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The acceptability of selected maize meal types in Mthatha in the Eastern Cape Province in South Africa

by

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DECLARATION

I ANDISWA TENJIWE NGQAKA, student number 21126055, declare that the work that is on this document is truly my work. This document has not been reproduced or plagiarized from other sources. All the information that has been obtained from other sources referenced accordingly.

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ABSTRACT

The acceptability of selected maize meal types in Mthatha in the eastern Cape Province of SA

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This study is aimed at investigating specific preferences for various types of maize meal in two rural communities of Mthatha. Consumption data shows that in very poor households, maize was the only and most consumed foodstuff. The acceptability and opinions of different maize meal types were investigated by this study, as well as awareness of technologies, food fortification and genetic modification. The first phase of the study employed a qualitative approach in which numerical data was collected using sensory evaluations and second phase being a qualitative approach in the form of focus group interviews.

In determining consumer acceptability, sensory evaluations were done amongst villagers from Ngqeleni and Mqanduli of selected age groups and gender. The sensory evaluation findings of the study indicate that fortified (special) maize meal is preferred over all other maize meal types, based on a higher liking of the aroma and colour. This was followed by unfortified (special) maize meal, although it was not significantly different to sifted white maize meal, sifted yellow maize meal, white sifted non-genetically modified maize meal, white genetically modified maize meal, in descending order. Younger adults (18-25years) had a stronger preference for white fortified maize meal, with older adults (>40years) all maize meal types similarly with the exception of yellow sifted maize meal. Males and females revealed equal liking behaviour. The Ngqeleni villagers preferred white fortified maize meal. Mqanduli participants preferred sifted maize meal, probable due to the fact that this is the staple food produced in the village.

Focus groups were used to capture understanding and/or opinions of food fortification and genetic modification. Ngqeleni and Mqanduli are two villages approximately 30km east of Mthatha and south east of Mthatha, respectively. Findings from the two villages differed. Somewhat the Mqanduli community was more subsistence farming based, therefore aware of farming practices and their technical benefits but not the facts behind the technology. In Ngqeleni, the community was more aware of the concepts even though they were not exposed to them. This deduced a low illiteracy rate in Mqanduli compared to Ngqeleni and it was confirmed during discussions and through a mini survey. Poverty was also evident in Mqanduli as most of the community was unemployed. This encouraged the community to use locally grown maize meal more than the commercial fortified maize meal. The issue of yellow and white maize brought good discussions, which led to conclusions that the choice of yellow maize depends on individual preferences. Most of the respondents in these communities consumed yellow maize in one state or another, with a few who did not prefer it at all as maize meal. Most men preferred yellow maize and yellow maize meal, as they believed that it had higher satiety level than white maize and white maize meal.

In conclusion, the study revealed very interesting differences in preference of different maize meal types. This could form part of understanding the dynamics related to staple foods in a rural context.

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I wish to dedicate this work to my Heavenly Father and our Lord Jesus Christ; it would not have been possible without the wisdom and knowledge imparted by my Saviour.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ADDENDA

Chapter 1

1.0 BACKGROUND AND MOTIVATION FOR THE STUDY

1.1 INTRODUCTION

The study was concerned with the level of acceptability and perceptions of traditionally prepared porridge cooked from commercially produced white maize meal (special unfortified and special fortified maize meal); local white non-genetically modified (non-GM) and local white genetically modified (GM) maize meal (hammermill); and local white maize meal and yellow maize meal (hammermill) among Xhosa households in Mthatha in the Eastern Cape province of South Africa. It was important to review the history of maize production, maize consumption and the basis of food fortification to gain knowledge for the shift to new technologies in the production and enrichment of maize.

Maize is a staple food for large groups of people in the world and was the second largest cereal grain crop in the world maize production in 1984/1985. In African countries, maize may account for 70-80% of the energy intake. Maize grown in subsistence agriculture has been and is currently used as a basic food crop (Bourne, 1989:1).

For many years the staple diet of the Black people in South Africa was sorghum. From the turn of the 20th century, maize gradually replaced sorghum. The reason for this was assumed to be economics in that the yield from maize was greater (Isaacson, 2004:658). White maize is regarded as a staple food in South Africa whereas yellow maize is rarely used for human consumption except in cases of severe shortage of white maize. Maize in South Africa is widely consumed in both urban and rural areas (FAPRI-UMC Report, 2006:4).

Maize production in South Africa and procurement

The growing season for maize is in South Africa is summer, which is heavily influenced by rainfall in October and April. According to Gouse, Pray, Kirsten & Schimmelpfennig (2004:3) farmers in the rural Kwa-Zulu Natal and Eastern Cape, store their maize in old maize meal bags as grain or on the cob in wooden or corrugated iron structures until it is needed. Farmers in poorer areas cannot afford milling costs and thus make use of hand

mills, hammer mills or crush their grain in a traditional way. Some farmers sell their grain to either the millers, the local cooperative or to the community. Farmers who produce surpluses sell grain for cash income, but unfortunately some farmers with bad harvests sometimes also sell grain for cash and thus miss out on the cost advantage they could have enjoyed by supplying their household's own need of maize meal.

Agricultural maize production is highly vulnerable due to year-to-year climate variability, because it is not known what to expect in the next growing season (Jones, Hansen, Royce & Mesina, 2000:170). This is impacting on people's livelihoods to a great deal, especially where many poor smallholders depend on agriculture and a few alternatives (Jones & Thornton, 2003:59). South Africa and other Southern African countries cannot sustain further maize crops losses, which are due to damage caused by the African maize stalk borer (Gouse, Pray, Schimmelpfennig & Kirsten, 2006:15).

According to Gouse, *et.al.* (2004:3) an unpublished "Crop production guidelines" of the South African Department of Agriculture (1991), reflected that it is especially the November plantings on the Highveld that four in every five seasons come under considerable pressure from second generation stalk borers. For this reason, South African smallholder farmers in various provinces including the Eastern Cape have adopted insect-resistant varieties of white maize, known as *Bacillus therungensis* (Bt) maize over the last three seasons (Gouse, *et.al.*, 2006:15). These pest resistant crops that have been developed produce a bacterial protein from *Bacillus therungensis (Bt)*. Proteins from different strains of *Bt* act on specific pests such as beetles, moths and soil nematodes. These crops have built-in resistance, which will reduce the reliance on conventional pesticides (Madden, 1995:18).

Malnutrition versus poor consumption

Nearly half of the world's population (2.9 billion people) lives on less than $2 per day. Already, 800 million people are malnourished and food production has to double in the next 35 years to meet future needs (Jones & Thornton, 2003:59). According to Purchase (2005:S20), poor consumers already spend more of their income on food and their diets consist primarily of staple foods, which lack vitamins and minerals and possibly other nutrients necessary for good health.

According to the Department of Health Small Millers Guide (1), it is the general practice that commercial farmers in South Africa plant maize for their workers, which would then be stored in silos or milled if required by means of hammer mills and shared amongst the workers. The small share of maize that the farm workers receive remained their only source of nutrient consumption. This is the reason why children living on commercial farms according to the National Food Consumption survey (NFCS) of 1999 (National Food Consumption Survey, 2000:183) were poorly fed, as they never had the benefit of the vitamin A and iron enrichment of maize meal that was the practice during the 80s and 90s.

The World Summit for children held in New York in 1990 arrived at propositions and committed political leaders from around the world to endorse “World declaration on Children” and targeted the year 2000 for the virtual eradication of vitamin A deficiency.
This was decided upon due to the serious problem since countries like Indonesia had uncovered this to be the cause of high children mortality. However, before the country embarked on a vitamin A intervention policy, data on the vitamin A status of it’s population was essential (South African Vitamin A Consultative Group, 1995:129).

Lack of the data in South Africa led to the South African Vitamin A Consultative Group (SAVACG), supported by the South African Department of Health to initiate this study to assess the vitamin A status of preschool children with a view of formulating an appropriate policy on the need for vitamin A intervention (South African Vitamin A Consultative Group, 1995:129). The SAVACG survey’s anthropometric findings of 1994 indicated that one in four preschool children was stunted due to chronic undernutrition and one in ten was underweight. In practical terms, approximately 660 000 preschool children were underweight and 1,5 million were stunted. Malnutrition was seen to be more prevalent in the Limpopo, KwaZulu-Natal, Mpumalanga and Eastern Cape provinces (Witten, Jooste, Sanders & Chopra:3). See figure 1.1 below.

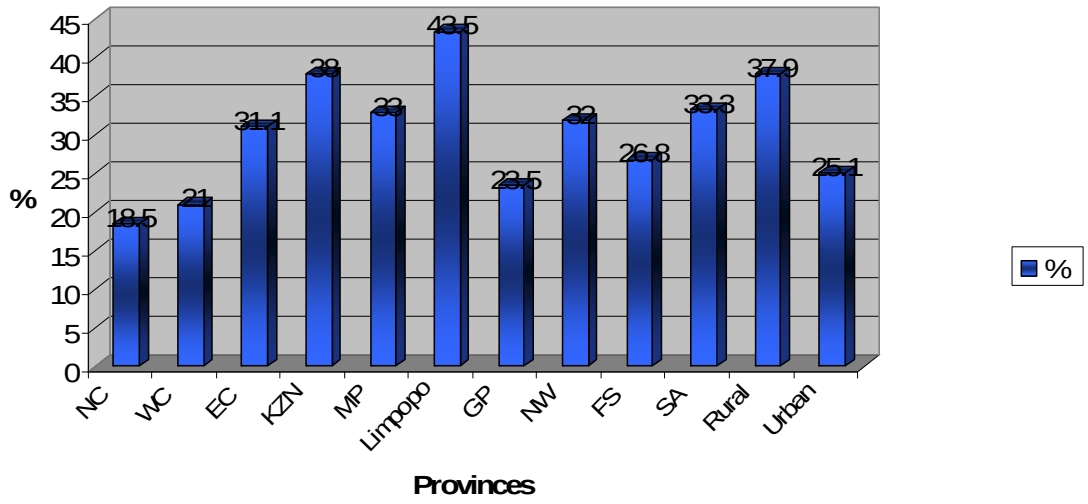

Figure 1.1: Prevalence of Vitamin A deficiency in SA (SAVACG, 1995:135)

The vitamin A deficiency prevalence was highest in peri-urban areas and in children with poorly educated mothers. (Witten, *et.al.*:3). Recommendations from the South African Vitamin A Consultative Group study (1995:138) for prevention and control of micronutrient deficiencies were to introduce micronutrient supplementation, food fortification, dietary diversification and linking these strategies with appropriate health programmes.

The next step was a South African NFCS, which collected data in 1999 to provide guidelines for food fortification. The NFCS revealed the following information about the nutritional status of children in South Africa: one out of two children had an intake of approximately less than half of the recommended level for a number of important micronutrients; great majority of children consumed a diet deficient in energy and of poor nutrient density; the dietary intake of children was less than 67% of the Recommended Dietary Allowance (RDA) for: energy, calcium, iron, zinc, selenium, vitamins A, C, D, E, riboflavin, niacin and vitamin B6 (National Food Consumption Survey, 2000:247,353); 20% of children (1-9 years) suffer from stunted growth and 10% of children are underweight (National Food Consumption Survey, 2000:183); and 50% of households experience hunger. The five most commonly consumed and purchased foods were maize, white sugar, tea, whole milk and brown bread (National Food Consumption Survey, 2000:247).

Vitamin A deficiency generally is evident where diets contain insufficient amounts of vitamin A. Vitamin A is needed for growth and development of physiologic functions, especially for periods of physiological stress (lactation) and periods of illness or parasitic infestation. In terms of diet, an inverse relationship exists between the intake of vitamin A-rich foods and the prevalence of vitamin A deficiency. A number of strategies have been used worldwide to control vitamin A deficiency. A periodic high dose of vitamin A has shown to be effective in many countries but was not sustainable. The success of the food fortification programme was dependent upon a number of factors including accessibility, affordability of the food vehicle and awareness of the targeted populations (South African Vitamin A Consultative Group, 1995:139).

The Food Fortification programme

Following the findings of the SAVACG study, experts came together to assist the South African National Department of Health in developing a food fortification programme through a process in line with the steps recommended in developing a food fortification programme (Lofti, Mannar, Merx & van den Heuvel 1996:8).

The Government's resolution to address micronutrient malnutrition was to introduce legislation making fortification of carefully identified foods mandatory (White Paper 1997:92; Department of Health, Integrated Nutrition Programme:1,2; Department of Health, Small Millers Guide:3).

The Bureau of Market Research, funded by the Department of Health, investigated and found maize meal and wheat to offer the most favourable distribution (Randall, 2002: 3).

The South African Department of Health implemented both a vitamin A supplementation targeting postpartum mothers and children (0-60 months) and the food fortification programme targeting the whole population to eradicate vitamin A deficiency on World Food day, October 2003. Accordingly, the Department of Health Regulations 24715 (2003:6-9) effected in October 2003 requires that all maize meal, wheaten bread flour and breads baked with wheaten bread flour be fortified.

Maize meal was a suitable food vehicle because 94% of the household surveys stated that they used maize meal as part of the diet. The food vehicles should be fortified at the

level designed to deliver 33% of the current recommended dietary allowances (RDAs) per serving at the point of consumption (National Food Consumption Survey, 2000:515; Gouse, *et.al.*, 2006:21). The micronutrients that are included in the fortification mix are; vitamin A, thiamine, riboflavin, niacin, pyridoxine, folic acid, iron and zinc. The amounts of these micronutrients to be added are specified in the regulations, as well as the methods by which the fortificant is added to food. The regulations make provision for manufacturers of fortified foods to make use of the food fortification logo, which if used, must be used in a specified format (Department of Health Regulations 24715, 2003:9). There are three kinds of maize meal produced (from the most highly to the least processed) that were fortified. These are: super, with a lower extraction rate, finer and higher price; special, with an intermediate extraction rate and intermediate price; and the sifted maize with a very high extraction rate and low price. (Witten, *et.al.*: 3; Gouse, *et.al.*, 2006:21).

Area of study

In 1997, 64% of working people in the former Transkei areas were to some extent involved in subsistence agriculture. Most production was for home consumption or limited local sale. Manufacturing is a small sector with 4% of value added and 6% of employment, centred in Mthatha formally known as Umtata as documented by the Eastern Cape Development Corporation (Southern Africa.co.za: 2).

Maize and wheat mills produce flour for local consumption, however, the province import from outside South Africa most of its maize and wheat for larger mills, although small-scale hammer mills locally-grown maize and have a potential to develop local markets (Southern Africa.co.za: 3).

After 1994, the Eastern Cape was subdivided into six districts of which Mthatha falls under the Oliver Tambo District. The Oliver Tambo District covers most of the former Transkei with Mthatha as the main centre and the district includes most of the Wild Coast and Pondoland. Pondoland is one of the most fertile areas of South Africa, with warm temperatures, frost-free conditions and good soils (Southern Africa.co.za: 1).

The district covers an area of 15,535 square kilometres. Oliver Tambo has the second highest population, an estimated 1,504,411 in 1999. It has a high population density for a

mostly rural district, 90/square kilometre (Southern Africa.co.za: 1). The population has an African majority of 99%, with very few coloured and white inhabitants. Xhosas are the indigenous people and Xhosa is the first language of almost all the population in the Eastern Cape (Southern Africa.co.za: 2).

1.2 MOTIVATION FOR THE STUDY

This script forms part of a larger research project funded by the National Research Foundation to ascertain whether white fortified maize meal is acceptable and whether yellow hammer milled maize meal produced by small scale farmers has a higher nutritional content and acceptability than the commercial white maize meal. This is important in terms of nutrition in South Africa as micronutrient deficiencies are prevalent throughout the country. In actual facts, Vitamin A deficiency has been declared a national public health concern as more than 33% of the population is vitamin A deficient (South African Vitamin A Consultative Group, 1995:135).

According to Purchase (2005: S20), in essence to the rising micronutrient deficiency in the world, there exists an opportunity to improve nutritional quality of food which would benefit the poor rural residents who obtain their maize and maize products from local production and village mills that cannot feasibly implement commercial fortification. FAPRI-UMC (2006:4,8) deduced that the expected result of modern biotechnology through biofortification, a genetic modification (GM) technology, would be a low-cost, self-sustaining food intervention. This maize can be grown and consumed by vulnerable populations with limited access to formal food distribution and health care systems.

This script would investigate the acceptability level and perceptions of traditionally prepared porridge cooked from commercially produced white maize meal (special unfortified and special fortified maize meal); local white non-genetically modified (non-GM) and local white genetically modified (GM) maize meal (hammermill); and local white maize meal and yellow maize meal (hammermill) among Xhosa households in Mthatha in the Eastern Cape province of South Africa.

CHAPTER 2

2.0 THEORETICAL FRAMEWORK (LITERATURE REVIEW)

2.1 INTRODUCTION

The theoretical background and the concepts relating to the chosen framework are discussed in this chapter. The theoretical framework (Figure 2.1) is adapted from Shepherd and Sparks of 1999 (Cox & Anderson, 2004:147). For the purpose of this study, focus is made on the socio-economic and psychological approaches to food choice as reflected in the Shepherd and Sparks adapted model. According to Shepherd's model, the factors influencing food choice by communities and individuals are categorized as those related to the food, to the person making the choice and to the external economic and social environment within which the choice is made (Shepherd & Raats, 1996:346).

There are various factors that affect what people eat. People eat to live and can be influenced by other individuals, organizations and professional groups, as well as through interaction of sociological, biological and psychological factors (Blades, 2001:71-74).
Social factors are determined by existing food-related issues and can also emanate from the individual's particular cultural heritage. Social factors affect a person's food selection (Krondl & Coleman, 1988:61; Cox & Anderson, 2004:147). Some of the chemical and physical properties of food perceived by an individual in terms of sensory attributes in a particular food does not necessarily mean that a person will or will not choose or consume that food. It is rather an individual likes for that particular food that will be the determining factor (Shepherd & Raats, 1996:346, 347).

Other chemical components in the foods, such as the amount of protein or carbohydrate have effects on individuals, such as reducing hunger. The learning association between the sensory attributes of a food and its post-ingestional consequences appear to be a major mechanism by which preferences develop. According to Shepherd and Farleigh, psychological differences between people such as personality, may also influence food choice. Marketing and economic variables as well as social, cultural, religious or demographics affect food choice (Shepherd & Raats, 1996: 346, 347).

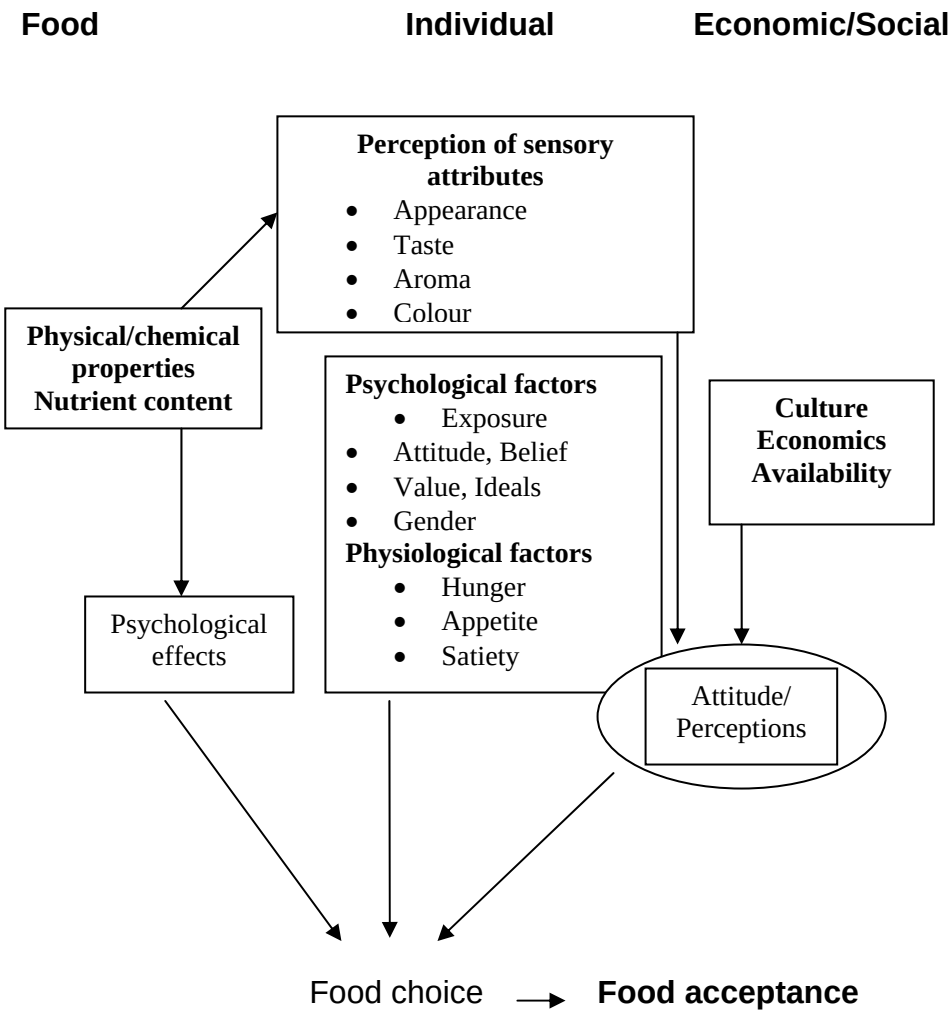

Figure 2.1: Shepherd's model. From Shepherd and Sparks, 1999 (Cox & Anderson, 2004:147)

The model reflects that populations and/or individuals' beliefs and attitudes affect food choices. Personal attributes may have major modifying effects to physiological reactions. These include perceptions of sensory attributes (e.g. taste, texture), psychological factors (e.g. belief, attitudes) and the social environment (e.g. cultural norms, economic factors and food availability).

The discussion would follow this order; firstly population or social factors, secondly individual factors; thirdly the food-related factors that influence food choice, food preference and food acceptability of food products. Then the following issues making a food choice, having a food expectation, food preference and finally food acceptance is explicated.

2.2 SOCIAL ISSUES AFFECTING FOOD CHOICE AND ACCEPTABILITY

2.2.1 Culture

Culture is defined as the pattern of knowledge, concepts, values, attitudes, beliefs and traditions that are learned and transmitted between individuals, often from generation to generation (Johns & Kuhnlein, 1990:19).

Culture is not static; it preserves traditions but also builds in mechanisms for change. Individuals are unconscious of culture because it becomes a habitual action that one is used to, imparted by parents in a particular community. Cultural traditions become internalised so that they become an inseparable part of our self-identity and it becomes difficult for one to realize how much one can be a creature of cultural traditions in which individuals are raised (Fieldhouse, 1995a:29; Shaw & Clarke, 1998:163-167).

Culture is thought to be the major determinant of food choice, due to the evidence that traditions, beliefs and values are among the main factors influencing preference, mode of food preparation, serving and nutritional status (Cox & Anderson, 2004:147).

Maize has long been the basis of African cuisine. The South African context reflects that each community in South Africa, whether Xhosa, Zulu, Sotho, Tswana or Swazi, holds to slight differences in preparing a maize dish and preferences in eating it, but certain dishes have the approval of nearly all. Here are some examples: fresh, "green" mealies, roasted and eaten on the cob, sold by hawkers almost everywhere, usually women, who set up their braziers on the pavement; dried and broken maize kernels, or samp; samp and beans (umngqusho), is a classic African dish. Dried maize kernels ground fine into maize-meal or mealie-meal, used for everything from sour-milk porridge to dumplings, crumbly phutu to fine-grained mealiepap are other classic dishes. Maize meal or mealie-meal is mixed with sorghum and yeast for umqombothi, a popular African beer, or with flour and water for mageu, a refreshing, slightly fermented drink (Afri-Chef: 1; Cuisine of South Africa: 3).

Cultural groups exhibit food practices that are related to their beliefs and value systems. Beliefs represent an interpretation of the food values and serves as cognitive elements of attitude. Values determine what is desirable and undesirable as food and which foods an

individual belonging to a certain cultural group holds in high esteem. Individuals within a culture respond to approved behavioural pressures by selecting from among the available foods those foods that are acceptable. (Parraga, 1990:661, 663; Shaw & Clarke, 1998:167).

2.2.2 Economics

Economics has a major influence on food availability, as in many cases the market forces influence the supply either directly, where there is management of food prices by the producers or governments through subsidies, or indirectly by the interplay of supply and demand. The economic status and political structures affect the access of foods mainly by their impact on food prices (Furst, Connors, Bisogni, Sobal & Falk 1996:254).

Income level influences the variety of foods from which people can choose. Low-income groups depend on lower cost foods, mainly cereals, to supply most of the energy and nutrient needs. According to various authors, they use smaller amounts of milk and meat groups. Whereas, a significant increase in consumption of dairy, fish, meat and vegetable products is observed when the income increases in a household (Robinson, Lawler, Chenoworth & Garwick, 1986:226, 227; Furst, *et al*., 1996:254).

In the South African context, the NFCS of 1999 findings indicated that only five foods found in the households that were mentioned to be frequently consumed, namely maize, sugar, tea, whole milk and brown bread. These findings were observed in lower income households (Vitamin information centre, 1999:6-9).

Even though people have nutritional knowledge on what would be good to eat, considerations of cost take precedence and economic factors limit their food variety. Money is known as an important tangible resource because of the degree of its availability, which affects the scope, and nature of food choice decisions people make (Messer, 1984:229; Furst, *et al.,* 1996:254).

2.2.3 Food access and availability

Adequate food at affordable prices is necessary if people are to have access to a healthy, balanced diet. Access to food can be influenced by area of residence, access to transport, shopping and storage facilities (Cox & Anderson, 2004:150).

The Department of Transport (2006:5) reflected from a study that 50 percent of the population of South Africa is rural and the National Food Consumption Survey of 1999 (Department of Health, 2000:74) also indicated that approximately 72 percent members of the population are poor. In the study of the Department of Transport (2006:5), the researcher observed that compared to their urban counterparts, rural people have inferior access to transport infrastructure. Rural transport infrastructure includes access roads and public transport. At village level or intra-farm transportation, women and farmers themselves provide transport services that involve head loading (carry parcels on the head), wheelbarrows, tractor-trailers, trucks and light delivery vehicles. The Department of Transport concluded that the inferior access to transport infrastructure might affect food transportation to most rural areas of South Africa, especially in the provinces of the Eastern Cape, which is regarded as one of the poor provinces.

Food access can also be influenced by culture, in cases where women and children are prohibited to eat certain foods. War and politics could affect access of food because food might not be available at the market and inaccessible because of fighting. Reduced purchasing power, where households cannot afford food at markets or supermarkets is another factor that influences food access (FAO & FSAU, 2005:10).

Availability is further described as the array of food options that are present and accessible in the food system. These foods should be acceptable to the consumer and be affordable. Immediate availability may refer to the readiness and convenience of a food type; whether it can be stored for a long time without spoilage (Nestle, Wing, Birch, DiSogra, Drewnowski, Middleton, Grant & Winston, 1998:S60-S74). In addition, food availability is a factor of production capacity, amount of imports and amount that is normally used at a given period in time and of the availability of storage. Food availability is influenced by the availability of seeds, pest infestation attack, weather conditions,

availability of pasture, land accreage under cultivation, labour availability and insecurity issues (FAO & FSAU, 2005:9).

In the South African population, the reasons for high consumption of maize meal and bread are their availability, ease of storage and convenience (Vitamin Information Centre, 1999:6-8; Viljoen, Botha, & Boonzaaier, 2005:58). It is confirmed by other research that the availability of foods within a community (at restaurants, schools, grocery stores, community centres and worksites) or country is dependent upon a number of interrelated factors such as cultivation, budget, potential profit margin, nutritional status, adequate storage and refrigeration and consumer demand (Nestle, *et.al.*, 1998:S60-S74). Food availability stretches from local retail provisioning to availability within the home (Nestle, *et al.,* 1998:S70-S74; Cox & Anderson, 2004:150; FAO & FSAU, 2005:9).

Sims and Smiciklas-Wright (1978:173-179) and Krondl (1990:9), portray that the physical environment also determine the type of foods produced, whereas the technological environment affects the type of food available for consumption. The physical environment includes climate, topography, soil conditions and this determines which foods are produced, while technology assists in food availability and distribution. Food availability has a direct influence on the food consumption in communities.

2.3 INDIVIDUAL ISSUES AFFECTING FOOD PREFERENCE AND ACCEPTABILITY

2.3.1 Food context and characteristics of food

Food context includes its name and packaging contributes to individual food preference and acceptability. According to Meiselmann (1996:246) food is often associated with a name and package. Consumers avoid risk of an unknown product by remaining loyal to a brand with which they are satisfied instead of purchasing new or untried brands. Similarly, when consumers have had no experience with a product, they tend to trust or favour a well-known brand name.

Characteristics of foods determine sensory attributes and hedonic scales of likes and dislikes, which have an effect of enhancing the acceptability of foods. An individual perceives the physical and chemical composition of food as sensory attributes such as

taste, aroma, sight and texture. These sensory attributes are known to influence both food preference and eating habits (Nestle, et. al., 1998:S60-S74; Conner & Armitage, 2002:8). Sweet, sour, salty and bitter are the terms used to describe the sensations that occur when foods placed in the mouth produce specific stimuli to the taste buds on the tongue (Robinson, *et al*., 1986:224).

Appearance

Appearance is a very important quality attribute of a food product (Walker, 2001:524). The appearance of food may be used as a cue such as for ripeness determined by colour, or colour determining acceptability for instance white maize meal versus yellow maize meal (Conner & Armitage, 2002:1-42).

Appearance may also encourage or discourage an individual to purchase or consume a food product. Other visual properties may be important but colour is the major contributory factor and known to be the first sensory property to evoke a response from a consumer (McKee & Harden, 1990:28; Walker, 2001:524).

Taste

Taste is the perception of chemicals in the food mixed with saliva on the taste buds of the tongue. This is one of the main sensory attributes used by consumers to accept or reject food products. There are four tastes that influence individuals' food choices: sweet, which is produced by substances such as sucrose; salty, which is produced by table salt and related substances; sour, from citric acid and similar compounds and bitter, which is produced by substances such as caffeine (Conner & Armitage, 2002:1-42).

Aroma

Aroma refers to sensations resulting from stimulation of the chemosensory receptor located in the olfactory epithelium of the nose. However, taste and odour(s) are the most important sensory factors in determining food choice (Kapsalis, 1986:68).

Odour can be perceived before or after the food is placed in the mouth. Along with taste, odour forms part of the total perception of overall flavour (Conner & Armitage, 2002:1-42).

It is evident that food flavour is a complex mixture of odours and one or more tastes (McKee & Harden, 1990: 30). Various compounds contribute to the taste and aroma of cooked food products, such as amino acids, fatty acids, polymers and many more (Walker, 2001:525).

Texture

Food texture can be described as the properties that are related to how a food feels in one's mouth. It can be measured by using a sensory panel (a group of people selected to taste food and give feedback) or by instrumental methods (Instron: 1). Texture describes the physical properties of food products such as fine, medium and coarse (Lawless & Heymann, 1998:388). Touch, sight and hearing are important in the perception of texture; particular types of texture are taken to be acceptable for different types of foods, like crunchy apples and creamy ice cream (Conner & Armitage, 2002:24). However, the texture of food is an important factor that influences the pleasantness of a food and how much is eaten. Texture does not only affect the acceptability of food but can affect the identification of foods. (Rolls, Verhagen & Kadahisa, 2003:3711).

Traditionally, the acceptability of the texture of maize meal porridge is evaluated when it is broken off from mould, when it is moulded in the hand and when it is chewed in the mouth.

2.3.2 Psychological factors

Individuals' food choice and acceptability can be influenced by psychological factors such as previous exposure, beliefs and attitudes, values and gender (Cardello 1994; 254; Shepherd & Sparks, 1994:204).

Exposure

Numerous experiments in children and adults have demonstrated that food preference increases with continual food exposure. The more food is tasted, the better it is liked and more frequently it is chosen. Ten exposures to a food in infancy or early childhood can lead to established preferences (Conner & Armitage, 2002:21; Cox & Anderson, 2004: 159-160). Conclusively, some degree of exposure or experience with food may lead to the formation of likes or dislikes toward a food product. Consumers in the area of study

are exposed to both white and yellow maize, although the latter is consumed more during famine.

Beliefs and attitudes

Many of the influences on food choice and acceptance are likely to be mediated by the beliefs and attitudes held by an individual. Beliefs about the nutritional quality and health effects of a food are more important than the actual nutrition quality and health consequences in determining a person's choice (Shepherd & Raats, 1996:347).

According to Cox & Anderson (2004:157-160), attitudes can be considered as a tendency which is long or short term. Attitudes are modelled as being the sum of beliefs about a food, multiplied by how important that belief is to an individual. Whereas, Conner and Armitage, (2002:8) indicated that attitudes of individuals, are known as the collection of beliefs constitute as a major determinant of many food choices. The factors influencing food choice have the effect of changing an individual's attitudes towards the food. These attitudes may concern the sensory attributes of food, the health or nutritional value of the food, or other characteristics of the food such as food cost. Attitudes towards foods are assumed to reflect the influence of many of these factors upon food choice. Shepherd and Raats (1996:349) also defines attitude as an expression of inner feeling that may induce acceptance or rejection of a food product.

Values and Ideals

Values determine what is desirable and undesirable as food and which foods are held in high esteem (Parraga, 1990:661). Values can be negotiated for specific foods and can also vary according to particular social events. Quality, which is one of the most difficult terms to explain, is one of the predominant characteristics of food that engage individuals in a value negotiation of food choice (Furst*, et al*., 1996:260-263).

Alternatively, ideals is known to be the most pervasive influence and can be defined as expectations, standards, hopes and beliefs that provide guidelines and comparison by which people judge and evaluate their food choices. Ideals have incorporated symbolic meanings in relation to food, such as social status and food choices (Furst, *et.al*., 1996:260-263; Devine, Sobal, Bisogni & Connors, 1999:88).

Gender

Various studies have reflected that there are differences in food choice among men and women. According to a study by Jamal (1996:19), interviews clearly indicated that differences among gender exist. A study from the University of Illinois (2003: 1) found that men preferred comfort foods, which were associated with meals prepared by their mothers (ethnic foods like maize porridge, meat and soup dishes) rather than snacks and sweets. “Comfort foods are foods whose consumption evoke a psychologically pleasurable state for a person," reported Brian Wansink, an Illinois marketing professor who heads the sensory laboratory. Drawing from national survey questionnaires, the laboratory has concluded that a person’s comfort-food preferences are formed at an early age and are triggered, in addition to hunger, by conditioned associations and gender differences.

2.3.3 Physiological factors

Hunger

Hunger is a physiological need for food. Feelings of hunger are stimulated by arrival of meal times, presence of food and stimulation and/ or thoughts about food. Hunger is associated with physical sensations of the body or head, such as stomach emptiness or cramps, light headed-ness, mild nausea, and tightness of the throat. These feelings stimulate thoughts about food and remind humans that the body needs food (Robinson, *et al*., 1986:222; Anderson, 1996:15; Conner & Armitage, 2002:16).

The South African context is captured in the Vitamin Information Centre (1999) by the South Africa’s National Food Consumption Survey of 1999 (2000:661, 662) where hunger is determined through food diaries. It gave a clear indication that the children living in rural households had a lower energy intake; and that the lowest was recorded in children living in commercial farms. At provincial level, households in the Eastern Cape had the highest percentage of hunger (83%). Households at risk of hunger or experiencing hunger had few items available in the house, namely maize, sugar, brown bread, tea and whole milk.

Appetite

Appetite is the desire to eat. It is associated with sensory experiences or aspects of foods such as sight and smell of food, emotional cues, social situations and cultural conventions (Anderson, 1996:15). According to Robinson *et.al.,* (1986:223), the term appetite is used to refer to a set of signals that guide selection and consumption of specific food and nutrients. It can be influenced not only by metabolic (physiological) factors but also by hedonic factors, environmental and social influences, cultural factors and learned preferences. Appetite is a reflection of eating experience affecting food acceptance or rejection.

Satiety

Satiety is the physiological and psychological experience of fullness that comes after eating or drinking. Satiety is characterized by gastric distension and elevations in blood glucose (Anderson, 1996:15). Satiety can also be referred to as the state of resistance to eating which follows food consumption (Robinson, *et al.,* 1986:224).

2.4 FOOD RELATED ISSUES THAT INFLUENCE FOOD PREFERENCE AND ACCEPTABILITY

2.4.1 Chemical properties of food: Nutrient content

A nutrient is a compound or molecule that helps to support life. The nutrient content is often expressed in terms of a food's macronutrient (carbohydrates, protein, fats) and micronutrient (vitamins, minerals, trace elements) contents (Food Constituents: 1; Conner & Armitage, 2002:7). The chemical such as the amount of carbohydrate, protein or fats in food may affect consumers' acceptance.

Carbohydrates are the main source of energy, while fats can be used as either an energy source or as an energy reservoir (if they are produced inside the body). The rest of the nutrients do not have a primary function of supplying or storing energy. However, they are just as important in the functions that they do perform (Food Constituents: 2). Proteins are large compounds that are formed when amino acids combine. They are the building blocks or cells, tissues, and organs (Food Constituents: 3). Potter & Hotchkiss (1998:383) reported the nutritional quality of cereal proteins such as maize, not to be high quality as that of animal protein.

Vitamins are needed in very small amounts. Most vitamins act as cofactors in reactions that take place in the body. Many vitamins can be synthesized in the body, and therefore, do not need to be included in the diet. However, some vitamins cannot be synthesized by the body and must be supplied. Vitamin deficiencies can cause easily visible symptoms (Food Constituents: 3).

Like vitamins, minerals are needed in only small amounts. However, minerals are not considered to be organic compounds. Minerals are actually elements. They can be classified according to their need into two groups: macro- and microminerals. Minerals also act like vitamins in that they help to control many body processes. Sodium, calcium, phosphorus and potassium are four of the macrominerals that are needed by the body (Food Constituents: 5).

Maize is composed of approximately 72% carbohydrates, 10% protein, 4% fat, 2% indigestible fibre, with moisture content of 11% and providing 352kcal per 100g prior milling. These values vary slightly depending on the varieties, geographical weather and other factors (Potter & Hotchkiss, 1998:382). Department of Health Regulations 24715 (2003:22), stipulate the amounts of critical micronutrients for inclusion in super, special and sifted maize meal. These micronutrients are vitamin A, thiamine, riboflavin, niacin, pyridoxine, folic acid, iron and zinc that all manufacturers need to ensure compliance during production in order to improve the health of South Africans.

2.4.2 Physical properties: Texture

Texture of food is defined as the general class of characteristics determined by physical properties such as fine, medium and coarse (Minoza-Gatchalian, 1981: 197). Depending on the practices of the community, acceptability could differ in various maize meal types, namely sifted, special and super. So texture of the maize meal in this study is visual and through mouthfeel, hence assessed through touch and sight of the maize meal dishes.

2.5 FOOD PERCEPTIONS, FOOD EXPECTATIONS, FOOD CHOICE AND FOOD ACCEPTANCE

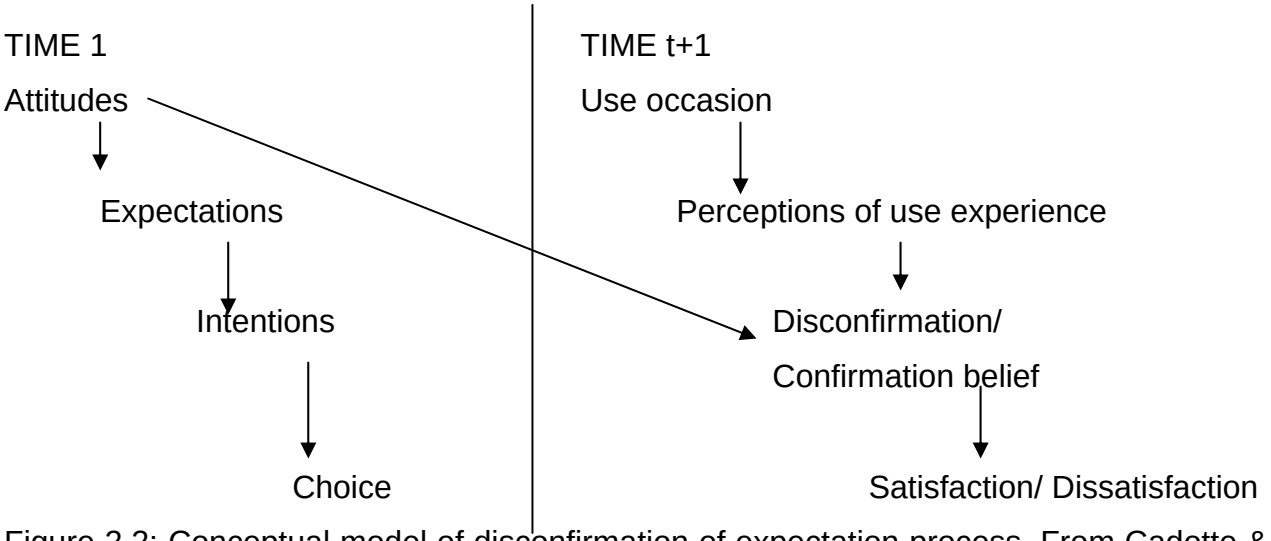

Figure 2.2: Conceptual model of disconfirmation of expectation process. From Cadotte & Oliver, 1980 (Spreng & Mackoy, 1996:202)

Food perception

According to Krondl and Coleman (1988:58-61) perception is an approximation of reality. The brain attempts to make sense out of the stimuli to which we are exposed. Several sequential factors influence perception. Exposure involves the extent to which we encounter a stimulus, for example, eating maize meal from home-grown maize. Exposure is not enough to significantly impact the individual, at least not based on a single trial. In order for stimuli to be consciously processed, attention is needed. New information or exposure triggers one's memory, then interpretation and integration in the new given situation occurs. Decision is made depending on the evaluation, which is based on the organized memory box. That event would lead to food selection being made. Perceptions can be measured by interviews as peoples' perceptions and intentions can be expressed in words (Krondl & Coleman, 1988:58-61).

Food expectations

According to Cardello (1994:277) food expectations can be classified as: a sensory-based expectation, for instance, a belief that the food product will possess sensory attribute at certain intensities and secondly, hedonic expectation, which is a belief that the product would be liked/disliked to a certain degree. A mismatch between expected and actual sensory attributes or between expected and actual liking can result in

disconfirmation. In the case of disconfirmed hedonic expectations, the disconfirmation can be positive when the product was better than expected or negative when the product was worse than expected (Cardello, 1994:277). Meisselman (1996:259) confirms that Cardello focuses on both novel and more common products and focused on when consumer expectations are not met.

There are two alternate models of disconfirmation; a contrast model, when ratings move away from expected rating, and an assimilation model, when ratings move towards the expected rating. Results from Cardello (1994:289) have supported assimilation, meaning that products with high expectations tend to actually be rated higher and products with low expectation to be rated lower than their baseline values. Once sensory response occurs, acceptability would be affected through ratings of satisfaction and dissatisfaction. Spreng and Mackoy (1996:202) explain that the evaluation is done within a framework of expectations to conclude a desires congruency (of what was expected), to conclude positive or negative disconfirmation.

Food choice

Food choice refers to a set of conscious and unconscious decisions made by a person at the point of purchase and at the point of consumption or at any point in between (Hamilton, McIlveen, & Strugnell, 2000:113). Influences on food choice are mediated by people's beliefs and attitudes, sometimes accompanied by learned sensory attributes instead of the actual nutritional quality and health consequences (Shepherd & Sparks, 1994:205).

Food acceptance

Food acceptance is determined by a series of chemical, physiological, diet related and psychological criteria. It can be determined by social environment of the eating person (Bergier, 1987:303). The best measure of acceptance has been observed to be a consumer test for the sensory attributes of food. This can be obtained through scaling of the hedonic elements of food (Cardello, 1996:10). Cardello (1996:56) further indicates behavioural measures to include those that are prominently purchased and consumed to determine food acceptance. In some situations both can be elicited simultaneously. In this study, consumer tests for the sensory attributes were conducted in order to measure the acceptance of the various maize meals.

CHAPTER 3

3.0 RESEARCH DESIGN AND METHODOLOGY

3.1 INTRODUCTION

The research design and methodology are based on a plan, which is essential for research, which assists to dictate and illustrate materials, methods, techniques and procedures used. The research design and methodology that were used to execute the study aim and objectives will be discussed in this chapter. The study was executed in two phases, which were sensory evaluations and focus group surveys in two villages (Ngqeleni and Mqanduli) of Mthatha in the Eastern Cape Province of South Africa.

3.2 RESEARCH AIM AND OBJECTIVES

The research aim for this study was to determine the level of acceptability and perceptions of traditionally prepared maize meal porridge made from commercially produced white maize meals (special unfortified and special unfortified maize meals); local white non-genetically modified (non-GM) and local white genetically modified (GM) maize meals (hammermill); and local white maize meal and yellow maize meal (hammermill) among Xhosa households in Mthatha in the Eastern Cape province of South Africa.

Phase I objectives are as follows:

- To quantify the level of acceptance of the sensory attributes of appearance, aroma, taste of traditionally prepared porridges made from commercially produced white maize meals (special unfortified and special unfortified maize meals); local white non-genetically modified (non-GM) and local white genetically modified (GM) maize meal (hammermill); and local white maize meal and yellow maize meal (hammermill) among Xhosa households in Mthatha in the Eastern Cape province of South Africa.
- To determine the overall acceptability of traditionally prepared maize meal porridge prepared from commercially produced white maize meal (special unfortified and special unfortified maize meal); local white non-genetically modified

(non-GM) and local white genetically modified (GM) maize meal (hammermill); and local white maize meal and yellow maize meal (hammermill) among Xhosa households in Mthatha in the Eastern Cape Province of South Africa.

Phase II objective is as follows

- To gather understanding or a perception of the traditionally prepared maize meal porridge from commercially produced white maize meal (special unfortified and special unfortified maize meal); local white non-genetically modified (non-GM) and local white genetically modified (GM) maize meal (hammermill); and local white maize meal and yellow maize meal (hammermill) among Xhosa households in Mthatha in the Eastern Cape Province of South Africa.

3.3 RESEARCH DESIGN

The research was empirical in nature and of primary data design to a real life situation that stimulated the curiosity of the researcher. The objectives considered were exploratory-explanatory (Babbie & Mouton, 2001:74, 76) and provided an opportunity for an improved understanding of the community of Mthatha's acceptance and perceptions on the different maize meals. An exploratory study determines interesting patterns in the data hence to explicate the concepts and the constructs, whereas an explanatory study explains the exploration or report causality between the variables (Babbie & Mouton, 2001:80, 81). The study was cross-sectional in nature, which according to Babbie & Mouton (2001: 92), is typical of exploratory and some explanatory studies.

The research was conducted from a quantitative methodological paradigm and included both qualitative as well as quantitative data collection techniques to explore the relevant phenomena. The use of multiple data sources and data collection techniques was to enhance the validity and the reliability of the study (Viljoen, Botha & Boonzaier, 2005: 46). This study was executed in two phases. Phase I, was a qualitative research approach which was employed through the use of consumer tests through sensory evaluations to measure the hedonic response of the products. Phase II, was a quantitative research approach through focus group interviews in order to obtain supportive information to interpret and explain data explained in phase I of this study.

Viljoen, *et.al.* (2005:46) deduced that both the sensory evaluation and the focus group interviews are some of the various appropriate techniques to utilise in fulfiling the research problem in order to complement and reinforce each other. The study was completed within one month that being July 2006 with the assistance of another master's student and trained fieldworkers.

3.4 RESEARCH METHODOLOGY

3.4.1 Sampling

Phase 1: Sensory evaluation

The sample framework consisted of consumers in LSM 3 according to the South African Population Living Standard Measure (LSM) Segmentation (2005) calculation. Irrespective of race and gender, four sets of twelve (12) household representatives were recruited through the local farming community organisations and the local churches, based on their availability and willingness to participate. These participants originated from two geographical areas of Mthatha. The two areas are Ngqeleni and Mqanduli, which are both approximately 30 km from Mthatha located east (off R61 to Port St Johns) and south (off N2 to East London), respectively.

For the purpose of this study judgement sampling was used (Lawless & Heymann, 1998: 94), hence making the sample size to be forty eight (48) participants from Mthatha area in total. Finally, there were 51 participants who participated in the study.

The participants were household representatives that were main purchasers of food irrespective of gender and had to be 18 years and older. The participants completed consent forms before they participated in the study.

The department of Agriculture regional office assisted in identifying and locating the villages for the study. We were accompanied by the department of agriculture's extension officers servicing the villages to meet with fieldworkers (helpers) for the study. These fieldworkers arranged venues and recruited community members to participate in the study. The fieldworkers were requested to complete a mini-survey (see addendum v) designed by the researcher to get a background of the two villages in terms of literacy

and cultural systems of the area of study. This survey reflected clearly that members of the villages were semi-illiterate.

Phase 2: Focus Group

Two focus groups consisted of fifteen (15) participants in Ngqeleni and sixteen (16) participants in Mqanduli who participated in the interviews until saturation.

3.4.2 Conceptual framework for the study

The theoretical framework (Figure 2.1) is adapted from Shepherd and Sparks model of 1999 (Cox & Anderson, 2004:147). The research process conceptual framework for the study is based on that adapted from Shepherd and Sparks model in figure 3.1. It reflects some of the factors relevant for this study, which influence food acceptability and perception in terms of the various maize meals.

3.4.3 Conceptualization

The concepts derived from the research process conceptual were defined in order to give guidance to what was to be measured in order to achieve the research aims and objectives.

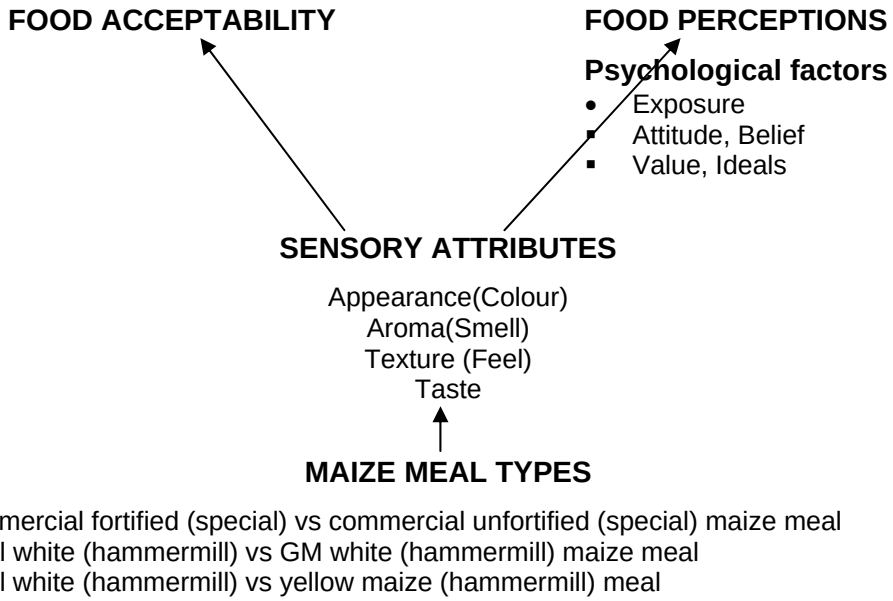

Figure 3.1: Research Process Conceptual Framework

Phase 1: Sensory evaluation

Appearance

Apperance is known to be the most salient aspect of the visual properties of foods in terms of texture, gloss and colour that play an important role in food acceptance (Cardello, 1996:11; Lawless & Heymann, 1998:804). The appearance in colour of food may be used as cue for ripeness or freshness (Conner & Armitage, 2002:1-42). Colour is an important trait that may induce acceptance or rejection in this study. McKee and Harden (1990:28) and Walker (2001:524) confirm that appearance encourages or discourages individuals to purchase or consume a food product.

Taste

Taste is an individual sensation (sweet, sour, bitter, salty) resulting from the stimulation of taste buds (chemosensory receptors) located in the tongue and certain other areas of the oral cavity when food is put in the mouth in a solution with saliva. It is an important sensory attribute for this study, according to Kapsalis (1986:65) used by consumers to accept or reject food products. For the purpose of this study, salt was not added during preparation in order not to obscure the real flavour of the maize meal porridges. The maize meal porridges were also prepared using the familiar local water available.

Texture

Texture of food is defined as the general class of characteristics determined by physical properties such as fine, medium and coarse (Minoza-Gatchalian, 1981:197; Lawless & Heymann, 1998;388). For the purpose of this study, texture is detected when breaking the mould, by feel in the hand and mouth.

Aroma

Aroma refers to sensations resulting from stimulation of chemosensory receptor located in the olfactory epithelium of the nose (Kapsalis, 1986: 68). Lawless and Heymann (1998:804) further define aroma as the fragrance or odour of a food product as perceived by the nose from sniffing the food product.

The variables that follow form part of the background for the qualitative part of the study, which was not measured. This information was useful in order to support the quantitative research of phase one.

Attitudes

Attitudes are classified as belonging to the affective domain that is pertaining to feelings and emotion of a consumer, which may induce acceptamce, or rejection of a food product. It is more predictive of behaviour than is knowledge and an important factor in food acceptance (Parraga, 1990:663; Sherpherd & Raats, 1996:246).

Beliefs

Beliefs about food represent an interpretation of the food values and serve as cognitive elements of attitude (Parraga, 1990:661).

Values

Values are defined as enduring beliefs, which guide and motivate behaviour (Connors, Bisogni, Sobal & Devine, 2001:190).

Ideals

Ideals are deeply held beliefs and expectations about food and eating that provide guidelines and rules for making food choices (Devine, Sobal, Bisogni & Connors, 1999:88).

Exposure

Exposure is determined by the numerous occasions of eating. The more often food is tasted, the better it is liked and more frequently it is chosen (Conner & Armitage, 2002: 21; Cox & Anderson, 2004:159-160).

Fortification

Fortification is the addition of specific amounts of one or more micronutrients (vitamins and/or minerals) to food to improve the nutritional quality of the diet of the consumer, leading to the reduction and prevention of micronutrient deficiencies in a country as per government legislation (Department of Health, Small Millers Guide: 1).

Genetically modified (GM)

Genetic modification is based on the artificial manipulation and transfer of genetic material (Madden, 1995:16).

Maize meal

Maize meal is milled maize products that are classified as super, special, sifted and unsifted. See maize meal types as tabulated by the Department of Agriculture Regulation 1739 (1993) in table 3.1 below. (Department of Health, Small Millers Guide: 3).

Table 3.1: Maize meal types. (Department of Health Small Millers Guide:3)

Maize meal Types:	Extraction rate	Fat Content	Fibre content	Texture
Super	Lower ↓ Higher	Lower ↓ Higher	Lower ↓ Higher	Finer ↓ Coarser
Special				
Sifted				
Unsifted				

Food choice

The term food choice refers to a set of conscious and unconscious decisions made by a person at the point of purchase and at the point of consumption or at any point in between (Hamilton, *et al*. 2000:113).

Food preference

Food preference is a general tendency for a particular food, independent of an eating situation (Parraga, 1990:663; Fieldhouse, 1995b:194).

Food Acceptability

Food acceptability is determined by a series of chemical, physiological, diet related and psychological criteria. It is determined by social environment of the eating person (Bergier, 1987:303).

Food perception

Food perception can be viewed as the outcomes of previous real food experiences. They form structures stored as memory schemata, which may be activated on new encounters with foods to provide an evaluation within a given situation (Krondl, 1990:12).

Food availability

Food availability is a factor of production capacity, amount of imports and amount that is normally used at a given period in time and of the availability of storage. Food availability is influenced by the availability of seeds, pest infestation/ attack, weather conditions, availability of pasture, land acreage under cultivation, labour availability and insecurity issues (FAO & FSAU, 2005:9).

3.5 DATA COLLECTION & COMBATTING ERROR

Phase1: Sensory evaluation

Definition: Sensory evaluation is a scientific discipline which employs the quantitative technique whose main objective is to evoke, measure, analyze and interpret reactions to those characteristics of foods as they are perceived by the consumers senses of sight, smell, taste, touch and hearing. The numerical data is collected to establish relationships between the products characteristics and human perception (Lawless & Heymann, 1998;2). Consumer testing was the sensory test used for this study, which was comprised of untrained users.

For the purpose of this study, an affective method was applied which evaluates preference and/or acceptance of the different maize meal products. The maize porridge was compared as follows; commercial white fortified (special) versus commercial unfortified (special) maize meal; local white (hammer mill) maize meal versus local GM white (hammer mill) maize meal; and local white (hammer mill) and yellow (hammer mill) maize meal.

Motivation: According to the British Nutrition Foundation, (2003:1), acceptability is tested through a sensory evaluation. For the purpose of this study, a consumer test was used to test the acceptability of various maize meal types in the community of Mthatha in the Eastern Cape of South Africa.

The aim of the sensory evaluations in this study is to test the acceptability of different types of maize meals. The main objective was to organise the participants to taste so that they could evaluate the acceptability of the samples in terms of taste, aroma, appearance and texture of the various types of maize meal porridges.

Procedure: The **sensory evaluation** was done in central locations, which were community facilities such as a church in Ngqeleni and at a community hall in Mqanduli. Participants were pre-recruited by a community contact person (Stone & Sidel, 1985:239-249).

Two masters' students, who had previously participated in conducting a similar consumer test under the supervision of two (2) professors from the department of Consumer Science and two (2) doctoral students from other related departments of the University of Pretoria, conducted the tests. For this study five fieldworkers, consisting of two (2) local cooks and three (3) additional volunteers were trained and utilized per village in total (ten) 10. These fieldworkers were utilized for the pilot study and trained prior to the data collection day.

Commercial unfortified (special) maize meal was organised by the University of Pretoria's researcher from Limpompo. Impala special maize meal was bought in Mthatha from Metro. The yellow, white and GM white maize were bought from a local farmer, Umtiza cooperatives in Mthatha. The field workers assisted the researcher to take these to a local small miller to be milled at a fee.

Most households are in the LSM 3 range hence had no electric stoves or fuel for paraffin or gas stoves. In both villages, the maize porridges were cooked in cast iron pots on open fire, as this was still their common way of cooking especially for larger households and for functions like weddings, funerals and umgidi (boys' post-initiation celebration).
Local cooks prepared the traditional porridges to ensure that they cook the local way because according to Schutz (1994:28), differences in preparation make a difference in the nature of appropriateness ratings. Cooking was done in semi-enclosed rooms in both villages. They prepared the porridges according to the acceptable practice per village. This was indicated clearly in the standardized recipes recorded on addendum IV. There was an evident difference in preparation methods, for instance in Ngqeleni village,

they made a paste which was added to boiling water but in Mqanduli, dry maize meal was added to the boiling water. Preparing maize meal porridge in the most familiar method to the area enhances acceptability and consistency, reducing error on data collection.

The lids of the pots were clearly marked with random codes corresponding to the maize meals being used to prevent bias. Coding was important and closely monitored from the pot to the tables to enhance accurate data collection. The researcher dished the samples and closed them immediately with corresponding coded foils to prevent mixing of the samples and loss of moisture and flavour. This also assisted in avoiding serving them cold as the participants normally consume maize meal hot to combat error. The researcher was assisted by the helpers to set on the tables, deliver samples and to collect them from the participants.

Psychological errors need to be addressed during a sensory evaluation. According to Stone and Sidel (1985:91), using scales with fewer extremes, for instance, can minimize extremes. For the purposes of this study, a smiley face scale was used, which was even the less extreme, as it was a 5-point scale. Effect of contrast takes place when the contrast between two successive samples is so great that the second may be rated unnecessarily high or low (Monoza-Gatchalian, 1981:125; Stone and Sidel, 1985:95). The participants were presented with the same consistency of maize meal at the same time in order to combat error. Whereas, effect of convergence is the opposite of the effect of contrast where there is minimal difference between samples. This error tends to be common when the products are known (Stone and Sidel, 1985:95). To combat this error, proper product selection was done and products were concealed from the panellists through proper coding of the samples. Proximity error is characterized by more similar ratings in adjacent products (Stone and Sidel, 1985:95). This was minimized by proper randomization of the samples. The middle number of the three-digit code represented the number of the sample. The coding was as follows 218, 429, 934, 549, 653 and 762, minimized bias in the study (Monoza-Gatchalian, 1981:124) and colour camouflaging in terms of personal characteristics that could have influenced panellists' judgement.

Participants were offered water to wash their hands at the beginning of the tasting sessions. Damp disposable kitchen towels were also offered so that they could wipe their hands if they needed to use their hands to eat or when checking the texture of the maize meal porridge. Carrots and water at room temperature were used for removing flavour in the mouth as Stone and Sidel (1985:35) and Kapsalis, (1986:9), which assist to combat error.

The tasting room was removed from the preparation area to avoid panellists gaining information that would influence judgement. Identical white disposable plates were used and served one at a time in random order. This was so that maize meal products of the same texture (both samples special maize meal per session) would be served one after the other. Serving the samples in pairs confused the panellists during the pilot study. Therefore is it was decided that one sample would be served randomly instead of in pairs. The pilot was conducted on the fieldworkers during their training sessions at each village approximately a week prior to the sensory evaluations in each village.
Forty-eight (48) participants were recruited and finally 51 participants completed consent form prior to the test. The sensory evaluation was representative of all age groups and both genders in order to be conclusive about a particular population. Since the criteria of the participants was that they are household representatives, people of 18 years and older were recruited to take part in the study. Walliman (2005:294,295) indicates bias is controlled by a cross-sectional representation of the population with varying age groups and gender distribution. For this study, both men and women participated. In most instances, it becomes difficult to get male respondents for the test but approximately 41% of men participated for this study. The participants were divided into age groups of 18-25 years, 25-40 years and older than 40 years, although the exact age was recorded on the consent forms and sensory evaluation forms.

The participants were given consent forms to complete prior the sensory evaluation. The participants were requested to make independent judgements. Since this was an acceptance test, the samples were served at the temperature at which they were normally eaten. The consumers expressed their acceptance for the maize meal products using hedonic scaling (Kapsalis, 1986:4-12; Bovell-Benjamin & Guinard, 2003:381). They were presented with one sample at a time and indicated their acceptance or rejection each for these sensory attributes namely; taste, appearance, aroma and texture. All

participants filled in the responses to each attribute at the same time step by step. The fieldworkers and the researcher walked to each panellist to check whether the response was correctly marked at the right places. There were three sessions and six porridges tested for this study. Although the porridges were served one by one per session, they were given to the participants randomly. This was to avoid a particular porridge being tasted last at each session, hence be disadvantaged hence encourage a bias assessment to the ones that always tasted last.

The research team were communicating in the local language, Xhosa. Respondents were given a token of appreciation for participating in the study in the form of a 5kg commercially packed fortified maize meal. The fieldworkers were reimbursed for their time and any travelling costs they might have incurred.

Measuring Instrument:

Find self-administered questionnaire attached on addendum I. Hedonic scaling, specifically smiley face scales was used to assist those with limited reading and/or comprehension skills (Stone & Sidel, 1985:58-86). Four sensory attributes were measured, namely taste, appearance, aroma (smell) and texture (feel). Smiley faces in figure 3.2 with 5-scales were used to record their preferences since this was a semi illiterate group to avoid confusion by use of complicated 9-scale hedonic scales to combat error. The researcher explained what the faces on the evaluation meant. The evaluation forms were also written below the faces in the local language in order to prevent misinterpretation of the faces in order to combat error.

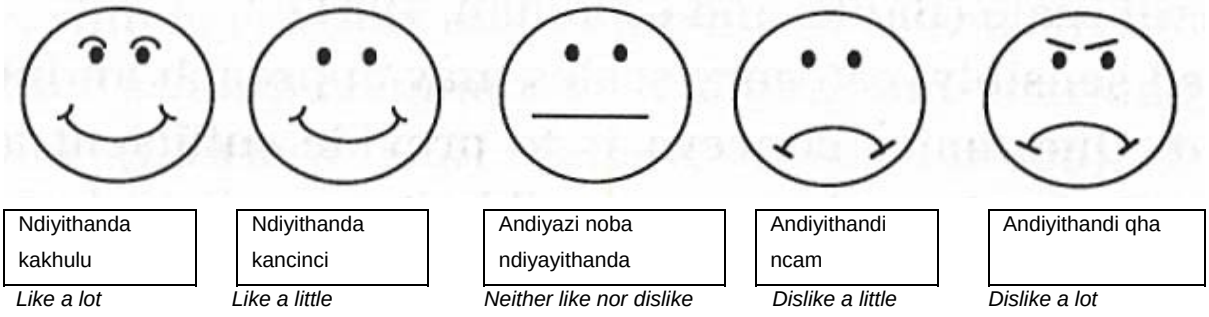

Figure 3.2 Smiley faces with 5-scales

The panellists expressed their feelings towards the food samples placed before them by crossing out the face they preferred (Minoza-Gatchalian, 1981:247). The panellists used

pencils to cross out the face they prefer per taste attribute before moving on to the second sample likewise.

Phase 2: Focus Groups

Definition: The focus group was the technique selected from the Participatory Rural Appraisal (PRA) methodologies. Using focus groups is a qualitative method of collecting data. Instead of numbers used in quantitative research, qualitative research is marked by observations or words, which describe the issue in question. Focus groups are group interviews that assist to better understand how people think about an issue or product. The main purpose of this focus group was to promote self-disclosure among participants and to know what people really think and feel. This gave an opportunity to listen to the participants and learn from them, and to create lines of communication (Vos, Strydom, Fouche & Delport, 2005:286-313; US Department of Labour:1-4). Focus groups are also useful in that they create meaning among groups rather than individually (Babbie & Mouton, 2001:292; US Department of Labour:1-2). Twelve (12) people were requested to participate to ensure maximum inputs in case some participants might be shy to talk. More people were interested and finally fifteen (15) people from Ngqeleni and sixteen (16) people from Mqanduli participated. The groups were large enough for everyone to exchange ideas and opinions but small enough for everyone to participate in the discussion.

The study investigated the perceptions of the various maize meal types namely, commercial white (special) fortified and commercial unfortified (special) maize meal; local (sifted) mill white maize meal and local (hammerill) GM white maize meal; and local white (hammermill) and local yellow (hammermill) maize meal in the community of Mthatha, in the Eastern Cape.

Motivation: **Focus groups** were conducted in order to determine opinions on various types of maize meal porridges amongst Xhosa consumers of Ngqeleni and Mqanduli villages in Mthatha in the Eastern Cape Province of South Africa. Focus groups allow the researcher to investigate multitudes of opinions and perceptions in a defined area of interest (Vos, *et al.,* 2005:287). Focus groups ensure the researcher receives high-quality data in a social context where people can consider their own views in the context of the views of others (Patton, 1990: 47). According to the US Department of Labour, (Simply

Better:2) the participants should have common demographic characteristics. This was achieved in this study because in one interview there were participants from Ngqeleni and Mqanduli villages respectively, in order to combat error.

The aim of the focus group surveys in this study was to obtain understanding of the phenomenon being studied in the defined area which would help explain the quantitative data collected. The objective is to gain understanding and/or opinions consumers have of various types of maize meal porridges, namely white fortified and unfortified; hammer mill white and hammer mill GM maize meal; and white and yellow maize meal

The focus group discussion was expected to probe attitudes and uncover underlying feelings about issues (Lawless & Heymann, 1998:553) which would encourage them to give an honest opinion about their understanding of the various technologies such as food fortification and genetic medication and their acceptability of the different types of maize meal. While a literature review was used to provide a theoretical framework for the study, the focus group discussions allowed for the inclusion of additional information that might not have been taken into consideration before.

Procedure: Two group sessions were facilitated. The participants sat in a group close to each other in front of the researcher to discuss perceptions with the different maize meal types of porridges. The researcher was standing in front of the participants in order to keep an eye contact and be able to observe facial expressions of the participants. The participants were encouraged to express their views without fear of intimidation. The discussion allowed the participants to contrast opinions and relate the information to the previous experiences. In order to enhance reliability and reduce possible error in focus groups, the following precautions were taken:

- The moderators spoke the local language of the area and one of them belonged to the same ethnic group. This avoided misinterpretation, which can easily distort information, while, at the same time, it could achieve a high level of trust with the participants (Kruger & Gericke, 2004:44).
- The focus group discussion was held in a neutral environment to enhance open communication between participants.
- A minimum of twelve willing individuals were allowed for each session and enough time to voice their opinions

Measuring Instrument: A structured interviewing questionnaire was compiled and used to guide the focus group discussion. Find attached addendum II. Notes were taken and a tape recorder was used to capture the information. A video recorder was not used as it can be invasive and affect the responses the participants make, resulting in a deviation of the results.

3.6 DATA ANALYSIS

Phase1: Sensory evaluation

Statistical analysis was done in order to comprehend the results (Leedy, 1997:243). The information obtained from the sensory evaluation forms was entered into spreadsheets, cleaned and coded for analysis using SPSS version 12 for the one-way tests. The one-way ANNOVA package was used for the analysis of variance on the data collected for possible correlations to be investigated between variables of age, gender and the different maize meals.

Phase 2: Focus Groups

This is an inductive form of analysis; the basis for analysis was transcripts, tapes, notes and memory. The tape-recorded focus group interviews were put into text-format to be cleaned, coded and analysed.

Information from the two groups was to be drawn together and discussions compared and examined to find whether these relate to the variation between the groups (Vos, *et al.,* 2005:286-313).

3.7 QUALITY OF DATA (VALIDITY/RELIABILITY - COMBATING OF ERROR)

The aim of any research is to provide data that is valid and reliable, hence giving confidence in the findings in order to understand whether the findings will also apply to other contexts.

Trochim (2005:1) described validity as an approximate truth of propositions, inferences or conclusions. Different dimensions of validity may apply to different stages of the research

process and it is essential that all the elements of validity be considered throughout the whole research process in order to describe the truth as closely as possible.

The following was done to limit error and to enhance validity and reliability of data during the research process.

Phase 1: Sensory evaluation

Validity refers to the extent to which data collected by the researcher adequately reflects the true meaning of the concepts, which are investigated (Babbie & Mouton, 2001:122). The constructs were conceptualised**,** which is proving a clear theoretical definition for each construct and making sure that each measure indicates one specific concept. Concepts provide the building blocks of scientific knowledge and refer to both the clarification and the analysis of the key concepts (Babbie & Mouton, 2001:125; Vos, *et al*., 2005:162,163). If concepts are poorly planned and conceptualised, the research, however carefully executed, will fail. It would be difficult for the researcher to identify what she was supposed to measure or investigate for the study. To enhance the theoretical validity, all the key concepts to be measured were clearly defined, for example, taste, appearance, aroma and texture before the compilation of the sensory evaluation questionnaire. This was further supported by focus group discussions to ensure that nothing relevant was overseen or omitted or incorrectly labelled, left vague or complex.

Sampling is an external validity, which is the degree to which the conclusions in the study would hold for other people in other places and at other times. According to Trochim (2005:1), there are two major approaches to provide evidence for a generalization. The sampling model is one approach, which determines the identification of the population to be generalized. The sample in the study is representative of the population, which would allow for the generalization of the results back to the population. Whereas, the proximal similarity model approach ensures that another population similar to our study is used. According to social research studies, random selection could improve the external validity of the study. A random selection was also used for this study. The population for this study has been well defined to be for rural communities with a special focus on lower socio-economic groups in the LSM 3 categories and consumers in areas where non-

fortified maize meal is available, as was targeted by the Department of Health's communication strategy.

For this study, both women and men participated in the study and the age ranged from 18 years to over 55 years. Faulty sampling is a threat to external validity, which occurs if the sample is representative of who is available in the population rather than the whole population (Walliman, 2005:294,295).

Content validity is required when determining the instrumentation used to measure the representativeness of the sample (Leedy, 1997:33,34; Vos, *et al*., 2005:161,162). According to Walliman (2005:294,295), content validity is classified as an internal validity which determines faulty inappropriate measuring instruments that lead to inaccurate data, as well as selection, where bias may occur due to faulty or inadequate sampling. Faulty measuring of instruments could occur if there was no good population representation and during cooking, as the cooks are community members who might not be familiar with measurements when cooking. There was strict monitoring of the cooks by an assisting researcher. Faulty measuring can occur even when an incorrect sample has been selected.

Three digit random codes would be used to avoid bias. The study also ensured that only household representatives participated in the study to further minimize bias.

Face validity refers to what an instrument appears to measure (Leedy, 1997:32,34; Vos, *et al.*, 2005:160,162). Sensory evaluation is used to evaluate people's likes and dislikes. A consumer test specifically was utilized to measure product acceptance or preference (British Nutrition Foundation, 2003:1) for this study. Construct validity refers to the extent to which a scale index measures the relevant constructs during operationalization (Babbie & Mouton, 2001:128). The hedonic scaling was used as major means of measurement in the questionnaire, based on its success in similar studies in the past. More specifically, smiley face scales were used to assist those with limited reading and/or comprehension skills (Stone & Sidel; 1985:58-86). Predictive validity assesses the operationalizations ability to predict something it should be able to predict or measure (Trochim 2005:7). For instance, we could theorize that the sensory evaluation tests should be able to predict the acceptance of the different maize meals.

According to Monoza-Gatchalian (1981:114), a sample of forty (40) to one hundred (100) panellists can participate in a consumer test. Schutz (1994:34) confirms that consumer tests require as few as twenty five (25) to fifty (50) respondents, if there is no further breakdown of the population to produce reliable means of an item and yield reliable results compared to market research judgements that require larger numbers of respondents.

External validity is a factor of reliability, through what is known as a vague identification of independent variables. This is characterized by the researchers inability to replicate the experiment (Walliman, 2005:294,295). Consumer tests do not require to be replicated as each respondent is expected to be a replication of another. First impression or degree of acceptance is the only information to be elicited from a consumer test.

The Hawthorne effect occurs when people tend to react differently when they are aware that they are the subjects of an experiment (Walliman, 2005:294,295). They may not give honest opinions because they know they are part of research. Clear explanation of the importance of their responses at the beginning of the test would assist to combat error.

Extraneous factors can cause unnoticed effects on the outcome of the experiment, reducing the generalizability of the results (Walliman, 2005:294,295). The standard cooking method may affect the response, as individuals prefer various variations of cooking maize meal porridge. Only the cooking method preferred in the area should be used to prepare for the tasting to ensure the appropriateness of ratings (Schutz, 1994: 28). For example, if soft porridge or crumbly pap is preferred in the Eastern Cape, the maize meal porridges should be prepared this way. The maize meal porridges were prepared in the locally preferred methods by the cooks.

Phase 2: Focus group

Credibility, transferability, dependability and confirmability are the major components that enhance trustworthiness of the focus group interviews conducted in this study.

To achieve credibility the data collected was recorded to avoid loss or distortion of information. The researcher can disturb the consumers' normal behaviour by writing at all

times. For this reason, tape and video recording would alleviate loss of the information (Vos, *et al*., 2005:346; Babbie & Mouton, 2001:277). In the end, however, video recording was avoided, as it can be extremely invasive.

Transferability refers to the extent to which the findings can be applied in other contexts or with other respondents (Vos, *et al*., 2005:346; Babbie & Mouton, 2001:277). The researcher ensured sufficient collection of information in the most accurate manner as possible.

Dependability refers to a similar audience that can provide the same evidence if it were repeated with similar respondents in the same context, then the data is dependable (Vos, *et al*., 2005:346; Babbie & Mouton, 2001:277). In this study, the respondents were questioned to saturation and similar information was obtained. Interview notes and audio recording was also useful to enhance dependability.

Confirmability refers to the ability to receive the information without distortion (Vos, *et al*., 2005:346; Babbie & Mouton, 2001:277), without any biases from the researcher. To combat this error, raw data was collected and made available as radio tapes to help confirm the findings.

3.8 RESEARCH ETHICS

The research proposal for this study was presented to the research panel and fellow research students for scrutiny and guidance. This was to ensure objectivity and to enhance quality control. Presentation of the proposal for approval to the ethic committee of the University of Pretoria was an attempt to protect the rights and interests of the participants, as Babbie and Mouton (2001:258) instigated.

The researchers were competent to undertake the investigations. The field workers who were helping the researchers were given training prior to the day of data collection. The researcher clarified the reasons for the study to the fieldworkers so that the research was conducted in an ethically correct manner (Babbie & Mouton, 2001:528; Vos, *et al*., 2005:65).

Since the study involves participation of humans and can result in intrusion into their lives. Therefore the participants' involvement in the study was voluntary. No one was forced to participate in the research. The respondents completed a written consent form. Find a copy attached on addendum III. Participants were informed thoroughly about all the aspects of the investigation; so as to be able to make informed decisions on whether to participate or not. This was to minimize deception by the participants. The responses of individuals will be made available to the public, but the respondent's particulars are kept confidential, so as not to violate their privacy and confidentiality.

Harm was minimized by a debriefing session that followed the focus group interview. Through debriefing, problems generated by the research experience were corrected by discussing respondents' feelings about the project (Vos, *et. al*., 2005:66). Their misperceptions were addressed through short massages on "What is Food Fortification and "What is Genetic Modification". Shopping bags with a logo that identifies fortified food products from the National Department of Health (Nutrition Directorate) with 5kg fortified maize meal were distributed as an awareness material, while brochures on "What is genetic modification?" from the National Department of Agriculture was also included in the bags.

The findings of the study would be made available at the library of the University of Pretoria and related publications. Findings presented should not be in favour of the donors but be a true reflection of what was recorded and observed (Vos*, et al*., 2005:64,65; Babbie & Mouton, 2001:528).

CHAPTER 4

4.0 RESULTS

4.1 INTRODUCTION

Demographic data and results of the study are presented in this chapter. The first phase employed a qualitative approach in which numerical data was collected using sensory evaluations and second phase being a qualitative approach in the form of focus group interviews.

4.2 DEMOGRAPHIC DATA

Since the participants were household representatives, they all had to be 18 years and older and had to reside in villages of Ngqeleni and Mqanduli, which are 30km east and south-east from Mthatha, respectively. The age limitation was to ensure that only individuals who influence or partake in purchasing of food were included in the study.

Gender

Table 4.1.1 and figure 4.1.1 reflect the gender distribution of the participants in this research study.

Table 4.1.1: Gender of the participants *(n=51)*

	Gender	
	Number (n)	***Percentage (%)***
Male	21	41
Female	30	59
Total	51	100

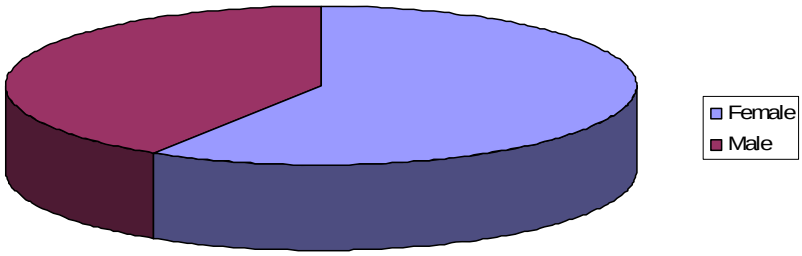

Figure 4.1.1: Gender of participants

The majority of the participants were female, which supports the belief that for lower LSM's more women are still available at home to run households and are responsible for food purchasing whereas men are out at work. During focus group interviews that were held after the sensory evaluation, most men indicated that they were involved in buying groceries, as they buy food on their way home from work, although the wives played a major role in deciding what to consume for the day. Both can therefore be seen as

household representatives. According to Levy and Weitz (2001:482) many authors are of the opinion that gender roles are changing (i.e. women are no longer responsible for the household groceries) and that the sharing of responsibilities is a characteristic of modern society. This could be further investigated in terms of gender roles in traditional rural communities in the South African context.

Age

Referring to table 4.1.2 for a summary of the age distribution of the participants. The minimum age for participation in the study was 18 years.

Table 4.1.2: Age of the participants (n=51)

Age Group	Number (n)	Percentage (%)
18-25yrs	10	19.6
26-40yrs	34	66.7
>40yrs	7	13.7

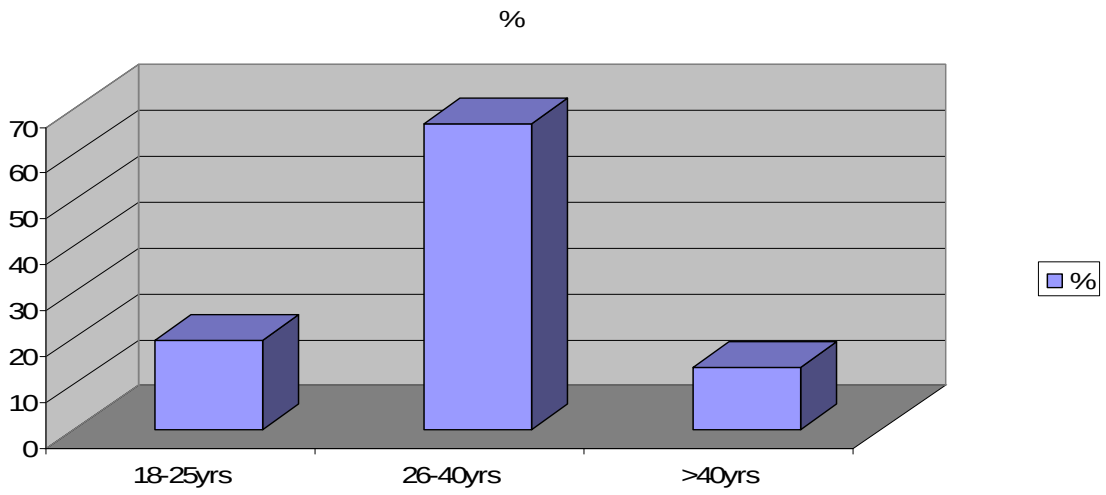

Figure 4.1.2 (a): Age of the participants

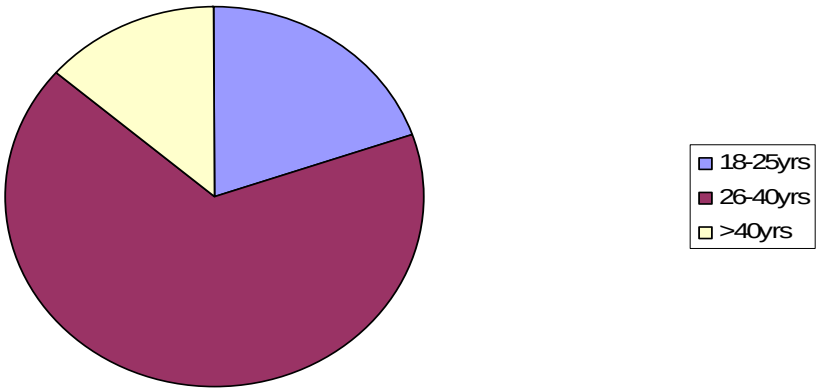

Figure 4.1.2 (b): Age of the participants

Graphical representations on figure 4.1.2(a) and figure 4.1.2(b) clearly illustrate that two thirds of the participants were between the ages 26 and 40 years. Although random selection was used, the sample was recruited based on their availability and willingness to participate, hence more of the ages 26 and 40 years represented in the study.

Geographical areas

The two areas were Ngqeleni and Mqanduli. Both villages are approximately 30 km from Mthatha, located east (off R61 to Port St Johns) and south-east (off N2 to East London), respectively. A map of the Eastern Cape is illustrated on figure 4.1.3 below. Data was collected from the rural communities as illustrated by figure 4.1.4 by the landscapes of rural Mthatha. Figure 4.1.5 illustrates typical huts that are still occupied in the villages of Mthatha like Ngqeleni and Mqanduli.

Figure 4.1.3: Map of the Eastern Cape Province (Southern Africa Places.co.za; 1)

Figure 4.1.4: Rolling hills near Mthatha (South Africa Travel Net: 1)

Figure 4.1.5: Traditional Xhosa rondavel (South Africa Travel Net: 1)

The participants

Fifty-one (51) people finally participated in the study. Schutz (1994:34) confirmed that twenty five (25) to fifty (50) participants for consumer tests were ideal. Fifteen (15) Ngqeleni and sixteen (16) from Mqanduli participated in the focus group. Pictures of the sensory evaluations and focus groups were taken during the study, see figures 4.17 and 4.18 below.

Figure 4.1.6 (a): Sensory evaluation assessment in Ngqeleni

Figure 4.1.6 (b): Sensory evaluation in Mqanduli

Figure 4.1.7(a): Collection of gifts post-sensory evaluation in Ngqeleni

Figure 4.1.7(b): Collection of gifts post-sensory evaluation in Mqanduli

Figure 4.1.8: Focus Group

4.3 SENSORY EVALUATION RESULTS

The attributes tested in each of the consumer tests were aroma, appearance (colour), texture (mouth-feel and hand-feel) and taste. The scores for the test were as follows:

1 = dislike a lot

2 = dislike a little

3 = neither like, nor dislike

4 = like a little

5 = like a lot

Scores below 3 signifies some level of dislike and scores above 3 signifies some level of liking an attribute.

Session 1

(a) White unfortified and white fortified maize meal

According to table 4.2.1 white unfortified maize meal did not differ significantly from white fortified maize meal in terms of texture ($p<0.574$) and taste ($p>0.135$). However, significant differences were observed for aroma ($p<0.047$) and colour ($p<0.025$). White fortified maize meal was significantly more liked in terms of aroma and colour compared to unfortified maize meal.

Table 4.2.1 Statistical analysis of white unfortified and white fortified maize meal

Attribute			**Average Mean ratings***	
	F-value	**Sig.**	**White unfortified (special) maize meal**	**White fortified (special) maize meal**
Aroma	4.029	0.047	3.33	3.92
App_colour	5.180	0.025	3.65	4.27
Text_feel	0.318	0.574	3.78	3.94
Taste	2.274	0.135	3.45	3.94
Total_score	3.830	0.053	14.22	16.08

*1= dislike a lot, 5 = like a lot

According to the sensory evaluation mean ratings on Table 4.2.1, white fortified maize meal is more acceptable ($p<0.05$) to the overall sample of respondents in Mthatha. Therefore, it can be concluded that all from both villages, even though they evaluated at

different locations accepted white fortified better than the unfortified maize meal based on the aroma and appearance.

(b) Gender

Table 4.2.2 (a) and Table 4.2.2 (b) reflects that the respondents' sensory evaluation of the white unfortified and white fortified maize meal did not differ significantly according to gender. There was no significant difference in any of the attributes for the two genders for white fortified and white unfortified maize meal.

Table 4.2.2 (a) Statistical analysis amongst gender for white unfortified maize meal

Attributes			**Average Mean ratings***	
	F-value	**Sig.**	**Male**	**Female**
Aroma	0.033	0.856	3.38	3.30
App_colour	3.363	0.073	4.10	3.33
Text_feel	0.254	0.617	3.90	3.70
Taste	3.195	0.080	3.95	3.10
Total	1.806	0.185	15.33	13.43

*1= dislike a lot, 5 = like a lot

Table 4.2.2 (b) Statistical analysis amongst gender for white fortified maize meal

Attributes			**Average Mean ratings***	
	F-value	**Sig.**	**Male**	**Female**
Aroma	1.303	0.259	4.19	3.73
App_colour	0.882	0.352	4.48	4.13
Text_feel	1.646	0.205	4.24	3.73
Taste	2.919	0.094	4.38	3.63
Total_score	2.540	0.117	17.29	15.23

*1= dislike a lot, 5 = like a lot

(c) Age range

White unfortified maize meal did not differ significantly in terms of aroma, colour and texture for the different age groups. However, a significant difference ($p<0.042$) was observed for taste in white unfortified maize meal at the 5% probability level. Young adults liked white unfortified maize meal significantly less than adults.

Table 4.2.3 (a) Statistical analysis amongst age ranges for white unfortified maize meal

			Average Mean ratings*		
Attributes	**F-value**	**Sig.**	**Young adults (18-25years)**	**Adults (26-40 years)**	**Mature adults (>40years)**
Aroma	0.927	0.435	2.25	3.24	3.57
App_colour	0.898	0.449	3.50	3.65	3.79
Text_feel	1.770	0.166	2.75	3.53	4.14
Taste	2.960	0.042	1.50a	3.18b	3.93b
Total-score	1.962	0.133	10.00	13.59	15.43

*1= dislike a lot, 5 = like a lot

**ab in a row indicate significant differences

Table 4.2.3 (b) showed no significant difference in respondents' sensory evaluation of the white fortified maize meal according to age range.

Table 4.2.3 (b) Statistical analysis amongst age ranges for white fortified maize meal

			Average Mean ratings*		
Attributes	**F-value**	**Sig.**	**Young adults (18-25years)**	**Adults (26-40 years)**	**Mature adults (>40years)**
Aroma	0.511	0.677	3.80	3.65	4.07
App_colour	0.150	0.929	4.20	4.18	4.32
Text_feel	0.552	0.649	3.40	3.82	4.07
Taste	0.152	0.928	3.60	4.12	3.89
Total_score	0.275	0.843	15.00	15.76	16.36

*1= dislike a lot, 5 = like a lot

(d) Location

Table 4.2.4 (a) reflects that the participants' there is no significant difference in the sample of the population of Mthatha in the areas of Ngqeleni and Mqanduli for white unfortified maize meal.

Table 4.2.4 (a) Statistical analysis amongst villages for white unfortified maize meal

Attributes			**Average Mean ratings***	
	F-value	**Sig.**	**Ngqeleni**	**Mqanduli**
Aroma	0.934	0.339	3.54	3.12
App_colour	0.164	0.688	3.73	3.56
Text_feel	0.261	0.612	3.88	3.68
Taste	1.215	0.276	3.19	3.72
Total-score	0.035	0.852	14.35	14.08

*1= dislike a lot, 5 = like a lot

However, in Table 4.2.4 (b) significant differences were observed in terms of aroma, colour and texture.

Table 4.2.4 (b) Statistical analysis amongst villages for white fortified maize meal

Attributes			**Average Mean ratings***	
	F-value	**Sig.**	**Ngqeleni**	**Mqanduli**
Aroma	14.514	0.000	4.58	3.24
App_colour	11.015	0.002	4.81	3.72
Text_feel	13.934	0.000	4.58	3.28
Taste	1.372	0.247	4.19	3.68
Total-score	13.533	0.001	18.15	13.92

*1= dislike a lot, 5 = like a lot

A higher mean rating is observed in Ngqeleni for white fortified maize meal. They liked white fortified maize meal in terms of aroma, colour and texture, then respondents from Mqanduli.

Session 2

(a) White local non-GM and white local GM maize meal

Table 4.2.5 showed that there were no significant differences in any of the sensory attributes for white non-GM and white GM maize meals.

Table 4.2.5 Statistical analysis of white local non-GM and white local GM maize meal

Attributes			Average Mean ratings*	
	F-value	Sig.	Non-GM maize meal	GM maize meal
Aroma	0.004	0.949	3.72	3.70
App_colour	0.015	0.904	3.38	3.34
Text_feel	0.033	0.856	3.40	3.34
Taste	0.477	0.491	3.38	3.14
Total_score	0.098	0.755	13.88	13.52

*1= dislike a lot, 5 = like a lot

Sensory evaluations of white GM and white non-GM maize meal showed no significant difference, hence the sample population of Mthatha depicted no difference in terms of aroma, colour, texture and taste of these two maize meals.

(b) Gender

Table 4.2.6 (a) Statistical analysis amongst gender for white local non-GM maize meal

Attributes			Average Mean ratings*	
	F-value	Sig.	Male	Female
Aroma	0.186	0.668	3.60	3.80
App_colour	1.849	0.180	3.00	3.63
Text_feel	1.959	0.168	3.00	3.67
Taste	0.391	0.535	3.20	3.50
Total_score	1.213	0.276	12.80	14.60

*1= dislike a lot, 5 = like a lot

Table 4.2.6 (a) above, and Table 4.2.6 (b) below, reflects that male and female sensory evaluation of the white non-GM and white GM maize meal showed no significant difference.

Table 4.2.6 (b) Statistical analysis amongst gender for white GM maize meal

Attributes			Average Mean ratings*	
	F-value	Sig.	Male	Female
Aroma	.000	1.000	3.70	3.70
App_colour	1.842	0.181	2.95	3.60
Text_feel	3.169	0.081	2.85	3.67
Taste	0.254	0.616	3.30	3.03
Total_score	0.507	0.480	12.80	14.00

*1= dislike a lot, 5 = like a lot

Generally the female respondents scored non-GM white maize meal higher than the male respondents although not significantly so. Hence, females seem to like these local maize meals more than their male counterparts.

(c) Age range

Table 4.2.7 (a) reflects that the respondents' sensory evaluation of the white local non-GM maize meal did not differ significantly in terms of aroma and taste. However, significant differences were observed for colour and texture.

Table 4.2.7 (a) Statistical analysis amongst age ranges for white local non-GM maize

			Average Mean ratings*		
Attributes	F-value	Sig.	Young adults (18-25years)	Adults (26-40 years)	Mature adults (>40years)
Aroma	2.870	0.067	3.00	3.18	4.18
App_colour	10.992	0.000	1.20a	2.88b	4.07c
Text_feel	9.932	0.000	1.20a	2.94b	4.07c
Taste	0.601	0.552	3.00	3.12	3.61
Total-score	5.992	0.005	8.40	12.12	15.93

*1= dislike a lot, 5 = like a lot; **abc means in a row with different subscript differ significantly

Young adults' liked white local non-GM ($p<0.000$) less than adults, which in turn liked it less than the mature adults. The score ratings at an average of 4 showed that the more mature adults liked the local white non-GM maize meal the most. Maybe this could have

been due to the fact that they were familiar to the local white maize meal as they were more exposed than the younger generations.

Table 4.2.7 (b) shows that the participants' sensory evaluation of the white local GM maize meal did not differ significantly in terms of colour and taste. However, significant differences were observed for aroma and texture.

Table 4.2.7 (b) Statistical analysis amongst age ranges for white local GM maize

			Average Mean ratings*		
Attributes	**F-value**	**Sig.**	**Young adults (18-25years)**	**Adults (26-40 years)**	**Mature adults (>40years)**
Aroma	4.007	0.025	2.00	3.71	4.00
App_colour	2.833	0.069	2.20	2.94	3.79
Text_feel	6.034	0.005	1.60	2.94	2.89
Taste	1.300	0.282	2.20	2.88	3.46
Total-score	4.081	0.023	8.00	12.47	15.14

*1= dislike a lot, 5 = like a lot

**ab in a row indicate significant differences

Young adults rated white local non-GM maize meal maize and white local GM maize meal porridges lower, which was an indication that this age group did not like these porridges at all. Whereas, both local maize meals were moderately liked and even better preferred by mature adults in the sample population of Mthatha in the areas of Ngqeleni and Mqanduli. This is similar for the local non-GM maize meals that mature adults prefer these porridges better. These are sifted types of maize meals produced from the local millers.

(d) Location

Table 4.2.8 (a) reflects a significant difference ($p<0.16$) in taste for white local non-GM maize meal. The score rating (3.96) indicates that Mqanduli liked the taste of the non-GM maize meal more than Ngqeleni.

Table 4.2.8 (a) Statistical analysis amongst villages for white local non-GM maize meal

Attributes			Average Mean ratings*	
	F-value	Sig.	Ngqeleni	Mqanduli
Aroma	0.336	0.565	3.85	3.58
App_colour	0.037	0.848	3.42	3.33
Text_feel	0.055	0.815	3.35	3.46
Taste	6.261	0.016	2.85	3.96
Total_score	0.290	0.592	13.46	14.33

*1= dislike a lot, 5 = like a lot

Table 4.2.8 (b) reflects no significant difference for white local GM maize meal for the sample population in the two villages.

Table 4.2.8 (b) Statistical analysis amongst villages for white local GM maize meal

Attributes			Average Mean ratings*	
	F-value	Sig.	Ngqeleni	Mqanduli
Aroma	0.773	0.384	3.88	3.50
App_colour	0.490	0.487	3.50	3.17
Text_feel	2.067	0.157	3.65	3.00
Taste	0.517	0.476	2.96	3.33
Total_score	0.365	0.549	14.00	13.00

*1= dislike a lot, 5 = like a lot

The total scores reflect that in both villages there is a level of acceptability of both local maize meal porridges (non-GM and GM).

Session 3

(a) Local white (hammermill) and local yellow (hammermill) maize meal

According to Table 4.2.9, there was no significant sensory difference in terms of liking between local white (hammermill) and local yellow (hammermill) maize meals. This was a very interesting finding as white maize meal is mostly commercially available with very little yellow maize meal. Only in times of severe drought in Southern Africa it is imported from other countries and used as a replacement staple food.

Table 4.2.9 Statistical analysis of local white (hammermill) and local yellow (hammermill) maize meal

Attributes			**Average Mean ratings***	
	F-value	**Sig.**	**White maize meal**	**Yellow maize meal**
Aroma	1.159	0.284	3.52	3.20
App_colour	1.796	0.183	3.72	3.30
Text_feel	3.133	0.080	3.64	3.08
Taste	3.068	0.083	3.24	2.60
Total_score	2.936	0.090	14.12	12.16

*1= dislike a lot, 5 = like a lot

(b) Gender

Table 4.2.10 (a) reflects no significant difference amongst males and females of the sample population for white and yellow maize meal porridges.

Table 4.2.10 (a) Statistical analysis amongst gender for local white maize meal

Attributes			**Average Mean ratings***	
	F-value	**Sig.**	**Male**	**Female**
Aroma	0.000	0.987	3.52	3.52
App_colour	0.140	0.710	3.81	3.66
Text_feel	0.076	0.784	3.57	3.69
Taste	0.224	0.638	3.10	3.34
Total_score	0.018	0.895	14.00	14.21

*1= dislike a lot, 5 = like a lot

According to Table 4.2.10 (b), no significant difference was shown amongst males and females of the sample population of Mthatha for local yellow maize meal.

Table 4.2.10 (b) Statistical analysis amongst gender for yellow hammermill maize meal

Attributes			Average Mean ratings*	
	F-value	Sig.	Male	Female
Aroma	0.350	0.557	3.05	3.31
App_colour	3.172	0.081	2.81	3.66
Text_feel	1.312	0.258	2.76	3.31
Taste	0.313	0.578	2.43	2.72
Total_score	1.326	0.255	11.05	13.00

*1= dislike a lot, 5 = like a lot

Local white maize meal total scores and attribute scores were higher, presumably liked better than for the yellow maize meal porridge amongst both males and females, but not significantly so.

(c) Age range

Table 4.2.11 (a) reflects a significant difference in aroma ($p<0.039$), colour ($p<0.009$), texture ($p<0.000$) and taste ($p<0.002$) of the sample population for the local white (hammermill) maize meal.

Table 4.2.11 (a) Statistical analysis amongst age ranges for white hammermill maize meal

Attributes			Average Mean ratings*		
	F-value	Sig.	Young adults (18-25years)	Adults (26-40 years)	Mature adults (>40years)
Aroma	3.478	0.039	3.60a	2.82b	3.93b
App_colour	5.246	0.009	2.80a	3.12b	4.25c
Text_feel	9.991	0.000	1.60a	3.29b	4.21b
Taste	8.202	0.001	1.00a	2.76b	3.93b
Total-score	7.536	0.001	9.00	12.00	16.32

*1= dislike a lot, 5 = like a lot; **ab in a row indicate significant differences;

***abc in a row indicate significant differences

Mature adults scored quite high, so accepted white maize meal porridge more significantly in all attributes. Colour was more liked by mature adults compared to adults, which in turn liked it more than the young adults. Texture and taste were more likedby adults and mature adults compared to young adults. Whereas, aroma was more liked by young adults and mature adults.

According to Table 4.2.11 (b) there was no significant difference from the local yellow maize meal in terms of colour. However, significant differences were observed for taste, aroma and texture in local yellow maize meal porridges.

Table 4.2.11 (b) Statistical analysis amongst age ranges for yellow hammermill maize meal

Attributes			**Average Mean ratings***		
	F-value	**Sig.**	**Young adults (18-25years)**	**Adults (26-40 years)**	**Mature adults (>40years)**
Aroma	4.846	0.012	2.20a	2.59a	3.75b
App_colour	1.359	0.267	2.40	3.06	3.61
Text_feel	4.240	0.020	1.40a	2.82b	3.54c
Taste	4.048	0.024	1.00a	2.18b	3.14c
Total-score	4.364	0.018	7.00a	10.65b	14.04c

*1= dislike a lot, 5 = like a lot

**ab in a row indicate significant differences

***abc in a row indicate significant differences

Score ratings of young adults for yellow maize meal is half of the mature adults, which clearly reflects that yellow maize meal is not acceptable to this age group in the sample of the population of Mthatha in the areas of Ngqeleni and Mqanduli villages. The young adults also scored white hammermill maize meal lower. Mature adults accepted yellow maize meal quite significantly compared to the other age groups. Even the total scores reflected poor acceptability amongst young adults and adults.

(d) Location

Table 4.2.12 (a) reflects no significant difference amongst the villages of the sample population of Mthatha for white hammermill maize meal.

Table 4.2.12 (a) Statistical analysis amongst villages for white hammermill maize meal

Attributes			Average Mean ratings*	
	F-value	Sig.	Ngqeleni	Mqanduli
Aroma	2.949	.092	3.19	3.88
App_colour	.286	.595	3.62	3.83
Text_feel	1.166	.286	3.42	3.88
Taste	1.656	.204	2.92	3.58
Total_score	1.781	.188	13.15	15.17

*1= dislike a lot, 5 = like a lot

Table 4.2.12 (b) reflects significant difference for taste amongst the villages of the sample population of Mthatha for yellow hammermill maize meal.

Table 4.2.12 (b) Statistical analysis amongst villages for yellow hammermill maize meal

Attributes			Average Mean ratings*	
	F-value	Sig.	Ngqeleni	Mqanduli
Aroma	1.309	.258	2.96	3.46
App_colour	1.300	.260	3.04	3.58
Text_feel	1.896	.175	2.77	3.42
Taste	5.580	.022	2.04	3.21
Total_score	3.012	.089	10.81	13.67

*1= dislike a lot, 5 = like a lot

Mqanduli tended to score higher, for both white and yellow hammermill. This gives an indication that white local maize mill porridges is more liked then followed by local yellow in Mqanduli.

4.4 FOCUS GROUPS' RESULTS

Table 4.3 is a summary of the focus group results that were held in both villages of Ngqeleni and Mqanduli in Mthatha in the Eastern Cape.

Table 4.3 Focus group interviews' results

Questions	Ngqeleni	Mqanduli
(a) What is your understanding of fortified maize meal? *(b) What was the source of information?*	"Nutritious" Department of Health officers and Agriculture & radio shows	*We know all maize meal is nutritious* *We are not sure whether we know the difference between maize meals because we buy maize meal or grind it on our own as we depend on a lot on what we grow in our gardens and fields.*
What do you think is the importance of fortified maize meal?	*Fortified maize meal gives you energy, nutrients and building blocks of the body. Gives you good health.*	*All maize meal is our source of energy; therefore we consume both maize meal from the shops and as well as grinded maize meal.*
Would you replace fortified maize meal with other maize meal? Which? Why?	*No, we would never replace our fortified maize meal especially White Star because it is nice and soft for crumbly pap.*	*Most of us are not sure about fortified maize meal but we would never replace our white maize that we grow. We use both grinded maize meal and commercial maize meal especially White Star when we have money.* *We prefer home-grown grinded maize for making mageu and commercial maize for making crumbly pap.*
(a) What is your understanding on GM maize? *(b) What was your source of information of GM maize?*	*(a) We do not know much about this technology.* *(b) Extension officers from the department of Agriculture have informed us about it.* *We are taught by extension officers about all concerning Agriculture so that we may be able to improve our agricultural practices.*	*Yes, we have been told by officers from Agriculture and have grown it in the past two years.*

Do you grow GM maize in your area? Why?	This maize is already grown in Lusikisiki because it grows well.	*We do not know much about GM maize but it looks the same as all maize as we are aware that most seeds have been technogically improved.* *Yes, we grown GM maize meal, because it is the same like other maize we have grown.*
What is your opinion on yellow maize meal?	*Yellow maize is for feeding chickens and making mageu.* *We consume yellow maize and yellow maize meal because it is tasty and filling. It keeps you full the whole day.*	*We consume yellow maize meal because when white maize is not available.* *We use yellow maize for feeding chickens and pigs, as well as making isophu "traditional maize soup" for human consumption.* *But we consume yellow maize on the cob.*
Was there any difference in all these maize meals that was outstanding in these tests?	*There was not much of a difference in all these maize meals except that yellow and white are different in terms of texture.* *All the other maize meals are very similar even in colour per test category.*	*There was not much of a difference in all these maize meals except for yellow and white are different in terms of texture. " All the other maize meals are very similar even in colour per test category. We also use yellow maize meal because it is really filling and it is really different from other maize meals.*

Summary of Ngqeleni Feedback

1. The respondents have heard about food fortification.
2. They understand the benefits of fortification.
3. Notice some brand loyalty to White Star (super maize meal) and expression of satisfaction.
4. They lack of knowledge on biotechnology although they have heard about it.
5. GM maize is grown in nearby areas like Lusikisiki, which is approximately 100km from Mthatha and people in these deep rural depend on subsistence farming.
6. Yellow maize and yellow maize meal is consumed in various dishes is therefore consumed by all, although it is not preferred as the number one maize meal.

7. No conspicuous difference expressed in all these different types of maize meal except for the obvious colour difference in yellow and texture expressed for yellow maize meal as well.

Summary of Mqanduli Feedback

1. The respondents have not really heard about food fortification.
2. The respondents do not know the benefits of food fortification
3. It is clear that they are not aware of the benefits of fortified maize meal, hence use both home grown and commercial maize meal.
4. They are aware of GM maize and have grown it in their community.
5. They grow GM maize but do not have an understanding of the facts behind the technology as they are encouraged to grow GM maize by their extension officers.
6. Yellow maize and yellow maize meal is consumed in various dishes and is therefore consumed by all, although it is not preferred as the number one maize meal of choice.
7. The respondents observed no major difference; only the colour differences were obvious with yellow maize meal.

4.5 DISCUSSION OF RESULTS

Phase I: Sensory evaluation results discussion

Session 1

In terms of the respondents' sensory evaluation of the white unfortified and white fortified maize meal did not differ significantly in terms of texture and taste. However, significant differences were observed for aroma and colour. The mean scores showed a liking of the fortified maize meal in terms of colour and aroma. The National Food Consumption Survey of 1999 (2000:183) reflected that consumers preferred special enriched maize meal, specifically Impala, which was used for this study although the participants were not aware of that. It means that they were exposed to the sensory attributes of the enriched maize meal, prior to the regulation of fortification. After the regulation was passed on World Food day in October 2003, more nutrients were added to the maize meals. In a study conducted by CSIR (Centre for Science Institute Research) at the Food

Science department at the University of Pretoria in 2000 conducted at 33% levels of fortification. Fifty (50) students who consumed maize meal as staple concluded that fortification of maize meal was detectable when cooked super and special porridges were tested using triangle difference test method. However, no taste differences were found using a consumer panel. Fortification did not influence consumer acceptance of flavour of super, special and sifted maize meal but fortification of sifted maize meal reflected a colour problem in cooked sifted maize meal because the samples were slightly more yellow than the unfortified counterpart. These findings led to subsequently reducing the levels to 25% (Department of Health, 2000:48,49). According to this current study, these lower levels are acceptable even to the extent that the colour and aroma of the fortified white maize meal is preferred to that of the unfortified white maize meal. These results differ to the data collected in 2005 amongst consumers of Kwa-Zulu and Limpompo by Vermeulen (FAPRI-UMC, 2006:7,8) that concluded that colour change influenced acceptability. Vermeulen observed that the acceptability was improved following nutrition education, hence giving consumers information on the benefits of fortification. This gave the consumers better understanding to be able to change their minds. This confirms Blades (2001:72) conclusions that regulators influence food choice of populations therefore food acceptability of various food commodities. McKee & Harden (1990:30) have observed continual exposure over time tends to influence preference and enhance acceptability. This could be the case with the white fortified versus white unfortified maize meal.

The average mean scores have produced the following deductions during the interaction of gender namely that fortified maize meal was more acceptable to males than females. Interaction of age ranges reflected that all range ranges preferred the white fortified maize meal to white unfortified maize meal, therefore it was liked amongst all age groups. The Ngqeleni villagers liked fortified maize meal more than of Mqanduli in terms of colour, aroma, texture and overall score.

Session 2

There was no significant difference for white local GM and non-GM maize meal both sifted, hence the sample population of Mthatha depicted no difference in terms of aroma, colour, texture and taste of these two maize meals. The total score reflect liking of both white GM maize meal and non-GM maize meals, which were locally produced and milled

by hammermill and not fortified. The Mqanduli villagers are dependent on growing their own crops Opare-Obisaw, Fianu and Awadzi (2000:145,146), who confirms that in communities where there is a low income, the main staple would be grown and consumed and cost would make them to access what is available.

When the interactions amongst genders were run, there were no significant differences for white GM and non-GM maize meal. Interaction among age groups in white non-GM maize meal reflected a significant difference in colour and texture and no significant difference in terms of aroma and taste. Young adults rated both GM maize meal and non-GM maize meal porridges very low (+_8), which depicts a dislike of the locally produced and milled maize meal porridges. Both colour and texture was liked or better preferred by mature adults compared to adults, which in turn liked it more than the young adults. White GM maize meal interaction was significantly different in terms of aroma and texture and there was no significant difference observed in colour and taste. Adults preferred the aroma and texture than the young adults. The total score reflected better liking for both of the local white non-GM and GM maize meals among mature adults (>15). In Mqanduli, a significant difference in taste for white local non-GM maize meal was observed but there were no significant differences for white local GM maize meal for the sample population in the two villages.

Session 3

There are no significant sensory differences between white hammer mill and yellow hammer mill maize meals. However, white maize meal scored higher than the yellow maize meal, which was locally produced, milled by a hammermill and not fortified. There is no significant difference amongst males and females of the sample population of Mthatha in sensory evaluating yellow hammermill maize meal.

A significant difference in aroma, colour, texture and taste for yellow hammermill maize meal porridges amongst the age groups was observed. Young adults rated it the lowest compared to both the adults and mature adult groups. Significant differences were observed for taste, aroma and texture of white hammermill maize meal. Young adults total scores reflect a total dislike of the colour, taste and texture of white hammermill maize meal, which is rather highly acceptable for mature adults and least acceptable for adults.

There were no significant differences amongst the villages of the sample population of Mthatha for white hammermill maize meal. There are significant differences for taste amongst the villages of the sample population of Mthatha for yellow hammermill maize meal. In Ngqeleni, the average score ratings reflected a less liking compared to the participants in Mqanduli. Mqanduli tended to score higher, for both white and yellow hammermill. In conclusion, there are no statistical significant difference between white hammer mill and yellow hammer mill maize meals, although liking is very age related.

Phase II: Focus Group Results Discussion

The participants of Ngqeleni have heard about food fortification. They understand the benefits of fortification. It was clear that the community in Ngqeleni preferred White Star (super maize meal) as close association to fortified maize meal. This was an indication of brand loyalty in the community of Ngqeleni. The National Food Consumption Survey of 1999 (2000:497) showed that 57% of households in the Eastern Cape preferred Impala, which was a special maize meal. Impala maize meal was used for this study as the fortified counterpart to the special maize meal.

The community of Ngqeleni had limited knowledge about modern biotechnology or GM technology although they have heard about it from extension officers who are guiding them in farming. According to the Ngqeleni village, GM maize is grown because of the benefits although not grown in their village they are aware that it is grown in the nearby areas like Lusikisiki. Areas like Lusikisiki are further from Mthatha and communities tend to depend on subsistence farming. Yellow maize and yellow maize meal is consumed in various dishes therefore consumed by all, although it is not preferred as the number one choice as maize meal. The respondents from Ngqeleni expressed no conspicuous differences during the testing of the different types of maize meal except for the obvious colour difference and texture expressed for yellow maize meal as well. However, they preffered white fortified maize meal in terms of colour, aroma, texture and overall score.

The participants of Mqanduli have not heard about food fortification. The respondents do not know the benefits of food fortification. It is clear that they are not aware of the benefits of fortified maize meal. They use both home grown and commercial maize meal as they use what is available and accessible. They grow GM maize but do not have an

understanding of the facts behind the technology, as they are encouraged to grow GM maize by their extension officers. Yellow maize and yellow maize meal is consumed in various dishes and is therefore consumed by all; it is not although not preferred as the number one as maize meal porridge. The respondents observed no major difference, except for the colour differences that was obvious with yellow maize meal. Conflicting ideas were expressed in this village that some did not like yellow maize meal while others, especially men expressed acceptance because they believe that it makes them feel full. This argument confirms that hunger, which is a physiological need for food is satisfied by the available maize or maize meal especially meeting hunger. The best choice amongst men is one meeting hunger without discriminating between brands. The Mqanduli villagers preferred the taste of yellow maize meal porridge more than those of Ngqeleni, as well as sifted non-GM local maize meal. It is interesting to note these differences between two closely located rural villages.

CHAPTER 5

5.0 CONCLUSIONS & RECOMMENDATIONS

5.1 INTRODUCTION

This chapter entails conclusions based from the quantitative and qualitative data findings of the study. It also includes a discussion on the current issues that have influenced the findings. Limitations and recommendations from the study would also be discussed in this chapter.

The theoretical framework adapted from Shepherd and Sparks of 1999 (Cox & Anderson, 2004:147) has given guidance to carry out the research aim of the study. There are many factors that influence acceptability and perceptions of consumers. The findings have also confirmed these factors somehow as the framework had illustrated on Chapter 2 that populations and individuals' beliefs and attitudes affected food choices and acceptance. The first phase of the study employed a qualitative approach in which numerical data was collected using sensory evaluations and second phase being a qualitative approach in the form of focus group interviews.

5.2 MAIN FINDINGS

Phase I: Sensory Evaluations

All the data was pooled and analysed together for an overview of not individual sensory characteristics but together.

Table 5.1: Summary of level of acceptability of the maize meal porridges in relation to total scores

Maize meal	Average mean scores	Acceptability
White unfortified maize meal (Special)	14.22	*
White fortified maize meal (Special)	16.08	**
White non-GM maize meal (Sifted)	13.88	*
White GM maize meal (Sifted)	13.52	*
White maize meal (Sifted)	14.12	*
Yellow maize meal (Sifted)	14.00	*

(a) 1= dislike a lot; 2=dislike a little; 3= neither like, nor dislike; 4=like a little; 5 = like a lot

(b) Total score=20 therefore, <10 indicates dislike; 10 indicates uncertainty; >10 indicates least level of liking, indicated with*, >15 indicates a better liking, indicated by **

In conclusion, white fortified white maize meal is generally the most acceptable amongst the Xhosa communities of Mthatha of the Eastern Cape in South Africa. According to the individual sensory attributes reported in Chapter 4 Table 4.2.1 it is based upon the fact that the respondents like the aroma and colour the most. These results confirm the findings of the National Food Consumption Survey of 1999 (2000:497), that reflected the approximately 13% consumers of the Eastern Cape used domestically milled maize meal, but rather used special enriched maize meal and sifted white maize meal. The special unfortified maize meal scored second. However special unfortified maize meal did not score significantly different to sifted white maize meal, sifted yellow maize meal, white sifted non-GM maize meal and white sifted GM maize meal, in descending order. The other sifted maize meals revealed a level of being liked as well. It was surprising that yellow maize meal scored quite reasonable (14) as it is not a well-documented finding. White unfortified maize meal scored secondly the most preferred maize meal type.

As in Table 4.2.5, there are no significant differences in locally produced non-GM maize meal and GM maize meals. Worldwide studies have shown that consumer concerns and acceptance of GM technology vary among countries (Huang, Qiu, Bai & Pray, 2005:144). Consumer awareness on GM issues is only starting to appear in South Africa. South African consumers are increasingly being exposed to GM foods. Better understanding of consumers' acceptance and opinions regarding GM food could benefit numerous role-players within the modern biotechnology industry, agricultural industry and food industry in South Africa (Vermeulen, Kirsten, Doyer & Schönfeldt, 2004:6). Hence, the behaviour of South African consumers regarding GM foods needs to be researched further.

There were no significant differences in the sensory acceptance of white maize meal and yellow maize meal porridges that are produced locally. This is also surprising findings as according to local belief yellow maize meal porridge is not well accepted, and especially not among rural traditional villagers.

Table 5.2: Summary of level of acceptability of the maize meal porridges in relation to total scores in terms of Gender

Maize meal	**Total scores** Male	Acceptability	**Total scores** Female	Acceptability
White unfortified maize meal (Special)	15.33	**	13.43	*
White fortified maize meal (Special)	17.29	**	15.23	**
White non-GM maize meal (Sifted)	12.80	*	14.60	*
White GM maize meal (Sifted)	12.80	*	14.00	*
White maize meal (Sifted)	14.00	*	14.21	*
Yellow maize meal (Sifted)	11.05	*	13.00	*

(a) 1= dislike a lot; 2=dislike a little; 3= neither like, nor dislike; 4=like a little; 5 = like a lot

(b) Total score=20 therefore, <10 indicates dislike, indicated with^; 10 indicates uncertainty, with$; >10 indicates least level of liking, indicated with*, >15 indicates a better liking, indicated by **, >17.5 indicates best liking, indicated with***

Table 5.2 depicts that males had a better liking of fortified and unfortified maize meal. According to the study from the University of Illinois (2003:1) more males than females prefer ethnic foods (like maize porridge, meat and soup dishes) rather than snacks and sweets. Table 5.2 shows that females' preferred only white fortified maize meal.

Table 5.3: Summary of level of acceptability of the maize meal porridges in relation to total scores in terms of age range

Maize meal	**Total scores** Young adults	**Acceptability**	**Total scores** Adults	**Acceptability**	**Total scores** Mature Adults	**Acceptability**
White unfortified maize meal (Special)	10.00	$	13.59	*	15.43	**
White fortified maize meal (Special)	15.00	**	15.76	**	16.36	**
White non-GM maize meal (Sifted)	8.40	^	12.12	*	15.93	**
White GM maize meal (Sifted)	8.00	^	12.47	*	15.14	**
White maize meal (Sifted)	9.00	^	12.00	*	16.32	**
Yellow maize meal (Sifted)	7.00	^	10.65	*	14.04	*

(a) Young adults = 18-25yesrs, Adults = 26-40yesrs, Mature Adults =>40years

(b) 1= dislike a lot; 2=dislike a little; 3= neither like, nor dislike; 4=like a little; 5 = like a lot

(c) Total score=20 therefore, <10 indicates dislike, indicated with^; 10 indicates uncertainty, with$; >10 indicates least level of liking, indicated with*, >15 indicates a better liking, indicated by **, >17.5 indicates best liking, indicated with***

When observing table 5.3 for a summary of the level of acceptability of the various maize meal porridges by age group measured in the study, an interesting pattern appears. It seems as if the young adults (18-25years) have a very strong liking of commercially

available white fortified maize meal. Unfortified white maize meal is less preferred, but all the other maize meal is strongly disliked. This group seems to be the most critical to any changes in the staple food product and most discriminative. The adult group preferred commercial available white fortified maize meal and all other maize meal types. Only the mature adult group liked all the maize meal types although they preferred yellow maize meal the least. Perhaps they have been exposed to the different types of maize meal over a longer period of time and are more tolerant to variation in their staple food supply. It is interesting to note that they scored yellow maize meal double that of young adults.

It seems as if young adults do not like ethnic foods like maize meal porridge. There are various reasons that could contribute to this, one being openly declared during focus group survey amongst the Shangaan community in Giyani in a study I assisted in. They were clear that maize meal porridge was not complete without a relish in their community. Mature adults accepted all maize meal very well. Conner & Armitage (2001:21) also confirm that continual exposure to food establishes acceptability. Shaw and Clarke (1998: 163-167) concluded that culture was not static, although it preserves traditions but is susceptible to change. Culture was noted to change when children attended school or due to migration, socialisation and food accessibility.

Table 5.4: Summary of level of acceptability of the maize meal porridges in relation to total scores in terms of Location

Maize meal	**Total scores** Ngqeleni	**Accept-ability**	**Total scores** Mqanduli	**Accept-ability**
White unfortified maize meal (Special)	14.35	*	14.08*	*
White fortified maize meal (Special)	18.15	***	13.92*	*
White non-GM maize meal (Sifted)	13.46	*	14.33*	*
White GM maize meal (Sifted)	14.00	*	13.00*	*
White maize meal (Sifted)	13.15	*	15.17**	**
Yellow maize meal (Sifted)	10.81	*	13.67*	*

1= dislike a lot; 2=dislike a little; 3= neither like, nor dislike; 4=like a little; 5 = like a lot (b) Total score=20 therefore, <10 indicates dislike, indicated with^; 10 indicates uncertainty, with$; >10 indicates least level of liking, indicated with*, >15 indicates a better liking, indicated by **, >17.5 indicates best liking, indicated with***

It was clear that in Ngqeleni, they preferred commercial fortified maize meal the most than in Mqanduli who had just a least liking. Mqanduli liked white sifted maize meal the most. This could perhaps be explained by the fact that they are more a farming community and produce white sifted maize meal from their own crops.

Phase II: focus Groups

Phase II of the study put some quantitative findings into perspective. Ngqeleni and Mqanduli are approximately 30km east of Mthatha and south east of Mthatha. Evidence from the two villages was slightly different. A mini survey that was conducted with the helpers in each of the areas made it easy to identify the differences. According to these surveys there was a higher illiteracy rate in Mqanduli than in Ngqeleni. The lifestyle in Ngqeleni was somehow more township style although the infrastructure still depicted a rural setting. Mqanduli was still more conservative.

Poverty was more evident in Mqanduli due to a higher unemployment rate. This was better in Ngqeleni because most households had at least one or two employed members. It was very clear in Ngqeleni that the respondents had heard about fortified maize meal due to exposure to health campaigns and access to media like radios. In Mqanduli they did not have the faintest idea and did not know the benefits of fortified maize meal. It was clear that the most preferred commercial maize meal around Mthatha was White Star, which was consumed more extensively in Ngqeleni than in Mqanduli. White Star is a new brand and classified as a super maize meal. This finding needs to be investigated further, as the National Food Consumption Survey of 1999 (2000:498) documented that Impala that is a special maize meal was most preferred nationally. The sensory evaluations also reflected a higher preference (total scores) of fortified maize meal specifically in Ngqeleni. At this point, it became clear that the Mqanduli community relied on growing their own crops, including maize, and milled it at the local small millers or by hand for own consumption. This confirms the literature according to Gouse, Pray, Kirsten and Schimmelpfennig (2004:3) that farmers in the Kwa-Zulu Natal and Eastern Cape store their maize in old maize meal bags as grain or on the cob in wooden or corrugated iron structures until it is needed. Those farmers in poorer areas that cannot afford milling

costs make use of hand mills, hammer mills or crush their grain in a traditional way. One could conclude that the Ngqeleni community was more exposed and consumed more fortified maize meal than in Mqanduli. The concept of food fortification was better understood in Ngqeleni.

The Mqanduli community was more aware of farming techniques than the community in Ngqeleni. Extension officers play an important role in communities, informing them of new technologies and advanced seeds in order for them to advance in Agriculture. In Mqanduli, the community was aware of GM maize and its benefits compared to the Ngqeleni community who were not aware of the benefits of GM maize. None of the communities reflected negative opinions about GM maize, as it is common in urban areas of South Africa. Although the Mqanduli community was aware of genetic modification, they could not articulate the benefits clearly. There was a survey conducted in 2004 by Human Science Research Council (HSRC) for Public Understanding of Biotechnology (PUB), which was funded by the Department of Science and Technology, which reflected that low income consumers have less negative feelings than high income consumers who might have better access to information through media and reading material (Rule & Langa, 2005:11,13). Another study further reflected a 55% increase in awareness in Gauteng consumers compared to a previous 27%. While most respondents were aware of the benefits of *Bt* technology, this seemed too distant to affect their buying practices (Africabio, 2004:2). This was also documented in the food fortification survey that the Eastern Cape province rated the highest level of unawareness of the food fortification concept which was related to the low literarily levels (approximately 50%) which was investigated to be approximately 8% of these consumers who had no schooling, 27% only had some primary school level attended and 14% having completed primary school (Research Report for Department of Health, United Nations Children's Fund & Micronutrient Initiative, 2002:94, 87).

The issue of yellow and white maize brought good discussions, which concluded that the choice of yellow maize depends on individual preferences. Most of the respondents in these communities consumed yellow maize in one state or another with a few who did not prefer it as maize meal. Men emphasized their liking of yellow maize and yellow maize meal, as they believed that it had higher satiety levels than white maize and white maize meal. This is confirmed by the sensory evaluation with no significant difference

amongst males and females, even the total scores (male=14, females=14.12), reflected some level of liking of yellow maize meal by both genders. Therefore, yellow maize meal is acceptable to the Xhosa communities of Mthatha in the Eastern Cape.

5.3 DISCUSSIONS

Ngqeleni compared to Mqanduli rated high for fortified maize meal. This was confirmed by the fact that the Ngqeleni population was more exposed to commercial fortified maize meal as disclosed in the focus group survey.

Young adults' rated low for session 2 and session 3, an indication of being not liked by this age group. Whereas, both local maize meals and hammer maize meals were moderately liked and even better preferred by mature adults in the sample population of Mthatha. It was clear in the findings that young adults did not like home grown and milled maize meal whereas mature adults preferred homegrown maize meals. This was confirmed by the focus group survey that mature adults prefer home ground maize meal and the hammer milled than the commercial type in both villages. According to the research report on the National Food Fortification Programme (2002:16), the unemployment rate was high in the Eastern Cape and it was difficult to make ends meet compared to other provinces. The villagers canvassed their own fields where they grew their own vegetables, especially maize, in vast amounts, which they stored in communal silos. It was very obvious that this practice was still practiced in Mqanduli as most of the men were rushing to go to the fields after the consumer test, hence were more familiar to home grown maize meals.

The results of the sensory evaluations reflected a higher liking of both locally milled and hammer milled maize meals in Mqanduli. This confirms the findings from the focus groups surveys that this community still relied on the homegrown maize meals. Most adults are no longer influenced by taste, but by their beliefs and attitudes as along with health effects (Shepherd & Raats, 1996:347).

Major differences in the three tests could not be contextualized from the focus group survey as the respondents felt it was very difficult to express a difference in a set of tests except for the test between yellow and white maize meals. Opinion for yellow and white

maize meal was guided by being able to identify the colour. At the end it was clear that there is no particular preference as different colour maize and maize meals have different dishes that can be prepared. The coarseness of yellow maize meal was an issue raised by the Ngqeleni community, whereas in Mqanduli, it was not the real issue.

Lack of information is the only reason that is obvious for the fact that respondents were not aware of new technologies available, such as food fortification and genetic modification, especially the benefits of these technologies in different villages of the same town. It was better in Ngqeleni because they were aware of fortified maize meal and its benefits, whereas in Mqanduli, they were aware of GM technology but not its benefits. In Mqanduli, low education levels could have contributed to their ignorance of concepts. Opare-Obisaw, *et.al.* (2000:147) concluded that low education propagates low adoption of unfamiliar concepts, especially unavailable foods in the area.

According to the tourism industry, the Transkei is still one of the best places in South Africa to experience an African culture. Even though most of the people here live in relative poverty, they can rely on a stable social order and a traditional belief system that is based upon ritual practices. (South Africa Travel Net:1). This gives an explanation of the fact that, although this is an impoverished province economically, as the SAVACG data reflected that the Eastern Cape was at least the third highest in terms of malnutrition prevalence in the country due to good communal practices, hunger was not a serious problem compared to other provinces (National Food Fortification Programme 2002:16).

According to the research report on the National Food Fortification Programme (2002:5), some communication activities were implemented between 2000 and 2001. There was a broad advocacy campaign through media; hence press releases and fact sheets were distributed. Consumer research was done in some rural and urban areas to test the different logos, identify possible barriers of food fortification and identify the best ways of communicating the concept. In 2002 there were also workshops held in nine (9) provinces for the identification of coordinating teams in order to develop provincial activities and give media training. However, it was clear from the 2002 report that there was still a critical need to continue to mobilize communities in order for them to understand (and own) the health reasons for the fortification process, as well as to make informed choices with regard to their buying power.

In terms of genetic modification, few research studies have been conducted regarding consumer issues related to GM food products in South Africa. In 2001 Pretoria Technikon, on behalf of AfricaBio, a non-profit Section 21 company representing stakeholders in the biotechnology industry conducted a survey to assess how much consumers knew about genetically modified foods (gene technology) and to see how they could be informed and educated. The study concluded that consumer education through the supply of appropriate information in the correct media was crucial and that a great deal of work needed to be done to educate consumers about GM foods (AfricaBio, 2002:1). The Foundation for Education, Science and Technology (FEST) commissioned a survey in 2001 that showed that there was a low level of awareness and understanding of GM foods in South Africa. Another important result was the support amongst South Africans towards the idea of using modern biotechnology to improve nutritional value and the taste of food. It was concluded that consumers' trust would depend on clear and consistent labeling of GM foods so that the consumer could always have the choice and the necessary information to make an informed choice. However, danger was identified that the public could rapidly turn against genetically modified food, like what has happened in Europe (Joubert, 2002). The Department of Consumer Sciences at the North West University also conducted a study during 2003, using focus group discussions in order to determine the knowledge and conceptions (constructs) of GM food and food products in the context of consumers' understanding. Some of the major findings of the study include the fact that consumers had a diversity of opinions about GM food and there were certain fundamental consumer issues and concerns about GM food, consumers had fears and misconceptions about GM food, which stemmed from a lack of knowledge and understanding hence consumer education was extremely important (Vermeulen, *et.al.*, 2004:22, 23).

The University of Pretoria conducted a study as well during November 2003 where respondents first participated in a conjoint experiment, followed by the completion of the survey questionnaire. The results suggested that South African urban white maize consumers definitely differed with respect to their behaviour towards GM food products. An interesting observation from the research was that only about a third of the respondents were completely against GM food. All the other respondents revealed some positive attitude towards GM food to varying degrees (Vermeulen, *et.al.*, 2004:22, 23). Since small-scale farmers are the producers and consumers of their product, acceptance

and opinions towards genetically modified white maize will be very interesting as they could enjoy the benefits on the production side and consumer side, with higher yields meaning higher level of food security for the household.

Since then, the Department of Health and United Nations Children's Fund (2005:3) proposed a community communication plan for the periods October 2005 to July 2006. This plan had to ensure that communication campaigns take place. Communication was planned to be through the use of radios, television, print and other production activities. For this study, unfortified maize meal could still be purchased from remote producers in the Limpompo and Eastern Cape. Information gained from the mini-survey showed that most community members, especially in Mqanduli, produced their own maize, which was hand grinded or collected by a nearby miller, who would collect their maize in a bakkie and return the maize meal the following day at a cost. These communities continued with their own practices and unfortified maize meal is still available from local millers. According to Opare-Obisaw, *et.al.* (2000:147), low education could affect the low adoption of the unfamiliar, especially unavailable food.

5.4 LIMITATIONS OF STUDY

The following are regarded as the most important limitations to the study.

- More communities around Mthatha could have been involved in the sensory evaluations and focus group interviews if there were enough funds. Interesting differences and information were uncovered in these two areas. If two more areas were used, it would have given information from 100 people of the population and could have allowed more concrete conclusions to be drawn in the areas of Mthatha.
- Participants of higher LSM groups were not included in the study, which means that certain attributes could not have been uncovered.
- These communities of Mthatha had low levels of education, hence were not familiar to certain concepts.
- No proper argumentative discussions could be recorded. This is because semi-illiterate communities give more straight answers on their experiences rather than opinions they have about certain concepts.

5.5 RECOMMENDATIONS

Conceptualisation is the most crucial step to improve awareness and gather opinions in a community. How well the concept of food fortification or genetic modification was truly understood or processed by the respondents. According to the research report on the National food fortification programme (2002:19), the respondents of the Eastern Cape expressed that they were people of strong traditions, cultures and suspicions, hence the introduction of the new concept needed to be handled with care in their area.

It was difficult for most respondents in Mqanduli to understand the concepts that we were trying to discuss with them during the focus group interviews. According to the research report on the National food fortification programme (2002:18) approximately 46% had no education at all in the rural population. Lack of education is one of the key barriers contributing to poor understanding and unawareness of modern technologies, which needs to be addressed extensively. Hence, any communication strategy should ensure it is spoken in the local language. It is even better if the community drives the communication process in their areas. This would improve trust, as mentioned that it could be a barrier if the communities are not properly addressed. The technologies could be entered into the school curriculum, since children are good teachers to their parents.

Any new food products especially, legislated by the government to benefit the lower LSM should be extensively subsidized to improve accessibility. According to the research report on National food fortification programme (2002:20), respondents expressed fear of not being able to afford to buy fortified foods. The study made it clear that at times, there was no money available to purchase what could otherwise be grown locally. This was observed in Mqanduli. Hence, biofortified maize would be ideal in these areas if acceptable and affordable.

Law enforcement to the Legislation should ensure there are no manufacturers who sell unfortified maize meal to the customers. Hence, environmental health inspectors should be encouraged to monitor the millers as it was done for iodated salt (i.e. use of test kits to monitor the availability of prescribed nutrients). It is understandable that consumers like in Mqanduli, are still consuming home grinded maize meal as they use what is easily available to them. Hence, biofortified maize would be ideal in these areas if acceptable

and affordable. But it is unacceptable when they purchase commercial maize, which is not fortified. The fact that some producers still have unfortified maize meal on their shelves is a problem. Vitamin A malnutrition education rate would be very low.

Sensitisation and further consultation with other professionals who are working directly with communities is important in increasing the awareness of food fortification. Food fortification is seen as a vehicle, which would further improve the health of fellow South Africans. Acknowledgement, utilization and integration of indigenous knowledge with scientific knowledge should be enhanced.

Any communication strategy should ensure that the communities are involved in the implementation and monitoring of the communication strategy. Involvement of the communities that were specifically investigated for vitamin A deficiency especially in the 1999 National Food Consumption Survey should be prioritised. As this could serve as report back system of the results taken from the communities and could perhaps involve the communities by giving feedback to other communities. Involvement of the community leaders and indunas (traditional leaders) in the strategy of the food fortification initiative, as well as the communication strategy is crucial to ensure involvement of the communities during the implementation of a food fortification process.

It is proposed to identify publications that speak to health professionals, nutritionists, the food industry, etc and encourage the publication of articles on technologies in question, like food fortification and/or genetic modification.

Since the food fortification strategy has already been implemented, the overall communication strategy, containing messages that are relevant to the programme's target audience, should be provided. A model for developing and implementing community communication strategies should be provided. This can be done through the identification of key stakeholders at community level and working with them to design a communication strategy that will help the programme team to meet their objectives.

5.6 CONCLUDING REMARKS

The findings reflected significant difference in white unfortified and white fortified maize meal. The statistical significance was observed for aroma and colour where it was clear that fortified maize meal was more preferred in the sample population of Mthatha especially among the community of Ngqeleni. Although fortified maize meal is acceptable in Mthatha, awareness about this technology is still scanty. The Mqanduli community had less exposure to commercial fortified maize meal. Their farming practices could also contribute to their unawareness of communication campaigns as they were always in the fields with no access to media or community road shows.

There was no significant difference in local GM and non-local GM maize meals. Hence, the respondents could not detect any differences in terms of aroma, colour, taste and texture. There was no significant difference in local white (hammermill) and yellow (hammermill) maize meals. This could answer the concern over biofortification as according to Purchase, (2005:S20) has revealed that this process of fortification would affect the colour of the biofortified maize meal. The above maize meals were grown locally and taken to small millers for milling prior the sensory evaluations. The scores depicted that females had the least liking of home grown maize. But the younger age group (18-25) disliked the locally grown and sifted maize meal types. Could this be an indication of exposure to various other foodstuffs by this age group? Further investigation could be done in this area.

The focus group interviews have shown that communication has somehow not filtered through to the vulnerable communities on the two technologies such as food fortification and genetic modification. Better interventions need to be administered in order to achieve complete awareness on new technologies.

The commercial white fortified maize meal had acceptable and positive perceptions. In conclusion, this gives an indication that it is highly accepted amongst the Xhosa communities of Ngqeleni and Mqanduli in the Eastern Cape in South Africa.

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ADDENDUM I

Amanquku yale mighubo mbhona /*Score sheet for maize meal*
Sample: 218

Sicela ugcwalise apha /*Please complete the following information*:

Igama/ *Name*:_____

Ngomhla/*Date*:_____**2006 Indawo/*Area*:**_____

Iminyaka /*Age*:_____ **Isini/*Gender*: Indoda/*Male*:**_____ **Obhinqhileyo/*Female*:**_____

1. Umbala/ *Colour*

Ndiyithanda kakhulu	Ndiyithanda kancinci	Andiyazi noba ndiyayithanda	Andiyithandi ncam	Andiyithandi qha
Like a lot	*Like a little*	*Neither like nor dislike*	*Dislike a little*	*Dislike a lot*

2. Ivumba/ *Smell*

Ndiyithanda kakhulu	Ndiyithanda kancinci	Andiyazi noba ndiyayithanda	Andiyithandi ncam	Andiyithandi qha
Like a lot	*Like a little*	*Neither like nor dislike*	*Dislike a little*	*Dislike a lot*

3. Ubulafulafu/*Texture*

Ndiyithanda kakhulu	Ndiyithanda kancinci	Andiyazi noba ndiyayithanda	Andiyithandi ncam	Andiyithandi qha
Like a lot	*Like a little*	*Neither like nor dislike*	*Dislike a little*	*Dislike a lot*

4. Incasa/*Taste*

Ndiyithanda kakhulu	Ndiyithanda kancinci	Andiyazi noba ndiyayithanda	Andiyithandi ncam	Andiyithandi qha
Like a lot	*Like a little*	*Neither like nor dislike*	*Dislike a little*	*Dislike a lot*

Sample: 429

Sicela ugcwalise apha*/ Please complete the following information*:

1. Umbala*/ Colour*

Ndiyithanda kakhulu	Ndiyithanda kancinci	Andiyazi noba ndiyayithanda	Andiyithandi ncam	Andiyithandi qha
Like a lot	*Like a little*	*Neither like nor dislike*	*Dislike a little*	*Dislike a lot*

2. Ivumba*/ Smell*

Ndiyithanda kakhulu	Ndiyithanda kancinci	Andiyazi noba ndiyayithanda	Andiyithandi ncam	Andiyithandi qha
Like a lot	*Like a little*	*Neither like nor dislike*	*Dislike a little*	*Dislike a lot*

3. Ubulafulafu/*Texture*

Ndiyithanda kakhulu	Ndiyithanda kancinci	Andiyazi noba ndiyayithanda	Andiyithandi ncam	Andiyithandi qha
Like a lot	*Like a little*	*Neither like nor dislike*	*Dislike a little*	*Dislike a lot*

4. Incasa*/ Taste*

Ndiyithanda kakhulu	Ndiyithanda kancinci	Andiyazi noba ndiyayithanda	Andiyithandi ncam	Andiyithandi qha
Like a lot	*Like a little*	*Neither like nor dislike*	*Dislike a little*	*Dislike a lot*

-ENKOSI!-
-THANK YOU!-

ADDENDUM II

FOCUS GROUP QUESTIONNAIRE

Date:_____

Group:_____

Location:_____

1. Wazi ntoni ngomgubo wombhona oone zakha mzimbha? Nalifumanaphi ulwazi nga lom mgubo wombhona?

What is your understanding of fortified maize meal? What was the source of this information?

2. Nicinguba kukhona ukobalulekileleyo ngalo mgubo wom mbhona oone zakha mzimbha. Ninga ndichazela.

What do you think is the importance of fortified maize meal?

3. Ningasebenzisa omnye umgubo endaweni yalo une zakha zimbha? Ngomphi omnye eningamsebenzisa? Ngoba?

Would you replace fortified maize meal with other maize meal? Which? Why?

4. Nazi ntoni ngombhona wobu cwepheshe be-biotechonology/GM? Nalifumanaphi ulwazi nga lombhona wobubu cwepheshe be-biotechnology/GM?

What is your understanding of GM maize? What was your source of information of GM maize?

5. Lombhona wobu cwepheshe be-biotechnology/GM utyaliwe apha eMpuma koloni. Niwulima na? Ngoba kutheni nikhetu lima lombhona?

GM maize is grown in Eastern Cape. Do you grow GM maize in your community? Why?

6. Uthini umbono wakho ngona obomvu?

What is your opinion of yellow maize meal?

7. Bekukhona Umehluko ubukhona kwezihlobo zemigubo beniyinchamla ebeninoku yibabaza?

Was there any difference in all these maize meals that stood out in these tests?

ADDENDUM III

ISIVUMELWANO/*CONSENT FORM*

Igama/*Name*:_____

Iminyaka/*Age*:_____ Isini/*Gender*: Indoda/*Male*:_____Obhinqhileyo/*Female*:_____

Mna,_____ndiyayi qonda inxaxheba emandiyithabathe kwesisifundo, kwaye ndiyavuma ukuthabatha inxaxheba kwesisifundo.

I,_____th e undersigned, fully understand the requirements of my role as a participant in this study and have consented to take part in the study.

Intsayino

gama_____

*Signature:*_____

Ngomhla_____ka July/August 2006. Indawo:_____

*Day of _____July/August 2006. Place:*_____

ADDENDUM IV

RECIPES

NGQELENI

Recipe 1 (Samples 218/429)

Ingredients
4 litres boiling water

Paste
1.5 kg maize meal
1.75 litre cold water

Method
Boil 4 litres of water. Add the paste to the boiling water. Cook for 15 minutes. Stir occasionally for even cooking approximately every 5 minutes. Leave to simmer for another 5 minutes. Ready to serve.

Additions in sample 218 to get desirable consistency:
200g maize meal
250ml cold water

Recipe 2 (Samples 934/549)

Ingredients
4 litres boiling water

Paste
2.2 kg maize meal
1.5 litre cold water

Method

Boil 4 litres of water. Add the paste in the boiling water. Cook for 15 minutes. Stir occasionally for even cooking approximately every 5 minutes. Leave to simmer for another 5 minutes. Ready to serve.

Additions in sample 549 to get desirable consistency:
400ml cold water

Recipe 3 (Samples 653/762)

Ingredients
4 litres boiling water

Paste
1.7 kg maize meal
1.5 litre cold water

Method

Boil 4 litres of water. Add the paste to the boiling water. Cook for 15 minutes. Stir occasionally for even cooking approximately every 5 minutes. Leave to simmer for another 5 minutes. Ready to serve.

Additions in sample 762 to get desirable consistency:
500g maize meal
300ml cold water

MQANDULI

Recipe 1 (Samples 218/429)

Ingredients
4 litres boiling water
1.4 kg maize meal

Method

Boil 4 litres of water. Add the dry maize meal to the boiling water. Simmer for 5 minutes. Stir the pap until smooth. Cook for approximately 15 minutes, stirring every 5 minutes for even cooking. Ready to serve.

Additions in sample 429 to get desirable consistency:
100g maize meal

Recipe 2 (Samples 934/549)

Ingredients
4 litres boiling water
1.5 kg maize meal

Method

Boil 4 litres of water. Add the dry maize meal in the boiling water. Simmer for 5 minutes. Stir the pap till smooth. Cook for approximately 15 minutes and stirring every 5 minutes for even cooking. Ready to serve.

Recipe 3 (Samples 653/762)

Ingredients
4 litres boiling water
1.7 kg maize meal

Method

Boil 4 litres of water. Add the dry maize meal to the boiling water. Simmer for 5 minutes. Stir the pap till smooth. Cook for approximately 15 minutes, stirring every 5 minutes for even cooking. Ready to serve.

ADDENDUM V

COMMUNITY BACKGROUND QUESTIONNAIRE

Community Background Survey

Area:_____

Date:_____

1. Do you grow your own maize?
2. Which maize do you grow?
   White conventional maize, white Bt maize, yellow maize, yellow Bt maize?
   What do you use it for?
   Do you have a local miller?
3. Which maize meal does the community prefer?
   Locally grown and grinded/ commercial
4. Which commercial maize meal is preferred in the area?
5. Where do most people buy it?
6. Are most people working in the area?
7. Can majority of the people read and write?

   Yes/ No

- THANK YOU -

ADDENDUM VI

Statistical analysis

Session 1

White unfortified and white fortified maize meals

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Aroma	.00	51	3.92	1.412	.198	3.52	4.32	1	5
	1.00	51	3.33	1.545	.216	2.90	3.77	1	5
	Total	102	3.63	1.502	.149	3.33	3.92	1	5
App_colour	.00	51	4.27	1.282	.179	3.91	4.64	1	5
	1.00	51	3.65	1.494	.209	3.23	4.07	1	5
	Total	102	3.96	1.421	.141	3.68	4.24	1	5
Text_feel	.00	51	3.94	1.392	.195	3.55	4.33	1	5
	1.00	51	3.78	1.419	.199	3.39	4.18	1	5
	Total	102	3.86	1.400	.139	3.59	4.14	1	5
Taste	.00	51	3.94	1.567	.219	3.50	4.38	1	5
	1.00	51	3.45	1.712	.240	2.97	3.93	1	5
	Total	102	3.70	1.652	.164	3.37	4.02	1	5

ANOVA

		Sum of Squares	Df	Mean Square	F	Sig.
Aroma	Between Groups	8.824	1	8.824	4.029	.047
	Within Groups	219.020	100	2.190		
	Total	227.843	101			
App_colour	Between Groups	10.039	1	10.039	5.180	.025
	Within Groups	193.804	100	1.938		
	Total	203.843	101			
Text_feel	Between Groups	.627	1	.627	.318	.574
	Within Groups	197.451	100	1.975		
	Total	198.078	101			
Taste	Between Groups	6.127	1	6.127	2.274	.135
	Within Groups	269.451	100	2.695		
	Total	275.578	101			

Session 2

White local non-GM and white local GM maize meals

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Aroma	.00	50	3.70	1.542	.218	3.26	4.14	1	5
	1.00	50	3.72	1.591	.225	3.27	4.17	1	5
	Total	100	3.71	1.559	.156	3.40	4.02	1	5
App_colour	.00	50	3.34	1.673	.237	2.86	3.82	1	5
	1.00	50	3.38	1.627	.230	2.92	3.84	1	5
	Total	100	3.36	1.642	.164	3.03	3.69	1	5
Text_feel	.00	50	3.34	1.624	.230	2.88	3.80	1	5
	1.00	50	3.40	1.666	.236	2.93	3.87	1	5
	Total	100	3.37	1.637	.164	3.05	3.69	1	5
Taste	.00	50	3.14	1.818	.257	2.62	3.66	1	5
	1.00	50	3.38	1.652	.234	2.91	3.85	1	5
	Total	100	3.26	1.733	.173	2.92	3.60	1	5

Descriptives

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Aroma	Between Groups	.010	1	.010	.004	.949
	Within Groups	240.580	98	2.455		
	Total	240.590	99			
App_colour	Between Groups	.040	1	.040	.015	.904
	Within Groups	267.000	98	2.724		
	Total	267.040	99			
Text_feel	Between Groups	.090	1	.090	.033	.856
	Within Groups	265.220	98	2.706		
	Total	265.310	99			
Taste	Between Groups	1.440	1	1.440	.477	.491
	Within Groups	295.800	98	3.018		
	Total	297.240	99			

Session 3

White hammermill and Yellow hammermill maize meal

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Aroma	.00	50	3.20	1.539	.218	2.76	3.64	1	5
	1.00	50	3.52	1.432	.203	3.11	3.93	1	5
	Total	100	3.36	1.487	.149	3.06	3.66	1	5
App_colour	.00	50	3.30	1.693	.239	2.82	3.78	1	5
	1.00	50	3.72	1.429	.202	3.31	4.13	1	5
	Total	100	3.51	1.573	.157	3.20	3.82	1	5
Text_feel	.00	50	3.08	1.676	.237	2.60	3.56	1	5
	1.00	50	3.64	1.481	.209	3.22	4.06	1	5
	Total	100	3.36	1.599	.160	3.04	3.68	1	5
Taste	.00	50	2.60	1.829	.259	2.08	3.12	1	5
	1.00	50	3.24	1.825	.258	2.72	3.76	1	5
	Total	100	2.92	1.846	.185	2.55	3.29	1	5

ANOVA white

		Sum of Squares	df	Mean Square	F	Sig.
Aroma	Between Groups	2.560	1	2.560	1.159	.284
	Within Groups	216.480	98	2.209		
	Total	219.040	99			
App_colour	Between Groups	4.410	1	4.410	1.796	.183
	Within Groups	240.580	98	2.455		
	Total	244.990	99			
Text_feel	Between Groups	7.840	1	7.840	3.133	.080
	Within Groups	245.200	98	2.502		
	Total	253.040	99			
Taste	Between Groups	10.240	1	10.240	3.068	.083
	Within Groups	327.120	98	3.338		
	Total	337.360	99			

ADDENDUM VI I

FOCUS GROUP INTERVIEWS' RESPONSES

NGQELENI

1. Wazi ntoni ngomgubo wombhona oone zakha mzimbha? Nalifumanaphi ulwazi nga lom mgubo wombhona?

   What is your understanding of fortified maize meal? What was the source of information?

   a. "Unesondlo" *Nutritious*
   b. "Isebe lempilo nolwezo limo". *The department of Health officers and Agriculture*
   c. "Siva nakunomathotholo". *We have also heard on radio shows*

   The respondents have heard about food fortification.

2. Nicinguba kukhona ukobalulekileleyo ngalo mgubo wom mbhona oone zakha mzimbha. Ninga ndichazela.

   What do you think is the importance of fortified maize meal?

   a. *"*Ukunika amandla, unesondlo nezakhamzimbha" *Fortified maize meal gives you energy, nutrients and building blocks of the body*
   b. "Ukupha impilo" *Gives you good health*

   They understand the benefits of fortification.

3. Ningasebenzisa omnye umgubo endaweni yalo une zakha zimbha? Ngomphi omnye eningamsebenzisa? Ngoba?

   Would you replace fortified maize meal with other maize meal? Which? Why?

   a. *"*Hayi ngeke si sebezise omnye umbhona une zondlo ngaphandle kwe White Star ngoba imunandi futhi ilafulafu kumphokoqo". *No, we would never replace our fortified maize meal especially White Star because it is nice and soft for crumbly pap.*

      Notice some brand loyalty to White Star (super maize meal) and expression of satisfaction.

4. Nazi ntoni ngombhona wobu cwepheshe be-biotechonology/GM? Nalifumanaphi ulwazi nga lombhona wobubu cwepheshe be-biotechnology/GM?

What is your understanding on GM maize? What was your source of information of GM maize?

a. "Asizazi incukagca zalombhona wobu cwepheshe kodwa saxelelwa ngabalimi bethu besebe lwezolimo". *We do not know much about this technology but our extension officers from the department of Agriculture have informed us about it.*
b. "Abalimi basi fundisa ngako konke, ngezolimo enzeluba siphuhle". *We are taught by extension officers about all concerning Agriculture so that we may be able to improve our agricultural practices.*

Lack of knowledge on biotechnology although they have heard about it.

5. Lombhona wobu cwepheshe be-biotechnology/GM utyaliwe apha eMpuma koloni. Niyawulima na? Ngoba kutheni nikhetu ukulima lombhona?
   GM maize is grown in the Eastern Cape. Do you grow GM maize in your area? Why?
   a. "Ewe siyawutyala ombhona wobu cwepeshe ngoba uyafana nomnye umbhona onobu cwepheshe njengokuba seyisetyenziswa kulemihla" Yes, we grow GM maize because it is the same as other maize which have been technologically improved because it is all used these days.
   b. "Lombhona sele utyaliwe eLusikisiki ngenxa yokudingeka kwaokuba uyalunga phaya" This maize is already grown in Lusikisiki because it grows well.

   Grown in nearby areas like Lusikisiki, these areas are further from Mthatha and people tend to depend on subsistence farming.

6. Uthini umbono wakho ngona obomvu? *What is your opinion on yellow maize meal?*
   a. *Yellow maize is for feeding chickens and making mageu*
   b. "Sindla umbono obomvu no graba wawo ngokuba unencasa futhi uyasihluthisa. Ukugcina imini yonke" *We consume yellow maize and yellow maize meal because it is tasty and filling. It keeps you full the whole day.*

   Yellow maize and yellow maize meal is consumed in various dishes is therefore consumed by all, although it is not preferred as the number one as maize meal.

7. *Bekukhona Umehluko ubukhona kwezihlobo zemigubo beniyinchamla ebeninoku yibabaza? Was there any difference in all these maize meals that was outstanding in these tests?*
   a. ”Umehluko ungekho mkhulu ngaphandle koba obomvu no mhlophe wehluke ngombala, nangobulafulafu”. *There was not much of a difference in all these maize meals except that yellow and white are different in terms of texture*
   b. “Obomvu uqinile, futhi uyehluthisa” *Yellow maize meal is coarser and more filling.*
   c. “Eminye ibithanda ukufana ngenhlelo zawo nangemibala” *All the other maize meals are very similar even in colour per test category.*

   No conspicuous difference expressed in all these different types of maize meal except for the obvious colour difference in yellow and texture expressed for yellow maize meal as well.

MQANDULI

1. Wazi ntoni ngomgubo wombhona oone zakha mzimbha? Nalifumanaphi ulwazi nga lom mgubo wombhona?

What is your understanding of fortified maize meal? What was the source of information?

a. “Asiqinisekanga ukuba siyawucana umahluko kwimighobo yombhona ngoba thina siya wuthenga umgobo yombhona okanye sizirhayele ngoba sithenbhele kakhulu ekuzityaleleni ezigadini nase ntsimini”. *We are not sure whether we know the difference between maize meals because we buy maize meal or grind it on our own as we depend on a lot on what we grow in our gardens and fields.*

b. “Siyazi yonke imighubo yemimbhona inezondlo”. *We know all maize meal is nutritious*

The respondents have not really heard about food fortification.

2. Nicinguba kukhona ukobalulekileleyo ngalo mgubo wom mbhona oone zakha mzimbha. Ninga ndichazela.

What do you think is the importance of fortified maize meal?

a. “Yonke imigubo yombhona isinika amandla, yiyolonto sidla yonke, ethengiweyo negutyiweyo”. All maize meal is our source of energy, therefore we consume both maize meal from the shops and as well as grinded maize meal.

The respondents do not know the benefits of food fortification

3. Ningasebenzisa omnye umgubo endaweni yalo une zakha zimbha? Ngomphi omnye eningamsebenzisa? Ngoba?

   Would you replace fortified maize meal with other maize meal? Which? Why?

   a "Asiqinisekanga ngalemigubo inezondlo kodwa ngeke si yeke ukusebenziza yomibini esiyithengayo nesiyigubayo" *Most of us are not sure about fortified maize meal but we would never replace our white maize that we grow*

   b. "Sisebenzisa yomibini, egutywayo ne thengwayo ngakumbhi iWhite Star xasinemali". *We use both grinded maize meal and commercial maize meal especially White Star when we have money.*

   c. "Orhayiweyo siyawakhetha kumarhewu, kwaye sikhethe owasevenkileni ukwenza umphokoqo." *We prefer home-grown grinded maize for making mageu and commercial maize for making crumbly pap.*

   It is clear that they are not aware of the benefits of fortified maize meal, hence use both home grown and commercial maize meal.

4. Nazi ntoni ngombhona wobu cwepheshe be-biotechonology/GM? Nalifumanaphi ulwazi nga lombhona wobubu cwepheshe be-biotechnology/GM?

   What is your understanding on GM maize? What was your source of information of GM maize

   a. "Ewe siyazi ngalombhona wobucwephesha kwi kampani Monsanto naku balimi besebe lwezolimo kwaye sayi tyala kwi minyaka emibini edlulileyo." *Yes, we have been told by officers from Agriculture and have grown it in the past two years.*

   b. "Asazilukhulu ngayo, kodwa uyafana nomye umbhona ngoba yonke sile inobu cwepheshe." We do not know much about GM maize but it looks the same as all maize as we are aware that most seeds have been technogically improved.

   They are aware of GM maize and have grown it in their community

5. Lombhona wobu cwepheshe be-biotechnology/GM utyaliwe apha eMpuma koloni. Niwulima na? Ngoba kutheni nikhetu lima lombhona?

   GM maize is grown in the Eastern Cape. Do you grow GM maize in your area? Why?

a. “Ewe, siyazi ngawo ngoba besiwutyalile kwi minyaka emibini edlulileyo kwaye ibifana neminye imibhona yethu.” *Yes, we grown GM maize meal, because it is the same like other maize we have grown.*

They grow GM maize but do not have an understanding of the facts behind the technology as they are encouraged to grow GM maize by their extension officers.

6. Uthini umbono wakho ngona obomvu?
   What is your opinion on yellow maize meal?

a. “Siwusebenzisa umbhona umgubo ubomvu kakhulu xa omhlophe uphelile” We consume yellow maize meal because when white maize is not available.

b. “Umbhona obomvu siwusebenzisa ukutyseni inkukhu, ihagu ne sophu yethu” We use yellow maize for feeding chickens and pigs, as well as making isophu “traditional maize soup” for human consumption.

c. “Siwutyalela ukuwuthengisa ubuninzi” We grow yellow maize to sell in most cases.

d. “Kodwa umbhona obomvu siywusebenzesa ukuwutya usisikwebu” But we consume yellow maize on the cob.

Yellow maize and yellow maize meal is consumed in various dishes and is therefore consumed by all, it is not although not preferred as the number one as maize meal

7. *Bekukhona Umehluko ubukhona kwezihlobo zemigubo beniyinchamla ebeninoku yibabaza? Was there any difference in all these maize meals that stood out in these tests?*

*a. ”*Umehluko ubungekho mkhulu ngaphandle koba obomvu no mhlophe wehluke ngombala, nangobulafulafu”. *There was not much of a difference in all these maize meals except for yellow and white are different in terms of texture.*

b. “Eminye ibithanda ukufana ngenhlelo zawo nangemibala” *All the other maize meals are very similar even in colour per test category.*

c. “Obomvu umgubo siwuthandela ukuhluthisa, ngokwenene wehlukile.” *We also use yellow maize meal because it is really filling and it is really different from other maize meals.*

The respondents observed no major difference; only the colour differences were obvious with yellow maize meal.