Castell-Perez & Moreira 2000). Familiar physical properties to consumers increase the level of product acceptability (Heldman 2004). Physical properties of food are perceived and tested using human senses and specific mechanical instruments which assess attributes such as

appearance, texture, viscosity, taste and flavour (Khumalo, Schönfeldt & Vermeulen 2011; Ngqaka 2008). In the next sub-section physical properties such as texture and colour are reviewed.

2.7.1.1 Texture

Texture is the physical and sensory expression of structural, mechanical and external qualities of food. These qualities are assessed using human senses such as sight (visual texture), sound (auditory texture), touch (tactile texture) and kinaesthetic (Szczesniak 2002; Lawless & Heymann 1998, p379). Lawless & Heymann (1998, p380) suggested that for some objects, only one of the human senses may be needed to perceive texture while a combination is required for other objects. Texture is among the most important food attributes following flavour and odour as the level of tolerance of poor texture may be higher than accepting a putrid odour (Szczesniak 2002).

By looking at a food product consumers assess the visual texture which creates expectations of how the tactile texture or the mouth feel should be. This is because of the tendency to associate specific types of texture with certain foods (Conner & Armitage 2002, p13). For example when a consumer looks at a fresh apple, a crunchy texture may be expected however if this expectation is not met the fruit is likely to be unacceptable. Product visual texture is a good indicator of food quality while colour and flavour indicates food safety (Lawless & Heymann 1998, p380).

In addition, consumers like to have control over the food introduced to the mouth. It is important to know whether the food is stringy, sticky or has foreign lumps or hard particles which may introduce fear of choking thus increasing the likeliness of food rejection (Conner & Armitage 2002, p13). Texture has various parameters depending on the structure of a food product. It encompasses tenderness, chewiness and spreadibility (Szczesniak 2002). The importance of texture in the overall acceptability of foods varies with different types of foods. For some foods it is more important while in other foods it may not be as important. For example, it can be a dominant factor for potato chips and the least important factor for bread (Jaworska & Hoffmann 2008). Consumer's liking of texture may also fluctuate with the development of new products or habits. For example, vegetables in the past were preferred overcooked, soft and floury while current consumers prefer firm, juicy and crispy vegetables (Szczesniak 2002). The hardness, consistency or viscosity of ready-to-use pastes may influence acceptability and perceptions of the product by consumers (Dibari *et al* 2012).

The visual and tactile texture of ready-to-use pastes has been associated with that of a commercial peanut butter spread. These spreads have high fat content therefore their textural qualities are likely to be hard or soft, chewy, greasy, viscous, smooth, creamy or crunchy depending on the product (Drewnowski 1987). The association of ready-to-use pastes with peanut butter set expectations for these spreads to be viscous, spreadable and appear like peanut butter. The viscous nature of spreads increases their acceptability to consumers as viscous spreads are commonly associated with higher product quality (Cooper 1987). Not meeting these expectations might lead to a lower evaluation of a product or product rejection by consumers (Jaworska & Hoffmann 2008; Conference Report 2002; Szczesniak 2002). Three novel amino acid-balanced peanut spreads fortified with: (i) 14% non-fat dry milk (NFDM) at a 40% total fat content (PSM); (ii) 19% roasted soybean at a 40.5% total fat content (PSSA) and (iii) 19% roasted soybean at a 44.5% total fat content (PSSB) were produced from Georgia, USA. These peanut spreads were also fortified with vitamin A, B_1, B_2, B_6, C, calcium and iron and had their texture, appearance and flavour profiles tested against that of a control (all peanut spread) to identify any changes and overall acceptability of the products (Yeh *et al* 2002).

The study was carried out among 50 participants from Georgia, USA, 92% of which were Caucasians and 8% Asian. Participants were between the ages 10-54 years and more than 90% of adults in the study had completed college studies or had higher degrees and were employed (Yeh *et al* 2002). More details about the study are included in Table 2.2. Based on the 9-point hedonic scale, consumers rated the texture of the all peanut control spread the highest, followed by similar ratings for PSM and PSSB. When a descriptive test was done, the spread fortified with 19% roasted soybean at a 44.5% total fat content (PSSB) had the stickiest and softest texture compared to other spreads. The all peanut control, PSM and PSSB were also acceptable to consumers with the control being liked the most. The acceptability and the nature of the texture of PSSB were because of high fat content and soy protein in the spread. The spread fortified with 19% roasted soybean at a 40.5% total fat content (PSSA) was not acceptable because of the low fat content, which resulted in low intensity of roasted peanut flavour and high intensities on mouthcoating, mouthdryness, and adhesiveness to teeth (Yeh *et al* 2002).

Table 2.2: Summary of studies on acceptability of ready-to-use locally produced supplements

Study	Objectives	Methodology	Results
1. Yeh *et al* (2002).	1. Determine consumer acceptability of 3 amino acid-balanced peanut spreads fortified with 7 vitamins and minerals, namely: PSM, PSSA and PSSB. 2. Determine flavor and texture profiles.	1. **Sensory evaluation:** 9-point hedonic scale and questionnaire. 2. **Fat:** Crude fat content of peanut, soybean and NFDM powder was extracted with petroleum ether using the Goldfisch apparatus (model 35001) according to AACC method number 30-20. 3. **Protein:** The Dumas method. 4. **Colour evaluation:** XL 800 series Gardner Colorimeter with XL845 circumferential Sensor was used to take Hunter colour values (Pacific Scientific, Bethesda, Md., USA).	1. **Sensory evaluation:** Consumers liked the control and PSM the most; PSSB was rated slightly lower, but not significantly different from PSM. Only PSSA was rated < 6 (neither like nor dislike). 2. **Protein:** All 3 fortified peanut spreads had higher protein content and lower fat content than the control. 3. **Colour:** The colour L* of 3 fortified peanut spreads was higher than that of the control.
2. Mazaheri-Tehrani, Yeganehzad, Razmkhah-sharabiani & Amjadi (2009).	1. Investigate the effect of whole soybean and soynut flour at 0, 5, 15, 20 and 30% (w/w) added to peanut spread formulations by determining measurable quality characteristics as instrumental and sensory analysis.	**1.** **Sensory analysis:** 15 panellists to determine textural characteristics; hardness, cohesiveness, adhesiveness intensity and flavour colour, aroma and preferences using 9-point hedonic scale. 2. **Fat:** Determined by Soxhlet extraction with diethyl ether. 3. **Protein:** Measured by microkjeldal. 4. **Sugar, ash & moisture content:** Measured according to Iranian standard number 5690. 5. **Texture profile analysis:** Universal Texture Analyser (CNS Farnell, UK) connected to a computer programmed with Texture Pro ™ texture analysis software.	1. **Flavour:** Ratings were the same as control for all peanut soy spreads except for Psn20 with the highest score. 2. **Colour and aroma**: No difference was observed between different samples. 3. **Fat:** The control had the highest fat content. 4. **Protein:** Psw30 and Psn30 had the highest protein content. Psn5 had the same protein as the control. 5. **Texture:** Psn30 and Psw30 scored the highest adhesiveness and the control was the least adhesive.

In another study with similar findings, a peanut spread was replaced by two types of soy flour at 4 levels (w/w), (i) Whole soybean flour at 5 (Psw5), 15 (Psw15), 20 (Psw20) and 30% (Psw30) and (ii) Soynut flour at 5 (Psn5), 15 (Psn15), 20 (Psn20) and 30% (Psn30). The control had peanut spread without soybean flour (ps0) and nine samples were prepared in total (Table 2.2). Both studies concluded that specific changes introduced to the spreads did not have a negative effect on the acceptability because consumers liked all the formulations. It was also concluded that the substitution of peanut with soybean or soynut introduced more protein to the sample, which increased adhesiveness and all controls maintained the highest fat content. There was limited data about the texture of ready-to-use pastes apart from the knowledge that these are pastes. In this study, the texture of Sibusiso was analysed instrumentally in comparison to that of a commercial peanut butter control. The mouthfeel of Sibusiso was also assessed using a 5-point facial hedonic scale.

2.7.1.2 Colour

Colour is the perception formed when light interacts with an object by being; refracted, reflected, transmitted and/or absorbed. This process is affected by the physical, chemical and spectral composition of a product. It is also affected by the spectral composition of the source of light interacting with an object and the spectral sensitivity of the eyes of the observer (Loughrey 2002; Lawless & Heymann 1998, p408). Colour is the first important physical characteristic exposed to and evaluated by consumers. This is because consumers are attracted to the appearance of a food product, as this encourages or discourages consumers from buying or eating the product (Khumalo *et al* 2011). Compared to texture, consumer's tolerance of a defect colour, taste and flavour is extremely low. An extreme shift in the colour of a food, even though accompanied by no change in flavour, can make it completely unacceptable to consumers (Yeh *et al* 2002).

Ready-to-use spreads are associated with peanut butter spreads therefore their colour is expected to be light brown or brown as described by a trained panel in a descriptive quantitative analysis (Dubost, Shewelt & Eitenmiller 2003). The Hunter Colour-difference values for quality assurance are used to assess the colour of commercial peanut butter spreads. The Hunter Lightness values of different peanut spreads were measured using a colourimetre in various studies (Mazaheri-Tehrani *et al* 2009; Yeh *et al* 2002). In the study conducted by Yeh *et al* (2002) an all-peanut control had the lowest L* (lightness) compared to 3 fortified peanut spreads, PSM, PSSA and PSSB. The addition of NFDM to PSM was reported to have contributed to the highest lightness of the spread followed by PSSB and PSSA, which had different compositions of roasted soybean and fat content. When all samples were

descriptively tested the all-peanut control had the highest rating for brown colour, followed by PSSA, PSSB and PSM rated the lightest in colour. The different colour ratings however did not affect the acceptability of the products by consumers as all spreads were slightly liked. The replacement of peanut spread with varying levels of soybean flour and soynut flour also seemed not to affect the colour and rating of a ready-to-use spread in another study (Mazaheri-Tehrani *et al* 2009).

In conclusion, the addition of soybean or soynut flour of different proportions to peanut spreads did not affect consumer acceptability of the colour and the overall product. The all-peanut control from both studies had the lowest L* value compared to other samples, therefore it can be concluded from the reviewed studies that the more peanut content in a paste the darker the sample. The product used in this study, Sibusiso, has peanuts and soya as the main ingredients and the proportion of these ingredients may affect the colour. In this study, the colour of Sibusiso was analysed instrumentally and sensorily using the 5-point facial hedonic scale.

2.7.2 Psychological factors

Food acceptability and consumer intake is also mostly influenced by psychological factors such as food preference, previous exposure, values, beliefs and attitudes towards the product (Asp 1999; Cardello 1994, p254). Attitude is an expression of internal feelings, beliefs, values or perceptions about the attributes of a tested product by consumers, which influences the decision to like or dislike a product (Asp 1999). This factor is not inherent but attained from personal experiences, exposure to what other people know and from the mass media (Johns & Kuhnlein 1990, p23). This suggests that the attitude of consumers can be changed depending on the information given. If consumers are informed about nutritional benefits of a food product their attitude towards the food may be positively or negatively influenced (Bagozzi, Gürhan-Canli & Priester 2002, p125).

Another psychological factor that affects product acceptability is consumer beliefs about a product. Consumer beliefs about the food nutritional quality and health benefits are more significant than the accurate nutrition quality and health benefits of a product in making a decision to accept or reject (Ngqaka 2008). Costell *et al* (2010) also added that valuable benefits of a product could not be more important than the nature of sensory properties. This was observed in organic foods where consumers considered their sensory properties even though their nutritional value was perceived acceptable (Costell *et al* 2010).

Giving ready-to-use spreads to patients on ARV treatment at a health institution resulted in beliefs that these supplements were medicinal (Dibari, Le Galle, Ouattara, Bahwere & Seal 2008). The association of the spread with HIV/AIDS led to stigmatisation and consumers being ashamed of taking the supplement. This affected consumer intake of the product, which ultimately affected the nutritional effect of the spread on the body (Dibari *et al* 2008). In this study, some of the consumers had been exposed to Sibusiso in their local clinics and hospitals before participating in this study. However, their perceptions of the product were not assessed, therefore in this study, beliefs and attitudes towards Sibusiso were qualitatively assessed in focus group discussions.

2.7.3 Consumer related factors

Furthermore, there are other consumer related factors that influence acceptability of a product. These are the age, gender, social status, culture, values, psychological state; context within which a food is consumed and the health status of consumers. Food habits, the component of culture, were described as "the culturally standardised set of behaviours" that influences consumer's food decisions. These were found to be common among individuals who were reared within a given cultural tradition (Mead 1943, p21, cited by Asp 1999). The culture to which the consumers belong affects the use of specific foods, which also affects their food intake (Asp 1999). For example, some cultures may not be familiar with consuming spreads solely but spreading on bread or adding to porridge, which could affect the efficiency of some supplements on the patients (Dibari *et al* 2012).

The age and the health status of a consumer have been reported to have an effect on the selection and consumption of a product. Healthy adults were more enthusiastic about adopting healthy diets than children and adolescents (Chambers, Lobb, Butler & Traill 2008; Hearty, McCarthy, Kearney & Gibney 2007; van den Bree, Przybeck & Cloninger 2006; Kearney, Kearney, Dunne & Gibney 2000). HIV infected consumers experience opportunistic infections and side effects, which causes sensory changes and affect the assessment of product acceptability (Avert 2011).

Older consumers experienced difficulty in classifying odour, texture and the taste of a product. According to Koskinen & Tuorila (2005); Schiffmann & Graham (2000) and Zandstra & de Graaf (1998) there is an association between increasing age and decreased ability of odour classification, texture and taste sensitivity scores. It was found that gender affects food acceptability. Females

showed more positive attitude towards trying to eat healthy and consider it more important compared to males (Hearty *et al* 2007; Kearney *et al* 2000; Roininen & Tuorila 1999). Furthermore, females tend to believe that healthy eating yields more benefits in European countries (Zunft, Friebe, Seppelt, de Graaf, Margetts, Schmitt & Gibney 1997). In this study, the acceptability and perceptions of Sibusiso were assessed by consumers of different health status, age, both genders and different experiences with supplements.

2.8 CONCLUSION

A number of nutrition interventions were developed by the South African Department of Health to combat the high prevalence of HIV/AIDS, TB and malnutrition. These strategies had shortcomings, which led to the failure to meet the increased nutritional requirements of HIV infected individuals. As a result, the combination of ART with nutritional assessment, education and provision of RUTFs as a standard of care for malnourished HIV/AIDS and HIV/TB treated patients was adopted. The RUTFs administered at clinics or hospitals have been proven effective in improving the nutritional status of HIV/AIDS treated consumers. The high nutrient content of such supplements had a positive impact on opportunistic infections and side effects experienced by the HIV/AIDS and HIV/TB co-infection treated consumers. Sibusiso, a ready-to-use supplementary food used in South African has been reported to be high in macro- and micronutrients according to the nutritional information on the label. Its nutritional composition was determined in order to confirm if the product meets the WHO/UNICEF/WFP/SCN specifications for RUTFs and was assessed in comparison to a commercial peanut butter to account for any physical differences between the products.

To ensure that consumer needs and expectations of the new product are met, various consumer acceptability studies were conducted in different African countries. Changes in the composition of peanut pastes were reported to have a slight but insignificant effect on consumer acceptability of these supplements. However, some consumers reported RUTFs to be too sweet, too salty, monotonous and with an unacceptable consistency. Consumers also felt stigmatised by the community when RUTFs were given with ART medication. Studies showed the importance of studying physical properties of novel supplements before their provision to the target group.

Therefore, in this study nutritional composition and physical properties of Sibusiso were assessed in comparison to that of a commercial peanut butter. The consumer perceptions of Sibusiso and other factors that might affect the acceptability of Sibusiso have not been studied in South Africa. This is especially so amongst HIV/AIDS and HIV/TB treated consumers who experience sensory changes and are the target group for RUTFs. Therefore, these were also assessed in this study.

CHAPTER 3
METHODOLOGY

This chapter describes the materials and methods used in this study. The chapter consists of three main parts, the determination of the nutritional composition; physical properties of Sibusiso; and consumer acceptability and perceptions of Sibusiso (Figure 3.1).

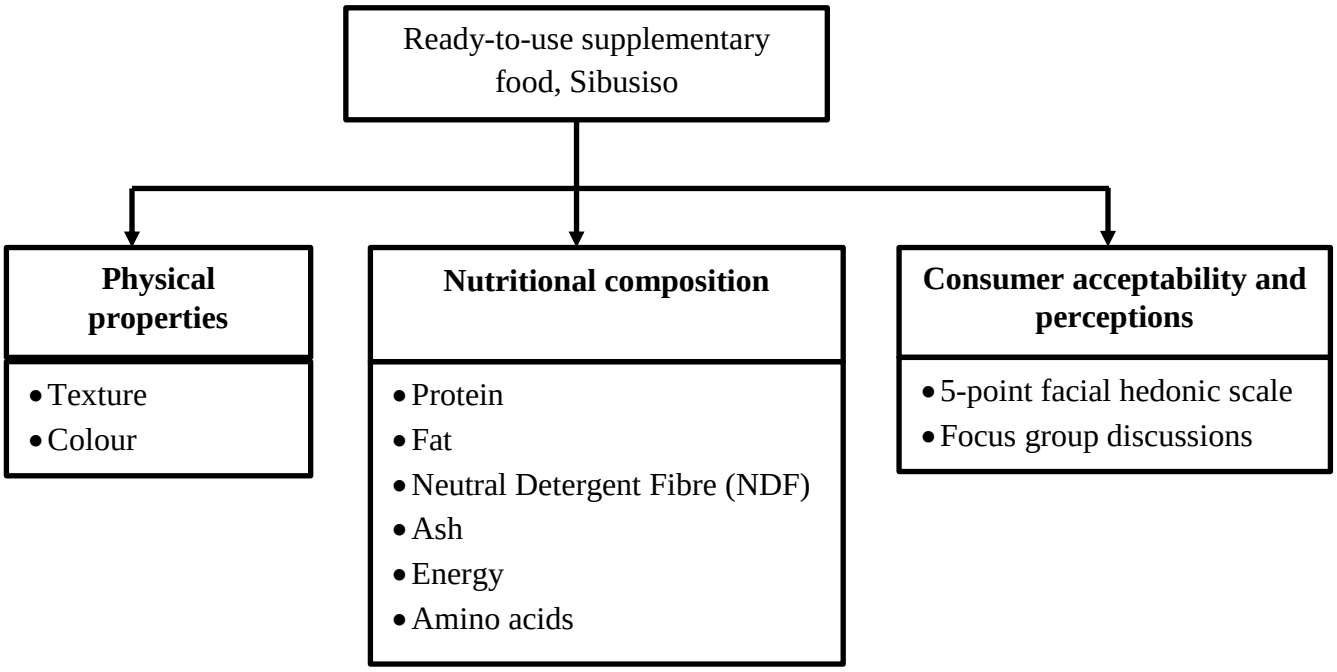

Figure 3.1: Experimental design

3.1 Materials and methods

3.1.1 Food samples

The Sibusiso samples used in this study were donated by the NGO, Gift of the Givers Foundation, whose Head Office is in Pietermaritzburg, South Africa. A smooth peanut butter bought from a supermarket in Pietermaritzburg was used as a control. The control was selected because its texture and colour were most similar to that of Sibusiso compared to other brands. Four ± 400 g of Sibusiso from four different batches and 1 ± 400 g of commercial peanut butter was used to analyse protein, fat, ash, NDF, moisture content and gross energy. Approximately 6 ± 50 g samples of Sibusiso from six different batches and 1 ± 50 g of the control were used to analyse physical properties. All measurements were done three times per sample and recorded.

3.1.2 Nutritional analysis

The protein, fat, ash, NDF, moisture content and gross energy was determined according to the Official Methods of Analysis of the Association of the Official Analytical Chemists (AOAC 2002).

The moisture content of the samples was analysed by drying the sample in an air circulated hot oven at 95ºC for 3 days (AOAC Official method 934.01) (AOAC 2002). Fat content was measured by extracting fat according to the Soxhlett method using the Buchi 810 Soxhlett fat extractor (AOAC Official method 920.39) (AOAC 2002). Total mineral content was measured as ash after incineration of the samples for 4 hours at 550ºC (AOAC Official method 942.05) (AOAC 2002). Fibre was determined as NDF on a Dosi-Fibre machine following the method explained by van Soest, Robertson & Lewis (1991). Gross energy was measured with a LECO AC500 automatic bomb calorimeter. The non-fibre carbohydrate content of the samples was estimated by difference (Mestrallet, Carnacini, Días, Nepote, Ryan, Conci & Grosso 2004). Protein was analysed by the Dumas combustion method using the LECO Truspec Nitrogen Analyser (AOAC Official method 990.03) (AOAC 2002). The amino acid content was analyzed by a reverse-phase High-Performance Liquid Chromatography (HPLC) Pico-Tag method for rapid analysis of amino acid by pre-column which was derivatised after acid hydrolysis (Bidlingmeyer, Cohen & Tarvin 1984).

3.1.3 Physical properties

3.1.3.1 Texture analysis

A texture analyser (TA.XTPlus analyser, Stable Micro Systems) was used to determine the texture of Sibusiso using the TTC spreadabillity rig, Reference: HDP/SR. Approximately 6 ± 50 g samples of Sibusiso from six different batches and 1 ± 50 g of the control were placed in female plexiglass cones for testing. The probe was set to penetrate the sample to a depth of 25.0 mm at a force speed of 0.5mm/s such that the sample flowed outward at 45° between the male and female cone. The ease of the flow showed the degree of spreadability of the sample whilst the withdrawal of the male probe indicated the adhesive characteristics of the sample (Stable Micro Systems Ltd 2009). Each sample was measured three times and the mean hardness, stickiness and work of shear were calculated.

3.1.3.2 Colour analysis

The colour of the ready-to-use food supplement was measured in terms of the Hunter Lab colour system using a HunterLab ColorFlex instrument (Hunter Associates Laboratory, Inc., Reston, Virginia, USA). In the HunterLab system, *L** is a measure of lightness (0 = black to 100 = white), *a** redness (+*a* = redness; -*a* = greenness), and *b** yellowness (+*b* = yellowness; -*b* = blueness) (DeMan 1999, p237). Calibration was done using a white reference tile (L*= 93.89, a*= -0.81 and b*= 1.93). The sample was evenly spread on the bottom of the ColorFlex sample cup and three readings were taken. The sample was stirred to ensure uniformity before measurements. The psychometric colour terms Chroma and hue angle were calculated from the a* and b* values using the formulas; Chroma = $[(a^*)^2 + (b^*)^2]^{½}$ and Hue Angle = $\tan^{-1} b^*/a^*$, respectively (Yeh *et al* 2002).

3.1.4 Consumer panel

The consumer panel was made up of two groups of subjects: the control group which comprised of UKZN students (18 - 26 years old), UKZN staff members (26 - 52 years old) and workers at a local day-care (23 – 40 years). The second group of panellists was the experimental group which comprised of patients from two local hospital clinics, Grey's and Northdale hospital clinic (Pietermaritzburg, South Africa). The experimental group consisted of two patient types: HIV only patients and HIV/TB (co-infected) patients. The HIV only patients were on ARVs drugs only, whilst the HIV/TB patients were on TB drugs. An average of 50 or more participants per groups was targeted as this number of participants has been found acceptable in consumer acceptability studies (Stone & Sidel 2004, pp247-277). Figure 3.2 shows the consumer panel sampling design.

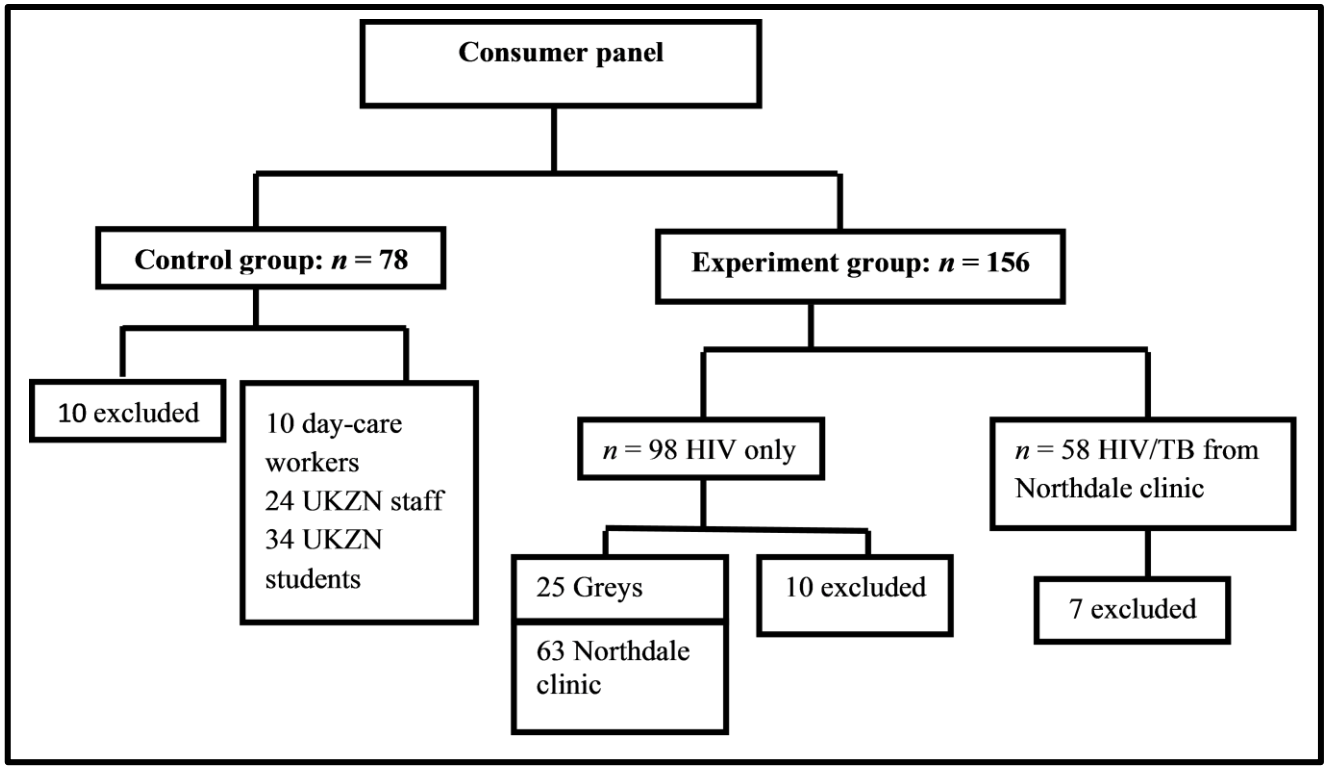

Figure 3.2: Sampling design for the consumer panel

3.1.4.1 Recruitment of panellists

The subjects were invited to be sensory evaluation panellists by word of mouth, written letters and adverts both at the university and hospital clinics. The English and isiZulu letter versions of the invitation letter are shown in Appendix A and Appendix B, respectively.

All co-infected panellists were recruited from Northdale hospital because it had significantly more patients per day (approximately seven) compared to Grey's hospital which had ≤ 2 patients. Ten subjects from both the control group and HIV only patients were excluded. Seven co-infected patients were excluded from the consumer panel. The exclusions were due to different reasons such as; allergy to nuts, age above 55 years, incomplete forms, pregnancy and alcohol consumption on the day of the study.

3.1.4.2 Site description

The two hospitals, Grey's hospital and Northdale hospital are public hospitals under the UMgungundlovu Health District and have fully established clinics that administer HIV/AIDS and TB

treatments (HIV/AIDS and TB clinics). Grey's Hospital is a regional tertiary level hospital providing 20% regional and 80% tertiary services to patients under UMgungundlovu district (DOH 2012). Northdale hospital on the other hand is a district level hospital located close to an Indian-dominated residential area of Pietermaritzburg. Both the Grey's and Northdale hospitals had Dietetics Departments where wasted or underweight patients received either ARVs or TB drugs, and dietary supplements such as RTUFS or porridge.

3.1.4.3 Inclusion criteria

The inclusion criteria for the experimental group was as follows: consumers had to have eaten peanut butter before and between the ages of 18 - 55 years, should not have smoked 30 minutes before participating in the study and should not have had a nut allergy. For the HIV only patients, clinic or hospital cards were taken from the hospital staff by the researcher to confirm that the patients were receiving ARVs. The HIV/TB patients had to produce the Directly Observed Treatment Short-course (DOTS) card as confirmation that they were receiving TB treatment. Data was collected from October 2011 to February 2012.

The control group had to be consumers between the ages of 18 - 55 years of age and should have eaten peanut butter at some time before the study. Consumers should not have been allergic to nuts, have smoked 30 minutes before participating in the study, be sick or taking medication for any chronic illnesses including HIV and TB treatment. The selection criteria were verbally communicated to the subjects and clarified in the informed consent form. All consumers who participated in the sensory evaluation had to be willing to sign the informed consent form (Appendix C - English version and Appendix D - IsiZulu version).

3.1.5 Sensory analysis by the consumer panel

All sensory evaluation sessions on the university campus or at the hospital clinics were held in a room where a booth was set up for each panellist to isolate him/her from other panellists. The UKZN Food Science laboratory was used for the panellists forming the control group. Before the evaluation of the samples started, the panellists were welcomed and asked to sign the informed consent form. The 5-point facial hedonic scale was explained to them and they were told not to communicate with each other. Each panellist was supplied with a glass of water, plastic teaspoon, serviette, small polystyrene cup containing approximately 5 g of the sample of Sibusiso, and an informed consent form (Figure

3.3). Each session took a maximum of 30 minutes and was conducted by the researcher with the help of three trained research assistants.

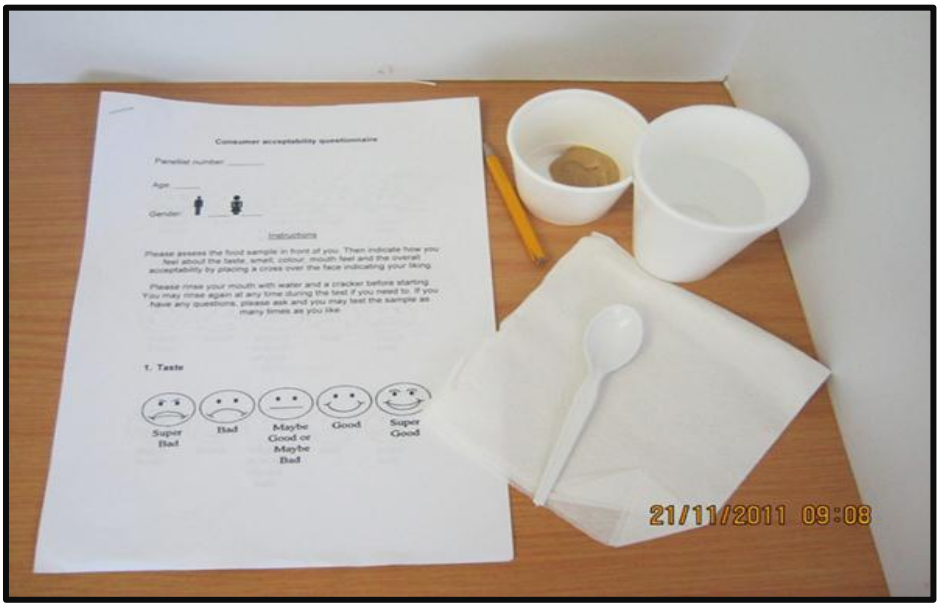

Figure 3.3: Booth set up for each panellist

A 5-point facial hedonic scale with ratings (5 = Super good, 4 = good, 3 = Maybe good or maybe bad, 2 = bad, 1 = Super bad) (Appendix E – English version and Appendix F – IsiZulu version) was given to consumers to rate the acceptability of Sibusiso. This scale is one of the most common hedonic scales that have been modified from the 9-point hedonic scale. According to Moskowitz, Muñoz & Gacula (2004, pp150-154) few categories on the scale have been preferred by some researchers. This is due to suggestions that consumers do not need as many as nine categories to rate acceptability and that too elaborative a scale may confuse consumers (Dubost *et al* 2003). The sensory attributes evaluated were taste, smell, colour, mouthfeel (texture) and the overall acceptability of Sibusiso. To simplify the results for easy interpretation, the 5-point facial hedonic scale data obtained were simplified to three scores. A score ≥ 4 to 5 signified that the attribute was good and hence liked. A score of three represented neutrality with respect to liking the product and lastly a score of ≤ 2 signified that the attribute was bad or disliked.

The questionnaires were written in English and translated into IsiZulu as the majority of the subjects were IsiZulu speakers. The researcher explained the instructions written on the form and what the faces indicated in the local language. Participants expressed their evaluations by placing a cross or ticking over or under the preferred face using a pencil. Before consumers could leave the sensory

evaluation venue their questionnaires were checked to ensure that there were no blanks or spoiled questionnaires.

3.1.5.1 Consumer perceptions, attitudes and beliefs about Sibusiso

The attitude, beliefs and perceptions of consumers about Sibusiso were assessed qualitatively through focus group discussions. Focus group discussions also helped to further understand data collected quantitatively using the 5-point facial hedonic scale and were also used as a platform to get views of a group of people instead of individuals (Vos, Strydom, Fouche & Delport 2005, pp286-313; Babbie & Mouton 2001, p292). Focus group discussions have between 6 - 10 people in order to ensure informative and inclusive discussions. The average duration for each session should be between 45 - 90 minutes long (Anon 2005). In this study, focus group discussions where held with HIV only subjects who had or had never, before the study, consumed Sibusiso and subjects treated for the HIV/TB co-infection who had or had not consumed Sibusiso before the study. Healthy consumers were not targeted for focus group discussions because Sibusiso was mainly developed for malnourished individuals therefore this study focused on these individuals. A list of questions was developed (Appendix G – English version and Appendix H – IsiZulu version) to guide the facilitator through the focus group discussion process. A pilot focus group discussion was conducted at the Northdale clinic using 6 HIV treated consumers. This was done to familiarise the facilitator, recorder and the scribe with their roles and to clarify their responsibilities (Paterson 2006). It was also done to evaluate if the predetermined questions were appropriate and effective to fulfil the purpose of the focus group discussions (Paterson 2006).

3.1.5.2 Consumer food perception

The perception of food by people differs with each consumer depending on a number of factors, including socio-economic factors, such as their experiences and personal situations. Food physical characteristics, external factors such as the media and the environment influence consumer perceptions of food (Johns & Kuhnlein 1990, p23). The panellists were asked to name spreads, supplements and immune boosters known and used by consumers, the reason for use and to name the one most liked. This was asked to understand how Sibusiso would fit into the diet of consumers and also to understand the perceived consumer description of Sibusiso.

3.1.5.3 Consumer expectations of Sibusiso

In order to assess consumer expectations of Sibusisoand learn what would be preferred by consumers, focus group discussion participants were asked about their expectations of the physical properties of a peanut-based paste. The question was asked before Sibusiso was presented to the subjects, and when it was presented, the panellists were asked to sensorily evaluate the sample and to describe its sensory properties. Consumers were also asked to suggest physical attributes that needed to be changed to meet consumer expectations.

3.1.5.4 Consumer willingness to buy

According to Al-Ghuraiz & Enshassi (2005) the willingness to pay is the total amount a consumer is willing to pay, sacrifice or exchange for a good or service (Al-Ghuraiz & Enshassi 2005). It is an indication that the consumer likes a specific good or service in the presence of other goods or services and has the ability to pay for it (Whitehead 2005). An assumption is made that consumers who report positively when asked about their willingness to pay should be prepared to pay for the product or service price when offered (Russell 1996). The willingness to buy Sibusiso was assessed and consumers were asked to explain the reason the product would be bought, for what price and how the product would be used and potential users in the household. In addition to the planned questions for the focus group discussions a question about stigmatisation of recipients of supplements came up and it was added to the list of questions for the participants.

3.1.5.5 Recruitment of participants for focus group discussions

A total of four groups were targeted for discussions: HIV only subjects who had never seen nor consumed Sibusiso; HIV only subjects who had consumed Sibusiso; HIV/TB co-infected subjects who had never seen nor consumed Sibusiso; and HIV/TB co-infected subjects who had consumed Sibusiso. Participants were recruited on a daily basis at Northdale hospital clinic. The same inclusion criteria for the consumer acceptability study were used in addition to the fact that participants had to state whether they had consumed Sibusiso before or not. Consumers were verbally invited to participate in the focus group discussions from different queues in the hospital clinic. There were few positive responses from patients as most patients were anxious about the long queues and that the focus group discussion sessions were too long (approximately 1 hour).

However, a total of 32 HIV only subjects participated in the focus group discussions. The HIV only subjects were divided into four groups, each with 6 - 8 subjects. The first three groups of the HIV only subjects consisted of subjects who had never seen and consumed Sibusiso before the study and the fourth group consisted of subjects who had consumed the product before the study.

Fifteen (15) HIV/TB co-infected subjects were divided into three groups. These groups were small with an average of five subjects in each group. This was due to a small number of co-infected patients treated at the hospital clinic daily. Data collected from one of these groups, which consisted of four subjects, was discarded as during the focus group discussion session one of the participants showed symptoms of being mentally disturbed. As a result data was collected from a total of 11 subjects who belonged to the remaining two groups. In these two groups of the co-infected subjects, one group was made up of subjects who had never seen and consumed Sibusiso before the study and the other group consisted of subjects who had consumed Sibusiso before the study.

The focus group discussions were conducted in a staff lounge at Northdale hospital. Eleven (11) chairs were arranged in a circle in the lounge. Before the participants entered the venue, the consent form, demographics information questionnaire, pen/pencil and the sample were already set up next to each chair. After entering the venue, participants were welcomed and were introduced to the facilitator, recorder and the scribe. The purpose of the session was explained and ground rules were communicated. According to Bloor, Frankland, Thomas & Robson (2001, pp51-52), a focus group discussion may be facilitated by anyone provided they ensure that the number of participants is appropriate, a proper venue is organised and predetermined discussion questions are available. The facilitator guided the discussion, asked all the questions ensuring that the aim of the discussion was fulfiled and ensured that a relaxed atmosphere was maintained. The focus group discussions were facilitated in IsiZulu because participants were IsiZulu speakers. This was also done to ensure that participants fully understood the questions and could freely comment in their language which offered more in-depth information (Paterson 2006). The recorder recorded the whole focus group discussion session using a recording device and also kept time. The scribe wrote down everything that was said during the focus group discussion and grouped similar comments from the discussions. All participants filled in the informed consent form and the demographic information questionnaire (Appendix I – English version and Appendix J – IsiZulu version). The facilitator facilitated each

session being guided by written questions on paper. The participants were provided with a meal after each focus group discussion session.

3.1.6 Ethical approval

Ethics approval was obtained from the University of KwaZulu-Natal, Humanities and Social Sciences Research Ethics Committee (Reference number HSS/0374/011M) (Appendix K). Approval to conduct research at the hospitals was obtained from Grey's and Northdale hospitals (Appendices L and M). All participants had to sign a written consent form before participating in the study.

3.1.7 Statistical analysis

Standard descriptive statistics (means, standard deviations and t covariance) of the nutritional composition and physical properties data were calculated. Data from the sensory evaluation questionnaires was entered onto a spreadsheet, cleaned and coded for analysis using the Statistical Package for the Social Sciences (SPSS) version 15.0 (SPSS Inc., Chicago, III, USA). The LSD test was performed to compare means of different health statuses and the chi-square test was used to generate p-values to analyse the relation between the acceptability of Sibusiso in relation to the health status, age and gender of consumers. Data from focus group discussions that was recorded by the recorder was listened to and common comments were grouped and then entered onto a spreadsheet. This data was also compared to notes that were taken by the scriber. A Social Scientist helped with the presentation and analysis of this data.

CHAPTER 4

RESULTS

4.1 Nutritional composition of Sibusiso

Table 4.1 presents the results of the nutrient composition of a ready-to-use supplementary food Sibusiso and a commercial peanut butter. The gross energy, protein, fat, neutral detergent fibre, ash and carbohydrate composition of Sibusiso across batches was similar, which suggested accuracy and consistency in the combination of ingredients during production. Further comparison will be based on the mean across batches of Sibusiso in comparison to the commercial peanut butter mean values. In general, Sibusiso had a lower gross energy, protein, fat and NDF content than the commercial peanut butter (control) but was higher in ash and carbohydrates.

The protein content of Sibusiso (16 g/100 g) was almost half that of the commercial peanut butter. The fat content of Sibusiso (40 g/100 g) was not substantially different from that of the commercial peanut butter (43 g/100 g). The NDF content of Sibusiso (6 g/100 g) was about 4 times lower than that of the commercial peanut butter. Sibusiso contained approximately 1.4 times more minerals (4 g/100 g) and had almost twice as much carbohydrate (39 g/100 g) compared to the commercial peanut butter. The gross energy of Sibusiso (2 624 kJ/100 g) was slightly lower compared to that of the commercial peanut butter (2 852 kJ/100 g).

When the energy content of Sibusiso was compared to the recommended intakes for healthy adults, the consumption of 50 g of Sibusiso per day was found to provide approximately 38% of the EER for female adults (data not showed) (Institute of Medicine 2005). The consumption of 50 g of Sibusiso per day was found to provide approximately 25% of the EER for healthy male adults. Sibusiso was found to provide approximately 14% and 17% of the RDA for protein (g/day) for adult males and females, respectively (data not showed) (Institute of Medicine 2005).

Table 4.1: Nutrient composition of a ready-to-use peanut based paste, Sibusiso[1]

Sibusiso batches	**Gross energy (kJ/100 g)**	**Protein (g/100 g)**	**Fat (g/100 g)**	**Neutral Detergent Fibre (g/100 g)**	**Ash (g/100 g)**	**Carbohydrates[2] (g/100 g)**
1	2 640.0 ± 0.0	16.0 ± 0.2	42.0 ± 0.8	1.3 ± 0.0	4.0 ± 0.0	37.0 ± 0.5
2	2 604.0 ± 0.1	16.0 ± 0.2	39.4 ± 0.6	2.0 ± 0.1	4.0 ± 0.1	39.0 ± 1.1
3	2 630.0 ± 0.0	15.0 ± 0.3	40.0 ± 0.4	1.2 ± 0.1	4.0 ± 0.1	40.0 ± 0.8
4	2 621.0 ± 0.1	16.2 ± 0.2	39.0 ± 1.1	2.0 ± 0.1	3.4 ± 0.0	39.4 ± 0.7
Grand mean	2 624.0 ± 0.1	16.0 ± 0.2	40.1 ± 0.7	2.0 ± 0.1	4.0 ± 0.1	39.0 ± 1.4
CV[3]	0.0	1.3	2.0	5.0	3.0	3.6
Peanut butter (commercial)	2 852.0 ± 0.1	25.4 ± 0.1	43.2 ± 0.4	6.2 ± 1.0	3.0 ± 0.0	22.2 ± 0.1
Institute of Medicine Recommendations[4]	**EER**	**RDA**		**AI**		**EER**
Males (age > 19 years)	12.8	56 g/day		38 g/day		130 g/day
Females (age > 19 years)	10.1	46 g/day		12 g/day		130 g/day

[1]Mean ± SD (n = 3) is reported on fresh weight basis
[2] Non-fibre carbohydrates calculated by difference
[3]CV coefficient of variation
[4]Estimated Energy Requirements (EER), Recommended Dietary Allowance (RDA) and Adequate Intake (AI) (Institute of Medicine 2005)

Table 4.2 presents the amino acid composition of Sibusiso and a commercial peanut butter. Sibusiso had a higher level of essential amino acids (393 mg/g protein) than the commercial peanut butter (292 mg/g protein) (Table 4.2). The glutamic acid, aspartic acid and arginine were the highest in Sibusiso, similar to the commercial peanut butter. However, the content of these amino acids was slightly higher in Sibusiso compared to the commercial peanut butter.

The lysine content of Sibusiso (58 mg/g protein) was 1.7 times, substantially higher than that of commercial peanut butter. The methionine content of Sibusiso (11 mg/g protein) was almost twice that of the commercial peanut butter. The histidine content (35 mg/g protein) was also 1.3 times higher compared to the commercial peanut butter. The content of threonine (42 mg/g) and leucine (86 mg/g protein) of Sibusiso was slightly higher than that of the commercial peanut butter. This was also observed about phenylalanine (65 mg/g protein) and tryptophan (10 mg/g protein) when compared to the commercial peanut butter. Sibusiso was slightly lower in valine (39 mg/g protein) than the commercial peanut butter (42 mg/g protein). It also had a slightly low amount of arginine (109 mg/g protein) compared to 119 mg/g protein in the commercial peanut butter. The high levels of amino acids in Sibusiso show a good quality of protein content compared to the commercial peanut butter (Table 4.1).

Comparing the essential amino acid content of Sibusiso with the FAO/WHO/UNU, Sibusiso met all the FAO/WHO/UNU recommendations for healthy adults (WHO 2007). An intake of 50 g of Sibusiso provides more than 55% of all essential amino acids except for valine (51%). An intake of 50 g of Sibusiso may provide up to almost 90% of histidine, isoleucine and tryptophan and 90% of threonine based on the FAO/WHO/UNU recommendations for healthy adults (WHO 2007). Almost 65% of lysine may also be obtained from an intake of 50 g of Sibusiso by adults.

Table 4.2: Amino acid composition (mg/g protein) of a ready-to-use peanut based paste, Sibusiso[1]

Amino acids (AA)			**FAO/WHO/UNU for adults, >19 years (WHO 2007)**	**% RDA met by** Sibusiso[2]
	Sibusiso	Peanut butter (commercial)		
Essential AA				
Methionine	11.1	7.0	10	56
Histidine	35.2	22.3	15	85.0
Threonine	42.0	32.0	23	90.2
Valine	39.2	42.0	39	51.0
Isoleucine	49.0	33.3	30	82.0
Leucine	86.0	65.0	59	73.0
Phenylalanine	65.0	51.0		
Lysine	58.0	34.0	45	64
Tryptophan	10.3	8.0	6	87.0
Total	395.0	292.4	227	
Non-essential AA				
Cysteine	18.0	14.2	6	66.3
Aspartic acid	136.0	111.0		
Glutamic acid	224.0	206.0		
Serine	67.1	51.0		
Glycine	65.0	64.1		
Proline	63.0	46.0		
Arginine	109.0	119.0		
Tyrosine	40.0	34.0		
Alanine	50.1	41.3		
Total	769.4	684.0	6	

[1]Mean ± SD (n = 2) is reported on fresh weight basis
[2]Percentage of RDA met when an adult above 19 years consumes 50 g of Sibusiso

4.2 Physical properties of Sibusiso

4.2.1 Colour

The L* values of Sibusiso across batches were not very different (Table 4.3). The a* and b* values of Sibusiso were also similar across batches. Sibusiso had a brown colour, similar to that of the commercial peanut butter but lighter (Figure 4.1 and 4.2). The chroma, degree of saturation of the colour of Sibusiso, and the Hue angle values were the same across Sibusiso batches.

Table 4.3: Colour of a ready-to-use peanut based paste, Sibusiso[1]

Sibusiso **batches**[2]	**L***	***a****	***b****	**Chroma**	**Hue Angle**
1	56.1 ± 0.0	6.1 ± 0.0	20.3 ± 0.0	7.2 ± 0.0	73.4 ± 0.0
2	57.0 ± 0.0	6.3 ± 0.0	21.3 ± 0.0	7.4 ± 0.0	74.0 ± 0.0
3	55.0 ± 0.1	6.3 ± 0.0	20.3 ± 0.0	7.3 ± 0.0	73.0 ± 0.0
4	59.0 ± 0.1	6.1 ± 0.0	21.0 ± 0.0	7.3 ± 0.0	74.0 ± 0.1
Grand mean	57.0 ± 0.1	6.2 ± 0.0	21.0 ± 0.0	7.3 ± 0.0	73.3 ± 0.0
CV	2.0	0.0	0.0		
Peanut butter (commercial)	55.0 ± 0.0	9.0 ± 0.0	23.0 ± 0.0	8.0 ± 0.0	69.0 ± 0.0

[1]Mean ± SD (n = 3) is reported

[2] L* (lightness), 0 = black and 100 = white; a* (redness), +a = redness and –a = greenness; b* (yellowness), +b = yellowness and –b = blueness; chroma = $[(a^*)\ 2 + (b^*)\ 2]^{1/2}$; Hue angle = $\tan^{-1}$ b^*/a^*

Figure 4.1: Colour of Sibusiso

Figure 4.2: Colour of commercial peanut butter

The lightness (L*) (57) of Sibusiso was not very much different from that of the commercial peanut butter. However, the a* value of Sibusiso (6) was lower than that of the commercial peanut butter. Sibusiso also had a b* value (21) slightly lower than that of the commercial peanut butter. The colour of Sibusiso was slightly saturated (7) compared to that of the commercial peanut butter. The Hue Angle value of Sibusiso (73) was slightly higher than that of the commercial peanut butter.

4.2.2 Texture

The hardness and stickiness of Sibusiso across batches was not very much different (Table 4.4). The work of shear indicating the compression energy varied across batches of Sibusiso. The hardness of Sibusiso (1.2 N) was almost the same as that of the commercial peanut butter. The compression energy for Sibusiso was high (848 N) compared to that of the commercial peanut butter. Sibusiso also had a higher stickiness (2 N) than the commercial peanut butter.

Table 4.4: Textural properties of a ready-to-use peanut based paste, Sibusiso[1]

Sibusiso **batches**	**Hardness (N)**	**Work of shear (N)**	**Stickiness (N)**
1	1.0 ± 0.0	746.3 ± 15.1	2.0 ± 0.0
2	1.3 ± 0.0	932.2 ± 89.3	2.0 ± 0.0
3	1.0 ± 0.0	721.0 ± 16.0	2.0 ± 0.0
4	1.3 ± 0.0	994.0 ± 15.0	2.0 ± 0.0
Grand mean	1.2 ± 0.0	848.2 ± 34.0	2.0 ± 0.0
CV	0.0	4.0	0.0
Peanut butter (commercial)	1.1 ± 0.0	817.3 ± 21.0	1.3 ± 0.0

[1]Mean ± SD (n = 3) is reported

4.3 Consumer sensory evaluation

A total of 207 consumers aged 18 to 55 years participated in the study (Table 4.5). These were grouped according to their health status as follows: the HIV treated group (n = 88), HIV/TB co-infection treated group (n = 51) and the healthy group (n = 68). Most consumers (n = 77) were between the ages of 26 – 35 years old. The black race dominated the sample. There was 190 (92%) black participants compared to other races and 149 (72%) of participants were females.

Table 4.5: Demographic characteristics of the sensory panel

Variables	***n* (%)***	**Variables**	***n* (%)***
Age		**Race**	
18 - 25 yrs	43 (21)	Coloured	3 (1.4)
26 - 35 yrs	77 (37)	Indian	9 (4.3)
36 - 45 yrs	51 (25.0)	Black	190 (92.0)
46 yrs and above	36 (17.4)	White	5 (2.4)
Gender		**Health status**	
Female	149 (72)	Healthy	68 (33.0)
Male	58 (28)	HIV/TB	51 (25.0)
		HIV	88 (43.0)
Total	207 (100)		

* % of total sample (*n* = 207)

4.3.1 Consumer acceptability

The acceptability of Sibusiso was significantly associated ($p < 0.05$) with the health status of consumers (Table 4.6). In terms of overall liking, 85% of the healthy group perceived Sibusiso as 'good' compared to more than 90% in the HIV and HIV/TB co-infected group. A similar trend of more consumers who rated attributes 'good' from the treated groups compared to the healthy group was also observed for the taste, smell, colour, and the mouthfeel. Approximately 88% of the HIV and HIV/TB treated groups rated smell 'good' compared to 82% of the healthy group. There was a lesser number of healthy consumers who perceived the colour (68%) and mouthfeel (70%) of Sibusiso 'good' compared to the HIV and HIV/TB treated groups, 86% and 85%, respectively.

Table 4.6: Sensory perception of a ready-to-use peanut based paste, Sibusiso in relation to the health status, age and gender of consumers

Sensory attributes	Health status				Age group					Gender		
	Healthy *n* (%)	HIV *n* (%)	HIV/TB *n* (%)	P value*	18-25yrs *n* (%)	26-35yrs *n* (%)	36-45yrs *n* (%)	> 46yrs *n* (%)	P value*	Female *n* (%)	Male *n* (%)	P value*
Overall liking				0.00					0.50			0.60
Bad	7 (10.2)	4 (5.0)	1 (2.0)		2 (5.0)	6 (8.0)	2 (4.0)	2 (6.0)		11 (8.0)	1 (2.0)	
Neutral	3 (4.4)	4 (5.0)	1 (2.0)		2 (5.0)	4 (5.2)	1 (2.0)	1 (3.0)		5 (3.4)	3 (6.0)	
Good	58 (85.2)	80 (91.0)	49 (96.1)		39 (91.0)	67 (87)	48 (94.1)	33 (92.0)		131 (89)	54 (93)	
Taste				0.02					0.30			0.30
Bad	7 (10.2)	5 (6.0)	1 (2.0)		3 (7.0)	6 (8.0)	1 (2.0)	3 (8.3)		11 (8.0)	2 (4.0)	
Neutral	2 (3.0)	3 (3.4)	4 (8.0)		2 (5.0)	3 (4.0)	4 (8.0)	0 (0)		8 (5.4)	1 (2.0)	
Good	59 (87.0)	80 (91.0)	46 (90.2)		38 (88.4)	68 (88)	46 (90.2)	33 (92.0)		128 (87)	55 (95.0)	
Smell				0.01					0.31			0.70
Bad	1 (1.4)	7 (8.0)	0 (0)		2 (5.0)	1 (1.3)	2 (4.0)	3 (8.3)		6 (4.1)	2 (4.0)	
Neutral	11 (16.1)	4 (5.0)	6 (12.0)		8 (19.0)	9 (12.0)	2 (4.0)	2 (6.0)		16 (11.0)	5 (9.0)	
Good	56 (82.3)	77 (88.0)	45 (88.2)		33 (77.0)	67 (87)	47 (92.2)	33 (92.0)		125 (85)	51 (88.0)	
Colour				0.00					0.05			0.34
Bad	9 (13.2)	9 (10.2)	3 (6.0)		7 (16.3)	8 (10.4)	3 (6.0)	3 (8.3)		19 (13.0)	2 (4.0)	
Neutral	13 (19.1)	3 (3.4)	4 (8.0)		9 (21.0)	6 (8.0)	2 (4.0)	3 (8.3)		14 (10.0)	6 (10)	
Good	46 (68.0)	76 (86.3)	44 (86.2)		27 (63.0)	63 (82.0)	46 (90.2)	30 (83.3)		114 (78.0)	50 (86)	
Mouthfeel				0.06					0.0			0.50
Bad	11 (16.1)	10 (11.3)	4 (8.0)		6 (14.0)	11 (14.3)	3 (6.0)	5 (14.0)		21 (14.3)	4 (7.0)	
Neutral	9 (13.2)	2 (2.3)	4 (8.0)		10 (23.3)	1 (1.3)	2 (4.0)	2 (6.0)		11 (8.0)	4 (7.0)	
Good	48 (71.0)	76 (86.4)	43 (84.3)		27 (63.0)	65 (84)	46 (90.2)	29 (81.0)		115 (78)	50 (86)	

Sample size: Healthy group (*n* = 88); HIV group (*n* = 68); HIV/TB group (*n* = 51)

*P-values generated using chi- square test

The colour and mouthfeel was also rated low (3.7) by the healthy group compared to the ratings of the overall product, taste and smell (Table 4.7). The HIV/TB co-infected group also had a lower rating of colour (3.9) and mouth feel (3.9) compared to the ratings of other attributes. This meant that healthy and HIV/TB co-infected groups moderately liked the colour and mouthfeel of Sibusiso. HIV consumers on the other hand rated all attributes equally high as the average rating was 4.2 on the 5 point facial hedonic scale.

Table 4.7: Effect of age and health status on the acceptability of a ready-to-use peanut based paste, Sibusiso[1]

	Sensory attributes[2]				
Age groups	Taste	Smell	Colour	Mouthfeel	Overall liking
18 - 25 yrs	4.1[a]	3.9[a]	3.6[a]	3.7[a]	4.1[a]
26 - 35 yrs	4.1[a]	4.2[a]	3.9[ab]	3.9[a]	4.1[a]
36 - 45 yrs	4.2[a]	4.2[a]	4.1[ab]	4.1[a]	4.3[a]
46 yrs and above	4.3[a]	4.1[a]	3.9[b]	3.9[a]	4.3[a]
Mean	4.2	4.1	3.9	3.9	4.2
Health Status					
Healthy	4.1[a]	4.1[a]	3.7[a]	3.7[a]	4.0[a]
HIV/TB	4.1[a]	4.1[a]	3.9[ab]	3.9[a]	4.1[a]
HIV	4.3[a]	4.2[a]	4.1[b]	4.1[a]	4.3[a]
Mean	4.2	4.1	3.9	3.9	4.2

[1]Mean of 207 evaluation, i.e $n = 207$

[2]Mean values within the same column with different letters are significantly different at $p < 0.05$ (LSD test)

Overall, more than 85% of all age groups perceived Sibusiso as ‘good’. The taste of Sibusiso was perceived ‘good’ by approximately 90% of all age groups. The taste of Sibusiso was perceived ‘good’ by 90% of the 36 - 45 year old and the ≥ 46 year old groups compared to a lesser number from the 18 - 35 year old group. The number of consumers who perceived the smell of Sibusiso ‘good’ was lower (77%) from the youngest group (18 - 25 years) compared to other age groups with an average of 90%. A significant ($p < 0.05$) association between the mouthfeel of Sibusiso and age groups was observed. There was a lower percentage (63%) from the youngest group who perceived colour and the mouthfeel ‘good’ compared to the average of other age groups (85%).

The number of consumers aged 26 – 35 years and 36 – 45 years old liked the taste, smell, colour and mouthfeel the same. However, for the youngest (18 – 25 years) and the oldest groups (≥ 46 years) the number of consumers who perceived taste, smell, colour and mouthfeel as ‘good’ decreased for the mouthfeel and colour. The youngest and oldest consumers were more discriminative in their evaluation of attributes. All age groups had an average mean of 4.2 for the overall liking of Sibusiso. This was similar to the rating of taste and smell (4.2 and 4.1 respectively) for all age groups except (3.9) for smell from the youngest age group. The colour and mouthfeel was rated lower (3.7) by the 18 – 25 year olds compared to other age groups with an average score of 4. Therefore all age groups liked the taste, smell, and the overall product well and the colour and mouthfeel was liked moderately.

There was no significant association ($p < 0.05$) between Sibusiso sensory perception and gender. Overall, approximately 90% of both genders liked Sibusiso. More than 85% of both genders rated the taste and smell of Sibusiso ‘good’. The colour and mouthfeel were liked by 78% and 86% of females and males, respectively.

Consumers from different health groups were asked to explain what they liked or disliked the most about Sibusiso. Most consumers said they liked everything about Sibusiso more specifically the taste and smell (Table 4.8). A small number of consumers disliked the sweetness, fattiness, colour and the grainy texture of Sibusiso.

Table 4.8: General expressions of like or dislike of Sibusiso from the consumer acceptability study

Sensory attributes	Like/Dislike		Frequency
Taste	Like	Taste	78
		Taste & smell	24
		Taste & colour	3
		Taste, smell & texture	5
		Has a peanut butter-like taste	19
	Dislike	Taste	1
		Grainy texture	8
Texture	Like	Nutty	5
		Too much sugar	3
	Dislike	Runny texture, smell & aftertaste	3
		Mouthfeel	5
		After taste, graininess & fattiness	7
		Crunchiness	2
		Too much sugar	14
		Too much sugar & fat	6
		Too much sugar & nutty	2
Colour	Like	Bland colour	3
		Colour & smell	6
	Dislike	Bland colour	8
Smell	Like	Smell	10
	Dislike	Smell	1
Other (s)	Like	Product	32
		Everything	126
		No comment	38
	Dislike	Product	3

4.4 Focus group discussion demographic characteristics

The demographic characteristics of consumers who participated in the focus group discussions are summarised in Table 4.9. There were a total of 43 consumers, 77% (n = 33) females and 23% (n = 10) males. Thirty seven percent of consumers were between the ages of 26 - 35 years followed by 28% of the 36 - 45 year olds age group. The majority of participants were blacks, 95%, with only 5% of coloureds. The highest level of education for the majority of consumers was high school (54%) followed by primary school, only a few (5%) had tertiary education. The unemployment rate was high amongst consumers with more than 60% unemployed. More than 50% of the participants received government grants, 79% of which received child support grants. Most households had an average of 6 family members and had more members between the ages of 6 – 17 years (27%) and 26 – 45 years (25%) and fewer children less than 1 year (5%) and ≥ 46 years of age (13%).

Table 4.9: Demographic characteristics of consumers interviewed in the focus group discussion

Variable	Category	*n* (%)*
Age (years)	18 to 25	7 (16.3)
	26 to 35	16 (37.2)
	36 to 45	12 (28.0)
	> 45	8 (19.0)
Gender	Female	33 (77.0)
	Male	10 (23.3)
Race	Black	41 (95.3)
	Coloured	2 (5.0)
Marital status	Single	39 (91.0)
	Married	4 (9.3)
Household size (N)	2-4	12 (28.0)
	5-7	18 (42.0)
	8-10	10 (23.3)
	11-15	3 (7.0)
Household age structure (years)	0 - 1	14 (5.0)
	2 - 5	29 (10.2)
	6 - 17	76 (27.0)
	18 - 25	55 (19.4)
	26 - 45	72 (25.4)
	≥ 46	37 (13.1)
Level of education	Primary School	14 (33.0)
	High School	23 (54.0)
	Tertiary education	2 (5.0)
	No formal education	4 (9.3)
Employment status	Employed	17 (40)
	Unemployed	26 (61.0)
Grant received	Child support grant	19 (79.1)
	Disability grant	5 (21.0)
	No grant received	19 (44.2)

* % of total sample (n = 43)

The total number of focus group discussion participants per groups is summarised in Table 4.10. There was a total of 5 focus group discussion sessions conducted with varying number of participants per groups, ranging from 5 - 13 persons per group.

Table 4.10: Number of participants in the focus group discussions

Name of group	***n* (%)***
HIV group session 1	9 (21.0)
HIV group session 2	10 (23.3)
HIV group session 3	13 (30.2)
HIV-TB group	6 (14.0)
HIV-TB group	5 (12.0)
Total	43 (100)

* % of total sample (n = 43)

Prior to focus group discussions, the majority of participants reported in a questionnaire that they used supplements. More than 70% of the consumers took multivitamin supplements that they received from the hospital as part of treatment (Table 4.11). The least taken supplements amongst others were porridge, iron and protein supplements. The majority of the participants received supplements monthly (71%) compared to (14%) who bought them. Seventy one percent of the consumers received supplements from the hospital and 11% from the clinics

Table 4.11: Consumer use, type and sources of supplements

Questions	*n* (%)	Questions	*n* (%)
Do you take supplements?		**How often do you receive /buy supplements?**	
Yes	35 (81.4)	**Receive:** Monthly	25 (71.4)
No	8 (19.0)	Sometimes	1 (3.0)
Type of supplements used		**Buy:** Monthly	5 (14.3)
Multivitamins	29 (83.0)	Sometimes	1 (3.0)
Future life	1 (3.0)	Every second week	3 (9.0)
Porridge	1 (3.0)	**Type of supplement taken**	
Iron	1 (3.0)	Pills	32 (91.4)
Porridge & multivitamin	1 (3.0)	Tubs	1 (3.0)
Protein supplement	1 (3.0)	Porridge	1 (3.0)
Sibusiso	1 (3.0)	Pills & sachets	1 (3.0)
Places where supplements are received /bought		**Do you use immune boosters?**	
Hospital	25 (71.4)	Yes	4 (9.3)
Supermarket	2 (6.0)	No	39 (91.0)
Clinic	2 (6.0)	**Type of immune booster used**	
Pharmacy	4 (11.4)	Cell food	1 (25)
Clinic, pharmacy, supermarket	1 (3.0)	Stameta	2 (50)
Hospital , supermarket	1 (3.0)	Module 8	1 (25)
		Amount of money spent on supplements	R25 – 400.00
		Amount of money spent on immune boosters	R20 – 130.00

Table 4.12 outlines responses to open-ended questions that were asked during focus group discussions. Consumers mentioned multivitamins as the commonly taken supplements because they are freely given at the hospitals and clinics. Before Sibusiso was revealed to consumers, consumer expectations of physical properties of a peanut-based paste were asked. The majority of participants, the HIV treated and the HIV/TB co-infection treated mentioned that they would like the product to taste like peanut butter, be smooth and have a brown colour like peanut butter. When Sibusiso was then presented for the sensory evaluation consumers; the HIV treated group liked the taste of Sibusiso and associated it with the porridge received from the clinic. Other HIV treated consumers associated the taste with that of peanut butter.

Table 4.12: Consumer's perceptions of Sibusiso from focus group discussions

CONSUMER PERCEPTIONS		Consumer health status	Comments
Consumer experiences and preferences of spreads, supplements and immune boosters	i. Commonly used spreads and reason for use	HIV	"Peanut butter, it has healthy fats and boosts the immune system." "Margarine, it's a common spread that can be used for cooking and baking." "Jam, it is liked by children".
		HIV/TB	Margarine, peanut butter, jam and fish paste "because these are nutritious common spreads a household cannot live without".
	ii. Commonly used supplements and reason for use	HIV	Multivitamins, "because they are freely given at the hospital". Syrup and porridge from the clinic and pharmacy.
		HIV/TB	Multivitamins, "because they are good for you especially if you do not eat vegetables and they are free from the hospital".
	iii. Commonly used immune boosters and reason for use	HIV	"Do not use because we were advised so by the nurses and the ARV drugs are sufficient to keep us well".
		HIV/TB	"Do not use because we were advised by nurses not to use, they are expensive and are unnecessary".
Consumer expectations and preferences of a peanut based product	iv. How do you expect peanut paste to taste, smell, look (colour) like?	HIV	"The taste should be like peanut butter, smooth and have a nutty smell". "The colour should be brown and should not be too sweet".
		HIV/TB	"It should be like peanut butter, smooth and spreadable".
Consumer sensory perceptions of Sibusiso	v. How would you describe taste, smell, texture and colour of Sibusiso	HIV	Taste: "It is like porridge we receive from the hospital, like peanut butter with a different smell. It's a bit bitter". Smell: "It is nice". "It is like that of baby food and nutty". Texture: "It's watery". "It is like maize meal with oil, has more powder than nuts". "It is rough or crunchy". "It's too oily for sick people". "It is nice but a bit choking". Colour: "It is ok".
		HIV/TB	Taste: "It is nice, tastes like porridge given at the clinic". "It is oily and cannot eat solely". Smell: "It is fine especially when compared to Sibusiso used to be given before". "It has a nutty smell". Texture: "It is rough, makes me feel like vomiting". "It feels like its powder porridge with oil". "I do not have any problems with it, you can get used to the crunchiness over time". Colour: "It is similar to that of peanut butter".
	vi. How would improve the product?	HIV	"I would like it smoother and less crunchy so that elderly people can eat it too".
		HIV/TB	"It should be made smooth".

Table 4.12: Consumer's perceptions of Sibusiso from focus group discussions continued

Consumer uses of Sibusiso	vii. How would you use Sibusisoin your household	HIV	"I would mix it with porridge". "It can be used on bread, porridge, and baking".
		HIV/TB	"I would eat it as it is or on bread". "I would add on my porridge".
Consumer willingness to buy Sibusiso	viii. How much would you pay for the peanut paste?	HIV	"It should be free at the hospital like before or be R5.00-R20.00 because that is the average price for peanut butter spreads". "I can buy for R12.99-R35.00 because of its nutritional value".
		HIV/TB	"It can be between R13- R50 because I know the benefits of the product". It has to be cheap because you will have to buy it more than once in a mouth and children will eat it too. "It can be R20-R80 because I know the benefits of the product".
	ix. Should the peanut paste be sold would you buy it?	HIV	"Yes due to its nutritional value". "The tub is big and looks expensive but I can when I get a job".
		HIV/TB	"Maybe if it is cheap, because it's given for free at the clinic". "Yes, I can buy it and use it sparingly".
Stigmatisation	x. Given the product would you be afraid to show your family and community members?	HIV	"Before we accepted our status we would have a problem showing people our medication and supplements but we do not care now". "People do not judge anymore like before".
		HIV/TB	"I would be shy to carry it if I was not open about my status". "I do not have a problem; my friends would eat it with me". "It mostly depends on the community you live in".

The HIV treated consumers liked the smell of Sibusiso and some associated it with that of baby food and said “it is nutty”. Texture was generally said to be rough, crunchy and oily by some consumers. The colour was liked and associated with that of peanut butter.

The HIV/TB co-infected group also liked the taste of Sibusiso and associated it with that of peanut butter and the porridge received from the clinic. These consumers also reported the smell and colour of Sibusiso to be nutty and like peanut butter, respectively. Both the HIV and HIV/TB treated groups suggested a change of texture to smooth as both groups considered the texture to be rough, crunchy and oily.

Regarding the willingness to buy Sibusiso, both groups agreed that they would buy Sibusiso. However, some consumers from the HIV/TB treated group showed the willingness to buy Sibusiso only if it were cheap and affordable to them. The HIV treated consumers suggested that the product should have a price ranging from R5.00 - R35.00 while the HIV/TB treated group suggested a price range of R13.00 – R80.00. Most HIV treated consumers suggested that Sibusiso should be given freely at the hospital. Consumers from both groups suggested the price for Sibusiso based on the amount of money spent buying peanut butter.

Some consumers from the HIV/TB treated group were willing to pay more for Sibusiso. These were mostly consumers who had taken Sibusiso before and observed its effect on improving their health.

Consumers reported large amounts of money spent on spreads and supplements, ranging from R4.00 - R400.00 monthly with an average of R150.00 (Table 4.11). Peanut butter, jam and margarine were the top three most known and used bread spreads in most households (Table 4.13).

Table 4.13: Spreads used by HIV and HIV/TB co-infected people in the households

Spreads	**HIV/AIDS group (*n* = 11)**	**HIV/TB group (*n* = 32)**	**Total *n* = 43 (%)***
Butter	4	16	20 (47.0)
Cheese spread	9	7	16 (37.2)
Cream	5	0	5 (12.0)
Fish paste	4	6	10 (23.3)
Honey	7	3	10 (23.3)
Jam	10	24	34 (79.1)
Liver paste	2	1	3 (7.0)
Margarine	10	22	32 (74.4)
Marmite	2	1	3 (7.0)
Mayonnaise	8	20	28 (65.1)
Meat paste	2	1	3 (7.0)
Peanut Butter	10	29	39 (91.0)
Sandwich spread	4	2	6 (14.0)
Syrup	2	0	2 (5.0)
Vegemite	2	1	3 (7.0)
Others	0	0	0
Amount of money spent on spreads			R4.00 – 400.00

* % of the total of both the HIV/AIDS and HIV/TB groups (*n* = 43).

Consumers in the focus group discussions reported no fear of being stigmatised when receiving supplements from the hospital or clinic. This was so because these consumers were comfortable with their HIV status. Consumers further explained that HIV patients are no longer stigmatised like in early years when communities were still not well informed about the infection. These consumers also explained that the response of HIV infected people to stigmatisation depends on their community background and on the attitude of the recipient towards their status.

CHAPTER 5
DISCUSSION

5.1 Nutritional composition of Sibusiso

The nutritional composition of Sibusiso was compared to that of existing ready-to-use food supplements. The protein content of Sibusiso was slightly higher than that of an internationally used ready-to-use therapeutic food, *Plumpy'nut*® (Latham *et al* 2011). The higher protein content may have been due to the use of soy protein extract in Sibusiso compared to *Plumy'nut*® which used peanuts only as the main ingredient (GOTG 2009). Sibusiso was found to meet the WHO's specifications for ready-to-use supplements in terms of protein content. The WHO specifies protein content between 12.8 – 16 g per 100g of a product (WHO/WFP/SCN/UNICEF 2007). This makes Sibusiso a suitable ready-to-use supplement to help alleviate malnutrition just as *Plumpy'nut*® has been proven a competent ready-to-use therapeutic food globally (Manary *et al* 2004).

The protein content of Sibusiso that was used in this study appeared very much similar to that reported on the label of the commercialized one. Sibusiso contains sufficient protein as a ready-to-use supplement to improve the nutritional status of the HIV and HIV/TB treated patients and improve the BMI (Manary, Ndekha & van Oosterhout 2010; Manary *et al* 2004). Protein intake is essential for the prevention of muscle loss, maintenance of a stable weight and the improvement of wound healing. Protein is also important for strengthening the immune system thus improving recovery from infections (DOH 2001). The food based dietary guidelines for people living with TB, HIV/AIDS and other chronic debilitating conditions recommend that "Meat and dairy foods may be eaten daily" and "Eat dried beans, peas, lentils, peanuts or soya regularly" (DOH 2001). Sibusiso may be added to the diet as a good source of protein to prevent wasting and malnutrition.

Protein is constantly broken down to amino acids and replaced in the body (Sizer & Whitney 2008, p186). The quality of protein is judged according to the amino acid composition of a product [Centers for Disease Control and Prevention (CDC) 2012]. Sibusiso had a higher amount of all essential amino acids, especially lysine the amino acid known to be deficient in peanut based products (Mazaheri-Tehrani *et al* 2009). The results were expected as soya is known to be

relatively rich in essential amino acids such as lysine compared to peanuts (Yeh *et al* 2002). In order to compensate for deficient amino acids such as lysine from peanut pastes a peanut-soya mixture such as Sibusiso is produced with good quality protein (Anon 2003; Dubost *et al* 2003; Yeh *et al* 2002). An increase in all essential amino acids in a peanut spread with 19 % roasted soybean added was observed in a study conducted by Yeh *et al* (2002).

The fat content of Sibusiso was slightly lower than that of the commercial peanut butter. This could be due to the addition of low fat soya extracts to the peanut butter paste. A decreased fat content was reported with addition of any soy bean or soynut flour in a peanut butter spread (Mazaheri-Tehrani *et al* 2009; Yeh *et al* 2002). In addition, peanuts are known to be a good source of fat as these contain 45 - 56% of oil (Andersen, Hill, Gorbet & Brodbeck 1998). This could be another reason for a slightly higher content of fat in the commercial peanut butter. However, when the fat content of Sibusiso was compared to that of existing ready-to-use supplements, Sibusiso had a higher fat content than *Plumpy'nut*® and *Immunut*®. This shows that Sibusiso had more soya oil added into it compared to the vegetable oil added to the other supplements (Diva 2011; Diop, Dossou, Ndour, Briend & Wade 2003). When the fat content of Sibusiso was compared to the WHO's specifications for fat in ready-to-use supplements, it was found that the fat in Sibusiso contributed more than the maximum of 60% of the total energy as stated by the WHO (WHO/WFP/SCN/UNICEF 2007). Therefore, Sibusiso had more than enough fat as a ready-to-use supplement and had slightly more than the WHO recommendations. When the fat content of Sibusiso (40.1 g/100 g) was compared to that of previously reported data (40.3 g/100 g) on the packaging of Sibusiso, there was no difference found.

Sixty two percent of the energy (kJ) in Sibusiso is from the fat content. Sibusiso had slightly lower gross energy than the commercial peanut butter. This was expected as it was reported that peanut seeds are higher in energy due to the high fat content (Anderson *et al* 1998). Sibusiso however, had sufficient energy and even more energy according to the WHO specifications of energy from ready-to-use supplements (WHO/WFP/SCN/UNICEF 2007). The gross energy of Sibusiso was also higher than that of *Plumpy'nut*® and *Immunut*® making Sibusiso a good vehicle for providing energy to the vulnerable groups (Diop *et al* 2003).

The higher carbohydrate content in Sibusiso, compared to the commercial peanut butter may be due to the lower content of protein in Sibusiso compared to the commercial peanut butter. Carbohydrates contribute more than 27% of the energy in Sibusiso which makes Sibusiso a good energy source. The high carbohydrate content in Sibusiso could be the reason for the low NDF in Sibusiso. Sibusiso contains four times lower NDF compared to the commercial peanut butter. The low fibre content is preferable for a supplement aimed at malnourished individuals. This is due to the effect that too much fibre consumption has on the bowel movement. Fibre has been reported to increase the bowel movement frequency which increases the risk of diarrhoea among the vulnerable groups (Meier & Gassull 2004). HIV infected individuals are vulnerable to diarrhoea which may be worsened when too much of fibre is consumed (Sizer & Whitney 2008, p112; Suttajit 2007). An excessive intake of fibre may also result in chelation, a process where some vitamins and minerals are trapped in fibre and quickly pass out before absorption, thus increasing the risk for micronutrient deficiencies (Sizer & Whitney 2008, p114).

The mineral content of Sibusiso was higher than that of the commercial peanut butter; this was similar to findings by Mazaheri-Tehrani *et al* (2009) in a study about fortified peanut spreads. According to the previously reported data on the package of Sibusiso, the product has been fortified with vitamins and minerals. This increased expectations for a higher amount of minerals in Sibusiso (GOTG 2009). Micronutrients are essential for immune recovery among HIV infected consumers (Kaiser, Campa, Ondercin, Leoung, Pless & Baum 2006). Generally, HIV infected consumers experience micronutrient deficiencies especially during the early stages of the infection. Such deficiencies increase disease progression, the risk of opportunistic infections and the risk of death due to HIV related disease (Kaiser *et al* 2006). The high level of micronutrients in Sibusiso may help to improve biochemical mechanisms in the body leading to functional organs and strong muscles. Micronutrients may also improve wound healing and the immune system (Sriram & Lonchyna 2009). Micronutrient supplementation for HIV infected individual and infected people on HIV treatment has been proven to be effective in improving the CD4 lymphocyte reconstitution (Kaiser *et al* 2006; Fawzi, Msamanga, Spiegelman, Kapiga, Villamor, Mwakagile, Mugusi, Hertzmark, Essex & Hunter 2004; Jiamton, Pepin, Suttent, Filteau, Mahakkanukrauh, Hanshaoworakul, Chaisilwattana, Suthipinittharm, Shetty & Jaffar 2003).

5.2 Physical properties of Sibusiso

The colour of Sibusiso was brown and similar to that of the commercial peanut butter, but slightly lighter. This finding was similar to that of Yeh *et al* (2002) where the addition of soya to a peanut butter spread resulted in a lighter colour. The colour of Sibusiso increases the acceptance to consumers who are familiar with the brown colour of peanut spreads. The a* and b* values of Sibusiso suggested that the colour of Sibusiso was slightly less red and yellow compared to that of the commercial peanut butter.

The texture of Sibusiso was almost as hard as that of the commercial peanut butter. Sibusiso was however a bit harder and took more energy to compress compared to the commercial peanut butter. According to Dubost *et al* (2003), a harder and adhesive texture is expected from a product with a high amount of soy protein. However, Sibusiso was slightly harder than the commercial peanut butter. This shows that the amount of soya incorporated into Sibusiso was not sufficient to significantly affect hardness (Mazaheri-Tehrani *et al* 2009; Dubost 2001). Sibusiso was more adhesive than the commercial peanut butter as it took more energy to overcome the forces of attraction between the surface of the spread and the probe (Szczesniak & Farkas 1962). The results were expected as the addition of soy protein is said to give a harder and a more adhesive product (Mazaheri-Tehrani *et al* 2009; Dubost 2001). Sibusiso was slightly stickier compared to the commercial peanut butter. A spread with more fat content was reported to be the stickiest and softest in a descriptive analysis test however this was not true in this study as the commercial peanut butter had more fat (Yeh *et al* 2002).

5.3. Consumer acceptability

The high acceptability of Sibusiso by consumers treated for HIV and HIV/TB co-infection implied that the ARV and TB treatment did not have an effect on the perception of sensory properties of Sibusiso. Physiological changes such as oesophageal thrush, lack of appetite, nausea and vomiting that were reported to have a negative effect on the consumer acceptability of food (Dibari *et al* 2012) did not have a negative effect on the consumer acceptability of Sibusiso. A lesser number of healthy consumers who liked Sibusiso may be due to a lack of interest in supplements and the fact that these consumers may not be in need of supplements. Therefore, that may cause these consumers to be stricter in their judgment of sensory properties of such products. A high

acceptability of a ready-to-use supplement was also observed in a study that was conducted among HIV infected patients from Kenya (Bahwere *et al* 2009). Another study conducted in Kenya using a peanut based ready-to-use supplement among adults treated for HIV and TB, reported a dislike for some properties of a supplement. Consumers found the supplement to be unacceptably salty or too sweet (Dibari *et al* 2012).

The high acceptability of taste and smell by healthy consumers in the study might be due to the unique peanut butter flavor from peanut containing foods (Nepote, Mestrallet, Olmedo, Ryan, Conci & Grosso 2008). Even though the colour of Sibusiso was liked by most consumers, a lower number of healthy consumers liked the colour of Sibusiso. The colour was similar to that of the commercial peanut butter. The reason for the lower number of healthy consumers who liked the colour might be due to a high level of objectivity from the healthy group. There were only a few consumers who said the colour was "bland", however, the majority of consumers associated the colour of Sibusiso with that of a commercial peanut butter which was in agreement with other studies (Dubost *et al* 2003).

The majority of both the HIV and HIV/TB co-infection treated consumers liked the mouthfeel or texture of Sibusiso as the average score was 4 representing 'good'. The lesser number of healthy consumers who liked the mouthfeel of Sibusiso may be due to the high level of sensitivity to taste by the healthy consumers. Sibusiso was found acceptable across all adult age groups however, the high level of acceptance of the taste, smell, colour and the mouthfeel of Sibusiso decreased among the younger consumers (18 – 25 years old). The number of the ≥ 46 year olds who liked colour and the mouthfeel also decreased among the older group. This implied that the middle age group (26 – 45 years of age) may be open to new products compared to the younger group. It was reported that as an individual grows older the sensitivity to sensory properties decreases (Koskinen & Tuorila 2005; Schiffmann & Graham 2000; Zandstra & de Graaf 1998).

5.4 Focus group discussions

In the focus group discussions, Sibusiso was associated with the most used spreads in different households. As an acceptable spread Sibusiso may easily blend with the diet of the HIV and HIV/TB co-infection treated consumers. The HIV and HIV/TB co-infection treated consumers also

associated the taste, smell, colour and the mouthfeel of Sibusiso with that of peanut butter. The majority of consumers had a positive attitude towards the sensory attributes of Sibusiso. Even though the majority of consumers liked the taste of Sibusiso some consumers from both the HIV and the HIV/TB groups associated the taste of Sibusiso with that of a porridge received from the clinic. The taste of the porridge associated with Sibusiso was said to be "nice" which therefore implied a positive attitude towards the taste of Sibusiso by consumers. Changes of the taste and smell sensations of patients on medication and experiencing side effects may also interfere with consumer's judgment of these attributes (Augustus 1997).

Regarding the texture of Sibusiso some consumers said the texture was "like maize with oil", "rough", "like powder porridge with oil added" and "crunchy". These different views about the texture might be the reason for a lower number of consumers who liked the mouthfeel from the sensory evaluation. The views are also in line with the instrumental results which showed that Sibusiso was slightly harder than the commercial peanut butter. The graininess of soya could be the reason for the poor acceptance of texture by consumers. Dibari *et al* (2012) also found some consumers who had difficulties swallowing a ready-to-use-supplement due to its consistency. Consumers suggested that the texture of Sibusiso should be made smoother. Such views were also reported from a study by Bouwer & Bosman (2008) where HIV consumers preferred a more runny porridge when given two instant soy maize and instant plain maize porridge supplements. Consumers suggested a change in texture due to oral lesions experienced by HIV patients which may affect chewing and swallowing (Bouwer & Bosman 2008). Dubost *et al* 2003 also reported that 67% of healthy consumers preferred a smooth peanut butter spread than the one with a crunchy texture.

In response to the question of willingness to buy the supplement, a few consumers expressed some willingness to buy Sibusiso. The majority however, stated that they would like the product to be given for free at the clinic as part of the ART program. The high dependence of HIV and TB treated consumers on receiving dietary supplements from the government hospitals or clinics may interfere with consumers' willingness to purchase supplements. This study revealed that the majority of consumers received free supplements from the health care facilities. Only consumers that have used Sibusiso before and experienced its benefits were willing to pay for it. It was observed that consumers were willing to pay more for normal spreads but were not willing to pay more for a supplement. This was also found in a study in Botswana where consumers were not

willing to pay more for a fortified product (Mabaya *et al* 2010; Spence & Townsend 2007). Consumers were worried that they would need more than one 500 g tub of Sibusiso (R60.00) per month and that the tub would be shared in the household therefore would be more expensive to sustain. The reluctance towards buying could be due to the low economic status of the majority of participants and their high sensitivity to price (Mabaya *et al* 2010). The lack of knowledge about the importance of supplements and what supplements are was observed. This highlighted the importance of conducting nutrition education among HIV and HIV/TB treated consumers about what supplements are and their benefits.

Unlike in most studies the majority of consumers in this study were not worried about being stigmatised when given dietary supplements (Dibari *et al* 2012; Ndekha *et al* 2009). This may be due to the fact that most participants were comfortable with their status and had no fear of being judged. It could also be that participants were hoping to be given samples after participating in the study therefore wanted to sound confident. However consumers mentioned that at their early stage of diagnosis they were afraid to receive dietary supplements as the disease was still new to them. Stigmatisation has been found to affect HIV and HIV/TB infected individual's intake of dietary supplements and compliance with medication (Dibari *et al* 2012).

The results from this study should be interpreted with caution due to the small size of the consumer sample and the racial imbalance. Most participants in the study were at the recovery stage of HIV/AIDS and were not experiencing severe symptoms of the infection especially in the mouth. Such symptoms could affect consumer perception of sensory attributes therefore, it is important to be considerate of the HIV stages of consumers when interpreting these results. This study was also cross-sectional therefore did not assess consumer's perceptions of the product over time. Therefore, it would be advisable to assess perceptions of the product taken over a longer period (Dibari *et al* 2012).

CHAPTER 6
CONCLUSIONS AND RECOMMENDATIONS

In this chapter, conclusions and recommendations from this study are discussed. The aim of this study was to determine the nutritional composition and physical properties of a locally produced ready-to-use supplementary food Sibusiso. It also aimed to assess the sensory acceptability and perceptions of this supplementary food by healthy consumers and consumers treated for HIV and HIV/TB co-infection.

6.1 Conclusions

Sibusiso is a better source of carbohydrates and ash compared to the commercial peanut butter. It is also a source of good quality protein in terms of essential amino acids, fats, minerals and energy according to WHO specifications for ready-to-use supplements. Thus, Sibusiso has the potential to prevent and alleviate malnutrition among adult individuals infected with HIV or HIV/TB co-infection.

In terms of physical properties, Sibusiso appears brown in colour similar to commercial peanut butter. Sibusiso seems to be slightly harder and stickier than the commercial peanut butter. This could be because of the addition of soya to Sibusiso compared to commercial peanut butter which contains no soya.

Sibusiso was found to be highly acceptable to HIV and HIV/TB co-infected consumers. HIV and HIV/TB co-infected consumers reported that sensory attributes of Sibusiso were similar to that of a peanut butter. HIV and HIV/TB co-infected consumers liked the taste, smell, colour and the mouthfeel of Sibusiso similar to the healthy consumers who liked all sensory attributes. The similarity of physical properties of Sibusiso with that of a commercial peanut butter could be the reason for its remarkable acceptability among HIV and HIV/TB co-infected adult consumers as well as the healthy consumers. Sibusiso was acceptable across age groups from the 18 year olds to the ≥ 46 year olds. The high acceptability of sensory properties of Sibusiso suggests that Sibusiso has the potential to alleviate malnutrition and to help improve the nutritional status of consumers with HIV and HIV/TB.

However, consumers may not afford the product as it appears expensive (R60.00/ 500 g of Sibusiso). Most vulnerable groups such as HIV and HIV/TB co-infected people have a poor financial status. This was confirmed in this study as the majority of consumers sampled were unemployed and depended almost entirely on government grants. Surprisingly, consumers spent more money on normal commercial spreads compared to what they would spend on supplements such as Sibusiso. This implies that nutrition programmes need to focus more on educating consumers about nutrient-dense foods. Sibusiso proved to be a good source of macro- and micronutrients. Therefore, it can be used by HIV and HIV/TB co-infected consumers as a ready-to-use supplement to effectively provide necessary nutrients and alleviate diseases or conditions related to malnutrition.

6.2 Recommendations

Although this study showed Sibusiso to be rich in macro- and micronutrients further research needs to be done to assess the effect of Sibusiso on the nutritional status of HIV and HIV/TB infected adults. The HIV and HIV/TB patients suggested a slight change in the texture of Sibusiso from a rough feel to relatively smooth. This was suggested by consumers who might have had a problem with swallowing Sibusiso. Improving the texture may increase the level of acceptability of the mouthfeel by the younger age group (18 - 25 years).

HIV/AIDS and HIV/TB consumers showed a lack of knowledge about dietary supplements, their importance and potential benefits in comparison to commercial spreads. Therefore, these consumers need to be educated about dietary supplements and how normal spreads may be substituted with supplements such as Sibusiso, supplements with high nutritional composition and better nutritional benefits.

This study has highlighted the need for the manufacturer to research different ways in which the product may be made more acceptable and more affordable. It also exposed the need for future research to look at different ways of making Sibusiso more affordable and accessible to consumers of diverse financial backgrounds. Because of the potential Sibusiso has to improve the nutritional status of malnourished individuals, it is recommended that the government consider this product to be part of supplementation programmes in South African clinics and hospitals.

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APPENDICES

APPENDIX A: INVITATION TO PARTICIPATE IN THE STUDY IN ENGLISH

INVITATION TO A SENSORY EVALUATION

You are invited to participate in a tasting study conducted by Human Nutrition Masters students from the University of KwaZulu-Natal.

The study will take place as follows:
Day:_____
Venue:_____
Time:_____

The tasting and evaluation should take 20 minutes. Participation is voluntary and you can choose to withdraw at any time during the study.

For further information you can contact Dr Siwela at 033 260 5459 or at SiwelaM@ukzn.ac.za, or Bongi at 082 269 6299 or Nita at 079 108 9956.

APPENDIX B: INVITATION TO PARTICIPATE IN THE STUDY IN ISIZULU

ISIMEMO ESIPHATHELENE NOCWANINGO LOKUHLOLWA KOKWAMUKELEKA KOKUDLA

Uyamenywa ukuba ingxenye yocwaningo lokuhlola ukwamukeleka kokudla esenziwa abafundi be-Human Nutrition, eNyuvesi yaKwaZulu-Natal.

Imininingwane yalolucwaningo:

Usuku:_____
Indawo:_____
Isikhathi: _____

Lolucwaningo lungathatha imizuzu engama-20. Ukuba yingxenye yalolucwaningo kusothandweni lakho futhi unelungelo lokuhoxa noma ngabe inini uma uthanda.

Ngemininingwane noma imibuzo mayelana nocwaningo ungaxhumana no-Dr Siwela ku-033 260 5459 noma SiwelaM@ukzn.ac.za, noma u-Bongi ku-082 269 6299, okanye u-Nita ku-079 108 9956.

APPENDIX C: CONSENT DOCUMENT FOR ALL PARTICIPANTS IN ENGLISH

INFORMED CONSENT TO PARTICIPATE IN RESEARCH

My name is Bongekile Mabaso, a Masters of Science in Human Nutrition student at the University of KwaZulu-Natal. I would like you to participate in a study entitled: ***The sensory evaluation of a ready-to-use food supplement by adults in Pietermaritzburg, KwaZulu-Natal (KZN).*** This study is conducted in fulfilment of my Masters of Science dissertation. In this study you will be required to eat a peanut based food supplement and then indicate and comment on what you think of the taste, texture, smell, colour and the overall acceptability.

Participation in this study is voluntary and should you want to withdraw you can do so at any point. Please read the information below and ask questions if there is anything you do not understand.

The purpose of the study

Malnutrition, which is either the lack of required nutrients or an excess intake of nutrients can cause heath conditions or diseases. Introducing fortified foods like the ready-to-use food supplement used in this study may improve the nutritional status of people and therefore their health. However, it is important to know whether people will accept the food supplement or not. It is for this reason you are being asked to participate in this study.

It is important to know that:

- You will be required not to smoke 30 minutes before participation;
- Participation is free and there will be no prize given;
- There are no risks unless you are allergic to nuts;
- All information will be kept confidentially and in line with the standard of the UKZN research ethics committee; and

Should you have any questions related to the study, please contact the supervisor of the study, Professor Veldman at 033 260 5453 or at veldmanf@ukzn.ac.za. Thank you for your time and cooperation.

Sincerely,

[redacted]

Prof F Veldman

[redacted]

Bongekile Mabaso

If you agree to participate in this study please sign the consent form.

I hereby declare that I understand the above information. I was satisfied by the way my questions were answered.

I also understand the purpose and benefits of the study as well as my role in the study.

Furthermore, I understand that it is my responsibility to inform the researcher about any allergies I may have. I also understand that there will be no risks or discomforts from the study and that I may withdraw from the study at any time without any consequences.

_____

Printed Name of Subject

_____ _____

Signature of Subject Date

APPENDIX D: CONSENT DOCUMENT FOR ALL PARTICIPANTS IN ISIZULU

Igama lami nginguBongekile Mabaso, umfundi we-Masters of Science in Human Nutrition eNyuvesi yaKwaZul-Natal. Ngicela ukuba ubeyinxhenye yocwaningo olusihloko sithi: ***The s**ensory evaluation of a ready-to-use food supplement by adults in Pietermaritzburg, KwaZulu-Natal (KZN).*** Lolucwaningo ngilenza ngenhloso yokuthola iziqu ze-Masters of Science eNyuvesi yaKwaZulu-Natal. Kulolucwaningo uzocelwa ukuba udle ukudla okwenziwe ngamakinati okunothiswe ngomnotho bese uyasho futhi uchaze ukuthi ucabangani ngendlela okunambitheka ngayo, okunuka ngayo, umbala wakho, nangendlela okuzwakala ngayo uma ukuthinta kanye nokwamukeleka kwakho. Ukuba inxhenye yalolucwaningo kudingeka ukwenze ngaphandle kokulindela inzuzo futhi ungahoxa noma inini uma ungasathandi. Ngicela ufunde imininingwane elandelayo bese ubuza uma kukhona ongakuzwa kahle.

Inhloso yalolucwaningo

Ukusweleka komsoco noma izakhamzimba kanye nokuba nakho kubekuningi kakhulu emzimbeni kungadala izinkinga zezempilo kanye nezifo. Ukuba nokudla okulungele ukudliwa okunothiswe ngezakhambimba nomcoso ama “ready-to-use food supplement” kungavuselela ukondleka kwabadinga umsoco, kwevuselele impilo. Kodwa-ke, kubalulekile ukwazi ukuthi lokhu ukudla kuzokwamukeleka na emphakathini noma cha. Yingakho-ke kubalulekile futhi ucelwa ukuba ube ingxenye yalolucwaningo.

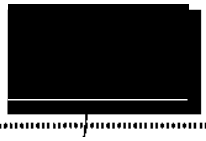
Kubalulekile wazi okulandelayo ngaphambi kokubayinxhenye yocwaningo:

- Kudingeka ukuthi ungabhemi emizuzwini engama-30 ngaphambi kocwaningo;
- Awukho umklomelo ozotholwa futhi uyavolontiya;
- Abukho ubungozi ngaphandle uma uguliswa amakinati;
- Yonke imininingwane eqoqwe ocwaningweni izogcinwa njengemfihlo kulandelwa imigomo yokugcina ulwazi yekomidi locwaningo yaseNyuvezi yaKwaZulu-Natal.

Uma unemibuzo mayelana nocwaningo ungaxhumana nomqaphi wocwaningo u-Professor Veldman ku 033 260 5453 noma ku- veldmanf@ukzn.ac.za. Siyabonga ngesikhathi sakho nangokubambisano.

Ozithobayo,

Prof F Veldman



Bongekile Mabaso

Uma uvuma ukuba inxhenye yocwaningo sicela ugcwalise ifomu elingenzansi.

Ngiyavuma ukuthi ngiyizwa kahle yonke imininingwaneechazwe ngenhla. Nginelisekile ngendlela imibuzo yami ephendulwe ngayo.
Ngiyayazi inhloso yalolucwaningo nokuthi luzosiza kanjani nokuthi mina ngizosiza kanjani noma ukuthi ngizokwenzani.

Okunye, ngiyazi ukuthi kungumsebenzi wami ukwazisa umcwaningi ngokudla okungigulisayo. Ngiyaqonda futhi ukuthi abukho ubungozi ekubeni inxhenye yocwaningo futhi ngingahoxa nama inini ngaphandle kokujeziswa.

Igama

I- signature Usuku

APPENDIX E: FIVE-POINT FACIAL HEDONIC SCALE IN ENGLISH

Consumer acceptability questionnaire

Panellist number: _____

Age: _____

Gender: _____

INSTRUCTIONS

Please assess the food sample in front of you. Then indicate how you feel about the taste, smell, colour, mouth feel and the overall acceptability by placing a cross over the face indicating your liking.

Please rinse your mouth with water before starting. You may rinse again at any time during the test if you need to. If you have any questions, please ask and you may test the sample as many times as you like

1. Taste

Super bad	Bad	Maybe good or maybe bad	Good	Super good

2. Smell

Super bad	Bad	Maybe good or maybe bad	Good	Super good

3. Colour

Super bad	Bad	Maybe good or maybe bad	Good	Super good

4. Mouth feel

Super bad	Bad	Maybe good or maybe bad	Good	Super good

5. Overall liking

Super bad	Bad	Maybe good or maybe bad	Good	Super good

6. What did you like about the product?

_____
_____

7. What did you not like about the product?

_____
_____

- THANK YOU!!! -

APPENDIX F: FIVE-POINT FACIAL HEDONIC SCALE IN ISIZULU

Consumer acceptability questionnaire

Inombolo ye-panellist: _____

Iminyaka: _____

Ubulili: _____

IMIYALELO

Hlola ukudla okuphambi kwakho. Shono ukuthi ucabangani ngendlela okunambitheka ngayo, iphunga, umbala, indlela okuzwakala ngayo emlonyeni kanye nendlela okuthanda ngayo nje. Khombisa lokhu ngokubeka uphawu [X] eduze kobuso obuqondene nomuzwa wakho.

Yakaza umlomo ngaphambi kokuba uqale.
Ungayakaza futhi nanoma ngasiphi isikhathi ngenkathi uhlola lokudla..
Uma unomubuzo ungabuza.

1. **Ukunambitheka**

Kubi ngokumangalisayo	Kubi	Angazi ukuthi ngiyakuthanda noma angikuthandi	Kuhle	Kuhle ngokumangalisayo

2. **Iphunga**





Libi ngokumangalisayo	Libi	Angazi ukuthi ngiyalithanda noma angilithandi	Lihle	Lihle ngokumangalisayo

3. **Umbala**





Mubi ngokumangalisayo	Mubi	Angazi ukuthi ngiyakuthanda noma angikuthandi	Muhle	Muhle ngokumangalisayo

4. **Indlela okuzwakala ngayo emlonyeni**





Yimbi ngokumangalisayo	Yimbi	Angazi ukuthi ngiyayithanda noma angiyithandi	Yinhle	Yinhle ngokumangalisayo

5. **Ukuthande kangakanani lokudla?**





Angikuthandanga kakhulu	Angikuthandanga	Angazi ukuthi ngikuthandile noma angikuthandanga	Ngikuthandile	Ngikuthande kakhulu

6. Yini oyithandile ngalokukudla?
   _____
   _____

7. Yini ongayithandanga ngalokudla?
   _____
   _____

- SIYABONGA!!! -

APPENDIX G: FOCUS GROUP DISCUSSION QUESTIONS IN ENGLISH

FOCUS GROUP GUIDE: THE EVALUTION OF A READY-TO-USE FORTIFIED FOOD SUPPLEMENT

Specify the group first if they have eaten the product or not.

1. **CONSUMER PERCEPTIONS TOWARDS SPREADS: Consumer experiences and preferences of spreads and supplements**

- Name all types of bread spreads you know & use. State why they are most liked or least liked and who likes them from the household.

  [*Rank these in order according to the most liked by the consumers and explain why they were the most liked; this question should also indicate which category of the persons in household like or least like each spread]*

- Give all the types of supplements you know & use. State why they are most liked or least liked.

  (*Rank these in order according to the most liked by the consumers and explain why they were the most liked)*

- Give all the types of immune boosters you know & use. State why they are most liked or least liked.

  (*Rank these in order according to the most liked by the consumers and explain why they were the most liked)*

2. **CONSUMER EXPECTATIONS and PREFERENCES: What influences consumer to consume a product *(Assessment of the best valued food product component)***

- How do you expect peanut paste to **taste, smell, look (colour**) like?
- If someone brings to you a consumable product such as the peanut paste, what would you do and or what kind of questions would you ask? *(Physical component, nutritional content or affordability)*

3. **CONSUMER PERCEPTIONS TOWARDS PEANUT PASTE: Consumer sensory characteristics**

- With regards to the peanut paste in front of you, how would you describe its physical component *(taste, smell, texture and appearance: colour).*

4. If one of the above mentioned physical components does not meet your sensory expectations, how would you like it to be improved?

5. PEANUT PASTE CONSUMER ACCEPTABILITY

- If the peanut paste could be commercialized would you buy it? Elaborate
- How would you use it in your household and who would you give it to most? Why
  (We want to know whether they use as a spread, add on their porridge etc.)

6. CONSUMER WILLINGNESS TO BUY

- How much would you pay for the peanut paste? *(Take the average prices mentioned or the least to the highest)*

APPENDIX H: FOCUS GROUP DISCUSSION QUESTIONS IN ISIZULU

FOCUS GROUP GUIDE: THE EVALUTION OF A READY-TO-USE FORTIFIED FOOD SUPPLEMENT

1. IMICABANGO YABANTU NGEZINTO ZOKUGCOBA ISINKWA.

- Shona zonke izinhlobo zezinto zokugcoba isinkwa ozaziyo nozisebenzisayo. Chaza ukuthi iziphi ozithanda kakhulu, nozithanda kancane shona futhi ukuthi ngubani ozithanda kakhulu ekhaya
- Shona zonke izinhloba zezakhamuzimba okukanye ukudla okunothiswe ngomsoco ozaziyo nozisebenzisayo. Chaza ukuthi iziphi ozithanda kakhulu, nozithanda kancane shona futhi ukuthi ngubani ozithanda kakhulu ekhaya.
- Shona wonke ama-immune booster okanye izakhamasotsha ozaziyo nozisebenzisayo. Chaza ukuthi iziphi ozithanda kakhulu, nozithanda kancane shona futhi ukuthi ngubani ozithanda kakhulu ekhaya.
- Chaza ukuthi imalini oyisebenzisa ukuthenga lemikiqizo.

2. OKULINDELWE KANYE NOKUNCAMELWAYO: Yini ekhuyhaza abanyu ukuthi badle ukudla abakudlayo

- Ingabe ulindele ukuthi i-paste eyenziwe ngamakinati **inambitheke, inuke futhi ibenombala** onjani?
- Uma unganikezwa umkhiqizo owenziwe ngamakinati ukuthi uwudle, ungenza njani futhi imiphi imibuzo ongayibuza?

3. IMICABANGO YABANTU NGESIGCOBO ESENZIWE NGAMAKINATI

- Uma uhlaziya lokudla onikiwe. Ungakuchaza kanjani ukunambitheka, iphunga, i-texture kanye nombala kwakho?
- Uma okunye kwalokhu okubalwe ngenhla kungenjengoba ulindele ungafisa ukuthi kushintshwe kanjani?

4. UKWAMUKELEKA KWE-PEANUT PASTE NGABANTU

- Uma ukudla okuphambi kwakho kungadayiswa ezitolo, ungakuthenga? Naba.
- Ungakusebenzisa kanjani ekhaya. Ubani ongakusebenzisa? Ngoba yini?

5. UKULANGAZELELA KWABANTU UKUTHENGA UKUDLA

- Imalini ongayikhokha ukuthenga lonkhiqizo?

APPENDIX I: DEMOGRAPHIC INFORMATION QUESTIONNAIRE IN ENGLISH

DEMOGRAPHIC INFORMATION FOR FOCUS GROUP PARTICIPANTS

1. **Name**_____
2. **Age** _____

3. **Gender**

   Female ☐ Male ☐

4. **Race**

   Black ☐ Coloured ☐ Indian ☐ White ☐ other_____

5. **Marital Status**

   Married ☐ Single ☐ Divorced ☐ Separated ☐ Widow/widower ☐

6. How many people (including you) live in your house? _____
   Indicate the number of people per age category by writing a number in a box.

   0-12 Months ☐ 1-5 years ☐ 5-17 years ☐

   17-25 years ☐ 25-45 years ☐ >45 years ☐

7. What is your highest **level of education** you have achieved?

   No schooling ☐ Primary school ☐ High school ☐ College diploma

   Bachelor's degree ☐ Master's degree ☐

8. What is your current **employment** standing?

   Unemployed ☐ Employed ☐ Self-employed ☐

Pension/grants ☐ *Please specify*

Old age	Child support	Foster child	Disability	Care Dependency	War Veteran's

9. Do you use any supplements? Yes ☐ No ☐ If **yes** please indicate below.

Vitamin A ☐ Iron ☐ Calcium ☐ Multivitamin ☐

Porridge ☐ Sibusiso ☐ Other (s) _____

10. Where do you source or get your supplements from?

Clinics ☐ Hospitals ☐ Pharmacy ☐

Doctor ☐ Supermarket ☐ Other (s) _____

11. If you buy supplement(s), how much do you spend on them? _____

12. How often do you buy or receive supplements? I buy ☐ or receive ☐ supplements:

Every week ☐ Every 2 weeks ☐ Monthly ☐ Other(s) _____

13. Please indicate the type or quantity you buy or are given.

Tablets/ 1 packet ☐ Sachets ☐ Tub (s) ☐ Other(s) _____

APPENDIX J: DEMOGRAPHIC INFORMATION QUESTIONNAIRE IN ISIZULU

DEMOGRAPHIC INFORMATION FOR FOCUS GROUP PARTICIPANTS

1. **Igama**_____
2. **Iminyaka** _____

3. **Ubulili**

   Owesimame ☐ Owesilisa ☐

4. **Uhlanga**

   Nsundu ☐ Khaladi ☐ Ndiya ☐

   Mhlophe ☐ Nolunye_____

5. **Isimo sokushada**

   Ngishadile ☐ Singili ☐ Ngihlukanisile ☐ Umfelwa/ umfelwakazi ☐

6. Nibangakhi ekhaya uma uzibala nawe? _____
   Khombisa inombolo yabantu ngokweminyaka ngokubhala inombolo ebhokisini noma emabhokisini afanele.

   0-12 Months☐ 1-5 years☐ 5-17 years ☐

   17-25 years☐ 25-45 years ☐ >45 years ☐

7. Iliphi izinga lokufunda eliphezulu onalo?

   Angiyanga esikoleni☐Amazinga aphansi ☐ Amazinga aphezulu ☐

   Ikolishi ☐ I-degree ☐ I-master’s degree ☐

8. Isimo sakho somsebenzi sime kanjani njengamanje?

   Angiqashiwe ☐ Ngiqashiwe ☐ Ngiyazisebenza ☐

Ngihola impesheni noma i-grant ☐ *Chaza ukuthi yiphi*

Eyabadala	Eyezingane	Foster care	Eyokukhu bazeka	Eyokunakekela Abangakwazi ukuzinaka	Eyamavikela mbuso

9. Ingabe uyazisebenzisa izakhamuzimba, ama-supplement? Yebo ☐ Cha ☐ . Uma impendulo kunguyebo khombisa ngenzansi.

Vitamin A☐ Iron ☐ Calcium ☐ Multivitamins ☐

Iphalishi ☐ Sibusiso ☐ Ezinye _____

10. Ingabe uzithola kuphi izakhamzimba noma ama-supplement akho?

Emtholampilo☐ Esibhedlela☐ Ekhemisi ☐

Kwadokotela☐ Esuphamakethe☐ Noma e_____

11. Uma uzithenga izakhamzimba noma ama-supplement, uchitha malini kuzo? _____

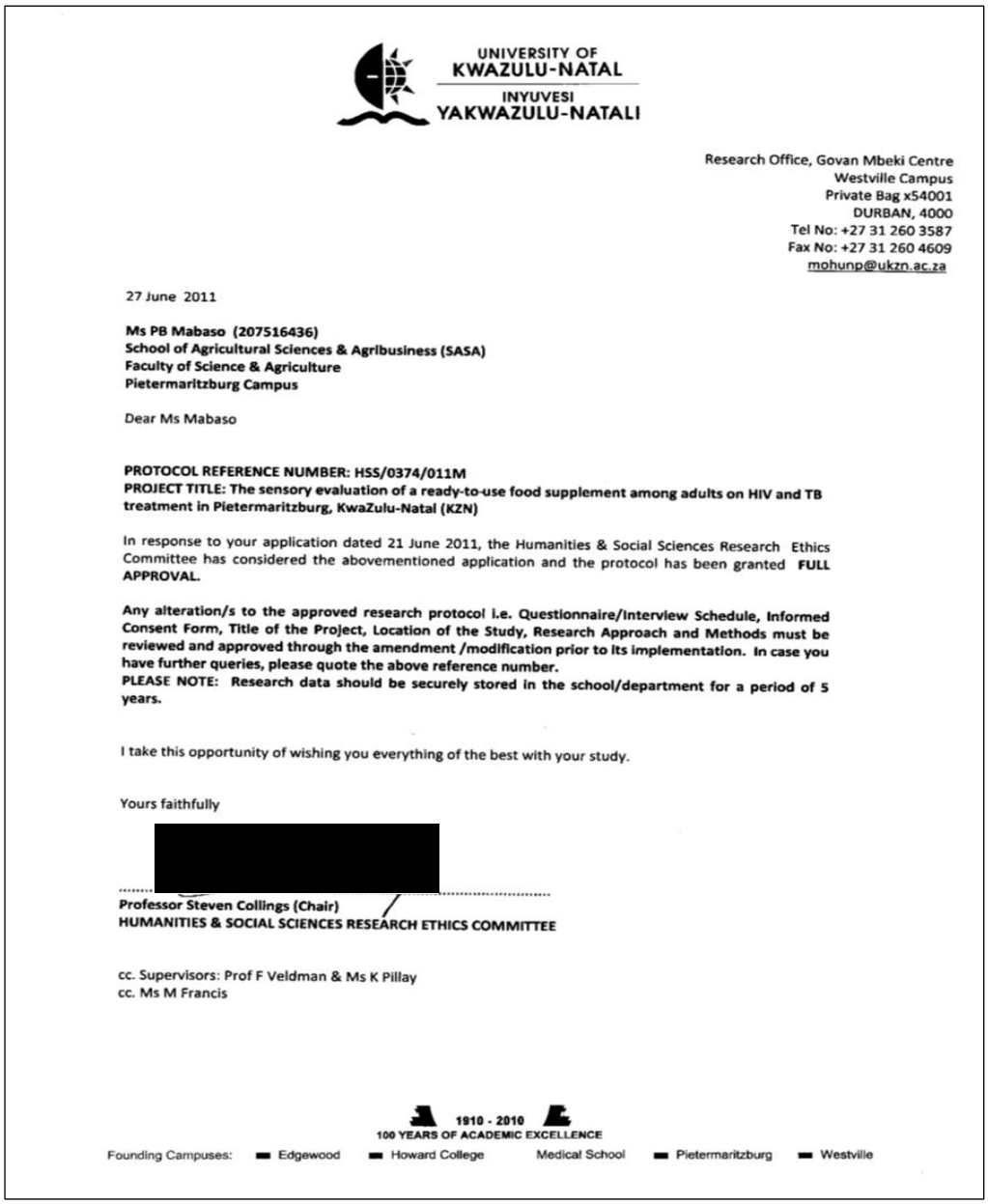
12. Ingabe uzamukela noma uzithenga kangakanani izakhamzimba? Ngizamukela ☐
Noma ngizithenga ☐ :

Masontonke ☐ Njalo emvakwamasonto amabili ☐ Nyangazonke ☐
Noma e_____

13. Khombisa inhlobo noma inani olitholayo noma olamukelayo.

Amaphilisi ☐ I- Sachets ☐ I- Tub (s)☐ Noma _____

APPENDIX K: LETTER OF ETHICS APPROVAL FROM THE HUMANITIES AND SOCIAL SCIENCES ETHICS COMMITTEE, UNIVERSITY OF KWAZULU-NATAL



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

Ms PB Mabaso (207516436)
School of Agricultural Sciences & Agribusiness (SASA)
Faculty of Science & Agriculture
Pietermaritzburg Campus

Dear Ms Mabaso

PROTOCOL REFERENCE NUMBER: HSS/0374/011M
PROJECT TITLE: The sensory evaluation of a ready-to-use food supplement among adults on HIV and TB treatment in Pietermaritzburg, KwaZulu-Natal (KZN)

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

[redacted]

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

cc. Supervisors: Prof F Veldman & Ms K Pillay
cc. Ms M Francis

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APPENDIX L: LETTER OF APPROVAL TO CONDUCT RESEARCH AT GREY'S HOSPITAL

HEALTH
KwaZulu-Natal
Pietermaritzburg Metropolitan Hospitals Complex
Department of Surgery
Private Bag X9001, Pietermaritzburg, 3200
201Townbush Road, Pietermaritzburg, 3201
Tel. 033-897 3381, Fax. 033-845 0325
E-mail.:nirusha.maharaj@kznhealth.gov.za
www.kznhealth.gov.za

UNIVERSITY OF KWAZULU-NATAL
University of KwaZulu Natal
College of Health Sciences
Nelson R Mandela School of Medicine
School of Department of Surgery

Reference :

Ms PB Mabaso (207516436)
School of Agricultural Sciences & Agribusiness (SASA)
Faculty of Science & Agriculture
Pietermaritzburg Campus

Dear Ms Mabaso

PROTOCOL REFERENCE NUMBER: HSS/0374/011M
PROJECT TITLE: The sensory evaluation of a ready-to-use food supplement among adults on HIV and TB treatment in Pietermaritzburg, KwaZulu-Natal (KZN)

Dear Ms Mabaso

The committee reviewed your publication at its meeting on 4 August 2011. This is a level one study and there were no ethical concerns and you have been granted permission to publish your work.

Regards

[redacted]

Damian Clarke
Chairperson UHERB

APPENDIX M: LETTER OF APROVAL TO CONDUCT RESEARCH AT NORTHDALE CLINIC

health

Department:
Health
PROVINCE OF KWAZULU-NATAL

NORTHDALE HOSPITAL
1389 Chota Motala Road, Pietermaritzburg 3201
P/B X9006, Pietermaritzburg 3200
Tel.: (033) 3879010, Fax.: (033) 3871990
E-mail:joyce.webster2 @kznhealth.gov.za
www.kznhealth.gov.za

Enquiries: DR MOLLA
Date: 04 November 2011

To : Zodwa Nita Mahlangu and Bongekile Prudence Mabaso

C.c : Prof. Frederick J. Veldman

RE: TO CONDUCT A SENSORY EVALUATION PANEL MGUNGUNDLOVU HOSPITAL

We have no objection for the above mentioned study utilizing our Health Facility.

Thank you

Yours Sincerely

Dr M.A.G MOLLA
MEDICAL MANAGER
NORTHDALE HOSPITAL