

**Determining the knowledge, attitudes,  
beliefs and practices of the adult  
consumer in the City of Cape Town,  
Western Cape, South Africa, regarding  
the inclusion of genetically modified  
foods in the diet.**

by  
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*Thesis presented in partial fulfilment of the  
requirements for the degree Master of Nutrition  
at the University of Stellenbosch*



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March 2017

## **DECLARATION**

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## ABSTRACT

**Introduction:** South Africa (SA) is the ninth largest producer of genetically modified (GM) foods in the world, and the only country to genetically modify one of its staple foods, maize meal. Despite the consumer being one of the major stakeholders in the long-term success of this technology, very little research has been done within SA on the stance of the consumer regarding GM foods.

**Objectives:** To determine 1) the level of knowledge of the adult consumer regarding GM foods and genetic engineering, 2) the attitudes, beliefs and practices relating to genetic engineering and GM foods in the diet, and 3) whether there are any differences in the knowledge, attitudes, beliefs and practices according to consumer characteristics such as gender, age, education level and income.

**Study Design:** An observational, descriptive study design, with an analytical component. A mixed-methods approach was employed, with Phase One being in the quantitative domain, and Phase Two in the qualitative domain.

**Methods:** For the quantitative phase, consumers ( $n=200$ ) were recruited from eight grocery stores across the City of Cape Town (CoCT). Data on demographics, knowledge, attitudes, beliefs and practices was collected using a researcher-administered questionnaire. Qualitative data was collected by means of five focus-group discussions (FGDs) ( $n=36$ ) conducted across the CoCT.

**Results:** The overall knowledge score of participants was 43,6%, with a statistically significant correlation between education level and the achieved knowledge score ( $p<0,01$ ). Overall, participants were found to have a more negative attitude towards GM foods, which was also evident in the FGDs. Both an increased knowledge score ( $p<0,01$ ) and a higher level of education ( $p<0,01$ ) correlated with having a more negative attitude towards GM foods. The majority of participants were of the opinion that GM foods were acceptable when developed to improve the nutritional value of foods (70,0%), and to increase food availability (75,5%), with food insecurity, an increasing population and drought conditions being raised in the FGDs. Concerns about the long-term health (74,5%) and environmental (74,5%) effects were raised during both Phase One and Two. There was a definite preference for non-GM foods (78,0%), which dropped to just over half when GM foods were offered at a better price (53,5%). Participants were of the opinion that consumers benefited the least from having GM foods available in SA. The vast majority felt strongly that GM foods should be labelled (97,5%) and the public consulted before the

release of GM foods (92,5%). A more positive attitude towards GM foods significantly decreased the likelihood of reading food labels ( $p < 0,01$ ).

**Conclusion:** Campaigns to improve consumer awareness on GM foods within SA need to be strengthened and monitored for effectiveness, and the public should be included in any further decision making. Public concerns regarding the safety and sustainability of GM foods should be addressed through long-term research studies, and these results should be made available to consumers in an understandable manner. The implementation and monitoring of food labelling regulations indicating the GM status of foods are pivotal to consumers being able to make informed choices.

## OPSOMMING

**Inleiding:** Suid-Afrika (SA) is die negende grootste produsent van geneties gemanipuleerde (GM) voedsel ter wêreld, en die enigste land wat een van die stapelvoedsels - mieliemeel - geneties modifiseer. Baie min navorsing is in die land gedoen oor die mening van verbruikers ten opsigte van GM voedsel, ten spyte daarvan dat die verbruiker een van die belangrikste belanghebbers is in die langtermyn sukses van hierdie tegnologie.

**Doelwitte:** Om te bepaal 1) wat die kennisvlak van die volwasse verbruiker is oor GM voedsel en genetiese manipulasie, 2) wat die gesindhede, oortuigings en praktyke oor genetiese manipulasie en GM voedsel in die dieet is, en 3) of daar enige verskille is in die kennis, gesindhede, oortuigings en praktyke wat verband hou met verbruikerskenmerke soos geslag, ouderdom, opvoedkundige vlak en inkomste.

**Studie-ontwerp:** 'n Waarnemende, beskrywende studie-ontwerp met 'n analitiese komponent. 'n Kombinasie-aanslag is gevolg met Fase Een in die kwantitatiewe en Fase Twee in die kwalitatiewe domein.

**Metodes:** Vir die kwantitatiewe fase is verbruikers ( $n=200$ ) by agt kruidenierswinkels in Stad Kaapstad gewerf. 'n Navorsing-geadministreerde vraelys is gebruik om data oor demografie, kennis, gesindhede, oortuigings en praktyke in te samel. Kwalitatiewe data is ingesamel deur middel van vyf fokusgroep-besprekings (FGBs) ( $n=36$ ) gedoen regoor die Stad Kaapstad.

**Resultate:** Die oorhoofse kennis-telling van deelnemers was 43,6%, met 'n statisties beduidende korrelasie tussen opvoedkundige vlak en die kennis-telling behaal ( $p<0,01$ ). Oorhoofs is bevind dat deelnemers 'n meer negatiewe gesindheid teenoor GM voedsel het, en hierdie resultaat het ook uit die FGBs geblyk. 'n Verhoogde kennistelling ( $p<0,01$ ), sowel as 'n hoër vlak van opvoeding ( $p<0,01$ ) korreleer met 'n meer negatiewe houding teenoor GM voedsel. Die meerderheid deelnemers het gevoel dat GM voedsel aanvaarbaar sou wees as dit die voedingswaarde (70,0%) of die beskikbaarheid van voedsel sou verhoog (75,5%) terwyl voedsel-onsekerheid, 'n verhoogde bevolking en droogtetoestande in die FGBs geopper is. Kommer is in beide Fase Een en Twee uitgespreek oor langtermyn gesondheid (74,5%) en die impak op die omgewing (74,5%). Daar was 'n duidelike voorkeur vir nie-GM voedsel (78,0%), maar hierdie persentasie het gedaal tot net oor die helfte (53,5%) wanneer GM voedsel teen 'n beter prys aangebied sou word. Deelnemers was van mening dat verbruikers die minste baatvind by die beskikbaarheid van GM voedsel in SA. Die oorgrote meerderheid voel sterk daarvoor dat GM voedsel op etikette aangedui moet word (97,5%) en dat die publiek geraadpleeg word

voor die vrystelling van GM voedsel (92,5%). 'n Meer positiewe gesindheid teenoor GM voedsel het die waarskynlikheid dat voedsel-etikette gelees word, aansienlik verminder ( $p < 0,01$ ).

**Gevolgtrekking:** Veldtogte om verbruikersbewustheid oor GM voedsel in SA te verbeter moet versterk en gemonitor word vir effektiwiteit, en die publiek behoort by verdere besluitneming betrek te word. Publieke kommer rakende die veiligheid en volhoubaarheid van GM voedsel moet deur langtermyn-navorsing aangespreek word, en hierdie resultate moet op 'n verstaanbare wyse aan verbruikers beskikbaar gestel word. Die implementering en monitering van regulasies insake voedsel-etikettering wat die GM-status van voedselprodukte aandui, is van kernbelang om verbruikers in staat te stel om ingeligte keuses uit te oefen.

## ACKNOWLEDGEMENTS

I would like to give a special word of thanks and acknowledgement to the following people, who have made the completion of this thesis possible:

- My supervisor, Ms Nelene Koen, for your expertise, encouragement and patience. Thank you for always being available, and for your willingness to offer insight.
- My co-supervisor, Ms Megan Pentz-Kluyts, for your expertise, encouragement and input on the topic.
- My statistician, Prof. Martin Kidd, for your expertise and time.
- My parents, Piet and Elize Naude, who encouraged me to pursue my master's degree, and then offered their unwavering support throughout. Thank you that nothing is ever too much for you, and for your belief in me. Without you, my master's would still be a dream.
- My husband, Willem-Daniël, who has been so incredibly supportive right from the start. Thank you for seeing the potential in me, and for being willing to help carry the load.
- All my family and friends who were so understanding and encouraging – thank you to each of you for the role that you played in this process.

## **CONTRIBUTION BY PRINCIPAL RESEARCHER AND FELLOW RESEARCHERS**

The principal researcher (Kari Jonker) developed the idea of the protocol. The principal researcher planned the study, undertook data collection (with the assistance of a research assistant), captured the data for analyses, analysed the data with the assistance of a statistician, interpreted the data and drafted the thesis. Ms Nelene Koen and Ms Megan Pentz-Kluyts (study supervisors) provided input at all stages and revised the protocol and thesis. This thesis was language edited by Dr Elizabeth van Aswegen BA (Bibl), BA (Hons), MA, DLitt, FSAILIS.

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**LIST OF ABBREVIATIONS**

<b>AfricaBio</b>	African Centre for Biosafety
<b>AgriSA</b>	Agriculture South Africa
<b>Codex</b>	Codex Alimentarius
<b>CoCT</b>	City of Cape Town
<b>CPA</b>	Consumer Protection Act
<b>DNA</b>	De-oxy-ribose Nucleic Acid
<b>EFSA</b>	European Food Safety Agency
<b>EU</b>	European Union
<b>FEST</b>	Foundation for Education, Science and Technology
<b>FG</b>	Focus Group
<b>FGB</b>	Fokusgroep-bespreking
<b>FGD</b>	Focus-Group Discussion
<b>GM</b>	Genetically Modified
<b>GMO</b>	Genetically Modified Organism
<b>HIV</b>	Human Immunodeficiency Virus
<b>HREC</b>	Human Research Ethics Committee
<b>IARC</b>	International Agency for Research on Cancer
<b>KABP</b>	Knowledge, Attitudes, Beliefs and Practices
<b>NBS</b>	National Biotechnology Strategy
<b>NCC</b>	National Consumer Council
<b>NFCS</b>	National Food Consumption Survey
<b>NGOs</b>	Non-Governmental Organisations
<b>PCR</b>	Polymerase Chain Reaction
<b>RA</b>	Research Assistant
<b>SA</b>	South Africa
<b>SANHANES-1</b>	South African National Health and Nutrition Examination Survey, Fortification Baseline 1
<b>SOP</b>	Standard Operating Procedure
<b>UNDP</b>	United Nations Development Programme
<b>USA</b>	United States of America
<b>WEMA</b>	Water Efficient Maize for Africa
<b>WHO</b>	World Health Organization
<b>WTO</b>	World Trade Organization

## LIST OF DEFINITIONS

<b>Adult</b>	Any person 18 years of age or older, which is the legal age at which a person may make independent decisions in South Africa <sup>(1)</sup>
<b>Allergenicity</b>	The capacity to illicit an immune response in animals or humans upon immunisation or exposure <sup>(2)</sup>
<b>Attitudes</b>	Refers to an individual's position on a subject, and their stance towards it, which is not directly observable <sup>(3)</sup>
<b>Beliefs</b>	Something one accepts as true and real, a firmly held opinion <sup>(4)</sup>
<b>Biotechnology</b>	Biological, or natural processes that have been engineered or changed for a specific purpose <sup>(5)</sup>
<b>Genetic Engineering</b>	The deliberate modification of the characteristics of an organism, by manipulating its genetic material <sup>(4)</sup>
<b>Genetically Modified Food</b>	Food produced through plants that have had their genetic material (DNA) altered in a way that does not occur naturally in nature <sup>(6)</sup>
<b>Genetically Modified Organism</b>	Organisms of which the genetic material (DNA) have been altered in a way that does not occur naturally in nature – for example, through the introduction of a gene from another organism <sup>(6)</sup>

**Knowledge**

A set of understandings, the degree of education and information an individual has on a particular topic. Objective knowledge is actual or real knowledge that a person has on a given topic, while subjective knowledge refers to self-perceived knowledge of a given topic <sup>(3,7)</sup>

**Practices**

The way someone behaves, observable actions in response to a stimulus <sup>(3)</sup>

# **CHAPTER 1**

## **LITERATURE REVIEW**

## 1.1 INTRODUCTION

Biotechnologically developed crops are the fastest adopted crop technology in the world, increasing 100 fold between 1996 and 2015.<sup>(8)</sup> South Africa (SA) has been producing genetically modified (GM) crops since 1997, namely cotton (100%), maize (86,6%) and soya beans (92%), and is the ninth largest producer of GM crops in the world. Figure 1.1 gives an indication of the current top nine producers of GM foods in the world. The name of the country is indicated on the map, together with a star.<sup>(9,10)</sup>



**Figure 1.1 A world map indicating the nine largest producers of GM crops worldwide<sup>(8)</sup>**

The South African government and industry are largely pro-biotechnology, with economic, environmental and social benefits being reported, including the advancement of agriculture, rural development and poverty alleviation with an increase in food security. Policies and programmes are continuously being developed within the country to continue the growth of biotechnology, including the agricultural sector. As part of the bio-economy policy, effective communication with the public has been identified as one of the key areas to be addressed for the technology to be successful in the long-term within SA.<sup>(9,11–13)</sup>

As consumers are one of the major stakeholders in the GM food chain, their role in its development within a country cannot be ignored. Worldwide, consumer perspectives in countries differ, and it has been shown that acceptance of GM foods by consumers in developing countries is different from that in developed countries.<sup>(14)</sup> Therefore, it is imperative for developing countries, such as SA, to determine the stance of the consumer on these GM foods.

Research on consumer knowledge, attitudes, beliefs and practices within SA is limited and varied, with no recent studies conducted on this topic.<sup>(15–18)</sup>

In order to give a broad overview of the topic, a conceptual framework has been drawn up and is depicted in Figure 1.2. The conceptual framework highlights the most important stakeholders in the process of developing and distributing GM foods to the public, as well as indicating various issues specific to the stakeholder and/or process of development and distribution.

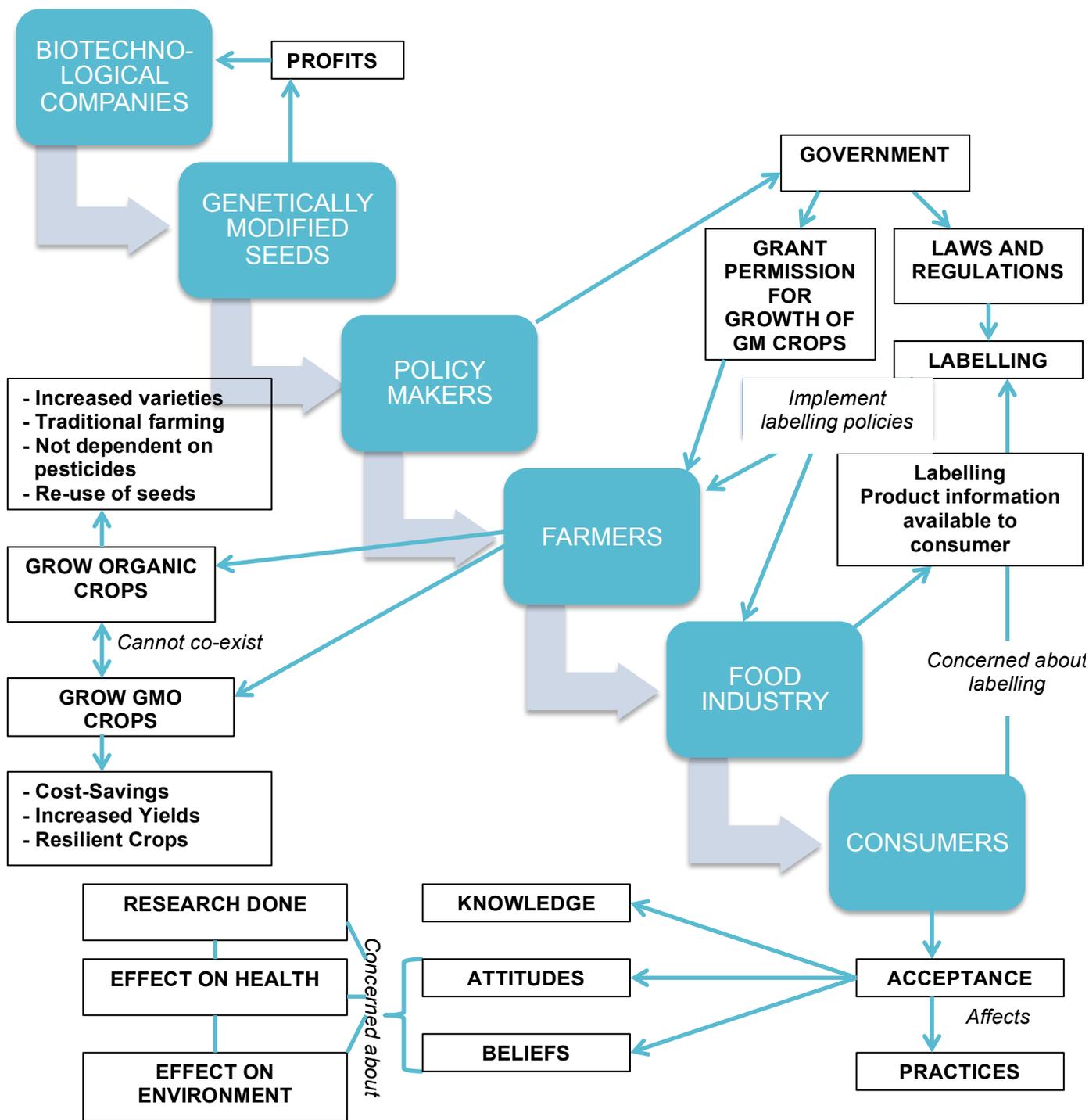


Figure 1.2 A conceptual framework indicating the major stakeholders in the development and distribution of GM foods to the public, as well as key aspects surrounding the specific stakeholder

## 1.2 UNDERSTANDING THE TERMINOLOGY

Biotechnology is an over-arching term used to refer to various scientific techniques employed in a number of different industries, essentially making use of living systems or organisms to alter processes or products for a specific use. This technology has been used for thousands of years, including early processes of fermentation, natural insecticides, and antibiotic development.<sup>(19)</sup>

In modern agriculture, biotechnology is widely used and includes genetic engineering, where individual genes are transferred between organisms as well as between non-related species. Organisms of which the de-oxy-ribose nucleic acid (DNA) has been altered in a way that does not occur naturally in nature, in order to enhance the end product, are referred to as genetically modified organisms. These genetically modified organisms are then used to grow genetically modified plants, which produce genetically modified food crops.<sup>(20)</sup> Generally, these foods are referred to as “GM foods”.

Crossbreeding or selective breeding has occurred for many years as a farming technique, and also occurs naturally in nature. As a farming technique, it is considered a time-consuming process, which requires generations of breeding to achieve desired traits, and eliminate unwanted characteristics. Genetic modification therefore allows this process to occur in an instant, and also allows for a wide variety of genes, also from an unrelated species, to be incorporated into an organism.<sup>(21)</sup> GM technology in agriculture therefore enables useful genes from a variety of organisms to be incorporated into one organism, producing superior crops with desirable traits, thereby overcoming limitations of traditional farming methods.<sup>(10)</sup>

## 1.3 HISTORY OF GENETIC MODIFICATION AROUND THE WORLD

One of the oldest examples of genetic modification in the form of crossbreeding in the world is the mule, a cross between a male donkey and a female horse, which was used for transportation many years ago.<sup>(19)</sup> From there, genetic modification continued to develop, until China became the first country to commercialise GM crops in the early 1990s in the form of virus-resistant tobacco, followed by virus-

resistant tomatoes. The United States of America (USA) followed suit by introducing GM crops into their market later in the 1990s, the first of which were tomatoes with a longer shelf life.<sup>(22)</sup>

Today, up to 28 countries around the world are planting GM crops – 20 of which are developing nations, and eight of these industrialised. The fact that so many developing nations are adopting GM crops could be an indication of the potential perceived benefits of this technology for these countries. Around 60% of the world's population lives in these 28 countries, indicating the significant and widespread impact of this technology. Interestingly, in 2015 the developing countries in Latin America, Asia and Africa were the leaders in planting GM crops for the fourth year in a row, growing around 54% of the global GM crops.<sup>(8,10)</sup>

With the 100-fold increase in GM farming between 1996 and 2015<sup>(8)</sup>, this field is expected to increase further in coming years, especially as population numbers increase, and with that, increased demands for food.

#### **1.4 EXPANSION OF GENETICALLY MODIFIED FOODS TO SOUTH AFRICA**

The South African Committee on Genetic Experimentation (SAGENE) has been researching the use of genetic modification in agriculture since 1979. This organisation was also the primary regulator of genetic modification in SA until the *Genetically Modified Organisms Act, Act No. 15 of 1997* (GMO Act) came into effect in 1999.<sup>(23)</sup>

The first application for field trials of GM cotton were received by the South African Department of Agriculture in 1989 from a seed company in the USA and a permit was granted. By 1997, SA was producing commercial crops of both GM cotton and maize and by 2001 GM soya beans were also approved for commercial use.<sup>(9,24)</sup>

The primary reason for commercialisation of these crops was related to high losses experienced among farmers either owing to pests or drought, and the increased yields that the genetically modified seeds were producing – seen as benefiting not only farmers, but also consumers.<sup>(9)</sup>

The growth and expansion of genetically modified food crops in SA occurred without

much resistance, and have been growing year on year. In 2000, after questions were raised globally on the benefits of genetically modified food crops, an international expert panel on the use of biotechnology in cotton was formed to provide scientific, objective information on genetically modified cotton production.<sup>(11)</sup>

It was found that there were numerous benefits to the cotton industry, including economic, environmental and social benefits. Direct benefits to these industries include improved yield and profitability, and the opportunity to expand crops in areas where it was previously difficult to grow crops – such as areas with drought or severe pest infestations. Indirect benefits are related to reduced pesticide use overall when compared with pesticide use before GM seeds became available, thereby holding potential benefit to the environment and wildlife, as well as decreasing overall labour costs and time. These benefits were not only limited to cotton, but were also relevant to GM maize.<sup>(11)</sup>

A non-governmental organisation, which still exists today, Agriculture South Africa (AgriSA), confirmed that these benefits were seen among both small-scale and large-scale South African farmers, helping to increase crop yields and improving food production.<sup>(25)</sup> These benefits have largely outweighed the overall risks and concerns among most farmers in SA. This has led to the exponential growth of GM crops in SA since their introduction in the 1990s, and GM crops continue to be used extensively in South African farming today.<sup>(9)</sup> The South African government has also recognised the benefits of genetically modified foods in advancing agriculture, assisting with rural development, alleviating poverty and improving food security.<sup>(12)</sup>

## **1.5 GENETICALLY MODIFIED FOODS IN SOUTH AFRICA: CURRENT SITUATION**

South Africa, Burkina Faso and Sudan are the only three countries in Africa to produce genetically modified crops for commercial use. SA is also the only country in the world to genetically modify one of its staple foods, namely maize meal.<sup>(26)</sup> It has become the world's ninth largest producer of GM crops, namely maize, cotton and soybeans. Based on hectares of GM crops planted, SA currently produces 86,6% GM maize, 92% GM soya beans and almost 100% GM cotton.<sup>(10,27,28)</sup>

In 2015, devastating droughts in SA led to a 23% decrease in the intended GM hectares, which for many highlighted again the importance of drought-tolerant crops. Under the Water Efficient Maize for Africa (WEMA) project, drought-tolerant maize has been approved for release in SA by 2017, which is considered an important development for farmers, consumers and the economy.<sup>(8)</sup>

In 2007, the South African government introduced a ten-year plan to transform SA's commercial market into one of the leader's for biotechnology.<sup>(29)</sup> This was followed in 2013 with a bio-economic policy that focuses on translating biotechnology in SA into economic output. This policy promotes partnerships of the different sectors in SA in achieving this goal, and the policy also highlights the importance of increased public awareness of the benefits of biotechnology – including the use of GM crops. As part of the policy, the government has identified effective communication with the public as one of the central focuses of ensuring that SA develops a successful bio-economy.<sup>(13)</sup>

When GM crops were introduced in SA, the government, industry and scientists made independent decisions regarding GM foods. However, over time, the public have become more involved, and today there are a number of high-profile court cases, demonstrations, media profiles and ongoing discussions with legislators, bureaucrats and scientists, all of which have negatively influenced the acceptance of GM foods by the public, and also the expansion of GM foods to include other GM crops in SA.<sup>(30)</sup>

Research in SA has shown that the government, academics, producers and industry are strongly in support of GM crop production and the potential benefits it may have for the country, while non-governmental and religious organisations largely oppose it, with the view that the potential risks outweigh the benefits.<sup>(31)</sup> SA is therefore often seen as a leader in both the promotion and opposition of agricultural biotechnology.<sup>(31)</sup> The view of the consumer has also been researched both internationally and within SA, but with varying results.

## **1.6 GENETICALLY MODIFIED FOODS AND THE CONSUMER**

The use of biotechnology in agriculture has been controversial throughout the world,

and even within SA opinions differ largely in respect of the use of this technology. Despite its being widely reported and accepted internationally that there is a general scientific consensus on GM foods not adding risks to either human health or the environment, the acceptance of biotechnology has varied worldwide.<sup>(32,33)</sup>

As the field of biotechnology can often be heavily jargoned, the literature universally and in SA has shown that public understanding remains limited, despite the public's interacting with biotechnology on a regular basis. The consumption of GM food crops and the use of medications such as insulin and antibiotics, diagnostic tests such as the polymerase chain reaction (PCR) test used in diagnosing the human immunodeficiency virus (HIV), as well as various food-processing systems, all implement biotechnology to some measure. This therefore means that biotechnology forms part of the public's everyday life on one level or another.<sup>(13,34)</sup>

In 2013, experts in the field of biotechnology agreed that universally, "sharing knowledge and communicating with the public on biotech crops was the top priority".<sup>(10)</sup> Although the scientific community is often focused on the benefits of GM foods, these benefits can only be realised if consumers accept the technology.<sup>(35)</sup>

### **1.6.1 International Research on GM Foods and the Consumer**

The World Health Organization (WHO) released a report in which it concluded that without good communication on the risk assessments of GM foods, and the evaluation of cost and potential benefits to consumers, the responses from consumers in many countries could remain negative. Consumer attitude to food has been found to relate to the nutritional value of foods, as well as various other factors such as religious, historical and societal connotations attributed by the consumer to the foods – all of which need to be addressed for consumer attitudes to improve towards this technology.<sup>(20)</sup> This corresponds to a 2014 symposium held in San Francisco on the "Challenges Associated with Global Adoption of Agricultural Biotechnology", where poor public understanding of GM technology and a need for increased communication strategies with the public were identified as major obstacles to the promotion of GM crops.<sup>(36)</sup>

In Europe, it has been shown that consumers have had an impact on slowing GM foods and crop production, while in the USA this has not been the case. Consumers

in the USA have been seen as either being apathetic towards the topic, or having very split opinions. One researcher highlighted that these differences found between continents may be due to subjective and objective knowledge, which refers to knowledge that consumers perceive themselves to have versus the actual, measurable knowledge that they have on a given topic. Differences were also found to be due to awareness, as well as the perceived risks and benefits of the technology.<sup>(37)</sup>

A review article published in the USA in 2013 highlighted some of the general findings supported by the literature regarding genetically modified foods and the consumer overall. Studies from various countries were included, as well as previous meta-analyses and reviews. One such finding is that consumers generally are willing to pay more for non-GM food, indicating a preference for these products, and that they are further influenced by the type of genetic modification that has occurred, the type of food product that is being genetically modified, and how the genetic modification process alters the final product.<sup>(38)</sup>

A 2004 study conducted on the consumer's acceptance of GM foods in the developing world (specifically Colombia and China), concluded that developing nations seem to have a generally positive perception towards GM foods, with food availability and nutritional concerns high on the agenda.<sup>(14)</sup> Studies like this indicate the need for research conducted specifically within developing countries for consumer perspectives to be established, as it appears that these would differ from those in developed nations.

### **1.6.2 South African Research on GM Foods and the Consumer**

Only limited research has been conducted on consumer perspectives in SA.

A 2001 study conducted nationally in SA by the Foundation for Education, Science and Technology (FEST) found that two-thirds of participants had never heard of the term "genetically modified" and more than half did not know that they were buying GM foods at grocery stores. In this study, almost as many participants felt that transferring genes from one organism to another was a good idea, compared with those that were unsure whether this was a good idea. Only about 1 in 5 participants felt it wasn't a good idea. The majority of participants felt that GM foods

should be clearly and specifically labelled as such.<sup>(17)</sup>

One of the largest and most extensive studies relating to the consumer was a survey conducted in 2004 regarding the public understanding of biotechnology. It included a total of 6 859 respondents across SA. These results confirmed what smaller previous studies had done in SA – the majority of participants did not know what the term “genetic engineering” meant, and also did not know whether it was a positive or negative term. Almost 9 out of 10 of participants did not know what “genetic modification” meant, and the majority was uncertain as to whether it was a positive or negative term. Most of those that had negative views could not give a reason for their feelings, although health concerns were most often mentioned when a reason was given. As previous studies had indicated, most participants in this study also did not know whether they had eaten GM foods or not.<sup>(39)</sup> The researchers of this study also emphasised the need for consumers to be informed on issues surrounding biotechnology and genetic engineering.

In 2006 a survey conducted by an international market research company compared the attitudes of consumers towards GM food in Greece, Indonesia, Poland, Singapore and SA. It was found that of all the respondents, South Africans were least likely to believe that GM foods could be harmful, and they were also least likely to read food labels to ascertain whether they were genetically modified. This survey also showed that South Africans thought any approach to decreasing the price of food and improving the taste was acceptable.<sup>(40)</sup>

On a provincial level, AfricaBio conducted a study in the Gauteng province of SA in 2000, assessing consumer knowledge of GMOs. Results of more than 1000 participants showed similar results to the FEST study in that almost three-quarters of participants felt that they were not well informed on the topic of GMOs. Almost one-third of participants indicated that they would not buy GM foods and about two-thirds could not identify any GM foods available in SA.<sup>(18)</sup>

In 2003, a small study consisting of 90 consumers was also conducted in the Gauteng province of SA. Here consumer attitudes and acceptance of GM white maize was researched, and it was found that only about one-third of consumers were completely against GM foods, while the rest of the participants had varying

degrees of positive attitudes towards GM foods.<sup>(16)</sup>

Qualitative data collected from focus groups (FGs) conducted in Potchefstroom in SA in 2003 also concluded that the South African consumer was not well educated regarding GM foods; a lack of knowledge was found across all consumer groups, regardless of education or socio-economic status.<sup>(41)</sup>

Overall therefore, the research conducted within SA indicates a generally uninformed public, with little awareness of genetic modification and GM foods, but with varying results when it comes to their views on their being regarded as harmful or negative. This disparity may be linked to the poor knowledge levels, as it is difficult to make an accurate assessment of something without adequate knowledge.

There have been attempts at increasing the information available to the public on GMOs in SA, as access to information is seen as being central to the protection of human rights within the country, as per the Constitution of the Republic of SA.<sup>(42,43)</sup> Although specific studies have not been conducted within SA, research abroad has shown that public controversy over the introduction of GM foods was related to the government's not taking into account concerns of the public, leading to public distrust of regulators and industry.<sup>(12)</sup> Therefore, it would appear that when the public have difficulties in obtaining information, the public loses confidence in the regulatory processes – and current approaches at disseminating information in SA are proving to be largely unsuccessful.<sup>(12)</sup>

## **1.7 REGULATIONS IN RESPECT OF GENETICALLY MODIFIED FOODS**

### **1.7.1 International Regulation of Genetically Modified Foods**

Internationally, it has been established that specific systems are necessary to evaluate GM foods when compared with conventional, non-GM foods, and that the evaluation needs to establish the impact on human health and on the environment. GM foods need to be evaluated on a case-by-case basis, meaning that the “general safety” of GM foods cannot be established, but rather the safety of specific food products are established as and when they are developed.<sup>(6)</sup>

The WHO assists authorities in determining which food products should undergo a risk assessment and then recommends that *Codex Alimentarius* (Codex) guidelines be used as guiding principles in their assessment. The Codex is considered an international food code, and principles on GM food safety specifically were developed in 2003.<sup>(6,44)</sup>

These principles look at the pre-market assessment, including possible direct and indirect implications of a GM product. Although Codex guidelines are not considered legally binding, members of the World Trade Organization (WTO) are recommended to implement Codex guidelines nationally to effect standardisation of these products.<sup>(6)</sup>

The WTO developed an “agreement on the application of sanitary and phytosanitary measures” in 1994, which states that each country has the right to establish whether imported food, animal products, and plants are considered safe. Essentially, therefore, the adoption of GM foods in a country remains that specific country’s choice. This has recently been applied within the European Union (EU), where countries that fall within the EU were permitted to ban the cultivation of GM crops within their own country, independent of the EU’s view of GM crops being generally safe. Currently, it is also being considered whether member states of the EU should be given the option of banning the import of GM foods into their territory as well.<sup>(45)</sup>

Once a product has been imported into a specific country, that country has the right to determine its distribution according to country-specific regulations, for example, the labelling of these products. The adoption of international labelling regulations is also disputed at present, with disagreement as to whether mandatory or voluntary labelling should be implemented internationally.<sup>(45)</sup>

### **1.7.2 Regulation of Genetically Modified Foods in South Africa**

The *GMO Act No.15 of 1997* is the primary legislation covering the production, commercial release, import and export of GMOs in SA. The GMO Act is supported by further legislation, including the *Consumer Protection Act No. 68 of 2008* (CPA),

the *Foodstuffs, Cosmetics and Disinfectants Act No. 54 of 1972*, and the *National Environmental Management: Biodiversity Act No. 10 of 2004*.<sup>(46–49)</sup>

SA has also been a member of the WTO since 1995, and therefore the country is further guided by Codex principles on determining the risks of GM foods.<sup>(44)</sup>

For any activities related to GM foods to take place, an application needs to be submitted for a permit, and the law places various restrictions on the research, production and marketing of GMOs. The permit application needs to include a scientifically based risk assessment, measures to overcome these risks, as well as relevant documentation pertaining to public information. If necessary, an environmental risk assessment may also need to be conducted by the applicant. Based on information provided, the application may be approved, rejected or further information be requested by the board. Should a permit be granted, specific terms and conditions apply, which would be guided by legislation. Any facility where GM crops are being produced also needs to be registered as such. These laws and regulations are further supported by separate legislation related to food labelling and safety, including the CPA.<sup>(42,48,50,51)</sup>

These measures all contribute to increased control over the production of GM food crops, and allow for improved management of the farming of GM crops in SA.

Until recently, the labelling of food products as containing GM ingredients was voluntary in SA. However, more stringent labelling laws were developed, and since October 2011 producers of foodstuffs have been lawfully bound to start labelling food products as containing GMOs. The labelling of foods containing GM ingredients in SA is regulated by the *Foodstuffs, Cosmetics and Disinfectants Act (Act No. 54 of 1972)*, and the CPA (*Act No. 68 of 2008*).<sup>(46,47)</sup> Mandatory labelling was contested by various interest groups in industry, but was considered a victory in terms of the protection of the consumer's rights.

A non-profit organisation, the African Centre for Biodiversity (AfricaBio) started testing food products in 2011 and found that there were food products containing anything from 30 to 100 percent genetically modified materials, but not having been

labelled as containing these, despite the law indicating that any product containing GMOs of more than five percent needing to be labelled as such. With the National Consumer Commission and the Consumer Goods Council of SA alerted to this, industry responded that the law was ambiguous and unclear regarding labelling requirements. They argued that it was impracticable to test for GMOs in certain food products, and therefore many instead opted to use the umbrella term of “may contain GMOs”, or none at all.<sup>(52)</sup>

In October 2012 amendments to the CPA were proposed by the Department of Trade and Industry, in which any product containing 5% or more GM ingredients have to be clearly labelled as such. Only products containing less than 1% GM ingredients may be labelled as being free from GM ingredients. Products containing between 1–5% GM ingredients may use voluntary labelling. However, these regulations are yet to be fully implemented in SA, as industry continues to delay compliance via loopholes in the Act.<sup>(21,53–55)</sup>

There is also a debate on whether products that do not contain GM ingredients should be labelled as not containing any, as opposed to those which do – an argument which is inconsistent with the CPA, which is firmly rooted in the “right of the consumer to know”.<sup>(54,55)</sup>

Without adequate labelling, it is impossible to trace the impact of foods, or allow for consumers to make informed choices about which foods they choose to consume.<sup>(56)</sup>

## **1.8 RISK ASSESSMENT**

### **1.8.1 Possible Benefits of GM Crops**

GM foods are developed and marketed because of the potential advantages to the producer and the consumer. For producers of food, crop protection is incorporated into the plant through drought resistance, and plants can be adapted to be able to grow in poor environmental conditions. This would mean that GM crops would grow in areas with adverse climates or in seasons and areas where they would not

normally be able to grow. Toxin production and virus resistance can also be incorporated into the GM crop to replace conventional pesticides, all of which potentially lead to increased yields of crops and less use of pesticides.<sup>(20)</sup> This also links to GM crops being viewed as more environmentally friendly, as chemical use is decreased. These crops also do not require such large areas of land to be produced, and therefore more food can be produced from smaller areas of land.<sup>(57)</sup>

Overall, it has been reported that the cost of producing GM crops is lower than that of traditional crops. An increase in yields leads to an increase in profits, which is highly beneficial to food producers. A meta-analysis conducted globally since 1995, and published in 2014, calculated an increased profit of 69% for farmers and concluded that increased yields and profits were higher in developing countries than in developed nations. It was found that overall, crop yields had increased by 21%, owing to more effective pest control and that pesticide use had decreased by 37%. Despite GM seeds being considered much more expensive when compared with their non-GM counterparts, it was found that the cost of production was not significant.<sup>(58)</sup> In SA, the economic gains from GM crops between 1998 and 2013 were estimated at R12,4 billion (US\$1,15 billion).<sup>(59)</sup>

The perceived benefits to consumers are related to products that are lower in price, as crop production and food availability increase. GM foods also have the potential to be produced with increased nutritional value, thereby addressing specific nutritional deficiencies that may be found in populations. For example, the vitamin A or protein content of a food crop can be increased through genetic engineering. GM crops are also being developed with an increased shelf life, meaning that foods can be transported for longer periods, and that they also stay riper for longer. GM foods can also be developed to eliminate the properties that cause allergies in populations, making foods accessible to more people.<sup>(57)</sup> There is also current research on foods being genetically modified to be able to produce edible vaccines against common illnesses, such as the potato currently investigated to provide vaccination against a harmful bacteria, *Escherichia coli* (*E. coli*), commonly associated with diarrhoea.<sup>(60)</sup>

In many developing nations, the issue of malnutrition and the right to food is high on the agenda of governments and non-profit organisations. The right to food relates to

food being available, accessible and adequate, which includes its acceptability.<sup>(61)</sup> Therefore, GM crops might address many of these aspects by increasing the availability, accessibility and adequacy of food to consumers; however, acceptability of GM foods among consumers needs to be considered.

### **1.8.2 Possible Disadvantages of GM Crops**

The transfer of genetic material from foods into the human gut bacteria or body cells has been raised as an issue, as this would mean that, for example, the gene for antibiotic resistance inserted into a plant may then be transferred into the human DNA, leading to catastrophic health effects. Concerns about altered gene expression have also been raised, as changing one part of an organism's genetic material may alter the final product in very different ways to what was anticipated, thereby leading to an unpredictable end product.<sup>(6,62)</sup>

Allergenicity has also been raised as a potential health hazard, where genetic material from a common allergenic organism is transferred into an organism that normally does not pose a risk for allergic reactions, leading to the development of allergic reactions to previously non-allergenic foods. According to the WHO, however, the use of genetic material from common allergens is discouraged, unless it can be proved that the end product does not pose a health risk.<sup>(6)</sup>

There is also a concern that cross-pollination or out-crossing may occur of a GM crop with a non-GM crop. This may have an effect on food safety, as products that are approved for animal consumption may then mix with products that are non-GM crops for human consumption, leading to non-tested end products, which may pose a health hazard. Environmentally, crop diversity may also be lost over time, as GM crops tend to be more domineering than other crops.<sup>(6,62)</sup>

One of the major advantages of GM food crops is their ability to withstand crop-destroying pests and weeds; however, it is starting to become evident that over time superweeds and superbugs are developing, which may escalate into a situation where humans can no longer control pests and weeds, as they develop resistance through continuous evolution in a bid to survive.<sup>(57,63)</sup>

A large corporation in the USA, Monsanto, developed and patented glyphosate,

more commonly marketed under the trade name of Roundup. It is the most widely used herbicide in the world, with its use having increased 100-fold since the 1970s. It is applied to, amongst others, maize, soya, wheat and barley, and traces of glyphosate have been found in foods produced with these products, including processed foods such as bread. In 2015, the WHO's International Agency for Research on Cancer (IARC) released a statement to say that glyphosate is "probably carcinogenic to humans", where it was previously considered to be safe to humans in limited amounts.<sup>(64)</sup> Therefore, it is worth considering the implications of this herbicide's wide use on staple foods, such as on GM maize, as in SA.

Consumers have raised concerns about the ethics of GM foods, with debates arising from the idea of humans "playing God" when genetic changes are made to foods, to consumers being uncomfortable with the idea of humans interfering with nature to achieve desirable results.

Health concerns are always high on the consumer agenda, with animal studies indicating health risks such as infertility, increased risk of cancer, poor immune health and faulty insulin regulation, changes to gut health, and negative effects on other major organs.<sup>(65)</sup> The applicability of these studies to humans remains uncertain.

There are also concerns about the monopoly that exists within GM seed development, where major corporations such as Monsanto and DuPont patent their seeds and sign agreements with farmers that seeds may not be re-planted from year to year.<sup>(66)</sup> Further to this, in 2016, the German crop- and chemical-producing company, Bayer, managed to win the bid to acquire Monsanto. This deal needs to be approved by regulatory authorities, and is expected to be complete by end of 2017. Should the takeover be successful, Bayer will own one quarter of the world's market share of seeds and chemicals.<sup>(67)</sup> The argument is that through creating this monopoly, these few companies will eventually control the entire food market, as there will be no competition to keep prices competitive. There is also the danger that seed varieties will keep decreasing, leading to a loss of variety.<sup>(68)</sup>

### **1.8.3 Safety Assessments of GMOs**

There have been evaluation systems set up internationally and nationally to

determine the impact and effect of GM foods on human health, as well as on the environment. The WHO, as an international body, is involved in the identification of GM products, as well as the management of their safety assessment, which includes toxicity, allergenicity, gene stability, nutritional effects and any other unintended effects that may occur owing to gene insertion.<sup>(20)</sup>

According to the WHO, the GM foods currently available have been assessed for safety, and therefore “are not likely to present risks for human health”.<sup>(20)</sup>

A panel of experts in the field of genetic modification, including biotechnology companies, the European Union, academic institutions, consumer groups and the American Food and Drug Association, agrees that GM foods “share the same health risks as conventional foods and that they are evaluated by tests that appear adequate”. It was agreed by all but one expert that the tests used are either “good or very good”, with the remaining expert rating the testing process as being “fair”. Allergenicity, toxic reactions and anti-nutrients found in GM foods have been found to be “no different to their conventional counterparts”, according to the panel of experts.<sup>(21)</sup>

In 2016, 110 Nobel-winning scientists wrote an open letter to organisations opposing GMOs to halt the campaign against this technology. These scientists stated that GMOs have consistently been proved safe for human consumption, and that their impact on the environment was “less damaging” (in comparison with non-GM farming techniques). One of the major concerns raised was the need to feed the growing world population, with estimations of food production needing to double by 2050.<sup>(69)</sup>

In 2015, an article was published in which over 300 independent scientists and researchers globally stated that “no scientific consensus on GMO safety” could be made, and that owing to lack of independent funding of research, safety assessment of GMOs had been hampered. The issue was also raised that research material was denied to researchers unwilling to sign contractual agreements with developers. This scientific consensus statement makes it clear that no claim can be made about the safety of GMOs, owing to a lack of scientific evidence, and therefore claims of “scientific consensus of safety” cannot be used as a blanket statement, as is

currently widely used internationally.<sup>(70)</sup>

Monsanto, the company that develops most GM seeds, states on its website that “in the years since GMO crops were first commercialized (1996–2016), millions of farmers in nearly 30 countries worldwide have planted more than 4 billion acres – with no evidence of harm to humans or animals”. According to Monsanto, vigorous testing is applied to all their seeds and products to ensure optimal safety.<sup>(71)</sup>

Currently, the testing of GM foods occurs only in laboratories and on animals, and usually feeding studies are for a period of 90 days or less. The entire process of testing generally lasts between 18 months and three years, and the applicability of animal studies to humans has been questioned in research.<sup>(21,72)</sup> Therefore, there are debates as to whether the long-term safety of these products has been adequately evaluated for human consumption.

One well-known, long-term study conducted over two years on rats found that rats fed corn treated with Roundup (glyphosate) had significant negative effects on major organs such as the kidneys and liver, and showed overall increased mortality rates. This study also found hormonal imbalances, and an increased risk of the development of tumours.<sup>(73)</sup> However, after the study had been published in a peer-reviewed journal in 2013, it was removed one year later when a newly appointed editor stated the article to be “inconclusive”. Monsanto and other pro-GMO campaigners claimed the research was “inaccurate” and “fraudulent”. The article was, however, re-published in a different journal in 2014 after the study was found to be scientifically sound. The authors of this article specifically emphasise the need for longer safety studies to be conducted on GM foods and their effect on the body.<sup>(74)</sup>

In response to the WHO’s IARC 2015 assessment of glyphosate being “potentially carcinogenic”, the European Food Safety Agency (EFSA), the Food and Agriculture Organization of the United Nations, and the Environmental Protection Agency stated that the chemical “is not likely to cause cancer”.<sup>(75)</sup> An article, published in 2016, highlighted various scientific flaws in EFSA’s assessment of glyphosate, among which were a lack of transparency.<sup>(76)</sup> This therefore indicates the level of disagreement on this chemical, and the very strong need for further research to be conducted.

Scientists and regulatory officials agree that the challenges in the long-term monitoring of GM foods are numerous, and therefore the best alternative to this, is to ensure effective pre-market safety assessments.<sup>(21)</sup>

For the commercial use of GM foods to be successful, confidence in the safety of the product amongst all the different stakeholders needs to be ensured. Globally, governments and consumers have taken differing stances towards this technology, with America being largely pro-GM, and Europe being largely opposed to GM foods. Regardless of the stance of governments, the need has been recognised to monitor the safety of GM foods, and thereby instil a sense of confidence in the safety of food provided to all citizens.<sup>(21)</sup> Therefore, it appears that perhaps more needs to be done to ensure that all the stakeholders, including consumers, are apprised of and comfortable with the safety assessments of these GM foods.

## **1.9 VALUE OF GENETIC MODIFICATION IN SA FROM A NUTRITIONAL PERSPECTIVE**

The international definition of *food security* in a society is when “all people, at all time, have enough food for an active, healthy life”. This includes the availability of food that is nutritious and safe, and the accessibility of individuals to this food both physically and economically. Therefore, *food insecurity* exists when households are unable to secure adequate, acceptable food for all the individuals of the household.<sup>(77)</sup> Hunger and malnutrition are also considered the leading risk to health worldwide – higher than AIDS, malaria and TB combined.<sup>(78)</sup>

SA, as a country, is considered to be largely food secure, meaning that the country produces sufficient food, and has the capacity to import food when needed. However, many households within SA remain food insecure, indicating that food distribution and access to food may be more of an issue than actual food production.<sup>(79)</sup> It is also estimated that one-third of all the food produced within SA is discarded or wasted, valued at around R60 billion.<sup>(80)</sup>

In SA, GM maize is a staple food, and is often promoted to help combat food insecurity, with close to 90% of all maize in SA being GM.<sup>(59)</sup> However, the average cost of a 5kg bag of maize meal has increased by more than 80% between 2008 and

2012.<sup>(81)</sup> There are also concerns that maize mono-diets may contribute to increased malnutrition in SA, opposed to alleviating it. Despite this, AgriSA president, Johan Moller, states: “If SA turned to non-GM maize crops, prices would increase... which could harm humans.”<sup>(82)</sup> Impact studies on the benefits of GM foods to consumers in SA are limited, and need to be conducted for more factual information to be made available.

The other major GM crop produced in SA is soya beans, but only about seven percent of soya beans produced in SA are used for human consumption – the rest are used mostly in animal feeds.<sup>(24)</sup>

When looking at the current nutritional situation in SA, there are two major national surveys used as reference, namely, the National Food Consumption Survey (NFCS), published in 2005, and the South African National Health and Nutrition Examination Survey (SANHANES-1), published in 2012.

The NFCS showed that one in two households experience hunger, and only one in five households are food secure, a number that has not improved since a similar baseline study conducted six years earlier in 1999.<sup>(83)</sup>

SANHANES-1 found that of households in SA, 45,6% were food secure, a number that had increased from previous studies. However, one in four households still experienced hunger, with 28,3% of the households being at risk of hunger. This study also found that vitamin A deficiency was moderate amongst adults, and severe among children, while anaemia and iron deficiency also remained high on the agenda.<sup>(84)</sup>

Malnutrition in SA remains a concern. Stunting, an indicator of chronic malnutrition, is the most common nutritional disorder in the country, affecting around 15,4% of children. An additional 3,8% of children in SA are severely stunted. Underweight is reported at around 5,8%, with 1,1% of children severely underweight. Wasting levels are low at a total of about 4%, but this number appears to be increasing, which is of concern. In adults, 4,2% of women and 12,8% of men are underweight.<sup>(83)</sup>

Together with food insecurity and malnutrition, the 2016 unemployment rate in SA was 26,7%, which adds to the economic burden many South African households are

experiencing.<sup>(85)</sup> In 2006, the United Nations Development Programme (UNDP) reported close links between poverty and unemployment, and food insecurity.<sup>(86)</sup>

Taking all the above factors into account, the economic, social and nutritional benefits of GM crops to a country such as SA cannot be ignored, and the expansion of genetic modification therefore needs to be seen in light of this information.

In terms of food security in SA, GM crops have the potential to make food available even during periods of poor weather conditions, such as droughts. SA experienced extreme droughts in most parts of the country for 2014/2015, and it is estimated that GM crops assisted with increased yields, despite this. A comparison was made with droughts experienced in 1991/1992, when 0,85 tonnes of maize were produced per hectare, versus the 2014/2015 droughts, where yields were estimated at 3,72 tonnes per hectare. This had massive cost-saving effects for SA, as less maize had to be imported for consumption, ultimately also improving the consumer price, despite these massive droughts. The approved drought-tolerant maize will be launched in SA in 2017, which will further improve crop yield.<sup>(87)</sup>

There is also the potential of GM foods to address nutritional deficiencies found in populations. An example of this is “Golden Rice”, developed to have higher vitamin A levels, and thereby contribute to reducing the vitamin A deficiency so common in developing countries. Other crops are also being engineered to have similar advantages.<sup>(88)</sup>

The benefit of GM crops to farmers means increased yields, increased income, and increased access to food in communities. However, research has shown that although there are definite positive economic benefits to large-scale farmers, there is less evidence of the same benefits to small-scale farmers in developing countries.<sup>(89)</sup>

Therefore, there are clear potential benefits of these foods to SA in terms of nutritional components, which need to be measured and reported for this technology to be effective and accepted by all stakeholders.

## 1.10 MEASURING KNOWLEDGE, ATTITUDES, BELIEFS AND PRACTICES

According to the WHO, a knowledge, attitude, beliefs and practices (KABP) study is a representative study of a specific population on what is “known, believed, and done in relation to a particular topic”.<sup>(90)</sup>

### 1.10.1 Interviewer-Administered KABP Questionnaire

Questionnaires allow the gathering of information in an objective manner, which gives information on knowledge, beliefs and behaviour. When well designed, they are useful to give high-quality, informative data, which can be used for planning of activities and interventions. They also allow for the identification of needs, barriers or issues, and possible solutions.<sup>(90–92)</sup> The goals of a KABP questionnaire are to determine the knowledge of a study population on a given topic and their attitudes and beliefs on the topic, while reaching an understanding of the factors that influence behaviour. This allows for the identification of what people do, and possible reasons for this behaviour.<sup>(90)</sup>

KABP surveys in nutritional studies are mainly used either to determine what the current situation is in a given setting or regarding a certain topic, or to evaluate interventions once they have been implemented.<sup>(93)</sup> In most KABP surveys, data is collected in an interviewer-administered survey using a structured, standardised questionnaire. The data can then be analysed qualitatively and/or quantitatively, depending on the study objectives.<sup>(94)</sup>

Knowledge is usually measured by employing either open-ended questions, pre-coded questions based on potential answers, or true/false/don't know questions. These answers can then be quantified by using either percentages or scores when reporting results.<sup>(93)</sup>

Attitudes, beliefs and practices are often determined using a rating scale, such as the Likert scale. The Likert scale is an internationally recognised and universally applicable scale, which means that comparison of data is possible through this method.<sup>(95)</sup> A Likert scale with more points available is thought to be able to give

greater intensity to an answer, providing a graded answer, in comparison with a scale with fewer points. It is, however, recommended to use a scale with fewer points when working with less educated participants, as it has been found that participants may be confused when too many options are available. Pre-testing the scale in the specific study population is also an important part of ensuring that the appropriate scale is used.<sup>(93)</sup> Likert scales therefore determine the level of agreement to a statement, and the likelihood or importance of something to a participant.<sup>(96)</sup>

There are no set rules regarding the number of points to use on a Likert scale, and therefore the number of points used remains at the discretion of the researcher in the context of the study objectives. However, research has shown that using fewer than five points or more than seven points significantly decreases the accuracy of data collected.<sup>(95)</sup> The researcher may opt either to offer a mid-point option to participants, or omit this option to ensure a positive or negative opinion is expressed. According to the literature, not having a mid-point seems to help decrease the bias of “social desirability”, which is when a participant wants to impress or please the interviewer, and therefore does not want to reveal his/her true response, opting instead for the neutral option on the scale.<sup>(97)</sup>

Advantages of an interviewer-administered questionnaire include the following:<sup>(98,99)</sup>

- The rejection rate is lower than in self-administered questionnaires.
- A more detailed response can be obtained.
- It does not rely on participant literacy, as the interviewer completes the questionnaire on behalf of the participant.
- It is possible to clarify answers given, thereby ensuring their completeness.
- It increases reliability of information obtained, as there is increased standardisation.

Table 1.1 lists examples of studies where questionnaires were used to determine consumer knowledge, attitudes, beliefs and/or practices on topics such as biotechnology and genetic modification in SA.

**Table 1.1 Examples of studies using surveys to determine knowledge, attitudes, beliefs and/or practices**

AUTHOR, COUNTRY, YEAR	TYPE OF STUDY CONDUCTED	PURPOSE OF THE STUDY
Vermuelen et al., South Africa, 2005 <sup>(16)</sup>	Survey	To determine the knowledge, attitudes and acceptance of urban consumers in South Africa regarding GM white maize
AfricaBio, South Africa, 2002 <sup>(100)</sup>	Survey	To determine awareness, exposure, knowledge, safety perceptions, information sources and perceptions regarding GM foods in South Africa
Rule and langa, South Africa, 2004 <sup>(15)</sup>	Survey	To measure public perceptions, attitudes and levels of understanding regarding biotechnology
Synovate International, multi-national study including South Africa, 2004 <sup>(40)</sup>	Survey	To determine consumer perspectives on genetically modified foods
Joubert, South Africa, 2001 <sup>(17)</sup>	Survey	To determine public knowledge and understanding of genetically modified foods, as well as review public attitudes about the usefulness of this technology, its acceptability to consumers and whether or not they thought the technology should be encouraged

### 1.10.2 Focus-Group Discussions

Focus groups, as a form of qualitative data collection, are facilitated and focused discussions held with small groups, which allow for an exchange of information or perspectives, going beyond superficial responses and really “evoking participants’ feelings”. FGDs provide descriptive data on a topic that cannot be statistically analysed or measured through quantitative methods.<sup>(90,101,102)</sup>

Focus-group discussions (FGDs) may be done in addition to a survey or questionnaire to complement the information gathered, or to gain further insight into themes established during the quantitative phase. They may also be the only form of data collection when in-depth information is being gathered on a topic. In nutrition-related research specifically, where human behaviour and behaviour change are critical, the combination of qualitative and quantitative data gives a more complete interpretation or explanation.<sup>(102,103)</sup>

FGDs often give insight into the “why” and “how” when themes have been identified by the KABP survey, generating theories and hypotheses. Attitudes, feelings and beliefs are more likely to be revealed in a social setting, which is what the FG aims to re-create. Different viewpoints can also be obtained within a group context, when compared with a one-on-one interview, and participants are able to clarify their viewpoints more clearly, and are more likely to reveal information that they perhaps would not be comfortable revealing in another setting. More information can also be obtained in a shorter period of time, which is advantageous. FGDs also allow exploration of the degree of consensus among participants on the given topic. Furthermore, as the results describe real-life situations and experiences, the results are often more accessible to a wider audience.<sup>(101,103)</sup> Table 1.2 gives examples of studies where FGs were used to determine consumer perspectives on GM topics.

**Table 1.2 Examples of studies using focus-group discussions to determine consumer perspectives on GM foods**

AUTHOR, COUNTRY, YEAR	TYPE OF STUDY CONDUCTED	PURPOSE OF THE STUDY
Kempen et al., South Africa, 2003 <sup>(41)</sup>	Focus-group discussion	To determine consumer’s understanding, views and awareness of GM foods and products in South Africa
Teisl et al., United States of America, 2002 <sup>(104)</sup>	Focus-group discussion	Using FGs to develop an understanding of the characteristics that may impact the effectiveness of a GM food-labelling policy
Smith, Australia, 2004 <sup>(105)</sup>	Focus-group discussion	To obtain information on Australian consumers’ level of awareness and perceptions of GM foods

Ideally, FGDs should have around 6–12 participants, with a facilitator, observer, and/or recorder. The group should not be so small that adequate conversation cannot be stimulated, while it should also not be too big, so that some participants are excluded. When groups are too small, individual participants may dominate the conversation, while larger groups run the risk of not having adequate involvement, with participants becoming despondent at constantly having to have to wait their turn.<sup>(106)</sup>

The facilitator will make use of a discussion guide to facilitate the discussion, which provides a framework for questions to be asked, with possible probes. The discussion guide is not the equivalent of a survey, and therefore should only be used as a guide to stimulate discussion on specific points. Questions in the discussion guide should be open-ended and unbiased. The facilitator will need to ensure that participants are guided through the discussion, while managing the group dynamics to ensure that all participants are given equal opportunity to participate.<sup>(106)</sup>

As the depth of the data gathered in the FG is more important than statistical significance, purposive sampling is normally recommended for FGDs. Snowballing is another technique that is recommended in the recruitment of FG participants. In this way, groups can be selected to cover all the participant characteristics that may affect the results. Groups that are more homogeneous may mean that participants will have more in common with one another, which may make participants feel more comfortable, thereby facilitating the group discussion. On the other hand, some group diversity may also ensure that discussions are enhanced and cover a wider range of opinions. It is therefore recommended that the FG should not be at either extreme of homogeneity or heterogeneity.<sup>(102,106)</sup>

Sample size, and therefore the number of focus-group discussions, are not statistically calculated, but are often influenced by time and funding available to the researcher, as well as the purpose and scale of the research. Generally, it is recommended that data collection continue until data saturation is reached – when no or very little new information is being gathered through the FGDs. The researcher may also stop data collection when the data that has been collected explains the research question adequately.<sup>(102,106)</sup>

The major disadvantages of FGDs are listed below:<sup>(102,103)</sup>

- Peer pressure may lead to participants not revealing their true viewpoint.
- Owing to the relatively small sample size, generalisation of the results is limited.
- The process is time consuming and costly.

- Success often relies on the facilitator's experience.
- Researcher subjectivity may influence the results during data analysis.

## 1.11 CONCLUSION AND RATIONALE FOR STUDY

The use of biotechnology in the agricultural sector has potential benefits for both consumers and producers in SA, and from the policies and programmes in place in SA, it is clear that this technology is being embraced by the South African government and scientific community. The growth of GM crops has increased annually in SA, with more crops continuously being approved, and therefore it appears that GM crops will continue to be part of SA's agricultural and nutritional future.<sup>(13,29)</sup>

Experts and international bodies have recently released reports stating that internationally, the public's understanding of biotechnology is poor, and that increased communication with the public is imperative for the success of GM crops worldwide.<sup>(6,36)</sup> It is thus clear that without consumers' understanding and acceptance of the technology, the benefits cannot be fully realised.<sup>(35)</sup>

Overall, it would appear that the scientific community is largely divided on the safety of GM foods, with some stating "consensus" on the safety thereof, while others have opposed the blanket safety consensus.<sup>(21,70)</sup> The long-term health effects and impact on the environment are among some of the major concerns raised in the literature, and continue to be central to the opposition of GMOs by various organisations and consumers alike.

Worldwide, consumer perspectives on GM foods vary between positive, negative and complacent, and even within SA, research has shown varying results in respect of consumer knowledge, attitudes, beliefs and acceptance of GM foods. Overall, it appears that consumers are not well informed, and that there is a lack of knowledge on the topic across all education and socio-economic groups. Some studies have shown fears and misconceptions among South African consumers, while others have shown consumers to be generally positive about GM foods. Studies have also shown that the South African consumer is interested in the labelling of food products

as being genetically modified, whereas industry has largely opposed the labelling of these foods.<sup>(15,17,18,37,41)</sup>

It is therefore important to gain as much insight as possible into the stance of the South African consumer on GM foods in order for this technology to be successful locally. It needs to be determined what the underlying issues and concerns of the public that may hamper the growth of this technology are, and what the best way is to address these concerns. It needs to be ascertained what the current public understanding, beliefs and practices are, considering that no recent studies have been conducted on this topic within SA. Furthermore, no studies have been conducted with a specific focus on nutritional components, as opposed to the technology as a whole.

## **CHAPTER 2**

### **METHODOLOGY**

## **2.1 STUDY AIMS AND OBJECTIVES**

### **2.1.1 Main Aim**

The main aim of this study was to determine the knowledge, attitudes, beliefs and practices of the general adult consumer in the City of Cape Town (CoCT), Western Cape, South Africa, regarding genetically modified (GM) foods, and their inclusion in the diet.

### **2.1.2 Primary Objectives**

- To determine, in the general adult consumer residing in the CoCT, the level of knowledge regarding genetically engineered and genetically modified (GM) foods.
- To determine and further explore the attitudes, beliefs and practices relating to genetic engineering, and the inclusion of genetically modified foods in the diet.

### **2.1.3 Secondary Objectives**

- To determine whether there is a difference in the level of knowledge according to consumer characteristics such as gender, age, education, and income level.
- To determine whether there are differences in the attitudes, beliefs and practices related to genetic engineering and the inclusion of GM foods in the diet according to consumer characteristics such as gender, age, education, and income level

## **2.2 STUDY DESIGN OVERVIEW**

The study was both in the quantitative and qualitative domains, and so a *mixed-methods* approach was employed. This methodology permits more integrated and complete data than a separate study of either quantitative or qualitative data. The

quantitative paradigm allows for breadth of information, while the qualitative approach allows for depth of information.<sup>(107,108)</sup>

The study was conducted in two phases. Phase One was an observational, descriptive study in the form of a cross-sectional survey, with an analytical component collecting mainly quantitative data. Phase Two was an observational, cross-sectional, descriptive study conducted by means of FGs, collecting mainly qualitative data to further explore quantitative findings. Therefore, the data was collected and analysed separately in two phases, with the findings interpreted simultaneously. This provides complementary data on the same topic, giving a more complete understanding of the factors under investigation.

## **2.3 STUDY POPULATION**

The study population consisted of consenting adults in the CoCT in the Western Cape that were 18 years and older and that met the inclusion criteria. Participants exiting a grocery store where research was conducted on the day of data collection were approached and the same participants were also requested to participate in the FGDs.

## **2.4 SAMPLING METHODS**

### **2.4.1 The City of Cape Town as a Sampling Area**

In 2015, SA had an estimated population of 54,96 million, with an estimated 51% females and 49% males, according to Statistics South Africa (Stats SA). The Western Cape is one of nine provinces in SA, and the CoCT's estimated population was 3 740 025 in 2012. As per the national statistics, the CoCT has a population of 51,1% female and 48,9% male inhabitants.<sup>(109,110)</sup>

With SA's diverse nation, the population can further be divided into four groups according to race, namely, black African, white, coloured, and other, which include Indian and Asian (Table 2.1). This figure indicates the CoCT to be the second

largest city in SA. The various racial population groups of SA are well represented, despite not reflecting a similar distribution as the national distribution.

**Table 2.1 The population distribution of South Africans by race according to the 2011 census<sup>(111)</sup>**

RACE	% OF TOTAL POPULATION IN SA	% OF TOTAL POPULATION IN CoCT
African	79,2	38,6
Coloured	8,9	42,4
White	8,9	15,7
Other	3,0	3,3

#### 2.4.2 Sample Selection

The CoCT consists of eight health districts, clustered according to geographical location (Figure 2.1). Summary statistics of the breakdown of each health district by population group is indicated below (Table 2.2).<sup>(112)</sup>

**Table 2.2 Population distributions by race in the eight health districts of the City of Cape Town**

HEALTH DISTRICT	AFRICAN %	WHITE %	COLOURED %	OTHER %
<b>Northern</b>	<b>24,7</b>	<b>47,2</b>	<b>25,6</b>	<b>2,6</b>
Tygerberg	19,3	10,8	66,3	3,6
<b>Eastern</b>	<b>34,7</b>	<b>15,8</b>	<b>47,2</b>	<b>2,3</b>
Khayalitsha	98,6	0,1	0,6	0,7
Klipfontein	44,7	0,7	48,7	5,9
Mitchells Plain	46,1	0,1	52,5	1,3
<b>Southern</b>	<b>19,4</b>	<b>25,3</b>	<b>49,9</b>	<b>5,4</b>
<b>Western</b>	<b>36,4</b>	<b>28,6</b>	<b>30,3</b>	<b>4,6</b>

In order to obtain a sample that included all the population groups in SA and be representative of the CoCT, the four health districts with the most even distribution per race group were selected. As per Table 2.2, these were the Northern, Eastern, Southern and Western health districts. Therefore, the CoCT was stratified into eight health districts, of which four of the eight were selected using purposive sampling.

### **2.4.3 Selection of Grocery Stores (Phase One)**

The four major grocery store chains in SA were selected for inclusion in this research study.<sup>(113)</sup> Using the online store locator function, a list of grocery stores was obtained for each of the included grocery store chains. Every store was given a specific number, and an online number generator was used to obtain one grocery store per health district from each of the four major retailers. Therefore, 16 grocery stores were included in the final sample. Simple random sampling was used to sample the grocery stores (Figure 2.2).

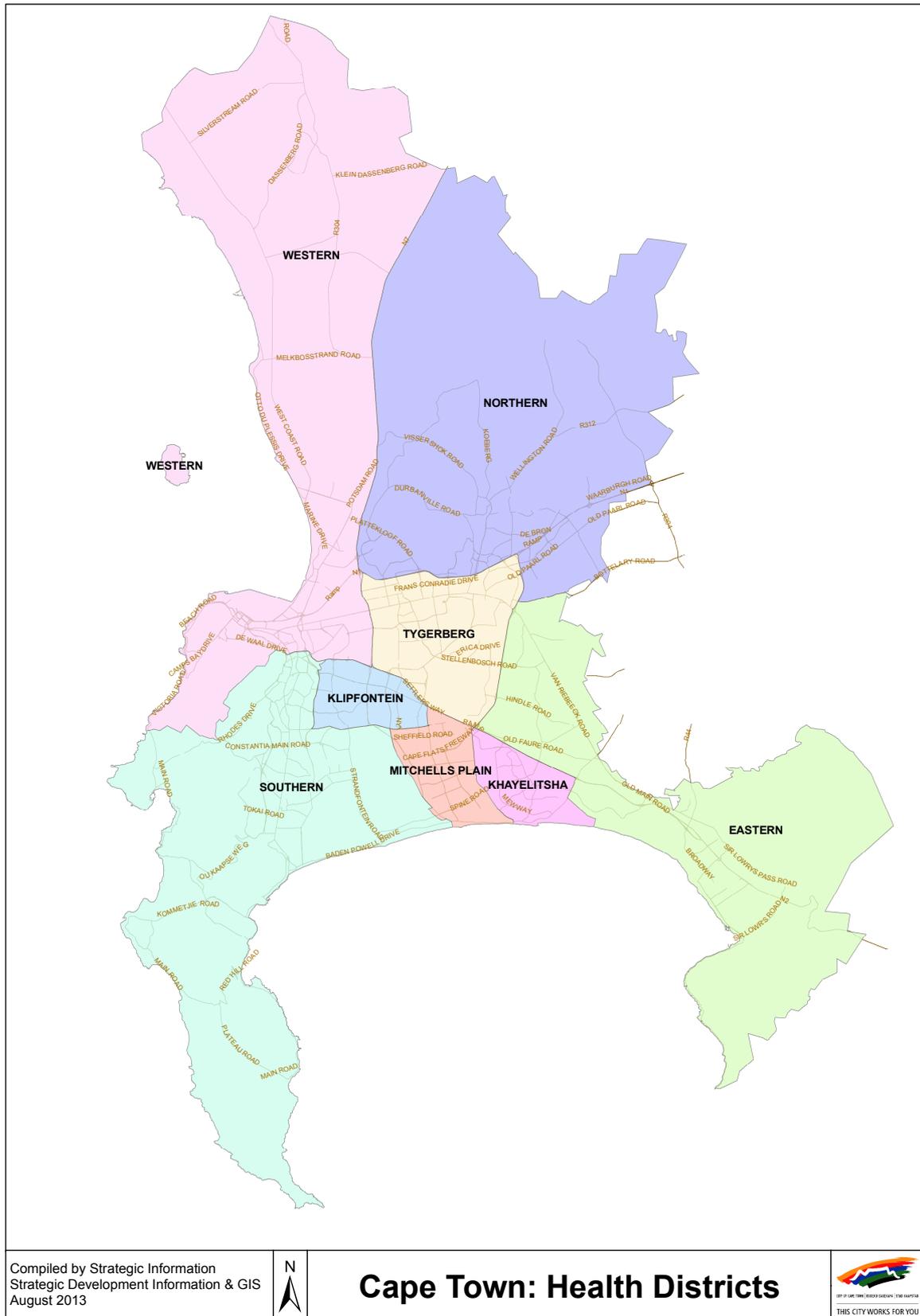
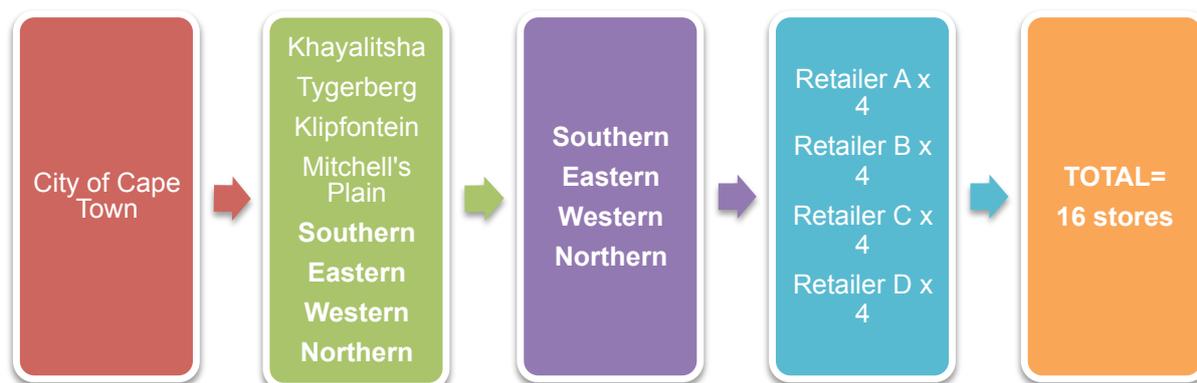


Figure 2.1 The City of Cape Town’s health districts



**Figure 2.2 Selection of the health districts and grocery stores**

#### **2.4.4 Selection of Participants (Phase One)**

Consumers were randomly approached, in no particular order, as they exited the grocery store and were requested to participate in the study. Non-random voluntary sampling was therefore used.

#### **2.4.5 Selection Participants (Phase Two)**

In qualitative research, purposive sampling is normally used to ensure that the sample is homogeneous, while covering all the participant characteristics that may affect the results. Participants also need to be selected on the basis of their suitability to answer the research question.<sup>(114)</sup>

All participants who met the inclusion criteria, and who had participated in Phase One of the research project, were asked whether they would be interested in participating in an FGD on the same topic. Those that were willing to participate in Phase Two gave their contact details to the researcher, who made a note of the participant's details and their demographic details in order to contact the participant at a later stage.

Additionally, advertisements on social media and snowballing were used to recruit participants. All those participants that were interested and met the inclusion criteria

were invited to participate in the FGDs. The researcher aimed to include between 6 and 10 participants per FGD. A total of four FGDs were conducted, with one FGD within each sub-district.

## **2.5 SAMPLE SIZE**

### **2.5.1 Sample Size: Phase One**

The sample size was calculated with the assistance of a statistician from the Stellenbosch University Centre for Statistical Consultation.

The sample size was estimated at 200 participants, which was weighted accordingly at the end. With the objective of this phase being descriptive, the size of the sample determined how accurately proportions and means were estimated. The relationship of the accuracy vs the sample size was such that when the sample size reached 100 and beyond, the accuracy improvement became marginal. Therefore, a sample of size 200 provided estimates with acceptable levels of accuracy.

### **2.5.2 Sample Size: Phase Two**

A total of four FGDs were conducted, one in each sub-district as selected in Phase One. The researcher aimed to include between 6 and 10 participants per FG.

## **2.6 INCLUSION AND EXCLUSION CRITERIA**

### **2.6.1 Inclusion Criteria: Grocery Stores**

- Grocery stores from the four major retailers in SA within the sampling district, from which permission could be obtained to conduct the research study.

### **2.6.2 Exclusion Criteria: Grocery Stores**

- Grocery stores included in the pilot study.

### **2.6.3 Inclusion Criteria: Participants Phase One And Two**

- Adults, 18 years and older.

- Written, informed consent given to participate in the study.
- Where applicable, written informed consent given to have the FGD voice recorded.
- Primary food shoppers of the household (shopping for food more than 50% of the time).
- South African citizens.
- The ability to speak and understand English, Afrikaans or isiXhosa.

#### **2.6.4 Exclusion Criteria: Participants Phase One And Two**

- Adults who had participated in the pilot study.

### **2.7 METHODS OF DATA COLLECTION**

#### **2.7.1 Ethics Approval and Permission**

Approval for the research to be conducted was obtained from the Human Research Ethics Committee (HREC), Faculty of Medicine and Health Sciences, Stellenbosch University. (Ethics reference number: S15/05/114) (Addendum A).

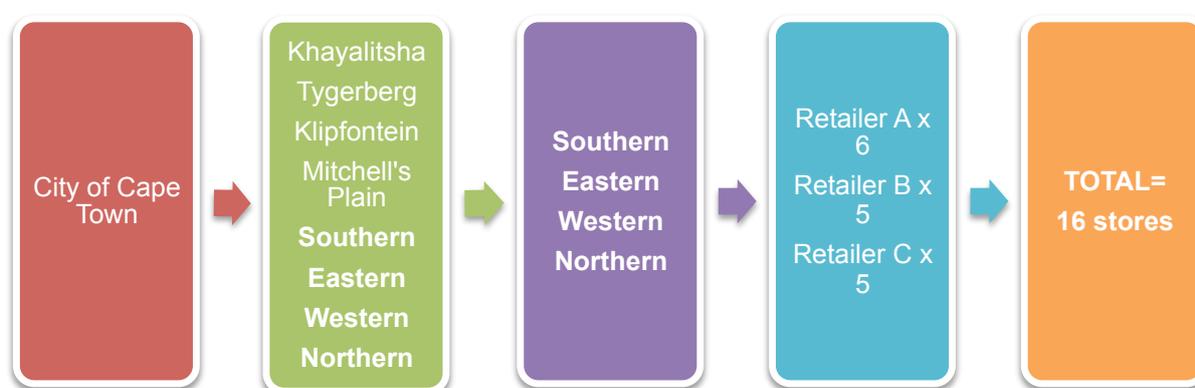
Once approval had been obtained, the researcher contacted the selected grocery stores telephonically to request permission to conduct research at the store.

For Retailer A, which has privately owned franchises, the researcher obtained permission from the storeowner of each individual store with relative ease, with none of the storeowners declining the research at their store. However, Retailer B required that permission be obtained from the head office, which the researcher then obtained telephonically. The head office then informed each store of the research to be conducted, and the researcher confirmed this telephonically with the relevant store manager.

Permission was obtained directly from the individual managers at each store for Retailer C, with no store declining permission.

Retailer D, however, declined permission from their head office for research to be conducted at any of their stores. For this reason, the retailer had to be excluded from the research study, and four other stores were randomly selected for each sub-district from the three retailers that had given permission for research to be conducted at their stores (Figure 2.3).

Once permission had been obtained from the HREC and various retailers, data collection commenced. Permission from the retailers was obtained in October 2015, with Phase One of data collection taking place from November 2015 – December 2015. FGDs (Phase Two) were conducted between February 2016 and April 2016.



**Figure 2.3 Selection of the health districts and grocery stores after permission could not be obtained from Retailer D for research to be conducted at their stores**

## 2.7.2 Data-Collection Tools

### 2.7.2.1 Researcher-administered questionnaire (Phase One)

The knowledge, attitudes, beliefs and practices of the general adult consumer in the CoCT were investigated by means of a researcher-administered questionnaire. The researcher compiled the questionnaire by adapting questionnaires used previously in studies on GM foods, and according to the objectives of the study, as well as current literature.<sup>(16,17,39)</sup> (Addendum B). The questionnaires were available in English, Afrikaans and isiXhosa, and their layout is summarised in Table 2.3.

**Table 2.3 Summary of questions included in the researcher-administered questionnaire of Phase One**

SECTION	NUMBER OF QUESTIONS	TYPE OF QUESTIONS
A: Demographic Information	7	Open- and closed-ended question
B: Knowledge	10	Closed-ended question (true/false/don't know)
C: Attitudes	7	Likert scale (strongly disagree, disagree, agree, strongly agree) One closed- and open-ended question
D: Beliefs	9	Likert scale (strongly disagree, disagree, agree, strongly agree) One closed-ended question
E: Labelling	1	Likert scale (strongly disagree, disagree, agree, strongly agree)
F: Practices	5	Likert scale (strongly disagree, disagree, agree, strongly agree) One closed-ended question One open-ended question

### 2.7.2.2 Focus-group discussion guide (Phase Two)

FGDs were conducted to obtain further, in-depth information regarding consumer beliefs, attitudes and practices regarding GM foods.

The discussion guide (Addendum D) was adapted from a discussion guide used by Kempen et al. in a previous research study in SA on consumer perspectives of GM foods. This tool had been piloted, and was found to match the results of other similar studies in the literature.<sup>(115)</sup>

The researcher further adapted the discussion guide in accordance with information gathered from Phase One of the data collection, as well as from the pilot study. Probes were also included in the discussion guide.

The discussion guide included the following information:

- An introduction, which included an explanation of the procedure and all the ground rules. The research team also decided after completion of the pilot study to provide participants with a short introduction to GM foods in SA to standardise the understanding of all participants, as it was found that their understanding of this topic was very poor, which made the discussion more challenging.
- Ten questions in total were included, which covered attitudes, beliefs and practices, in addition to further exploring labelling and the regulation of genetically modified foods in SA.
- A list of probes was included to facilitate the discussion where needed.

### **2.7.3 Data-Collection Process**

#### **2.7.3.1 Phase One: researcher-administered questionnaire**

The researcher contacted the various grocery stores to determine a suitable date and time for the research to be conducted at the specific store. The researcher requested times that were in the morning, afternoon and early evening, to ensure that a broad range of consumers were included in the research.

On the day of data collection, the researcher and research assistant (RA) arrived at the store as was pre-arranged. The researcher then consulted the store manager to confirm that he/she was aware of the researchers' presence for data collection and to confirm the most convenient location for the researchers to conduct the data collection.

Where there were two exits to the grocery store, the researcher and RA stood at each entrance. Where there was only one exit, the researcher and RA stood at the same exit. As a shopper exited the store, the researcher/RA would ask the person whether he or she would like to participate in a research study, which would take approximately 10 minutes to complete. If the shopper declined, he/she was thanked

for his or her time, and the next potential participant was approached to participate. If a participant agreed to take part in the research, the researcher would take the participant aside to a more quiet area to complete the screening questionnaire. Once determined that the participant met the inclusion criteria, informed consent was obtained from the participant in his/her preferred language and a copy of the informed consent form (Addendum E) was given to every participant. After this, the researcher completed the questionnaire together with the participant, starting with the demographic information. Once the questionnaire was completed, participants were offered a gift to the value of R50 to thank them for their time and willingness to participate.

Each questionnaire was given a unique code for data-capturing purposes. At the end of the questionnaire, each participant was also asked whether he or she would be willing to participate in an FGD on the same topic, and if willing, contact details were requested for use for the focus-group recruitment. The researcher captured contact details on a separate form, with potential participants' basic demographic information.

All consent forms and questionnaires were checked by the researcher after completion, and placed in an enclosed box.

### **2.7.3.2 Phase Two: focus-group discussions**

FGDs were conducted to explore further the attitudes, beliefs and practices of the general adult consumer with regard to the inclusion of GM foods in their diet.

All the participants that indicated a willingness to participate in the FGDs from Phase One were contacted via email to determine whether they would still be willing to participate, as well as their availability.

As the response was low (fewer than ten participants volunteered their personal information), the researcher made use of an advertisement on social media (Addendum F), as well as snowballing to recruit participants for each of the different

sub-districts. This method proved to be more effective, with a number people indicating their willingness to participate in the FGDs.

The researcher obtained the contact details of all participants, and made contact via email and telephonically to determine a suitable day/time of day for the FG to take place, as well as their preferred language. Once a date, time and venue had been arranged, this was confirmed with all the participants via email and telephonically, and a reminder was sent out on the day of the FGD.

The researcher aimed to recruit at least seven participants per FGD. Table 2.4 gives a depiction of the breakdown of the number of participants recruited, and the actual number of participants included in the FG discussion.

**Table 2.4 Recruited and actual participants for the FGDs in Phase Two**

<b>SUB-DISTRICT</b>	<b>PARTICIPANTS RECRUITED</b>	<b>ACTUAL NUMBER OF PARTICIPANTS</b>
Pilot Study (Northern)	8	7
Northern	11	11
Southern	7	6
Eastern	7	7
Western	7	5
<b>TOTAL</b>	<b>40</b>	<b>36</b>

On the day of the FGD, the venue was prepared to help facilitate the FGD. Chairs were placed around the dining room table if the FG was in a private residence (Southern and Eastern sub-district), or around a boardroom table where it was in a non-residential space (Eastern and Western). Snacks and drinks were provided at all the FGDs for the participants.

The researcher introduced herself and the observer, and gave each participant an opportunity to introduce him or herself to the group. Each participant was given a nametag with a number for identification during the discussion, such as Participant One, Two, Three, etc.

The researcher explained the purpose of the FGD, and written informed consent was obtained from each participant to participate in the discussion, as well as consent to

have the FG recorded using a voice recorder (Addendum E). Each participant was also asked to fill in an anonymous demographic form (Addendum G) before the FG commenced. Once all the forms had been completed, the participants were given a copy of the informed consent form in their preferred language.

FGs were therefore arranged according to language as far as possible. One of the FGDs was a mixed language group, with Afrikaans, English and isiXhosa participants. Participants with isiXhosa and Afrikaans as a first language indicated that they were comfortable conversing in English for the FGDs, as they spoke English at work, and therefore felt comfortable expressing themselves in this language.

The researcher then explained the process of the FGD, as well as the ground rules to all participants (Addendum H). These rules included that one person was to speak at a time, all participants needed an opportunity to state their opinion, that there was no right or wrong answer, and that all cellular telephones needed to be switched off for the duration of the FGD. Before the FG commenced, the researcher gave a short definition and introduction to GM foods globally and in SA (Addendum H).

At the start of the FGD, the researcher switched on the voice recorder and conducted the FG, while the observer made notes throughout. The researcher facilitated the discussion by making use of a list of pre-determined questions and probes (Addendum D). After each question, the researcher would summarise the information gathered, and ask whether there were any other thoughts or ideas that the participants would like to add. An opportunity was also given at the end of the FG discussion for any additional thoughts to be added. Once everyone had given his or her final opinion, the FG discussion was brought to a close, and the voice recorder was switched off. The discussion time for all the various FGDs ranged from between 40 and 60 minutes.

The participants were then thanked for their time, and were offered a grocery store voucher to the value of R100 in compensation for their time and effort.

## **2.8 QUALITY CONTROL**

### **2.8.1 Training and Standardisation of Field Workers**

The research assistant (RA) was a 25-year-old female, with a degree in a field unrelated to nutritional sciences. She was recruited by means of a reference, and was found to be a suitable candidate based on her availability for the duration of the study, fluency in both English and Afrikaans, and level of education.

The observer was a 58-year-old female with a postgraduate qualification in a field not related to nutritional sciences. She had previous experience in conducting FGDs. She was recruited by means of a reference, and was found to be suitable based on her availability for the duration of the study, fluency in both English and Afrikaans, level of education, and previous experience.

Prior to Phase One of data collection, the researcher met with the RA. The RA's role for this research project was discussed, and the Standard Operating Procedure (SOP) was used during the training (Addendum I). The informed consent form and questionnaire were discussed in detail, and the method of obtaining informed consent and conducting the questionnaire was explained to the RA. The role of the RA remained the same throughout Phase One, and the same RA was used on all days of data collection. The RA was also given a copy of the research protocol.

The researcher met with the observer prior to the FGDs to explain the role of the observer during the FGDs. The SOP was used during training (Addendum I) to ensure standardisation. The role of the observer was to make notes on the general discussion and group dynamics, as well as non-verbal communication of participants, and to assist with administrative tasks during the FGDs. Her role remained the same for all FGDs, and was therefore standardised throughout the process. Obtaining informed consent was discussed in detail, and the observer was also given a copy of the FGD guide (Addendum D) and the research protocol. The same observer was used for all the FGDs.

### **2.8.2 Storage of Collected Data**

All consent forms and questionnaires completed during Phase One of data collection were checked by the researcher after completion, and placed in a sealed box for safekeeping. After every day of data collection, the completed forms were stored in a box, in a locked office, which only the researcher had access to. The data from the questionnaires was transferred to an Excel spreadsheet, which was saved on the researcher's personal, password-protected computer and password-protected cloud service.

The consent forms from Phase Two were stored with those from Phase One, in a private, locked office to which only the researcher had access. The voice recordings from Phase Two were loaded onto the researcher's personal, password-protected computer and deleted from the voice recorder's memory card after transcription. The researcher did all the transcription of the FGDs, and the transcriptions were also stored on the researcher's computer. All the electronic data was backed up to a private, password-protected cloud facility, to ensure further safekeeping of the data. Voice recordings will be permanently deleted once the data has been published.

### **2.8.3 Participant Incentives**

Participants from Phase One of data collection were offered a gift to the value of R50 for their participation in the research study, while the participants from Phase Two were each given a R100 grocery store voucher as compensation for their time and effort in participating in this research study.

## **2.9 PILOT STUDY: RESEARCHER-ADMINISTERED QUESTIONNAIRE**

A pilot study was conducted at one randomly selected grocery store within the Northern Sub-District in November 2015 to determine the validity and reliability of the questionnaire. A total of 20 participants were included in the pilot study, with the researcher-administered questionnaires completed by both the researcher and the RA.

## **2.10 VALIDITY**

The questionnaire's validity was determined by means of face validity and content validity.

### **2.10.1 Face Validity**

Face validity refers to “the extent to which the question makes sense to those knowledgeable about the subject or to interviewers familiar with the language and culture or participants”.<sup>(98)</sup> Face validity was established during the pilot study by determining whether participants understood all questions, whether the questionnaire was practical, and whether the layout of the questionnaire worked well. Subsequently, it was found that the layout of the questionnaire needed to be altered, as well as the wording of some of the questions. Both the researcher and research assistant had flagged questions that seemed to be problematic, and it was found that many of these correlated afterwards. Therefore, the necessary changes were made and implemented for the main study. The time that it took to complete the questionnaire was between 10 and 12 minutes, and therefore this was found to be adequate for the main study.

### **2.10.2 Content Validity**

Content validity determines whether the tool used measures all the elements of the concept investigated.<sup>(98)</sup> Content validity was established by asking experts in the field of GMOs and nutrition to assess the completeness and relevance of questions included in the study (Addendum J).

Six subject experts were requested to give feedback on the tool, with a final total of three experts providing feedback. One of the experts was from the environmental sciences, one was from the agricultural sector, and one was a dietician, also knowledgeable in the development of questionnaires.

The experts were asked to comment on the relevance of the questions, their appropriateness for the target group, and whether all the important aspects were

included. They were also asked to give feedback on the general flow of the questionnaire and were afforded the opportunity to change any questions they deemed necessary.

Overall, suggestions were made in terms of using different terminology and moving questions between sections, as well as adding certain questions and removing others. There were also suggestions in terms of layout. The language level was found to be appropriate for the general consumer.

## **2.11 RELIABILITY**

Reliability was improved through the training of the research assistant and ensuring standardisation by using the same methods for recruitment and data collection throughout the study. The same research assistant was used for all the data collection to ensure further standardisation.

## **2.12 PILOT STUDY: FOCUS-GROUP DISCUSSION**

A pilot of one FG was conducted in the Northern Sub-District in February 2016. A total of eight participants were recruited for the pilot study, with seven participants arriving on the day of the FGD. The researcher and observer were able to establish that the procedure for obtaining informed consent, as well as the FGD itself, worked well. The time allocated to the FGD was within the recommended 60-minute time frame, and the voice recording was checked for quality purposes.

Once the FGD had been completed, it was established that the participants had a very low level of initial understanding of GM foods, which made it difficult for them to give their full opinion on the topic. As the purpose of the FGD was not to establish the level of knowledge of the participants, it was decided to include a short introduction to GM foods both internationally and locally to give all the participants background information from which they could form their opinion. Therefore, the first question (which was initially about the understanding of GM foods) was adapted, while the rest of the questions in the FGD guide remained unchanged.

## **2.13 ANALYSIS OF DATA**

### **2.13.1 Data Analysis for Phase One – Quantitative Data**

The researcher captured all the data on MS Excel (2012). A statistician from Stellenbosch University used STATISTICA version 13 (Dell Inc. 2015, [software.dell.com](http://software.dell.com)) to analyse the data. Once data had been entered into Excel, data entries were checked again to ensure accuracy.

Cronbach's alpha was calculated to determine item-reliability analysis on the attitude scale. Summary statistics were reported using histograms and reporting percentages, means, medians and standard deviations. Relationships between continuous and ordinal variables were investigated using Pearson correlations, while analysis of variance (ANOVA) was conducted to test for mean differences between groups.

A  $p$ -value of  $p < 0.05$  represented statistical significance in hypothesis testing and 95% confidence intervals were used to describe the estimation of unknown parameters.

### **2.13.2 Data Analysis for Phase Two – Qualitative Data**

In order to analyse the qualitative data collected, the researcher systematically conducted content analysis. All the data was transcribed into MS Word verbatim by the researcher, and each transcription was checked against the recording to ensure all the information was correct and complete. Observation notes were included in the transcription, and this then formed the main source of data for analysis of the data.

The data was coded by hand, and was divided into various themes, as per the objectives of the study. Themes that emerged while data was being processed were also included. Data was then further coded into specific categories, and quotations pertaining to the specific theme and category were cut from the original text and then pasted under the most suitable heading (Addendum K). Thus the researcher was able to interpret the information under the various categories.

## **2.14 ETHICS AND LEGAL ASPECTS**

### **2.14.1 Ethical Approval**

This study was carried out in accordance with the declaration of Helsinki, and the Medical Research Council guidelines.<sup>(116,117)</sup>

Ethics approval was obtained from the Health Research Ethics Committee of the Faculty of Medicine and Health Sciences of Stellenbosch University. (Ethics reference number: S15/05/114.)

### **2.14.2 Permission**

Permission was obtained from the relevant grocery store telephonically, and where needed, via email from the grocery chain head office. (Addendum L). Please also refer to Section 2.7.1 for more information on the process.

### **2.14.3 Informed Consent**

Written, informed consent was obtained from all participants for Phases One and Two of this study, in the participant's preferred language. For Phase Two, written consent was also obtained for permission to voice record the FGDs.

### **2.14.4 Participant Confidentiality**

Confidentiality of all participants was ensured throughout the research process. As participants had to give written, informed consent, and participation was voluntary, participants were given the freedom to withdraw from the study at any point, should they wish to. This could be done without any consequences.

For Phase One, a unique code was assigned to each questionnaire for the purpose of data capturing and processing, and therefore the names of participants did not appear anywhere on the answer sheet. For Phase Two, unique numbers were used again for each participant, and therefore throughout the FGDs, numbers instead of

names were used to identify participants. On the transcription document, these same numbers were used to identify each person's opinion.

## **CHAPTER 3**

### **RESULTS**

### 3.1 INTRODUCTION

The results obtained from the researcher-administered questionnaires and the focus-group discussions are presented in this chapter, with qualitative and quantitative data presented simultaneously, as per the study objectives.

### 3.2 DEMOGRAPHIC AND BACKGROUND INFORMATION – PHASE ONE AND TWO

#### 3.2.1 Demographic Information for Researcher-Administered Questionnaire

A total of 200 participants took part in Phase One of the study. The demographic information of participants is summarised in Table 3.1.

**Table 3.1 Participant demographic information for Phase One (N=200)**

DEMOGRAPHIC VARIABLE	RESULT	
	%	<i>n</i>
<b>Gender</b>		
- Male	46,0	92
- Female	54,0	108
<b>Highest Level of Education Completed</b>		
- None	0,0	0
- Primary (Gr.7)	16,0	32
- Secondary (Gr.12)	38,5	77
- Diploma	17,5	35
- Degree (3/4 years)	23,5	47
- Postgraduate	4,5	9
<b>Employment Status</b>		
- Unemployed	7,0	14
- Full-time employee	51,5	103
- Part-time employee	5,5	11
- Home maker	7,0	14
- Self-employed	10,5	21
- Retired	13,0	26
- Student	5,5	11
- Other	0,0	0
<b>Total household monthly income</b>		
- R1 – R5000	17,0	34
- R5001 – R10000	16,5	33
- R10001 – R20000	18,0	36
- >R20 000	31,5	63
- Do not want to answer	17,0	34

More than half of the participants ( $n=108$ , 54%) were female, with a mean age of 41,65 years ( $SD\pm 17,06$ ). All participants had some formal education, with 39% ( $n=77$ ) of participants having completed secondary education. Tertiary education accounted for 45,5% of the participants ( $n=91$ ), while 16% ( $n=32$ ) of participants had primary education as their highest level of education.

More than half of the participants were full-time employees ( $n=103$ ), and they were spread relatively evenly across all the income groups, except for those families where household income was more than R20 000 – this category included 32% ( $n=63$ ) of the participants.

### **3.2.2. Phase Two – Focus-Group Discussions**

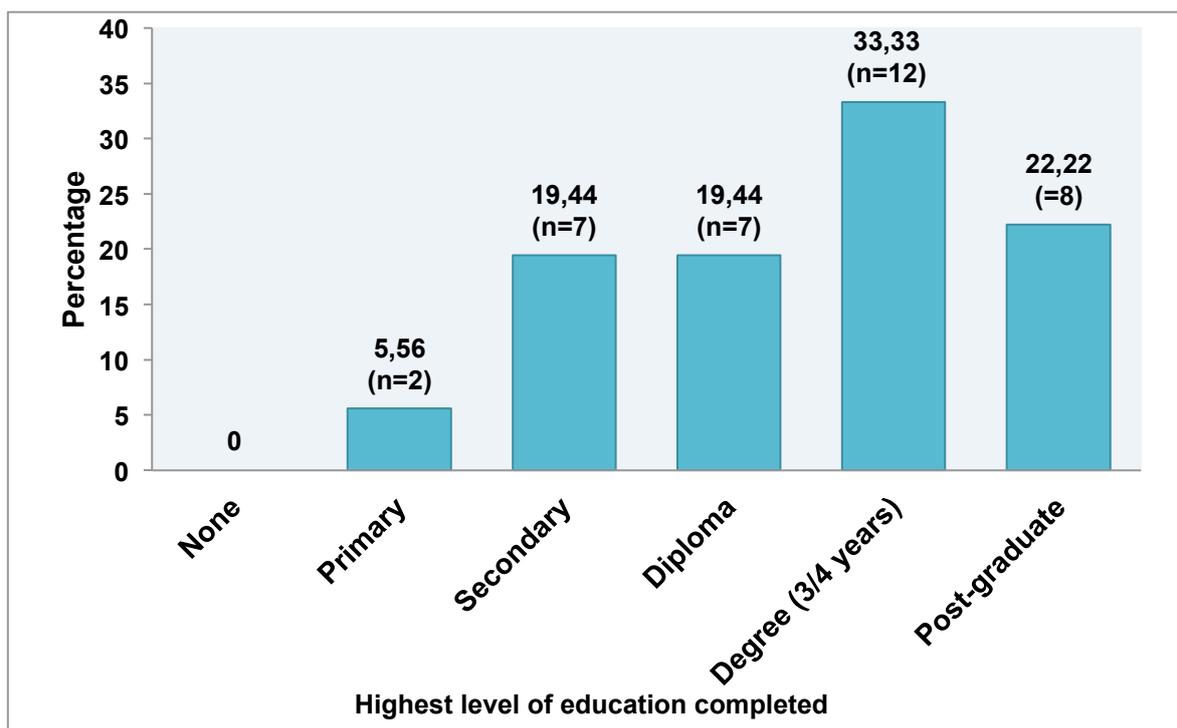
#### **3.2.2.1 Demographic information for FGDs**

Participants were recruited using two methods:

- Method one: Recruitment from Phase One of the research study.
- Method two: Social media advertisement and snowballing.

A total of 36 participants took part in the pilot study and the four FGDs. After the pilot study, only minor changes were made to the discussion guide, and therefore data obtained from the pilot study was included in the final analysis.

The majority of participants were female ( $n=21$ ; 58,3%) and all participants were fluent in Afrikaans and/or English. Three quarters of participants ( $n=27$ ; 75%) indicated that they had completed a post-school qualification (Figure 3.1). The mean age of participants was 31,39 years ( $SD\pm 9,3$ ).



**Figure 3.1** Highest level of education completed for the focus-group discussion (N=36)

### 3.2.2.2 Background information for focus-group discussions

The researcher was a 27-year-old female. Prior to conducting the research, the researcher completed a theoretical module in epidemiology, which included basic principles of qualitative research.

The observer was a 58-year-old white, postgraduate-qualified female, who was fluent in both English and Afrikaans. The observer had conducted FGDs before, and therefore had experience in the process.

For the pilot study, the researcher was nervous as to whether the questions posed would lead to meaningful conversation, and also whether the participants would interact. As the topic is not something that is always easily understood, the researcher was concerned that the questions might not be easy to answer. However, after the pilot study, the researcher was more relaxed and felt confident facilitating the discussion.

Some of the participants mentioned that they were nervous about participating, as they felt they did not know a lot about the topic. The participants did not always know one another, so it took time for them to get to know one another. However, once the conversation started, the participants were mostly willing to give their input, and the conversation appeared relaxed, with natural flow.

Participants seemed to enjoy the conversation, and wanted to participate in the different questions. Often the conversation ventured into many different areas, and the participants were energetic and involved.

Overall, the researcher felt that the FGs supplied sufficient information and results for the purpose of the research study, as data saturation was reached by the last FGD.

### **3.3 KNOWLEDGE OF PARTICIPANTS**

#### **3.3.1 Participants' Knowledge: Researcher-Administered Questionnaire**

In order to determine the knowledge of participants regarding GM foods in general, and specifically within SA, the questionnaire included ten true/false/don't know questions (Addendum B). If a participant selected "don't know" as an answer, the answer was considered to be incorrect. Results are summarised in Table 3.2.

Just before the knowledge section was completed, participants were asked whether they had heard the terms "genetic modification" or "genetically modified organism" before. It was found that 32% ( $n=63$ ) of participants indicated that they had never heard these terms before, with 69% ( $n=137$ ) indicating that they had heard these terms before. All participants were then given a standard definition of GM foods in order to complete the knowledge section (Addendum C).

**Table 3.2 Results from the knowledge section of the questionnaire (N=200)**

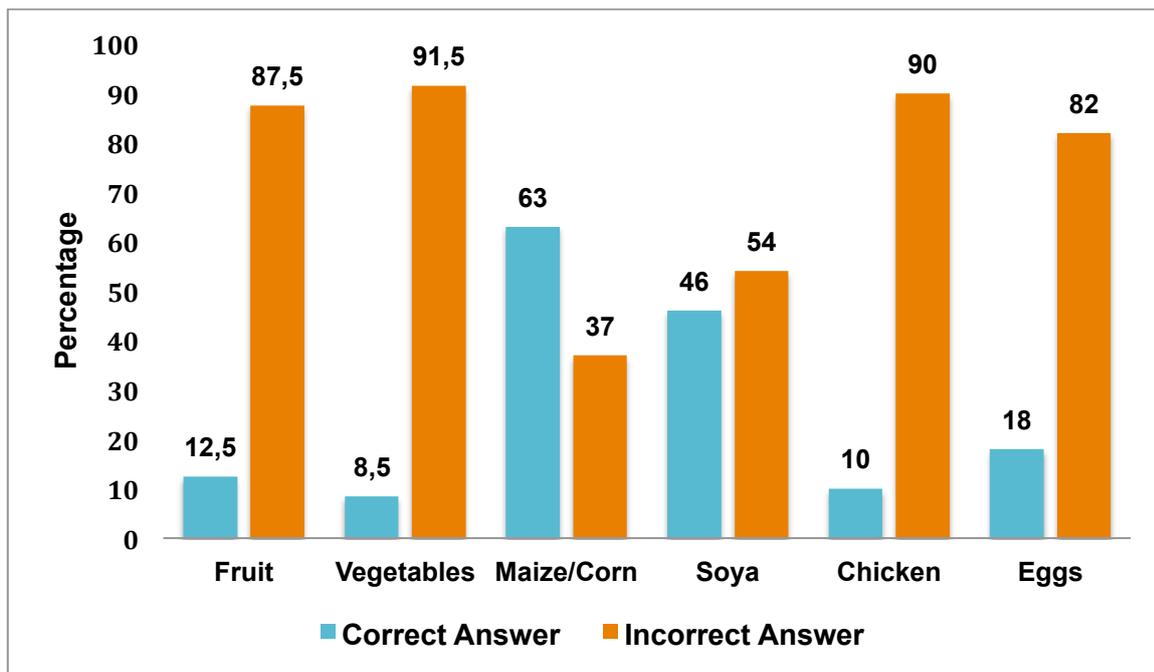
STATEMENT	CORRECT		INCORRECT	
	%	<i>n</i>	%	<i>n</i>
Q: By looking at a food, one can tell whether it has been GM A: <i>False</i> *	62,0	124	38,0	76
Q: Eating foods that are GM could change your body's DNA A: <i>False</i> *	50,5	101	49,5	99
Q: GM foods are available in South Africa A: <i>True</i> *	83,0	166	17,0	34
Foods that are genetically modified in SA:				
Q: None A: <i>False</i> *	82,5	165	17,5	35

\* *The correct answer*

It was found that the mean overall knowledge score for all the participants was 4,36 (SD±2,035) answers correct out of a possible ten, or 43,6%. This therefore indicates a knowledge score that can be considered below average in terms of international standards, which normally considers 50% as the cut-off value for knowledge scores.<sup>(118)</sup> The 25<sup>th</sup> – 75<sup>th</sup> percentile indicated that most of the participants scored between three to six answers correctly out of the possible ten questions.

When looking at specific questions, 49,5% (*n*=99) of participants incorrectly thought that eating GM foods could change one's body's DNA, while 62% (*n*=124) could correctly state that one cannot identify a GM food by simply looking at it.

Most of the participants knew that GM foods were available in SA (82,5%, *n*=165), but the knowledge of which foods are GM was poor (Figure 3.2).



**Figure 3.2 Participants' knowledge of GM foods available in South Africa (N=200)**

When looking at the correlation between level of education and knowledge scores from the questionnaires, it was found that there was a statistically significant positive correlation ( $r=0.19$ ,  $p<0.01$ ) between having a higher level of education and obtaining a higher knowledge score, indicating that overall education does show an increased knowledge of GM foods.

Interestingly, it was found that monthly income did not have a statistically significant correlation, with a higher knowledge score ( $r=0.09$ ,  $p=0.25$ ). This therefore indicates that an increased income level does not indicate a higher level of knowledge regarding GM foods. No statistically significant difference was found between the knowledge scores of participants and their gender ( $p=0.41$ ). There was also no statistically significant correlation between knowledge and age ( $r=-0.03$ ,  $p=0.68$ ), indicating that age did not affect the knowledge scores of participants of GM foods.

### 3.3.2 Participants' Knowledge: Focus-Group Discussion

Although determining the knowledge levels of participants regarding genetic engineering and GM foods was not a specific objective of the FG discussions, the following emerged from the FGDs pertaining to their knowledge on the topic:

The FGDs was the first time where many of the participants had heard of GMOs, while others had heard the term, but did not have an understanding of what it meant:

“I have never been aware of it, this is the first time ... like I have heard the word, but I have never known what it actually means” – FG Participant to K Jonker, 2016.

Participants thought that it had to do with “chemicals”, while others were under the impression that it had to do with hormones. Some participants were concerned that it had been available in SA since 1997, but that they had only heard of it for the first time in 2016.

### **3.4 ATTITUDE OF PARTICIPANTS**

#### **3.4.1 Participants' Attitudes: Researcher-Administered Questionnaire**

Attitudes of the general consumer towards GM foods were determined by including six four-point Likert scale questions in the questionnaire. The options from which participants could select were strongly disagree, disagree, agree or strongly agree. There was also one multiple-choice question to determine which sources consumers trust to give them adequate information on the topic of GM foods. For this question, they could choose more than one option. The FGDs provided further, in-depth information on the attitude of participants relating to various components of GM foods.

To determine inter-item reliability analysis, Cronbach's alpha was done for the attitude questions, and it was found to be 0,85, suggesting a relatively high internal consistency between the questions included in the questionnaire.

**Table 3.3 Results from the attitude section of the questionnaire (N=200)**

QUESTION	STRONGLY DISAGREE		DISAGREE		AGREE		STRONGLY AGREE	
	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>
GM foods are important for a healthy diet	20,5	41	38,0	76	32,5	65	9,0	18
GM foods are acceptable if they increase the nutrients (vitamins/minerals) in the food	12,0	24	18,0	36	58,0	116	12,0	24
GM foods are acceptable if they increase the sensory properties of the foods (they look better/taste nicer)	18,5	38	33,0	65	38,5	77	10,0	20
GM foods are acceptable if they increase crops and food produced, so that we have more food available to eat	9,5	19	15,0	30	56,5	113	19,0	38
Even if GM foods have health benefits, it is still an unnatural process	1,5	3	22,0	44	54,5	109	22,0	44
I would buy GM foods above non-GM foods if they were better priced	18,5	37	35,0	70	31,5	63	15,0	30

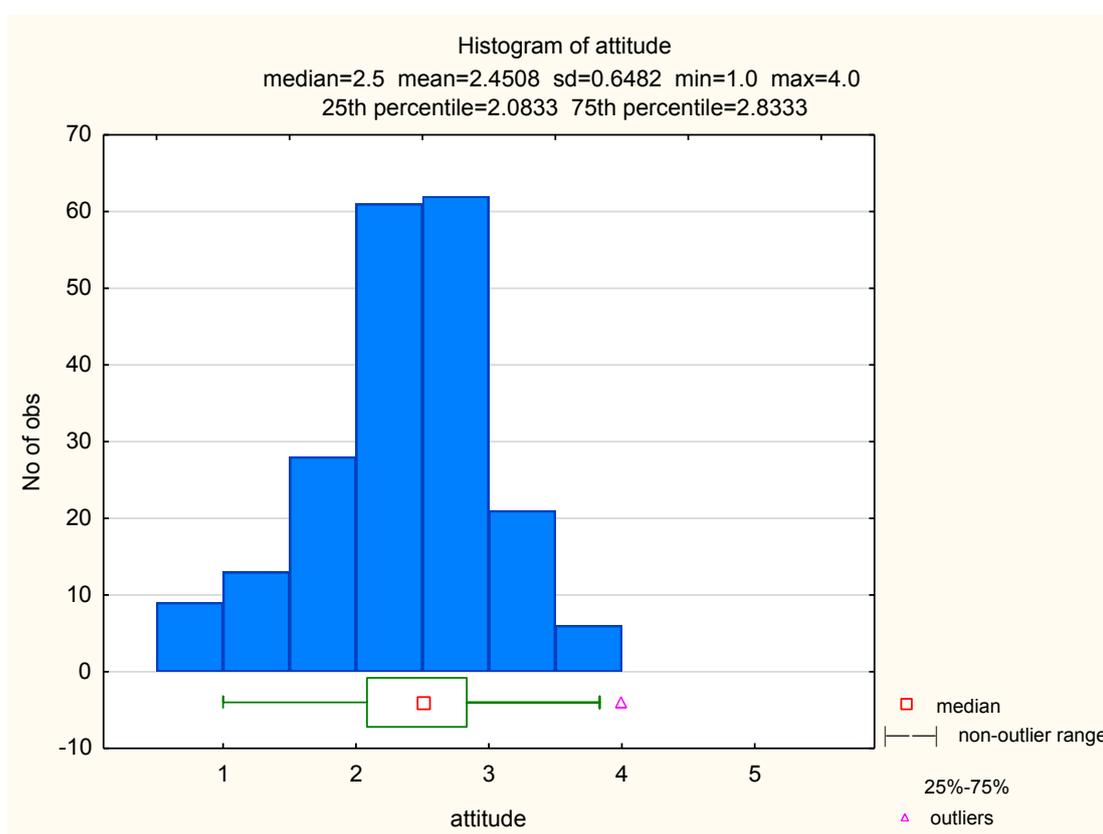
From Table 3.3, it can be seen that the majority 58,5% ( $n=117$ ) of participants felt that GM foods were not important for a healthy diet, with 32,5% ( $n=65$ ) agreeing and 9% ( $n=18$ ) strongly agreeing that they were considered an important part of a healthy diet.

Seventy percent ( $n=140$ ) of participants were of the opinion that GM foods were acceptable if they increased the vitamins and minerals in the food, with 30% ( $n=60$ ) stating that even if GM foods increased their nutritional value, they remained unacceptable. When GM crops are grown with the result of increasing crops and food availability, the majority of participants (75,5%,  $n=151$ ) were of the opinion that it was considered acceptable, while 24,5% ( $n=49$ ) indicated that even in the instance of increased food availability, GM foods remained unacceptable.

When sensory properties are considered, just fewer than half of participants (48,5%) were of the opinion that it was acceptable for foods to be GM in order for the food to either look better or have an improved taste. Therefore, sensory enhancement through genetic modification was considered to be acceptable to these participants.

The majority of participants (76,5%,  $n=153$ ) indicated that despite possible health benefits, GM foods remained unnatural, and more than half indicated that even if GM food were cheaper than non-GM food, they would still not buy the GM food (53,5%,  $n=107$ ).

In considering the overall attitudes of the participants, the results show a tendency towards more negative attitudes (Figure 3.3).



**Figure 3.3 Overall attitudes of participants towards GM foods**

A correlation was done on the information obtained from the questionnaire to determine whether an increased knowledge score of participants had an influence on their attitudes towards GM foods. A statistically significant negative correlation was

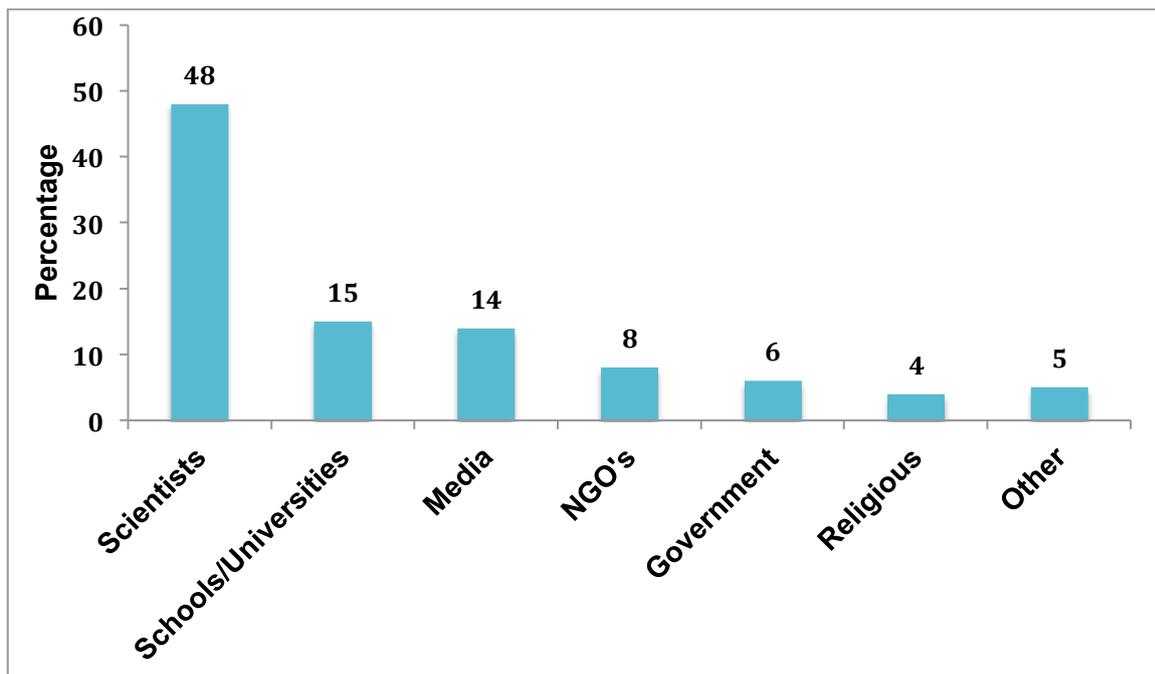
found, indicating that as knowledge of participants increased, their attitudes towards GM foods became more negative ( $r = -0.26, p < 0.01$ ).

A statistically significant, negative correlation was also found between education level and attitude towards GM foods ( $r = -0.28, p < 0.01$ ), indicating that with a higher level of education, participants' attitudes towards GM foods decreased, or became more negative. When looking at specific questions related to the acceptability of GM foods being developed for increased nutrients ( $r = -0.19; p < 0.01$ ), improved sensory properties ( $r = -0.28; p < 0.01$ ) and food availability ( $r = -0.17; p = 0.02$ ), more highly educated groups were overall more negative towards GM foods being developed for these purposes.

Neither a participant's age ( $r = 0.01, p = 0.87$ ) nor their gender ( $p = 1.00$ ) affected their overall attitudes towards GM foods. Income ( $r = -0.11, p = 0.13$ ) also did not affect the overall attitude of participants, but higher income groups were found to be more negative towards GM foods being developed for sensory purposes ( $r = -0.24; p < 0.01$ ) and for increased food availability ( $r = -0.19; p = 0.01$ ) when compared with lower income groups.

The sources which participants trust to give them adequate information about GM foods are summarised in Figure 3.4. Where "other" sources were mentioned, the majority of these participants stated that they would not trust anybody and that they would do their own research on the topic.

When looking at the top three sources participants trusted, level of education and income level did not have statistically significant effects on the source a participant selected. Interestingly, a small significant difference was found with higher income groups, who were less likely to select scientists as a trusted source of information ( $p = 0.04$ ).



**Figure 3.4 Information sources trusted by participants to give them adequate information on GM foods**

### **3.4.2 Participants' Attitudes: Focus-Group Discussions**

Overall, the focus-group discussion revealed that participants largely agreed that the process of producing GM foods was unnatural, and with that came a feeling of its being negative. Foods not GM were considered to be more “pure” and “natural” than those that were GM, and there was scepticism about why GM foods were developed.

“I don't actually see the reason why we need to genetically modify foods ... because your body is ... a natural thing, that kind of ticks by itself, and so are the plants ... so for me ... that's nature and I'm nature, so it should sync.” – FG Participant to K Jonker, 2016.

However, regarding the specific reasons for the development of GM foods, participants agreed with the majority of participants from Phase One that GM foods were more acceptable if they improved the nutritional value of the food. They were of the opinion that in a country such as SA, where nutritional deficiencies were common, GM foods could be an effective, sustainable solution to help eradicate nutrient deficiencies.

“If you can increase your yield, but provide a better quality of product at the end of the day, then it makes a lot of sense in this country, because we have got all those nutrient deficiencies, so if somebody’s primary source of nutrients, is their maize – if you can add in more of the nutrients into that, and because, you can’t force them to be able to buy all the fresh veggies and things, so that’s a ... it’s [a] sustainable source of more nutrients and then it is beneficial to the population regarded” – FG Participant to K Jonker, 2016.

It was, however, felt that perhaps developing GM foods just to increase nutritional value could not be beneficial to the entire population, as everyone’s nutritional needs would differ.

The development of GM foods for sensory purposes did not emerge strongly in the FGDs. One participant mentioned the possibility of its development for “aesthetic” or “taste” reasons, but overall it was not a very strong discussion point.

On the other hand, food insecurity emerged as a significant theme in most of the FGDs. Participants were of the opinion that GMOs could definitely be a positive solution to food insecurity, as there were “many more people now that there were in earlier years”.

There were other participants, however, that felt that GMOs would only be a short-term solution to food security, and that they may come at the cost of health in the long run, “extending their life, but not their quality of life”. They were of the opinion that GMOs would be detrimental to population health, and therefore should not be considered an adequate solution to the problem of food insecurity. It was felt that food security should not be attained “at the cost of health”, while others were of the opinion that it is “better than starving to death”.

“I don’t think that there is a silver bullet (to food security), which is going to fix everything. I think there are a few things that need to play a part, but I think we also live in a world where everything is quick fixes. We try to fix everything immediately ... so yes, a short-term advantage (of GMOs) would be food security for me” – FG Participant to K Jonker, 2016.

Interestingly, participants in various FGDs were of the opinion that perhaps other options needed to be explored before further seeing GMOs as a solution to eradicating food insecurity. They felt that perhaps SA could expand on its agricultural land usage, and ensure that all the land available for farming was used to its maximum potential.

“If we had no options available, no agricultural land to further expand on, or if we had reached our limit, then I would say: ‘Yes, now we have to ...’ So, I would suggest first trying the natural way, and if you reach a point where all of our agricultural land has been used to its maximum, then we might not have the choice, and then we will have to weigh up the hunger versus the negative effects – if there are any ... so I would say, first put all of the resources and attention into the available agricultural land” – FG Participant to K Jonker, 2016.

Similarly, it was felt that the money and resources used to develop GM foods should perhaps be used in a different manner to meet nutritional requirements. Participants were of the opinion that if GM foods were developed to eradicate poverty, then the resources invested in their development rather needed to be used in other areas “to meet the need for people who are starving”.

There was an overall preference for non-GM foods among participants. In respect of the cost of food, they were of the opinion that if the GM foods were much cheaper than the non-GM foods, they would buy the GM options, although some felt that then they “would not have a choice”. In order to have real options, participants discussed that these options would have to fall within a similar price range in order for consumers to be able to make their choice without being influenced by price.

Others, however, felt that they would definitely consider buying GM foods if they were cheaper than non-GM foods, because they “have been eating the food, and nothing went wrong” with them, and as food prices were increasing, they would always opt for the cheaper option. However, some were of the opinion that they would only make this consideration once they had all the information on GM foods.

“... If the price is cheaper, I might consider buying it, but then on the other side, I need to also know if there are any other effects that I’m ... that I don’t know about. That is why I said, if only we have been explained about it [sic], just to know more, just to know better ...” – FG participant to K Jonker, 2016.

When looking at the information sources that participants trust to give them adequate information regarding GM foods, many of the same stakeholders as in Figure 3.4 emerged in the FGDs. During the FGDs, it was further explored who the participants felt had the responsibility to educate the public on GMOs.

Participants indicated that it was the responsibility of schools, universities, and educational institutions to provide adequate information on GMOs to the public, stating that it should be included in the school education system, as part of the school curriculum.

Participants were of the opinion that perhaps independent organisations should provide information on the possible advantages and disadvantages of these foods, and that larger organisations, such as the WHO, should release a statement on GMOs, to “have a greater impact”, and for the public to be able to make informed decisions.

The companies that develop and supply GM foods were also mentioned as having a responsibility towards the consumer to inform them of GMOs, as well as of their benefits and risks.

“If you get the profit out of it – you should have to take the bad with the good, so, put money into educating people about your product ... “ – FG Participant to K Jonker, 2016.

Many participants stated that it was the government’s responsibility to educate the public on this, “as the government started this ... it is their responsibility to inform us”.

Interestingly, participants were also of the opinion that it was the consumers' own responsibility to educate themselves on the topic:

"I feel that it is the consumer's responsibility. If he is focused on it, if he doesn't want to buy GM products, then he needs to know what it is ... it is the consumer's responsibility" – FG Participant to K Jonker, 2016.

Others, however, felt that this was an "unrealistic expectation" to place on the consumer, as it assumed that everyone could read, and "process sophisticated material". Therefore, participants stated that the government needed to find ways to educate the public in such a way that the information was accessible to all consumers.

### **3.5 BELIEFS OF PARTICIPANTS**

The beliefs of participants were determined by including eight four-point Likert scale questions in the questionnaire. The options from which participants could select were strongly disagree, disagree, agree or strongly agree. There was also a multiple-choice question, where participants could select more than one option. These beliefs were further explored in the FGDs during Phase Two.

#### **3.5.1 Participants' Beliefs: Researcher-Administered Questionnaire**

The results from the beliefs section of the questionnaire are summarised in Table 3.4. It can be seen that there were almost an equal number of participants that believed the government would not allow foods to be sold that could harm the consumer in any way (49%), as there were those that believed that the government would allow harmful foods to be sold (51%).

**Table 3.4 Results from the beliefs section of the researcher-administered questionnaire (N=200)**

QUESTION	STRONGLY DISAGREE		DISAGREE		AGREE		STRONGLY AGREE	
	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>
I believe the government will not allow the sale of foods which could be harmful to consumers in any way	19,0	38	32,0	64	37,5	75	11,5	23
Food safety is more important than food price	1,5	3	2,5	5	44,5	89	51,5	103
I believe the risks of GM foods to me as a consumer are low	14,0	28	36,5	73	45,0	90	4,5	9
GM foods go against my principles	11,0	22,0	45	90	25,0	50	19,0	38
By developing GM foods, we are tampering with nature	3,5	7	26,5	53	34,5	69	35,5	71
I am concerned about the long-term health effects of GM foods	1,5	3	24,0	48	35,0	70	39,5	79
I am concerned about the long-term effect of GM foods on the environment	5,5	11	20,0	40	40,0	80	34,5	69
The government and other organisations should consult with the public before releasing GM foods to be sold	1,5	3	6,0	12	40,0	80	52,5	105

The vast majority of participants (96%, *n* =192) believed food safety to be more important than food price.

There were almost an equal number of participants that believed the risks of GM foods to them as a consumer were low (49,5%, *n*=99), as there were participants that believed the risks were high (50,5%, *n*=101). It was found that there was a statistically significant, positive correlation between believing the risks of GM foods

were low and attitude ( $r=0,50$ ,  $p<0.01$ ). This therefore indicates that when participants had more positive attitudes towards GM foods, they believed the risks of GM foods to them were low.

The same number of participants, which comprised almost three-quarters of the participants, was concerned about the long-term health effects of GM foods, as those who were concerned about their effect on the environment (74,5%,  $n=149$ ). One quarter of participants (25,5%,  $n=51$ ) indicated that they were not concerned about the effect of GM foods on their health or the environment. Most of the participants (70%,  $n=140$ ) believed that by developing GM foods, we were tampering with nature.

A statistically significant, positive correlation was found between the attitude of participants and their lack of concern about the long-term effects of GM foods on health ( $r=0,53$ ,  $p<0.01$ ) and the environment ( $r=0,48$ ,  $p<0.01$ ). Therefore, having a more positive attitude towards GM foods in general meant that participants were less concerned about long-term health and environmental effects. Age, education level, monthly income and knowledge did not have a statistically significant effect (Table 3.5). The vast majority of participants in Phase One (92,5%,  $n=185$ ) were of the opinion that the public should be consulted before GM foods were made available to be sold.

**Table 3.5 Consumer characteristics that did not affect concern for long-term health or environmental effects**

	LONG-TERM EFFECT ON HEALTH	LONG-TERM EFFECT ON THE ENVIRONMENT
<b>Gender<sup>^</sup></b>	$p=0,29$	$p=0,34$
<b>Age<sup>*</sup></b>	$r=0,01$ ; $p=0,89$	$r=0,06$ ; $p=0,43$
<b>Education level<sup>*</sup></b>	$r=0,01$ ; $p=0,91$	$r=0,02$ ; $p=0,79$
<b>Monthly income<sup>*</sup></b>	$r=-0,13$ ; $p=0,09$	$r=-0,09$ ; $p=0,26$
<b>Knowledge level<sup>*</sup></b>	$r=-0,09$ ; $p=0,21$	$r=-0,07$ ; $p=0,36$

<sup>^</sup>The ANOVA analysis was done to test for differences ( $p<0,05$ )

<sup>\*</sup>The Spearman correlation test was done to test for statistically significant differences ( $p<0,05$ )

When participants were asked whom they believed benefited from GM foods in the food system, seed companies (29%), the government (28%) and farmers (24%) were found to benefit the most. Participants were of the opinion that the consumers (20%) benefited the least from GM foods in the food system.

### **3.5.2 Participants' Beliefs: Focus-Group Discussions**

From the FGDs, various aspects relating to the participant's beliefs emerged, which are summarised below.

#### **3.5.2.1 GMOs in South Africa**

The FGDs revealed that participants were concerned that SA allowed GMOs to be grown, while they were banned in many European and African countries. Participants were of the opinion that the motives behind the government's allowing GMOs were questionable, and they explored whether this could be because of financial gain, as opposed to health and consumer benefit. As the government had not made its decision regarding GM foods widely known to the public, participants discussed the possibility of the government having a hidden agenda.

“Somewhere there has to be benefit in the political field as well for the government to allow it, because otherwise, why do people in other countries not allow it? Is it only about the health? Or are there other factors also involved?” FG Participant to K Jonker, 2016.

#### **3.5.2.2 Safety of GMO**

There were participants that believed that the government would not allow foods to be sold that had not been tested for safety, and therefore felt that these foods would be safe to eat.

“... Surely the government won't approve something that hasn't been tested for any side effects that it might cause, do you understand? So, I believe

before they even did it, there were tests done ... even though we don't know about it ... so, I think I will buy it ...” FG Participant to K Jonker, 2016.

Participants from the FGDs were largely in agreement with those from Phase One in that food safety was more important than food price, although the cost of food remained a concern. Food safety to the participants included food produced sustainably, also for future generations. There was concern about the long-term effect, which participants believed could not be overlooked just to make food available at a cheaper price.

“In South Africa, with the hunger needs and malnutrition that we have, I think there is a need for this ... but we also have to be more clever, to see how to solve the problem now, but later create problems ... such as [question mark], cancers or other things, then we are just making more problems for ourselves in the future by solving this one problem now” – FG Participant to K Jonker, 2016.

Among the concerns raised regarding GM foods, health risks were mentioned in all the FGDs – from allergenicity, to the effect of GM foods on gut bacteria and overall health, to the development of disease in the long run. It was felt that perhaps the decline in overall health of SA's population could be due to these GM foods' availability.

“I think this GM is already killing us ... it is killing our nation, because we are experiencing a lot of sickness ...” – FG Participant to K Jonker, 2016.

There were also those that stated that they would have to take an “educated guess” regarding the long-term effects, as they did not have enough knowledge of the topic, or believed that there had not yet been enough research done on the topic. Therefore, the lack of research – or knowledge of this research – created fear among consumers. One participant believed that consumers were “human guinea pigs” trialled with ‘Franken foods’”, where the government and authorities would just “see what happens in 10 years' time”.

“I think it’s difficult, because you don’t know what these long term effects are ... there could be benefits, that maybe outweigh the [negative] effects ... but, it’s hard to say, because you’ve got a population of maybe fuller tummies, but there might be that negative effect ... there might be benefits, but it’s hard to know without more research being done in smaller groups before, you know, mass producing it to the rest of the country” – FG Participant to K Jonker, 2016.

Environmental concerns were also raised – participants believed that processes occurring naturally in nature could be affected owing to genetic modification. There were concerns that perhaps variety in nature would cease, as farmers would always opt for the GM seed because of its benefits to farmers. Participants were of the opinion that humans were “destroying nature” by developing these foods.

“If 80% of the maize in South Africa is genetically modified, then we are going to get to a point where we will only have genetically modified maize, and not really have pure maize, if I can put it that way ... because that’s not far out of the equation ... so if everybody is going for productivity, they are always going to use the maize and the seed that produces the most, and can have the ... can be ... how can you say, resistance against pesticides and least water and that kind of stuff ... then we’re at a fast rate eliminating natural maize out of the equation ...” – FG Participant to K Jonker, 2016.

In contrast, some participants believed that until there was a “proven increase in illness”, perhaps we needed to focus our attention on other areas of concern within SA, as there were “so many other things to give attention to”.

### **3.5.2.3 Ethics and beliefs**

From the FGDs, it was clear that there were participants that were of the opinion that GM foods went against their beliefs and principles, while others did not feel that they conflicted with their beliefs and principles.

Where GM foods did not go against a participant's principles, this was linked to a belief that changes happened in nature on a continuous basis in order for plants to adapt to their surroundings. Therefore, by genetically modifying seeds and plants, science was replicating a naturally occurring process. This was, however, on condition that the benefits outweighed the risks, and that if at any point the risks became too high, participants felt that it would be against their principles and beliefs.

“I wouldn't have an issue ... but when there's a negative, then it's kind of out for me ...” – FG Participant to K Jonker, 2016.

There were also participants that were of the opinion that GM should stop at plants, and that animals should not be genetically modified for our benefit. It was felt that genetic modification in itself was perhaps not an issue, but that the product developed could potentially be.

Those that believed it went against their principles, were concerned that humans were “playing God”, and destroying nature by genetically modifying plants, which would have long-lasting effects for future generations.

There was also concern about the ethics of GM food, and communication with the public in general – participants were of the opinion that there was a “non-declaration” of these foods, which went against their principles and human rights. They felt that the companies developing these foods “most probably do know of negative side effects”, which they did not make available to the public. Participants raised this as an ethical concern. They were also of the opinion that at some level the development of GM foods could be considered an exploitation of consumers reliant on cheaper foods.

“I'm just sceptical, because of like the exploitation that comes with capitalism ... I just feel that big companies are exploiting people who need cheap food ... and that just doesn't sit well with me ... but obviously I don't know much about this ... but that's just my gut feeling ... like, there's ... like corporations are benefiting, and people are suffering ... potentially...” – FG Participant to K Jonker, 2016.

It was also mentioned as a counter-argument to those stating that nature changes food over time, that in nature it happens much slower and more naturally, which means that nature has time to adapt to these changes.

#### **3.5.2.4 Public consultation**

Participants from the FGDs were in agreement with those from Phase One, in that the government should have consulted with the public before these foods were developed, and should have informed the public of the decisions. Many were of the opinion that they were not aware of GM foods being developed or introduced in South Africa, and that perhaps if they had known, they could have made an informed decision not to buy GM foods.

“I think, next time, government should maybe keep people informed ... before trying something ... before, putting something on the market. I mean, everything has to go through a process ... before it gets on the market, before it gets on the shelf ... but why not keep us as the consumer informed about it, before you even start processing this stuff...” – FG Participant to K Jonker, 2016.

#### **3.5.2.5 Stakeholder benefits**

With regard to who benefited from GM foods in the food system, seed companies, the government, farmers and consumers were highlighted as benefactors.

Participants were sceptical about large seed companies having the monopoly of these seeds, as they were of the opinion that it would eventually affect the price of foods, as there would not be competition among companies any longer, which would essentially skew the market. It was mentioned more than once that companies developing GM seeds should have a social responsibility to plough resources into unbiased research, and into educating communities about these foods.

“... [If] the producers get the profit out of it – you should have to take the bad with the good, so, put money into educating people about your product, so that you can skim off all the profit ... I mean, I don’t think you should just be able to get away with ... making so much money, and not sort of having any social responsibility with it...” – FG Participant to K Jonker, 2016.

The government also emerged as one of the strongest benefactors of GM foods in the FGDs. Participants were of the opinion that as they had approved it, they should be benefiting from it, and that the benefit would be greater for the government than it would be for the consumer.

FG participants also mentioned farmers’ benefiting, but it was believed that they did not have that much choice in the matter.

“... the farmers are not doing it with bad intentions, it is actually more the companies behind it, because it is so difficult to be non-GM ... I mean, really difficult...” – FG Participant to K Jonker, 2016.

The FGDs also focused on consumers’ benefiting, by being able to buy food at lower prices, and GM foods being developed to meet consumer demands. This linked to food security in South Africa, and how food-insecure consumers could benefit from GM foods.

“... At the end of the day, if the bread price is increased by R3, for a poor person, R3 is the difference between bread and no bread...” – FG Participant to K Jonker, 2016.

### **3.6 PRACTICES OF PARTICIPANTS**

As part of the objectives of this research study, the practices of participants were determined during Phase One, by asking three four-point Likert scale questions. The options from which participants could select were strongly disagree, disagree, agree or strongly agree. There was also a Likert scale question on whether GM foods should be labelled as such, as well as a question regarding sources of information

participants used to obtain information on GM foods. Practices were further explored in the FGDs, and themes on purchasing of GM foods, labelling, and preferences for GM products were discussed.

### **3.6.1 Participants' Practices: Researcher-Administered Questionnaire**

Overall, participants did grocery shopping for an average of three people per household ( $SD \pm 1,73$ ).

When asked whether they read a food label to determine whether any GM ingredients had been used, more than half of participants either agreed or strongly agreed (52,5%,  $n=105$ ). This therefore indicates that more consumers do actually claim to read food labels to determine whether GM ingredients have been used than those that do not (42,5%,  $n=95$ ). No statistically significant difference was found between checking a label for GM ingredients and knowledge scores, education level, age or monthly income of a participant, indicating that none of these consumer characteristics influenced label reading.

Despite this, the vast majority of participants agreed, or strongly agreed that GM foods should be labelled as such (97,5%,  $n=195$ ). Only 2,5% ( $n=5$ ) of participants disagreed, or strongly disagreed.

A statistically significant negative correlation was found between food label reading for GM ingredients and attitude, indicating that as participants' attitudes became more positive towards GM foods, they were less likely to read a food label to check for GM ingredients. ( $r=-0,16$ ,  $p=0.02$ ).

From the questionnaire, it was found that 20,5% ( $n=41$ ) of participants were of the opinion that they had not eaten GM foods before, while the majority of participants agreed that they had eaten GM foods before (79,5%,  $n=159$ ).

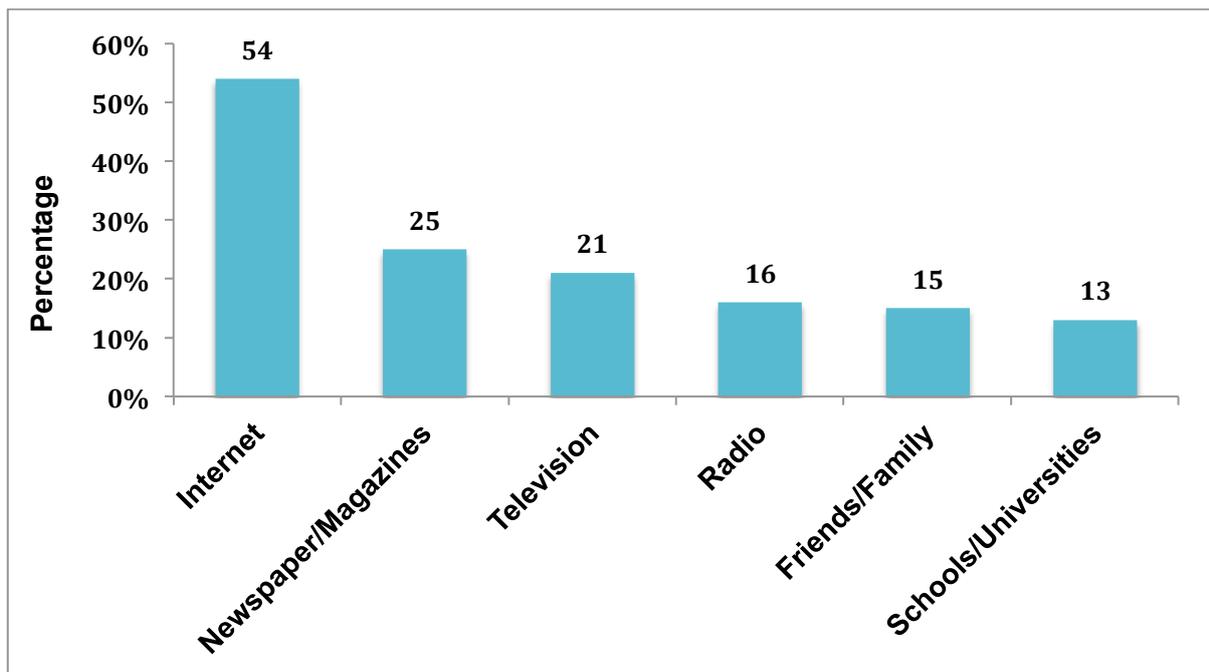
Consumers were also asked whether, if there were a GM option, they would choose that above the non-GM option. Of the participants, 45% ( $n=90$ ) disagreed, while 33%

( $n=66$ ) strongly disagreed, indicating that only 22% ( $n=44$ ) of participants preferred GM products to non-GM products when given the choice.

A statistically significant positive correlation was found between attitude and preferring GM options above non-GM options ( $r=0,63$ ,  $p<0.01$ ). This therefore indicates that a more positive attitude towards GM foods also led to a preference for GM foods, which is to be expected. A statistically significant yet relatively small negative correlation was also found between education level and preference for GM foods ( $r=-0,15$ ,  $p=0,03$ ), as well as knowledge scores and preference for GM foods ( $r=-0,16$ ,  $p=0,02$ ). This indicates that as participants' education level and knowledge score increased, their preference for GM foods decreased. Age ( $r=0,04$ ,  $p=0,53$ ), gender ( $p=0,09$ ) or monthly income ( $r=-0,07$ ,  $p=0,31$ ) did not significantly affect a preference for or against GM foods.

As an open-ended question, consumers were asked how they would know whether a product that they were buying contained GM ingredients. The majority of participants indicated that they would read the label, or read the packaging. Other participants stated that "there is no way of knowing", or that they "don't know". A number of participants also said that they would look at the "colour, size, price and feel" of the product, or that they would "ask the store manager" or "ask the supplier". Some participants indicated that "products that are not originals" could be considered as containing GM ingredients.

In terms of sources that consumers used to obtain information on topics such as genetic modification, it was found that the majority of participants used the Internet (38%), followed by print media (17%) and television (15%) (Figure 3.5).



**Figure 3.5 Major sources of information for consumers**

### **3.6.2. Participants' Practices: Focus-Group Discussions**

In the FGDs, it emerged strongly that most of the participants were of the opinion that GM foods should be labelled as such, but very few knew whether these products were already labelled, while participants were also unsure if the general public would understand what the term meant when seeing it on a food label. They also stated that they wouldn't even know which products to look for as being GM, as they were uncertain of their availability in SA.

"I don't know which products it is in, so if I go and buy something now, I won't know ... I am not focused on that at all, so I don't know ... I don't know which products have it at the moment" – FG Participant to K Jonker, 2016.

Regarding participants' consumption of GM foods, participants were of the opinion that "most of our foods contain GM ingredients", and therefore they would definitely have consumed these foods. There were other participants that believed that GM foods did not affect them, as they either did not buy foods containing GM ingredients, or there was a misconception that they would only affect the "rural population".

“... (GM foods) are not going to affect us. They will affect the rural population, where the food prices are going up, that affects them quite majorly, so stuff like that will probably affect the 1% of the population sitting in this room absolutely last...” – FG Participant to K Jonker, 2016.

The FGDs also revealed that where given a choice, they would opt for the non-GM option, the “organic” option or the “original”, but that they sometimes felt that they did not have the choice because of lack of knowledge, inadequate labelling, or lack of trust of the labelling. There were also thoughts on the idea that being able to choose non-GM meant that one would need to be in a financial position to be able to do so. There were participants, however, that were of the opinion that if there were benefits such as longer shelf life or cheaper price, they would consider choosing the GM option.

Others were of the opinion that if the GM option were the only option available, they would still opt to buy the product.

“If I had the choice, I would want to go as natural as possible, but at the moment, I take what I get ... I won't go looking whether something is GM or non-GM ... honestly, I am not willing to pay three times more for something just because it says 'non-GMO' on it...” – FG Participant to K Jonker, 2016.

The FGDs revealed that most of the participants were of the opinion that GM foods should definitely be labelled. This formed part of a participant's right to know, and their right to health and to be able to make their own health choices. They were also of the opinion that labelling these food products clearly would help them to be able to make informed choices, but that the labelling should be done through a standardised system with a standardised symbol, as one would have for kosher foods.

“I feel that information must be made available, and the most reliable way is a third party, like your kosher ... which states whether it is kosher or halaal, where you have to get certification from someone to put that stamp on your product ... there has to be a company like that. Then you know it is a

universal sign that everyone can look at, instead of someone just putting 'GMO free' on their label..." – FG Participant to K Jonker, 2016.

However, participants felt that even if such GM foods were labelled, they would still not be sure whether they could trust the food label, because of a lack of standardisation in South African labelling laws. This was related to poor control over the labelling of items, such as vitamins and minerals, and that this would then possibly also apply to the labelling of GM foods. They were also of the opinion that the labelling would be more about marketing for companies than it would be about food safety for consumers.

"One doesn't know if you can trust the systems of food labelling anymore ... because it is all about marketing..." – FG Participant to K Jonker, 2016.

There were also suggestions that perhaps the label needed to indicate what kind of genetic modification the product had undergone – whether it was done to grow in drought-resistant areas, to avoid pesticide use, or to increase certain nutrients or yield. This would allow consumers to choose for themselves whether they found the product acceptable or not.

"I think, sort of on her note, to be like informing the people, so with making the change on the packet of oranges, to say: This has been genetically modified, now you are going to be getting more vitamin C or less" – FG Participant to K Jonker, 2016.

As per the results from Phase One, participants indicated that the media would be an effective way to communicate information to the public about GMOs, especially as this would simplify complicated information that would normally be found in scientific journals. There were suggestions that television advertisements could be useful, or that information could be included as themes in television series or soap operas.

"The majority of our population watches TV ... I don't think that they are going to read long pamphlets that are given out with their product, or if there's a lot of information on the packaging, I don't think that they will necessarily read it

... And also, our population is not that well read, so if there are comprehensive words in there, it's going to hamper their understanding of it if they can't read it..." – FG Participant to K Jonker, 2016.

Some suggested that the radio could be a good medium to convey information, and that social media were good options for the younger generation. Participants also mentioned that they would use Google to ascertain more about the topic, or that websites or webpages should be made available together with adequate food labels. Schools and universities were mentioned by a number of participants as good places to implement education on GMOs.

"I generally experience things when things go viral on twitter – so I'm pretty sure that you can make some obscene advertising or marketing thing ... get it cancelled off air, because then everyone in the country will see it. So yes, I think education definitely, but generally even then: some form of a campaign on social media is probably the easiest way..." – FG Participant to K Jonker, 2016.

Other suggested information sources included magazines, articles in free magazines offered by some grocery stores, clinics and hospitals.

Participants were also of the opinion that all consumers had the responsibility to educate others once they were aware of GMOs and had knowledge of the topic, as that way information would be spread faster.

"I think it is everyone's responsibility that now [one] knows about it, because for example now, I know about it ... it's also my responsibility to educate somebody else, and it is also number 7's responsibility ... so it is everyone's responsibility ... as long as you know about it, then try and share ... positive things ... so that you can also educate, because I think that then it will go faster..." – FG Participant to K Jonker, 2016.

### 3.7 CONCLUSION

The data collected in the CoCT during both the researcher-administered questionnaire of Phase One, and the FGDs of Phase Two, indicated a number of significant findings.

Overall, the knowledge of participants regarding GM foods was found to be below general average international knowledge scores. Participants further had low levels of knowledge of specific GM foods currently available in SA. There was a clear correlation between having a higher level of education, and an increased knowledge of GM foods. However, the same correlation did not exist for age, gender or income level.

Overall, participants were found to have a slightly more negative attitude towards GM foods, as indicated by the overall attitude score from the questionnaire and the FGDs. The majority of participants were of the opinion that GM foods were more acceptable when developed to improve the nutritional value of foods, or to increase crop yields, and thereby increase food availability. When GM foods were developed for sensory properties, their acceptability dropped for less than half of participants. There appeared to be a preference for non-GM foods, even when given a price trade-off; however, it was felt that if the price difference were significant, consumers would be forced to opt for the GM option. Consumers were more concerned about the safety of food than the food price.

An increased knowledge of GM foods and a higher level of education correlated with a more negative attitude towards GM foods overall. As the attitude of participants became more positive, they also became less concerned about the long-term effects of GM foods on health and the environment. The overall risk of GM foods also decreased when a participant had a more positive attitude towards GM foods.

Scientists, schools/universities and the media were found to be the most trusted sources of information by consumers, while the Internet, print media and television were the most used sources of information by consumers. Participants were of the opinion that consumers, the government, educational institutions, independent

organisations, developers and distributors of GM foods were all responsible for educating the public on GM foods.

Overall risk perception was almost equally high as it was low; however, when asked about specific long-term risks regarding the environment and health concerns, overall risk perception increased. Various environmental and health concerns were discussed in the FGDs, largely indicating uncertainty and concerns.

Participants in this study were of the opinion that seed companies benefited the most from GM foods in the food system, while consumers benefited the least. The vast majority felt strongly that GM foods should be labelled, and that consumers should be consulted before GM foods were released for sale. Where participants had more positive attitudes towards GM foods, they were significantly less likely to read food labels to check for GM ingredients. An overall preference to purchase non-GM foods was found, which increased with participants' education and knowledge levels.

## **CHAPTER 4**

### **DISCUSSION**

## **4.1 INTRODUCTION**

The main aim of this study was to determine the knowledge, attitudes, beliefs and practices of adult consumers regarding GM foods and the inclusion of such foods in the diet. The primary objectives were to determine the level of knowledge regarding GM foods, and the attitudes, beliefs and practices of consumers regarding the inclusion of GM foods in the diet. Secondary objectives were to determine whether there were differences in knowledge, attitudes, beliefs or practices of consumers in relation to gender, age, education or income level. Food labelling and sources of information were also investigated.

This information was obtained by using a researcher-administered questionnaire and FGDs to obtain in-depth information on the topic, and the results from these are discussed simultaneously.

## **4.2 REPRESENTATION OF STUDY SAMPLE TO POPULATION IN CoCT AND SOUTH AFRICA**

In order for the results of this study to be interpreted, one needs to look at the study population included during Phase One and Two of this research study, and compare it with both provincial and national population statistics.

From Table 4.1, it may be seen that the gender distribution of participants in this study generally accords with that of the CoCT and SA. The unemployment rate of those included was lower than that at provincial and national level, and the level of higher education of participants in this study was also higher compared with provincial and national levels. It would also appear that this study population consisted of more higher income participants, taking into consideration provincial and national income averages.

This may have been due to the areas selected for data collection, which excluded some of the lower socio-economic areas in the CoCT. It may also have been due to one major retailer's refusal to participate in this study. This particular retailer is known to be popular among lower socio-economic groups, as prices have been reported to be more affordable than at the other three retailers that were

included.<sup>(119)</sup> Lower income and lower education groups may also not have wanted to participate in the study because of the topic, often considered a complex one by the public. The results from this study therefore have to be interpreted in light of this information.

**Table 4.1 Comparison of the demographics of participants included in this study to those in South Africa and the CoCT**

DEMOGRAPHIC	SOUTH AFRICA <sup>(120-122)</sup>	COCT <sup>(112)</sup>	PHASE ONE	PHASE TWO
Male participants	51,3%	48,9%	46%	41,7%
Female participants	48,7%	51,1%	54%	58,3%
Unemployment rate	26,6%	23,9%	7%	0%
Post-matric qualification	12,8%	18,8%	45,5%	75%
Monthly household income	27,2% (>R11,000)	25,6% (>R12 800)	49,5% (>R10,000)	N/A

## 4.2 KNOWLEDGE OF CONSUMERS

Research has shown that objective or factual knowledge of GM foods significantly impacts on a consumer's risk perceptions of GM foods, and ultimately also their acceptance of these foods.<sup>(35)</sup>

Overall, the level of actual knowledge of participants regarding GM foods indicated an average score of below 50%, which is often considered the cut-off for an acceptable knowledge score both nationally and internationally.<sup>(118)</sup> Given the fact that the participants in this study represented more highly educated groups, one can expect this score to be even lower among lower education groups. The positive link between knowledge scores and education levels is supported by this study as well as by previous research in SA as highlighted below.

In this study, a higher level of education was the only consumer characteristic that was found to significantly increase a consumer's knowledge score. This indicates that the more educated a participant is, the more factual knowledge the participant has of genetic modification and GM foods. This finding relates to two earlier studies within SA, where it was also found that the level of education of participants made a significant difference to the knowledge of participants with regard to GM foods and biotechnology in general.<sup>(15,17)</sup> This may be attributed to the fact that the technology

used in the genetic modification of foods is fairly complex, and therefore possibly more difficult for less educated consumers to understand.

The majority of participants in this study had heard of “GM foods” or “GMOs”; most were aware of the availability of GM foods in SA, and the majority agreed that they had eaten GM foods previously; however, it was clear that various misconceptions exist with regard to GM foods.

An international study conducted in 2004 by a market research company, Synovate International, found that 63% of participants in SA stated that they were familiar with GM foods, which agrees with the findings from this research study.<sup>(40)</sup> This number is higher than what was found in earlier research within SA, which may indicate increasing awareness among South African consumers, or may be due to different population groups included in the various studies.<sup>(17,18)</sup>

Almost half of the participants indicated that eating GM foods could directly change one’s DNA, and knowledge of specific foods being GM was very low, with most participants (between 80 and 90% for all questions) believing fruit, vegetables, chicken and eggs to be GM in SA. A previous national study conducted within SA in 2001 by Joubert found that only 20% of participants could confidently say that eating GM foods did not change one’s DNA.<sup>(17)</sup> This research study therefore indicates a higher level of knowledge among participants about GM foods and their ability to change a person’s DNA than found in this earlier study within SA. This may, once again, be attributed either to increased awareness, or to different demographic profiles of the sample, such as higher levels of education.

Although there may be some awareness of GM foods, consumers in this study do not appear to carry high levels of factual knowledge of specific foods being GM within SA. This is supported by international studies that have found that while there may be awareness among consumers, actual knowledge levels are often limited, and misconceptions are common.<sup>(123)</sup>

There was a definite increase in the knowledge of participants in respect of maize and soya being GM in SA when compared with the other food categories; however,

this may be attributed to participants believing *all* foods are GM, as opposed to an actual increased level of knowledge of these specific foods. When asked which foods were GM in SA participants agreed with all the statements, as opposed to identifying soya and maize as GM foods specifically. More participants could correctly identify maize (63%) than those who could identify soya (46%) as being GM. In future research therefore, it may be more effective to ask participants to select foods they believe are GM from a list of various foods provided, as opposed to participants agreeing or disagreeing with foods being GM from set categories, as was the case in this research study.

The findings in this study relate to a study published in 2005 by Rule and Ilanga on 7000 consumers residing within the nine provinces of SA that indicated that the foods consumers most often thought were GM were fruits, vegetables, dairy, eggs, and maize.<sup>(15)</sup> Therefore, it would appear from previous research and this research, that consumers in SA are under the impression that fruits, vegetables and eggs are genetically modified, when in fact they are not.

This study further highlighted that consumers are under the impression that animals are GM within SA for commercial use, as 90% of participants either indicated that chickens are GM, or were unsure of whether they are GM. This is a very high level, considering participants in this study were mostly from more highly educated groups, and indicates the need for misconceptions to be clarified among consumers.

Furthermore, misperceptions also exist about what is considered a GM food product, and what is not – for example, participants in this research study mentioned “treatment with hormones” in the FGDs when discussing GM foods. Previous research within SA also found that participants had misconceptions of what would be classified as a GM food product.<sup>(41)</sup>

The FGDs revealed that participants felt that they had limited to no knowledge of the topic. It therefore appeared that participants’ perceived knowledge was low, with many stating that they had heard of GMOs, but did not know what they meant, while others had not heard of GM foods’ availability in SA. This relates to an earlier FG study conducted in the North-West province of SA that also found a lack of

understanding among consumers, with participants either being uncertain about GM foods, or having never heard of the concept.<sup>(41)</sup>

The 2005 national survey done in SA by Rule and Inga asked participants to explain what they understood by the term “genetic modification”, and it was found that almost nine out of ten participants could not explain the term.<sup>(15)</sup> Therefore, research within SA, together with this study, indicates that a gap exists between participants having heard of GMOs, and having a clear understanding with factual knowledge of GMOs.

This therefore highlights the importance of educating the public on all levels regarding the technology used in the genetic modification of foods, as well as on food availability within SA. Offering factual knowledge may not, however, increase understanding, and therefore emphasis needs to be placed on increasing the understanding of consumers. This needs to be done in a manner that is accessible and understandable to all the different consumer groups within SA.

Given that the government of SA is largely pro-biotechnology, consumers, as one of the major stakeholders in the success of the technology, have to be kept informed on the topic on a continuous basis. This is in agreement with the South African bio-economy policy, which has made communication with the public one of the key focus areas.<sup>(13)</sup> More programmes with the aim of increasing consumer knowledge and understanding of the topic of genetic modification should be designed and implemented, and increased information should be conveyed to the public through various sources, including the education system and the media. Clear, measurable outcomes need to be developed and monitored throughout to ensure that there are improvements in both the knowledge and the understanding of consumers, in order for them to be able to make informed choices regarding their food intake.

Legally, the CPA in SA focuses on the “right of consumers to know”, which would imply having awareness and understanding of the topic. Currently, the research within the country does support that consumers do “know” about GM foods.<sup>(47)</sup>

One might have expected that older generations would have less knowledge on the topic of GM foods, with younger generations having more access to information; or that women, who traditionally do most of the household grocery shopping, would be more informed. Additionally, the literature from international studies has shown that higher income groups are more willing to pay a premium for non-GM foods, indicating these groups as being more concerned about whether a product is GM or not.<sup>(124)</sup> Therefore, there may have been an expectation that higher income groups in SA would be more concerned about GMOs, and subsequently better informed on the topic. However, this research study did not support any of these expectations.

### 4.3 ATTITUDE OF CONSUMERS

The attitude of consumers toward GM foods has been shown in the literature to affect their acceptance of these foods, and attitude has also been shown to affect consumer practices related to GM foods.<sup>(125)</sup> It has, in some instances, been found to be the most significant predictor of a consumer's acceptance and behaviour related to GM foods.<sup>(125)</sup> Therefore, determining the attitude of South African consumers towards GM foods is an important component in their overall stance towards this technology, and ultimately their acceptance thereof.

The overall attitude of participants in this study was found to be slightly more negative than positive. Furthermore, the results indicate that there was a significant correlation between an increased knowledge level of GM foods, and having a more negative attitude towards GM foods. Therefore, the more participants know about GM foods, the more negative they become towards the technology. Previous international studies have found similar results, where increased knowledge led to a more negative attitude towards GM foods, while other studies have found an increased knowledge led to participants having a more positive attitude towards GM foods.<sup>(126,127)</sup> This discrepancy may be explained by a recent international study, published in 2015 by Zhu et al. The researchers investigated the difference between having knowledge of the *risks* of GM foods, versus having knowledge of the *benefits* of GM foods, and the effect of this on the attitude formation of a participant. It was found that the type of knowledge a participant has directly influences the attitude of a participant, either positively or negatively. Knowledge of the benefits of GM foods led

to a more positive attitude, while knowledge of the risks of GM foods led to a more negative attitude.<sup>(128)</sup>

This therefore indicates a need for balanced information to be provided to the public regarding GM foods to ensure that both the risks and benefits of GM foods are made known. Given that the South African government is pro-biotechnology, and pro the further development of GM foods, there may be a tendency for more positive information to be made available to the public.<sup>(13)</sup> Therefore, factual information should be provided that gives different views on the subject to ensure that consumers can develop their own opinions on the topic.

The results from this study also indicate a significant correlation between having a higher level of education, and having a more negative attitude towards GM foods. This is in agreement with previous research conducted nationally within SA by Rule and langa, which found that increased education levels lead to more negative feelings towards biotechnology on the whole.<sup>(15)</sup> This is contrary to studies conducted within more developed countries, which found a higher level of education to be linked to a more positive attitude towards GM foods.<sup>(129)</sup> Therefore, this may indicate that differences exist between developed and developing countries; however more research would need to be done to substantiate this idea.

The 2005 research by Rule and langa linked a higher income to having a more negative attitude towards biotechnology, but did not find a link with gender.<sup>(15)</sup> Differences according to age groups have not previously been reported within SA. This research study did not find a correlation between income, age or gender and a participant's attitude.

In order to fully understand the different aspects regarding the attitude of participants, each question from the attitudes section of the questionnaire is discussed below, together with the results from the FGDs.

## **“GM foods are important for a healthy diet”**

Around two out of five participants were of the opinion that GM foods were important for a diet to be considered healthy. This would imply that according to these participants, GM foods are necessary for a person to be able to have a healthy diet, and that without them, essential dietary components would be lacking. Participants therefore mostly do not agree that GM foods are a necessity for a healthy diet, or that they are an important component of a healthy diet. This may be linked to participants not seeing GM foods as currently being developed specifically for nutritional purposes, and therefore not placing value on GM foods as an essential part of the nutritional component of their diet. In the FGDs, participants focused more on food availability, food production and the potential cost saving of GM foods than on their nutritional benefits when discussing possible reasons for the current development of GM foods. Conversely, participants who are of the opinion that GM foods are important for a healthy diet might be those participants that perceive GM foods as currently being developed for nutritional purposes, which may benefit dietary intake.

Currently, GM foods in SA are grown with the benefit of increased food production and yields, and subsequently also increased food availability and lower food prices. Further research is being conducted on genetically modifying foods to have increased nutrients, such as “Golden Rice”, which has been developed to have a higher vitamin A content to help combat vitamin A deficiency worldwide. There is also further work being done on increasing the nutritional value of staple foods commonly grown in Africa, such as maize meal and sweet potatoes.<sup>(88,130)</sup> As maize meal, a staple food in SA, is currently being modified to increase yields, it may hold more direct benefits for the consumer in the future to know that there are also nutritional benefits.

However, these foods are not yet being grown in SA, and therefore GM foods do not directly contribute to a more nutritional diet at present. Indirectly however, increased physical and economic availability of a staple food such as maize meal may affect the nutritional quality of a consumer’s diet.

**“GM foods are acceptable if they increase the nutrients (vitamins and minerals) in the food”**

The majority of participants (70%) agreed that GM foods could be considered acceptable if they increase the nutritional value of a food product, and this was supported by the results from the FGDs. Participants were of the opinion that within a country such as SA, where nutritional deficiencies are common, using technology to improve the nutritional quality might be beneficial.

Linking to the question above, the fact that consumers appear to be more accepting of GM foods when developed for an increase in their nutritional value indicates that this may be one area that does need to be further developed within SA. GM foods that offer higher nutrients would have more tangible benefits to consumers, and may also increase consumer acceptability of GM foods. It would also make sense from a nutritional point of view, with the high levels of malnutrition and nutritional deficiencies so rife in SA. Specific nutrients to be focused on would be vitamin A, iron and zinc, which are the main nutrients South Africans are often deficient in.<sup>(83,84)</sup>

Previous research conducted by Joubert in 2001 on 1000 South Africans living in metropolitan areas found similar results to this study, where the development of GM foods for nutritional purposes was found to be acceptable by the majority of consumers.<sup>(17)</sup> Interestingly, more highly educated groups were less accepting of GM foods being developed, even when done so for improved nutritional value. Overall, Joubert’s research also found that where participants were given the assurance that the GM food would be healthier and more nutritious than the non-GM food, participants did not alter their response to the acceptability of GM foods. Therefore, when a participant felt it was unacceptable, nutritional benefits did not make the food more acceptable to the participant.<sup>(17)</sup>

**“GM foods are acceptable if they increase crops and food produced, so that we have more food available to eat”**

Slightly more participants either agreed or strongly agreed that GM foods were

acceptable when produced for increased food availability, when compared with the acceptability of GM foods for nutritional purposes.

Overall, the results show that the majority of consumers have an acceptance of GM foods when developed specifically for nutritional purposes or increased food availability. This was strongly linked by participants to SA's increasing population and the drought conditions which SA has been experiencing – all of which were mentioned as concerns that may directly affect food production and food availability. Food insecurity was a major theme in the FGDs, with participants linking increased food production and availability to decreased food insecurity and hunger within SA. These results are supported by previous qualitative research in the North-West province of South Africa by Kempen et al., where participants saw genetic modification as a method to ensure the provision of sufficient food for SA.<sup>(41)</sup>

In this study, higher income groups and those with a higher level of education were more negative towards GM foods being further developed for the purpose of increased food production. It appeared that where a participant was of the opinion that GM foods are unacceptable despite the possibility of increased food availability, that under no circumstances would GM food be acceptable to these participants. This may be owing to the potential risks as perceived by the participants. It was also suggested that perhaps alternative options needed to be explored before genetic modification was used as a way to increase food production, such as increased use of currently available land in SA.

Recently, international food wastage has been under the spotlight, prompting an increase in global action to decrease this. Statistics indicate that there is sufficient food produced for human consumption, but that hunger and food insecurity remain a challenge in many nations, with an estimated one in nine people not having access to sufficient food.<sup>(131)</sup>

Currently it is estimated that up to a third of all food produced for human consumption worldwide is wasted. The Food and Agriculture Organization (FAO) of the WHO have developed a "Save Food" initiative, focusing on reducing food loss and wastage internationally. This is in accordance with other international

frameworks, such as the Millennium Development Goals, Sustainable Development Goals, and the Zero Hunger Challenge – all aimed at alleviating hunger and poverty.<sup>(132)</sup>

Therefore, within SA, it is clear that the consumer is concerned about food insecurity and the need for increased food availability. Therefore it needs to be critically examined whether the development of GM food contributes towards decreasing food insecurity at household level for South Africans, and this information needs to be communicated to the public so that they are informed of the role of GM foods in this process. In addition to this, there should be other strategies to improve food security, including food wastage within the country, given that an estimated one-third of all the food produced in SA is discarded or wasted.<sup>(80)</sup>

**“GM foods are acceptable if they increase the sensory properties of the foods (the food looks better or tastes nicer)”**

When compared with the previous questions in the questionnaire, there was a noticeable drop in the number of participants that agreed with GM foods being acceptable for increased food availability and nutritional value, when compared with the sensory enhancement of foods. Despite this, almost half of the participants in Phase One of the research agreed that the development of GM foods for improved sensory properties, such as looking better or tasting nicer, was acceptable. Higher income groups and those with a higher level of education were more negative towards GM foods being developed for sensory purposes, when compared with other consumer characteristics such as age and gender.

The research conducted in SA by Joubert in 2001 found very similar results, also reporting that almost half of the participants in that particular study would buy GM foods if they tasted better, which is more than double the percentage previously reported in Europe.<sup>(17)</sup> An international study conducted in 2004 by Synovate International in five different countries, found that the majority of South Africans (62%) felt that *“anything that makes food taste better is fine”* – more so than any of the other countries included in the study.<sup>(40)</sup>

It would therefore appear that South Africans value the sensory properties of foods being enhanced through technology more than consumers in other countries, as shown by this and previous research.

### **“Even if GM foods have health benefits, it is still an unnatural process”**

It has been shown in the literature that consumer acceptance of GM foods is associated with the extent to which the consumer perceives GM foods to be “unnatural”.<sup>(133)</sup>

Just over three in every four participants agreed that GM foods were unnatural, despite potential health benefits. The FGDs also had themes on the process of genetic modification being unnatural, and this was further related to participants feeling uncomfortable with the process as a deviation from what nature intended. Therefore, even with potential benefits, there was an element of unease with the technology among participants.

The research by Rule and Ilanga, conducted nationally in SA, supports the idea that consumers feel GM foods are “unnatural” and “artificial”.<sup>(15)</sup> Another South African study found that participants were of the opinion that nature should not be altered, and that instead the technology should be used to further other areas to benefit the public, such as HIV research.<sup>(100)</sup> This could therefore potentially be seen as a barrier to the acceptance of GM foods in SA, and is a topic that should be addressed for consumers to fully understand the technology in relation to nature and food production.

### **“I would buy GM foods above non-GM foods if they are better priced”**

More than half (53,5%) of participants in this research study had a preference for non-GM foods, despite having the option to pay less for the GM product.

When comparing this research with previous research in within SA, one study found very similar results; just over half of participants (53%) would not buy GM food sold at a lower price, while an earlier study found that around one-quarter (27%) would

not buy GM foods sold at a better price. Similarly, 32% of South African participants in another study were found to be willing to pay more for non-GM foods. When compared with other countries, previous research found that South Africans were most likely to buy GM foods if they were better priced.<sup>(15,17,40)</sup>

Given SA's high levels of household food insecurity and unemployment, one would expect the results from SA to differ from those in other countries, as the needs of local consumers would be different from those in a developed country. The FGDs strongly supported the idea that participants would want to have a choice of whether to buy the GM or non-GM option, which participants felt they would no longer have should GM foods be significantly cheaper than non-GM foods. Therefore, although participants conceded that they would buy the cheaper GM option, for some this was not out of choice, but rather owing to increasing food prices in SA.

Food inflation in SA has been following an upward trend, with the Consumer Price Index reporting around 10% increase in a food basket from March 2015 to March 2016. Breads, cereals, fruits and vegetables were among the food items found to contribute the most to an increase in the price of a food basket.<sup>(134)</sup> In addition to this, the continuing drought in the country – reported as the worst in 23 years – means that food prices are set to increase even further in the near future.<sup>(135)</sup> Given the very high unemployment rate in SA, this would further affect the ability of consumers to be able to choose the food products they prefer, as opposed to the cheapest products.

There is considerable international research on consumers' willingness to buy GM foods rather than non-GM foods if they were better priced, but very limited research within SA and other developing nations.<sup>(14)</sup> One of the most important determining factors related to a consumer's decision to purchase GM foods has been found to be a participant's overall attitude towards GM foods and technology.<sup>(136)</sup> Therefore, research needs to be conducted within SA to determine whether purchasing of GM foods is linked to consumer attitudes, or whether it is purely because of a lack of accessibility to the non-GM option.

### **“Information sources participants trust to give them adequate information on genetically modified foods”**

Participants in this study considered scientists, schools/universities and the media to be the most trusted source of information on GM foods. The government and religious organisations were stated to be the sources participants would trust the least. Earlier research in SA by Rule and Ilanga found that participants first trusted universities, then the media, and lastly the government.<sup>(15)</sup>

In addition to this, participants in this research study indicated that they would mostly make use of the Internet and the media (print and television) to obtain information on topics such as GMOs. The FGDs confirmed these sources, and it was further explored in the FGDs which sources the participants believed should be responsible for the dissemination of information to the public.

Overall, participants in this research study were of the opinion that multiple organisations should be responsible for the sharing of information on GMOs – from the government launching campaigns, to its being included in the school curriculum, to non-governmental organisations (NGOs) and independent organisations providing information. Participants further explored the idea that the consumer should also carry the responsibility for educating themselves and those around them. The media emerged quite strongly in various forms – from radio and television to print media. The FGDs also revealed that seed companies should have a social responsibility towards countries producing GM foods, in informing consumers about the technology.

Previous studies have found similar results in SA, with the school curriculum, scientists (nutritionists, biotechnology companies), and different forms of media being the preferred sources of information sharing by consumers.<sup>(15,41,100)</sup>

This information is important in terms of planning with regard to the sharing of information with the public. Programmes designed to increase consumer knowledge should include various sectors and stakeholders to ensure that a wide audience is reached. Any programme designed specifically within SA should also take into

consideration literacy levels, and information should be conveyed in manner that is easily understood by the general public.

#### **4.4 BELIEFS OF CONSUMERS**

Previous research done internationally has shown that consumers' beliefs affect whether they are willing to consider buying GM foods products or not – and that consumers with informed beliefs are not significantly affected by new information about GM foods. On the contrary, those with uninformed beliefs are more susceptible to new information – regardless of whether this information is correct or not.<sup>(127)</sup> Research further suggests that consumers' beliefs about the risks of GM foods influence their behaviour and acceptance of GM foods more than an objective risk assessment, as provided by scientists, would do.<sup>(7)</sup> This therefore supports the idea that beliefs are strongly held opinions, which this research study aimed to explore further to obtain a clearer understanding of the consumer stance towards GM foods. The beliefs section below is discussed according to broad themes that were identified by the researcher.

##### **4.4.1 Consumer Trust In The Government**

Given that the South African government is the major regulator of GM foods within SA, and further supporting its expansion, consumers' trust in the government is an important component of the further expansion and acceptance of GM foods in SA.

Just over half of participants (51%) in this research study either believed or strongly believed that the government would allow the sale of foods that could be harmful to consumers. This therefore indicates a lack of trust by the consumer in the government's ability to provide safe foods to the consumer. This links to a previous question (Section 4.3), where participants rated the government as being among the least trusted sources of information on GM foods.

Previous research conducted in SA also found that the public trust of the government was lower than for other institutions in SA.<sup>(30)</sup> This lack of public trust in the government could be seen as a definite barrier to the acceptance of GM foods, as

consumers may already perceive GM foods as carrying an intrinsic risk, and therefore further lack of trust in the government as the managing body would add to the perception of risk by consumers.

The overwhelming majority of participants from this research study also believed that the public should be consulted before the release of GM foods for sale to the public. This was confirmed by FGDs, where participants were perturbed that they had not been informed about or consulted on GM foods being on the market, despite being the stakeholders most affected by the availability of GM foods.

This therefore indicates that consumers have a strong need to be included in the decision-making process related to GM foods, which perhaps to date has been one of the biggest shortcomings of the introduction of GM foods into the South African market.

It has been highlighted in the South African National Biotechnology Strategy (NBS) that there has been a failure in giving the public sufficient detailed information on GMOs to improve understanding, and that scientists and the media have not always succeeded at relaying information in a comprehensible manner to consumers. Therefore efforts need to be increased to ensure the public are informed and consulted on matters related to GMOs in future.<sup>(137,138)</sup>

#### **4.4.2 Risk Perception and Benefit to Consumer**

Research conducted internationally has found that when GM foods are introduced into a market, adequate consumer safety policies should be developed and communicated to the public to decrease consumer risk perceptions, an important component of consumer acceptance of GM foods.<sup>(57)</sup> Interestingly, the literature has shown that the perceived benefits are more important than the perceived risks to consumers when interrogating their willingness to consume GM food products.<sup>(139)</sup>

In SA, the 2001 NBS highlighted a lack of understanding by the public of the potential risks and benefits, and ethical and environmental issues.<sup>(138)</sup> This strategy was followed by the updated South African Bio-Economy Strategy, which was

launched in 2013.<sup>(13)</sup> This policy again highlighted that the success of biotechnology in SA relies on effective communication with the public on the various aspects relating to biotechnology. The safety of GMOs in SA is further regulated by, amongst others, the GMO Act and the CPA.<sup>(51,55)</sup> Therefore, policies and plans in respect of the regulation and safety of GMOs are being developed and are available in SA; however these need to be communicated with the public, and inconsistencies and loopholes have to be addressed to improve public trust.

The vast majority (96%) of participants in this research believed that the safety of food was more important than food's being cheap, as was confirmed by the results from the questionnaire and the FGDs.

One might expect that within a country such as SA, where household food security and unemployment are high, that participants might favour more affordable products over foods being safe; however, the research does not support that. This indicates that participants place a very high value on the safety of food, and this should therefore be a priority in the development of GM food products and communication with the public. The South African government therefore needs to focus its attention on the fact that consumers are not only interested in having sufficient food at lower prices, but also want full assurance with regard to the safety of their food.

This study and other research conducted by Rule and Ianga (2005) and Synovate International (2004) found that consumers in SA were often more willing to buy GM foods if sold at a better price; however, it would appear that that this would not be at the cost of food safety.<sup>(15,40)</sup>

Participants from this research study were almost exactly split in half on whether the perceived risks of GM foods to them as consumers were low or high. The majority of participants neither strongly agreed nor disagreed with this statement, but rather just agreed or disagreed, indicating that the belief of perceived overall risks might not be as strongly held as for other questions. Previous research conducted in SA also found that consumer risk perceptions of GM foods were not overwhelming high or low, with many participants also indicating that they were uncertain whether GM foods could be considered safe or not.<sup>(15,40,100)</sup>

This may therefore indicate that consumers are either not well informed on the risks and benefits of GM foods, or that their beliefs about the risks and benefits are not as deeply rooted as for other beliefs. With more information made available to the public, this belief may be better informed.

In this study, having a more positive attitude towards GM foods was linked to believing the risks are low, while having a more negative attitude was linked to believing the risks are high, which indicates that attitude is linked to the beliefs about the risk perception in this research study. This further supports the notion that risk perceptions need to be addressed to change the attitudes of consumers towards GM foods.

An exact, equal number of participants were concerned about the long-term health effects, as those concerned about the effects on the environment in this research, and comprised the majority of participants. This number was around 25% more than when examining the overall general risk perception of GM foods, indicating that overall risk perception is less clearly defined for participants when compared with specific health or environmental concerns.

This finding was supported by the FGDs where themes on health and the environment emerged very strongly with participants believing that not enough research had been conducted, or that research that had been conducted was skewed and influenced by corporate funding.

Around a quarter of participants were not concerned about long-term health or environmental risks of GM foods, and this was significantly linked to participants having a more positive attitude towards GM foods. This therefore confirms that in this study, having a more positive overall attitude towards GM foods affects overall risk perception.

The statement on “tampering with nature” implies an interference with the natural course of events in nature. This research study found that the majority of participants were of the opinion that by developing GM foods, nature was being tampered or

interfered with. Concerns about the effect of GM foods on the environment and health have also emerged in previous research studies in SA; they have not been previously quantified, but rather linked to the overall risk perceptions by consumers.<sup>(100,115)</sup> International studies have found health concerns to be the factor consumers are most concerned about regarding GM foods, which has also been found in research conducted within SA by Rule and langa.<sup>(15,57)</sup>

Overall, therefore, this research indicates that consumers want to know that their food is safe; they are concerned about the environment, believe that nature is being tampered with through the development of GM foods, and are concerned about health risks – all of which outweigh the overall risk perceptions that participants have of GM foods. Therefore, when addressing the risk perceptions of consumers, these specific topics should be addressed to ensure that concerns and fears are allayed.

Despite GM foods being developed with the purpose of benefiting the consumer in some way, participants in this research study were of the opinion that the consumer benefited the least from the availability of GM foods. Seed companies and the government were thought to benefit the most from the availability of GM foods.

If consumers are unable to see the personal benefits of GM foods, their support will in effect decline. Therefore, consumer benefits need to be made clear for consumers to believe that GM foods can be advantageous to them in some way, and in turn, increase their acceptance of these foods.

#### **4.4.3 Ethical Concerns**

This research study found that more participants believed that GM foods did not conflict with their principles (56%) than those that believed GM foods did conflict with their principles (44%). The FGDs also revealed that although there were participants that definitely felt that “we are playing God”, or that it was contrary to their religious beliefs, there were also those participants that were not against GMOs in theory, but rather that it would go against their principles if GMOs were found to be harmful to consumers or the environment. Therefore, it appeared that once again the risks and benefits of GM foods played a role in the formation of this belief among participants.

Previous research in SA found a “violation of religious or ethical principles” to be the second most important reason after health concerns for participants’ reservations about GM foods.<sup>(15)</sup> It was also found that South African consumers believe it is “against God’s will”, it is “against religious beliefs”, or “it doesn’t feel right”.<sup>(100,115)</sup> Despite these concerns, a study by Joubert found that only approximately 17% of South Africans were completely against the genetic modification of foods.<sup>(17)</sup>

Therefore it would appear that whereas ethical components are often mentioned in the literature as a major concern among consumers, this research indicates that perhaps ethical concerns are less pronounced than previously thought, or that consumers are not necessarily against GM foods in principle, but that their support for these foods relies on the safety of these foods to the consumer and the environment.

#### **4.5 PRACTICES**

The vast majority of participants were of the opinion that GM foods should be labelled as containing GM ingredients. This was important for consumers to be able to make an informed choice whether they wanted to consume GM food products or not, in accordance with consumer rights in SA. Previous research in SA also found that the majority of consumers believe GM foods should be labelled, but with varying results. The results from this study indicate an overwhelming majority in comparison with some of the earlier research in SA.<sup>(17,40,115)</sup> This may be due to an increased awareness among consumers, as the previous studies are more than a decade old, or it could be due to an increased need for consumers to be informed with regard to the foods they eat in general.

Around four in five participants would not choose GM foods if they had the choice, which further indicates a strong case for adequate labelling of GM foods in SA for the consumer to be able to make an informed choice. The research further indicates that participants with a more negative overall attitude towards GM foods, those with a higher level of knowledge, and those with a higher level of education have a preference for non-GM foods.

It is interesting to note that this research study showed that overall the majority of participants would choose a non-GM food product, but when given the option of paying less for the product, the preference decreased to just more than half of participants. Furthermore, when developing GM foods for benefits such as improved sensory properties, increased food production, and increased nutrients, the acceptability of such foods increased. For this reason, it would appear that where consumers are given very clear benefits, their acceptability increases, which may also affect consumer preference.

Just more than three in four consumers said the only way they would know whether a food was GM or not, was if the packaging or label clearly stated this. Many other participants stated that they would not be able to identify a GM food product, or were unsure whether GM foods looked or tasted different from their non-GM counterparts.

For this reason, consumers rely predominantly on labelling to guide them on whether food products have been genetically modified or not. Despite this, just more than half of participants claim to read food labels to determine whether products have been genetically modified or not. The FGDs revealed that participants often did not know what to look for, or were unsure whether GM products were currently labelled. There was also a sense that because participants overall felt that they were not well informed on the topic, they did not see the value of ascertaining whether a food product was GM or not. Furthermore, the research indicates that attitude affects whether a participant reads food labels or not – having a more positive attitude towards GM foods means a participant is less likely to read food labels to check for GM ingredients.

Earlier research in SA found very similar results to this research study with regard to consumers' reading of food labels, and a relationship was also previously found between their having a more positive attitude towards GM foods in general, and being less likely to read a food label.<sup>(15,40)</sup>

To some degree this is to be expected, as having a more positive attitude in effect means that a participant's risk perception is lower, and therefore the importance of

checking a food label for at-risk ingredients would not be a high priority for that participant.

Food labelling in SA has gone from a voluntary to a legal obligation, despite being heavily contested by industry. It is of concern that despite laws being recently reviewed, many SA companies are still not complying with labelling laws, as loopholes continue to be found. <sup>(21,53–55)</sup>

The major challenges in addressing the labelling situation in SA include a lack of communication by the National Consumer Council (NCC) with all the various stakeholders to determine the barriers to labelling, and ways that loopholes can be eliminated. There is also a major lack of adequate recourse for non-compliance with labelling regulations, despite provision for recourse being in place. If these lacunae are not addressed, it will mean that GM foods will continue to be inadequately labelled, and consumers will not be able to make an informed choice regarding GM foods, despite this constituting their consumer rights. <sup>(55,140)</sup>

**CHAPTER 5**  
**SUMMARY OF FINDINGS, RECOMMENDATIONS, STUDY LIMITATIONS,**  
**FUTURE RESEARCH AND CONCLUSION**

## **5.1 SUMMARY OF FINDINGS**

### **5.1.1 Knowledge**

Most of the participants in this research study indicated that they had heard of GM foods, agreed that GM foods were available in SA, and that they had previously consumed GM foods; however knowledge of specific foods being GM in SA was poor. Participants thought that fruits, vegetables, chickens and eggs were currently genetically modified within SA for public consumption. Further misperceptions were found in respect of what is considered to be a GM food, and the effect of GM foods on the body's DNA. The only consumer characteristic found to affect the knowledge of consumers was their level of education.

### **5.1.2 Attitudes**

The overall attitudes of participants in this study were found to lean towards being slightly more negative than positive. Increased knowledge and education level were linked to a more negative attitude. Participants also appeared to be more accepting of GM foods when produced for nutritional benefit and increased food availability, than when produced for sensory properties. When given the option of buying GM foods at a cheaper price, participants were almost equally split on whether they would still prefer GM foods. Scientists, schools and universities, and the media were the most trusted sources of information on GM food products.

### **5.1.3 Beliefs**

Overall, an interesting finding was that more participants were not opposed in principle to the genetic modification of food, in comparison with those that were opposed to it.

When looking at trust in government, participants believe that the government will allow the sale of unsafe foods. Food safety was found to be a top priority for participants, with the overwhelming majority indicating food safety to be more important to them than food price. Furthermore, there is a strong belief that

consumers should be consulted before GM food products are made available to the public. The overall risk perception of GM foods was equally split between participants; however the risk perception increased somewhat when asked specifically about health and environmental concerns. A more negative attitude towards GM foods in general was correlated to having a higher concern for health and environmental risks. It was further found that consumers believe they benefit the least from GM foods being available, while the government and seed companies are thought to benefit the most.

#### **5.1.4 Practices**

Participants rely predominantly on packaging to guide them in terms of whether a product is genetically modified or not. Despite only around half of the participants indicating that they read food labels, the vast majority felt that GM foods should be labelled as such. Participants with a more negative attitude towards GM foods tended to read food labels. Most participants show a preference for non-GM foods, and this is further linked to having a more negative attitude, a higher knowledge score, and a higher level of education.

## **5.2 RECOMMENDATIONS TO DIFFERENT STAKEHOLDERS**

Following the results of this research study, recommendations to the various stakeholders have been identified.

### **5.2.1 Recommendations to empower consumer decision making**

- The media should be encouraged to provide consumers with scientifically sound, well-researched information, which can be easily understood by the general public, in order to increase consumer awareness.
- All the various stakeholders involved in the development and distribution of GM foods should realise their responsibility towards the consumer in terms of funding unbiased, scientifically sound research and making these results available to the public.

- Consumer education is central to improving knowledge, and addressing concerns and fears that may negatively affect consumers' attitudes, beliefs and practices is imperative.
- Information provided should include both the positive and negative effects of GM foods to allow consumers to make educated decisions regarding these foods.
- Labelling of GM foods is an important component in empowering the consumer, but this has to be paired with relevant educational activities. A few examples of this include:
  - Implementing consumer education on GM foods at school level as part of the curriculum.
  - Designing and implementing consumer education campaigns that may include various forms of media, for example, radio, television, print media and social media. This should be rolled out at all levels of society. Where access to media may be limited, campaigns should be launched at community level in the form of, for example, information sessions at community centres, sporting events, and churches. These need to be assessed in terms of efficacy, by including clear targets measured before, during and after the consumer education campaigns.
  - Making use of clinics and other governmental institutions to provide consumers with information, either through written or oral communication.
  - Having information available at the various points of sale of GM foods.
- Consumers need to be made aware of recourse available, should GM foods not be labelled as per labelling laws.

### **5.2.2 Recommendations to government and policy makers**

- Greater emphasis needs to be placed on developing programmes to ensure adequate communication with the public, together with well-designed educational programmes. These need to have a monitoring component to measure effectiveness over time.

- More large scale, well-designed research should be conducted within SA to ensure monitoring of South African consumers' knowledge, attitudes, beliefs and practices over time, to ensure that effective communication and educational strategies can be developed.
- Research within SA to date indicates that consumers are in favour of GM foods being clearly labelled, and therefore every effort needs to be made to ensure that labelling regulations are adequately enforced, with adequate recourse where regulations are not implemented. These need to be clearly outlined within a policy, and should include a fine or imprisonment after investigation by an inspector, as directed by the NCC.
- Biotechnological programmes developed within SA should have a clear consumer component in terms of ensuring that consumers remain informed of any such activities, especially as they relate to GM foods.
- The media should be provided with any information relating to GM foods within SA to provide information to consumers on such activities. Any new developments within the field of GMOs in SA should regularly be released in official media statements, in order to update the consumer.
- The South African public should be consulted on any further decisions relating to GM foods, which will only be meaningful and possible with increased consumer education and awareness.

### **5.2.3 Recommendations to grocery stores**

- Stores should make every effort to ensure that all employees are educated on what GM foods are, as well as their availability within a store, in order for employees to assist consumers with any questions that they might have.
- Grocery stores should make information available to consumers on whether food products within their store are GM.
- Where possible, grocery stores should include information on GM foods within store catalogues and on websites to increase consumer awareness.
- Where possible, non-GM options should be made available to those consumers that prefer these, to ensure that consumers have a choice when it comes to GM foods.

#### **5.2.4 Recommendations to seed companies developing GM seeds**

- It is essential for seed companies to make funding available for unbiased research on GM foods. This could be done by their funding research done not only by the company, but also by independent researchers. More specifically, the long-term effects of GM foods on human health and the environment need further research.
- In countries where GM foods are available, such as SA, seed companies should be involved in consumer education by assisting government and other organisations, such as NGOs to educate the public. This could be done through funding, or assisting with programme development. Therefore, collaboration is of utmost importance to avoid the dissemination of biased information.
- Seed companies should make all their research, which should be conducted by independent bodies, available to the public to ensure that the public can make their own informed decisions on GM foods.

#### **5.3 LIMITATIONS OF STUDY**

Limitations of this research study were identified and need to be taken into consideration when interpreting the results of this study.

- Participants in the FGDs were sampled using various methods, including social media and snowballing. This may have led to parts of the consumer population being excluded, as can be seen from the demographic information of the participants. The majority had completed tertiary education (75%), indicating that for this study, more highly educated participants responded.
- Although isiXhosa forms and questionnaires were available, participants in this research study opted predominantly for Afrikaans or English. This was most likely linked to the specific areas included in the research study, or because most people in SA are comfortable with using a second language. However, considering that isiXhosa is one of the major languages spoken within the Western Cape, this may be seen as a limitation.

- Given that the research for this study took place at grocery stores, on occasion the researcher and RA felt rushed in completing the questionnaire when a consumer felt that it was too time-consuming.
- The questionnaire included questions that were asked both in a positive and negative light; however, this may still have affected the response of participants.
- The question in the beliefs section which states: “I believe the risk of GM foods to me as a consumer is low”, was sometimes found to be confusing to participants. Despite the questionnaire’s being piloted, it was found that on occasion, participants were unsure whether they needed to agree or disagree in order to state their opinion. Therefore, the researcher and RA at times had to spend more time clarifying this question to participants. Nevertheless, this may still have affected the results of this specific question.

#### **5.4 FUTURE RESEARCH RECOMMENDATIONS**

- There is a need for more published research on consumer perspectives of GM foods within SA. Well-designed studies should be planned to include all the various socio-economic groups within SA.
- More large-scale research studies are needed on the knowledge, attitudes, beliefs and practices of the consumer in SA regarding GM foods. Results of these have to be critically assessed in order to give clear recommendations to various stakeholders.
- Qualitative research is lacking on consumer perspectives of GM foods within SA and therefore more large-scale research on this topic should be conducted. Research should be planned to include all the various socio-economic groups within SA.
- Further research is needed into the most effective way to disseminate information to consumers on GM foods, in order to educate the public. An example is identifying the types of media that would be most effective. It also needs to be determined what type of information would empower the consumer to make an informed decision – for example, information on the risks and benefits, information on what GM foods are, and information relating

to beliefs, amongst others. Therefore, information provided needs to be specifically planned according to research that is currently lacking in SA.

- There also needs to be research into the best way to indicate that a product is GM in SA to ensure that more consumers understand the information provided on the food label – for example by means of a logo, a phrase or a barcode, amongst others. This would be in accordance with the CPA and the right of the consumer to know.
- Concerns among consumers on the risks of GM foods to consumer health and the environment reveal the need for further research to be conducted to determine the long-term effects of GM foods, and this information needs to be made available to the consumer.

## **5.5 CONCLUSION**

This research study supports that of earlier research conducted within SA, in that consumers are generally uninformed when it comes to GM foods, with low levels of knowledge and understanding of the topic. Therefore, campaigns to improve consumer awareness within SA need to be developed, and this should be coupled with well-designed research to monitor effectiveness. Long-term research on GM foods and their impact on consumer health and the environment needs to be conducted, and the information made available to the public, as concerns about these were evident in this research study. The media should collaborate with the scientific community to provide the public with scientific information in a manner that is understandable to the various consumers in SA. Government, the media, the food industry, independent organisations and seed companies should all collaborate to ensure that the consumer is empowered to make an informed decision when it comes to GM foods. Labelling regulations and compliance are of utmost importance, and these therefore to be finalised and implemented in SA as a central component of consumers' ability to make informed choices regarding GM foods.

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## **ADDENDA**

## ADDENDUM A: HUMAN RESEARCH COMMITTEE ETHICS APPROVAL LETTER



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### Approval Notice New Application

08-Jun-2015  
Naude, Kari K

**Ethics Reference #:** S15/05/114

**Title:** **Determining the knowledge, attitudes, beliefs and practices of the adult consumer in the City of Cape Town in the Western Cape regarding the inclusion of genetically modified foods in the diet.**

Dear Ms Kari Naude,

The **New Application** received on **13-May-2015**, was reviewed by members of **Health Research Ethics Committee 1** via Expedited review procedures on **08-Jun-2015** and was approved.

Please note the following information about your approved research protocol:

Protocol Approval Period: **08-Jun-2015 -08-Jun-2016**

Please remember to use your **protocol number (S15/05/114)** on any documents or correspondence with the HREC concerning your research protocol.

Please note that the HREC has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

#### **After Ethical Review:**

Please note a template of the progress report is obtainable on [www.sun.ac.za/rds](http://www.sun.ac.za/rds) and should be submitted to the Committee before the year has expired. The Committee will then consider the continuation of the project for a further year (if necessary). Annually a number of projects may be selected randomly for an external audit.

Translation of the consent document to the language applicable to the study participants should be submitted.

Federal Wide Assurance Number: 00001372  
Institutional Review Board (IRB) Number: IRB0005239

The Health Research Ethics Committee complies with the SA National Health Act No.61 2003 as it pertains to health research and the United States Code of Federal Regulations Title 45 Part 46. This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South African Medical Research Council Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes 2004 (Department of Health).

#### **Provincial and City of Cape Town Approval**

Please note that for research at a primary or secondary healthcare facility permission must still be obtained from the relevant authorities (Western Cape Department of Health and/or City Health) to conduct the research as stated in the protocol. Contact persons are Ms Claudette Abrahams at Western Cape Department of Health ([healthres@pgwc.gov.za](mailto:healthres@pgwc.gov.za) Tel: +27 21 483 9907) and Dr Helene Visser at City Health ([Helene.Visser@capetown.gov.za](mailto:Helene.Visser@capetown.gov.za) Tel: +27 21 400 3981). Research that will be conducted at any tertiary academic institution requires approval from the relevant hospital manager. Ethics approval is required BEFORE approval can be obtained from these health authorities.

We wish you the best as you conduct your research.

For standard HREC forms and documents please visit: [www.sun.ac.za/rds](http://www.sun.ac.za/rds)

If you have any questions or need further assistance, please contact the HREC office at 0219399657.

**ADDENDUM B: RESEARCHER-ADMINISTERED QUESTIONNAIRE****SCREENING QUESTIONNAIRE**

CODE: \_\_\_\_\_

	YES	NO
1. Are you the main grocery shopper of the household (i.e. do you shop for at least 50% of the food in the household)?		
2. Are you a South African citizen		
3. Are you 18 years of age or older?		
4. Did you NOT participate in the pilot study?		
5. Are you fluent in English, Afrikaans or isiXhosa? (Please specify)		
English		
Afrikaans		
isiXhosa		

***If participant responded “yes” to all 5 questions, continue to questionnaire.  
If participant answered “no” to any of the questions, please thank the participant for their time, and explain that they do not meet the inclusion criteria for this study.***

**DATA COLLECTION TOOL: PHASE ONE QUESTIONNAIRE****SECTION A: DEMOGRAPHIC INFORMATION**

1. Please state your current age: \_\_\_\_\_ years
2. Please indicate your gender: MALE / FEMALE
3. Please indicated the highest level of education you have successfully completed:

None	Primary (Grade 7)	Secondary (Grade 12)
Diploma	3 or 4-year degree	Postgraduate

4. Please indicate your current employment status:

Unemployed	Full time employee	Part-time Employee
Homemaker	Self-employed	Retired
Student		

Other (please indicate ) \_\_\_\_\_

- 5. Indicate total monthly income by choosing one of the following options:  
(This is purely for statistical purposes, and will remain confidential.)**

R1 – R5000	R5001 – R10 000	R10 001 – R20 000
>R20 001	Do not want to answer	

- 6. How many people, including yourself, do you buy groceries for?  
(Indicate just the number.)**

\_\_\_\_\_

- 7. Have you heard of the terms “genetic modification” or “genetically modified organism” before?**

**YES / NO**

***Give all participants a definition as per definition list to ensure standardisation.***

### **SECTION B: KNOWLEDGE**

**Please indicate for the below statements: TRUE, FALSE, OR DON'T KNOW**

	True	False	Don't know
1. By looking at a food, one can see whether it is genetically modified or not.			
2. Eating foods that are genetically modified could change your body's DNA/genetic material.			
3. Genetically modified foods are available in South Africa.			
4. The following genetically modified foods are available in South Africa:			
4.1 No foods are genetically modified			
4.2 Fruit			
4.3 Vegetables			
4.4 Maize/Corn			
4.5 Soya			
4.6 Chicken			
4.7 Eggs			

**SECTION C: ATTITUDES****1. Genetically modified (GM) foods are important for a healthy diet**

Strongly Disagree	Disagree	Agree	Strongly Agree
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**2. GM foods are acceptable if they increase the nutrients (vitamins/minerals) in the foods**

Strongly Disagree	Disagree	Agree	Strongly Agree
-------------------	----------	-------	----------------

**3. GM foods are acceptable if they increase the sensory properties of the foods (they look better, taste nicer)**

Strongly Disagree	Disagree	Agree	Strongly Agree
-------------------	----------	-------	----------------

**4. GM foods are acceptable if they increase crops and food produced, so that we have more food available to eat**

Strongly Disagree	Disagree	Agree	Strongly Agree
-------------------	----------	-------	----------------

**5. Even if GM foods have health benefits, it is still an unnatural process**

Strongly Disagree	Disagree	Agree	Strongly Agree
-------------------	----------	-------	----------------

**6. Which sources do you trust will give you adequate information about GM foods? (Please tick all that apply.)**

6.1 Government	6.2 Scientists	6.3 Media (television, radio, newspapers, magazines)
6.4 Religious organisations	6.5 Schools/University	6.6 Non-Governmental Organisations

6.7 Other (Please indicate) \_\_\_\_\_

**7. I would buy GM foods above non-GM foods, if they were better priced**

Strongly Disagree	Disagree	Agree	Strongly Agree
-------------------	----------	-------	----------------

**SECTION D: BELIEFS**

**1. I believe the government will not allow the sale of foods which could be harmful to consumers in any way.**

Strongly Disagree	Disagree	Agree	Strongly Agree
-------------------	----------	-------	----------------

**2. Food safety is more important than food price.**

Strongly Disagree	Disagree	Agree	Strongly Agree
-------------------	----------	-------	----------------

**3. I believe the risks of GM foods to me as a consumer are low.**

Strongly Disagree	Disagree	Agree	Strongly Agree
-------------------	----------	-------	----------------

**4. GM foods go against my principles.**

Strongly Disagree	Disagree	Agree	Strongly Agree
-------------------	----------	-------	----------------

**5. By developing GM foods, we are tampering with nature.**

Strongly Disagree	Disagree	Agree	Strongly Agree
-------------------	----------	-------	----------------

**6. I am concerned about the long-term health effects of GM foods.**

Strongly Disagree	Disagree	Agree	Strongly Agree
-------------------	----------	-------	----------------

**7. I am concerned about the long-term effect of GM foods on the environment.**

Strongly Disagree	Disagree	Agree	Strongly Agree
-------------------	----------	-------	----------------

**8. The government and other relevant organisations should consult with the public before releasing GM foods to be sold.**

Strongly Disagree	Disagree	Agree	Strongly Agree
-------------------	----------	-------	----------------

**9. Who do you believe benefits from GM foods in the food system (please select all that apply).**

9.1 The government	9.2 Farmers	9.3 Consumers	9.4 Seed Companies
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### **SECTION E: LABELLING**

**1. As a consumer, I have the right to know that I am eating GM foods, and therefore it should be clearly labelled on the packaging.**

Strongly Disagree	Disagree	Agree	Strongly Agree
-------------------	----------	-------	----------------

### **SECTION F: PRACTICES**

**1. When I buy foods, I read the label to see whether any genetically modified ingredients have been used.**

Strongly Disagree	Disagree	Agree	Strongly Agree
-------------------	----------	-------	----------------

**2. As far as I know I have eaten GM foods before.**

Strongly Disagree	Disagree	Agree	Strongly Agree
-------------------	----------	-------	----------------

**3. I receive most of my information about issues like genetic modification from:**

3.1 Internet	3.2 Newspaper/Magazine	3.3 Television
3.4 Radio stations	3.5 Friends/Family	3.6 School/University

**4. If there is a GM option available, I would choose that above the non-GM option.**

Strongly Disagree	Disagree	Agree	Strongly Agree
-------------------	----------	-------	----------------

**How would you determine if a product you are buying has GM ingredients?**

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## **ADDENDUM C: PARTICIPANT DEFINITION LIST**

### **GENETIC MODIFICATION**

The DNA or genetic information of something (such as food) is changed. This is done to give the new product specific characteristics, which are not found in the original organism. For example, scientists may change the genetic information of a certain food so that it can grow easily in areas that are dry, where it normally would not be able to, thereby making it easier to grow food in even dry areas.

### **GENETICALLY MODIFIED FOOD**

The genetic information of foods is changed so that we have a food product that has properties different from those of the original food. Examples would be:

- Increasing the vitamins and minerals in a certain food.
- Changing certain aspects to make it possible to grow foods throughout the year instead of just during certain seasons.

## **ADDENDUM D: DISCUSSION GUIDE FOR FGDs**

### **ENGLISH QUESTIONS**

1. Would you buy GM foods and why, or why not?
2. Why do you think GM foods are being developed? [Health, food shortage, farming, poverty, price, nutrition]
3. Specifically in a developing country such as South Africa, do you think GM foods can be beneficial? Why or why not? [Health, poverty, nutritional quality, developing country, price]
4. What concerns, if any, do you have about the long-term effects of GM foods? [Long Term, short term, disease, allergies, consumers, environment]
5. Do you think there is any control over the way GM foods are grown, marketed and then made available to general consumers in South Africa? [Laws, regulations, government, NGOs]
6. How do you feel about products containing GM ingredients being labelled as such? [Right to know, consumer protection act]
7. Do you think there is a need for more information about GM foods to be made available to consumers? [Informed decision making, knowledge of what they are purchasing]
8. How should the consumer be given this information about GM foods? [TV, radio, community engagement, leaflets, schools, religious organisations]
9. What concerns do you have regarding GM foods in terms of ethics, or your moral values and beliefs? [Religion, tampering with nature]

## **VRAE IN AFRIKAANS**

1. Sou jy GM kosse koop en hoekom, of hoekom nie?
2. Hoekom dink jy word GM kosse ontwikkel? [gesondheid, voedsel te kort, boere, armoede, voedingswaarde]
3. Spesifiek in 'n ontwikkelende land soos Suid-Afrika, dink jy GM kosse kan voordele he? Hoekom? Hoekom nie? [gesondheid, armoede, nutrisionelewaarde, ontwikkelde land, prys]
4. Wat se bekommernis, indien enige, het jy oor die langtermyn effek van GM kosse? [langtermyn, korttermyn, siekte, allergiee, verbruikers, omgewing]
5. Dink jy daar is enige beheer oor hoe GM kosse gegroei en bemark word, as ook die beskikbaarheid aan die algemene verbruiker? [wetgewing, regulasies, regering, nie-regering's organisasies]
6. Hoe voel jy daaroor dat produkte wat GM bestandele bevat so geetiketeer moet word om die verpakking? [reg om te weet, "consumer protection act"]
7. Dink jy dit is nodig vir meer informasie oor GM kosse om beskikbaar gemaak te word aan verbruikers? [Ingeligte besluit, kennis oor wat hulle koop]
8. Hoe behoort verbruikers hierdie informasie gegee te word? [tv, radio, gemeenskapsgesprekke, informasieblaadjies, skole, godsdienstige organisasies]
9. Wat se bekommernisse het jy oor GM kosse in terme van etiek, of jou morele waardes en oortuigings? [godsdien, meng in met die natuur]

## **ADDENDUM E: INFORMED CONSENT FORMS**

### **ENGLISH INFORMED CONSENT FORM: QUESTIONNAIRE**

#### **TITLE OF THE RESEARCH PROJECT:**

Determining the knowledge, attitude, beliefs and practices of the adult consumer in the City of Cape Town in the Western Cape regarding the inclusion of genetically modified foods in the diet.

**REFERENCE NUMBER: S15/05/114**

**PRINCIPAL INVESTIGATOR: Kari Naude**

#### **ADDRESS:**

**Department of Human Nutrition, Tygerberg Campus  
Stellenbosch University, Cape Town**

**CONTACT NUMBER: 0720144839**

You are being invited to take part in a research project. Please take some time to read the information presented here, which will explain the details of this project. Please ask the researcher any questions about any part of this project that you do not fully understand. It is very important that you are fully satisfied that you clearly understand what this research entails and how you could be involved. Also, your participation is **entirely voluntary** and you are free to decline to participate. If you say no, this will not affect you negatively in any way whatsoever. You are also free to withdraw from the study at any point, even if you do agree to take part.

This study has been approved by the **Health Research Ethics Committee at Stellenbosch University** and will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, South African Guidelines for Good Clinical Practice and the Medical Research Council (MRC) Ethical Guidelines for Research.

### **What is this research study all about?**

- *This is a study, which will be conducted in the City of Cape Town to determine the knowledge, attitudes, beliefs, and practices of the general consumer relating to the inclusion of genetically modified organisms in the diet .*
- *The study is being conducted at four major shopping centres across the City of Cape Town, where a total of 200 participants will be selected to participate.*
- *This research project is being done to gather information around consumers and genetically modified foods. This information could help the government and other organisations to determine how the general consumers feel and what they know about genetically modified foods, so that they can be included in the process.*
- *Data will be collected by means of a questionnaire, which will be completed with you, by a fieldworker. The questionnaire is a total of 4 pages and should not take longer than 10 minutes. The questionnaire is available in English, Afrikaans and Xhosa, and you are therefore encouraged to answer the questions in the language with which you are most comfortable.*
- *The supermarket we are at today was randomly selected we are approaching all adults exiting the supermarket during the research times.*

### **Why have you been invited to participate?**

- *The researchers are conducting this study on the general consumer, and therefore chose supermarkets as the best place to obtain our sample. As the primary food shopper of your household, you were selected to participate.*

### **What will your responsibilities be?**

- *A fieldworker will complete the questionnaire with you, which you are requested to answer to the best of your ability.*

### **Will you benefit from taking part in this research?**

- *There are no direct benefits related to you participating in this study. However, the information obtained from this study may be used for future programme development and planning by various organizations in South Africa.*

### **Are there in risks involved in your taking part in this research?**

- *There are no risks involved in your participation in this study.*

### **If you do not agree to take part, what alternatives do you have?**

You may refuse to participate in this study, at the beginning, or at any point during the study. If you do not wish to participate, you will not be discriminated against in any way.

### **Who will have access to your records?**

- *All questionnaires are completed anonymously and assigned individual codes – so your name will not appear anywhere on the actual questionnaire. Once all the questionnaires have been completed, the researcher will enter the data onto a secure database, ensuring confidentiality throughout. Questionnaires will be securely stored.*
- *Should you indicate that you are interested in participating in the focus group discussion, your details will be stored on a separate form, which will be accessed by only the researcher in order to contact you for the focus group discussion. This information will also be securely stored, and discarded of in an appropriate manner once the focus group discussion has taken place.*

### **What will happen in the unlikely event of some form injury occurring as a direct result of your taking part in this research study?**

- *As this research will be conducted in the form of a questionnaire, no injuries are anticipated.*

### **Will you be paid to take part in this study and are there any costs involved?**

No, you will not be paid to participate in the study and there are no costs involved to you as the participant. As compensation for your time, you will be offered a complimentary gift.

### **Is there anything else that you should know or do?**

- You can contact the Health Research Ethics Committee at 021-938 9207 if you have any concerns or complaints that have not been adequately addressed.
- You will receive a copy of this information and consent form for your own records.

### **Declaration by participant**

By signing below, I ..... agree to take part in a research study entitled “Determining the knowledge, attitude, beliefs and practices of the general adult consumer in the City of Cape Town in the Western Cape regarding the inclusion of Genetically Modified Foods in the diet.”

I declare that:

- I have read or had read to me this information and consent form and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is **voluntary** and I have not been pressurised to take part.
- I may choose to leave the study at any time and will not be penalised or prejudiced in any way.

- I may be asked to leave the study before it has finished, if the study doctor or researcher feels it is in my best interests, or if I do not follow the study plan, as agreed to.

Signed at (*place*) ..... on (*date*) .....  
2015.

.....  
**Signature of participant**

.....  
**Signature of witness**

**Declaration by investigator**

I (*name*) ..... declare that:

- I explained the information in this document to  
.....
- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above
- I did/did not use a interpreter. (*If a interpreter is used then the interpreter must sign the declaration below.*)

Signed at (*place*) ..... on (*date*) .....  
2015.

.....  
**Signature of investigator**

.....  
**Signature of witness**

**Declaration by interpreter**

I (*name*) ..... declare that:

- I assisted the investigator (*name*) ..... to explain the information in this document to (*name of participant*) ..... using the language medium of Afrikaans/Xhosa.
- We encouraged him/her to ask questions and took adequate time to answer them.
- I conveyed a factually correct version of what was related to me.
- I am satisfied that the participant fully understands the content of this informed consent document and has had all his/her question satisfactorily answered.

Signed at (*place*) ..... on (*date*)  
.....

.....  
**Signature of interpreter**

.....  
**Signature of witness**

## **ENGLISH INFORMED CONSENT FORM: FOCUS GROUP DISCUSSION**

### **TITLE OF THE RESEARCH PROJECT:**

Determining the knowledge, attitude, beliefs and practices of the general adult consumer in the City of Cape Town in the Western Cape regarding the inclusion of Genetically Modified Foods in the diet.

**REFERENCE NUMBER: S15/05/114**

**PRINCIPAL INVESTIGATOR: Kari Naude**

### **ADDRESS:**

**Department of Human Nutrition, Tygerberg Campus  
Stellenbosch University, Cape Town**

**CONTACT NUMBER: 0720144839**

You are being invited to take part in a research project. Please take some time to read the information presented here, which will explain the details of this project. Please ask the study staff any questions about any part of this project that you do not fully understand. It is very important that you are fully satisfied that you clearly understand what this research entails and how you could be involved. Also, your participation is **entirely voluntary** and you are free to decline to participate. If you say no, this will not affect you negatively in any way whatsoever. You are also free to withdraw from the study at any point, even if you do agree to take part.

This study has been approved by the **Health Research Ethics Committee at Stellenbosch University** and will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, South African Guidelines for Good Clinical Practice and the Medical Research Council (MRC) Ethical Guidelines for Research.

### **What is this research study all about?**

- *This is a study, which will be conducted in the City of Cape Town to determine the knowledge, attitudes, beliefs, and practices of consumers relating to the inclusion of genetically modified foods as part of their diets.*
- *The study is being conducted at various locations throughout the City of Cape Town, where a total of four group discussions are being held. All participants were selected based on their willingness to participate.*
- *This research project is being done to get information around consumers and genetically modified foods. This information may help various organizations and stakeholders to see how consumers feel, and what they know about genetically modified foods, so that they can make good decisions based on this.*
- *Data will be collected by means of a group discussion, which will be led by the researcher. The discussion should not take longer than 60minutes, and will be conducted in the pre-determined language of English or Afrikaans.*
- *Your selection for this focus group discussion was based on you volunteering to participate in the discussion, and the location was selected based on centrality and ease of access for all participants.*

### **Why have you been invited to participate?**

- *The researchers are conducting this study on the general consumer, and therefore chose individuals from across the City of Cape Town to participate. For this focus group discussion, participants volunteered to take part.*

### **What will your responsibilities be?**

- *This discussion will be for a total of 60minutes, in which you are requested to answer any questions, and to add your opinion to the topic being discussed. Please adhere to the ground rules, as given by the researcher, so as to ensure that the discussion is meaningful and that everyone has an opportunity to give their opinion.*

### **Will you benefit from taking part in this research?**

- *There are no direct benefits related to you participating in this study. However, the information obtained from this study may assist with future programme development and planning by various organizations in South Africa. All participants will also be offered a R100 food voucher to compensate for any convenience and travel costs.*

### **Are there in risks involved in your taking part in this research?**

- *There are no risks involved in your participation in this study.*

### **If you do not agree to take part, what alternatives do you have?**

You may refuse to participate in this study, at the beginning, or at any point during the study. If you do not wish to participate, you will not be discriminated against in any way.

### **Who will have access to your records?**

- *This focus group discussion will be recorded by means of a voice recorder. The recorded information will be typed onto a computer in order for the researcher to analyse the results. Once all the information has been described, the tapes will be safely stored in a secure location until the study has been completed, after which they will be destroyed.*
- *Please note that all participants will be given a unique letter to identify themselves before speaking, which will allow for you to remain anonymous throughout.*

### **What will happen in the unlikely event of some form injury occurring as a direct result of your taking part in this research study?**

- *As this research will be conducted in the form of a discussion, no injuries are anticipated.*

### **Will you be paid to take part in this study and are there any costs involved?**

No, you will not be paid to participate in the study, however a R100 food voucher will be offered to every participant to compensate for any inconvenience and travel costs incurred. The costs for the study participant will only be the travel costs to the venue on the day of the study, as well as the participant's time.

### **Is there any thing else that you should know or do?**

- You can contact the Health Research Ethics Committee at 021-938 9207 if you have any concerns or complaints that have not been adequately addressed.
- You will receive a copy of this information and consent form for your own records.

### **Declaration by participant**

By signing below, I ..... agree to take part in a research study entitled "Determining the knowledge, attitude, beliefs and practices of the adult consumer in the City of Cape Town in the Western Cape regarding the inclusion of genetically modified foods in the diet."

I declare that:

- I have read or had read to me this information and consent form and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is **voluntary** and I have not been pressurised to take part.
- I may choose to leave the study at any time and will not be penalised or prejudiced in any way.

- I may be asked to leave the study before it has finished, if the study doctor or researcher feels it is in my best interests, or if I do not follow the study plan, as agreed to.

Signed at (*place*) ..... on (*date*) .....  
2015.

.....  
**Signature of participant**

.....  
**Signature of witness**

**Declaration by investigator**

I (*name*) ..... declare that:

- I explained the information in this document to .....
- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above
- I did/did not use a interpreter. (*If a interpreter is used then the interpreter must sign the declaration below.*)

Signed at (*place*) ..... on (*date*) .....  
2015.

.....  
**Signature of investigator**

.....  
**Signature of witness**

### Declaration by interpreter

I (*name*) ..... declare that:

- I assisted the investigator (*name*) ..... to explain the information in this document to (*name of participant*) ..... using the language medium of Afrikaans/Xhosa.
- We encouraged him/her to ask questions and took adequate time to answer them.
- I conveyed a factually correct version of what was related to me.
- I am satisfied that the participant fully understands the content of this informed consent document and has had all his/her question satisfactorily answered.

Signed at (*place*) ..... on (*date*)  
.....

.....

.....

.....

**Signature of interpreter**

**Signature of witness**

### Declaration by participant: Voice Recording

By signing below, I ..... agree to take part in a research study entitled "Determining the knowledge, attitude, beliefs and practices of the adult consumer in the City of Cape Town in the Western Cape regarding the inclusion of genetically modified foods in the diet" and **agree to the researcher recording the conversation by means of a voice recorder.**

I declare that:

- I have read or had read to me this information and consent form and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is **voluntary** and I have not been pressurised to take part.
- I may choose to leave the study at any time and will not be penalised or prejudiced in any way.
- I may be asked to leave the study before it has finished, if the study doctor or researcher feels it is in my best interests, or if I do not follow the study plan, as agreed to.

Signed at (*place*) ..... on (*date*) .....  
2015.

.....

**Signature of participant**

.....

**Signature of witness**

**Declaration by investigator**

I (*name*) ..... declare that:

- I explained the information in this document to  
.....
- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above

- I did/did not use a interpreter. *(If a interpreter is used then the interpreter must sign the declaration below.*

Signed at (*place*) ..... on (*date*) .....  
2015.

.....  
**Signature of investigator**

.....  
**Signature of witness**

## **ADDENDUM F: SOCIAL MEDIA ADVERTISEMENT**

Hi Everyone! For those who missed it – I am in the process of conducting focus-group discussions around the City of Cape Town on genetically modified foods for my master's. You do not have to know anything about the topic, or be a specific age or gender.

If you, or anyone you know would be willing to take part in a one-hour discussion at various locations around Cape Town, please get hold of me on Facebook, or via email: [knaude@yahoo.co.uk](mailto:knaude@yahoo.co.uk)

Thank you!

## **ADDENDUM G: DEMOGRAPHIC FORM (FOCUS GROUP DISCUSSIONS)**

### **DEMOGRAPHIC INFORMATION**

Gender:

---

Age in years:

---

Highest level of education completed:

---

Residential area:

---

## **ADDENDUM H: GROUND RULES OF FGDS AND INTRODUCTORY INFORMATION**

### **1. Welcome and informed consent**

Welcome all participants

Introduce all members of the research team, as well as the role of each person

Explain the purpose of the day, the purpose of the focus group discussion and what will be discussed

Explain the purpose of the voice recorder

Explain how anonymity will be ensured, by using individualized letters

Explain the informed consent form in detail to every participant, and ask each person to sign the consent form, as well as the part indicating whether they consent to the conversation being recorded.

Every participant will be given a copy of the informed consent form for personal record keeping.

Ask the assistant to collect the informed consent forms – and to check each one for completeness

### **2. Ground rules**

Explain to all participants that there are ground rules, which need to be adhered to throughout.

- The researcher will ask the group a question, which can be answered by any one in the group. Every time before speaking, please begin by stating your unique letter that has been assigned to you.
- One person is to talk at a time
- Please speak loudly, and clearly and give your opinion
- Please allow everyone the opportunity to participate in the conversation
- There is no right or wrong answer, all opinions are welcome and none will be judged, or spoken of outside of the discussion
- Please switch off all cellular telephones
- The focus group discussion will be 60 minutes in duration

### **3. Ask whether there are any questions before the discussion begins**

#### **Introduction ENGLISH**

Genetically modified foods are foods that have been developed through plants that have been genetically modified, meaning that their genetic material has been changed in such a way that does not occur naturally. This occurs in a laboratory and at a DNA level, where they will change the genetic material of the organism, for example by introducing a gene from another organism so that the plant can grow in an area where it would not normally be able to grow.

Genetically modified crops have been grown in South Africa since 1997, and we are the 8<sup>th</sup> largest producer of GM crops – namely our maize, cotton and soya beans.

South Africa is one of only 3 countries in Africa producing GM crops for commercial use, and the only country in the world to genetically modify one of its staple foods, namely maize meal.

#### **Possible probes questions:**

- Can you talk more about that?
- Help me understand what you mean?
- Can you give me an example?
- Let's have some other participant's opinions

#### **Inleiding AFRIKAANS**

Geneties gemodifiseerde kosse is kos wat deur plante wat geneties gemodifiseerde is ontwikkel word. Dit beteken dat hulle genetiese materiaal verander op so 'n manier wat nie natuurlik voorkom in die organisme/kos nie.

Dit gebeur in 'n laboratorium op 'n DNA-vlak, waar wetenskaplikes die genetiese materiaal van die organisme verander, byvoorbeeld deur om 'n geen van 'n ander organisme by te oorspronklike DNA te voeg, so dat die plant kan groei in 'n gebied waar dit nie normaalweg in staat sou wees om te groei nie.

Geneties gemodifiseerde kos is seder 1997 in Suid-Afrika beskikbaar, en ons is die 8ste grootste produsent van GM-kosse. Ons mielies, katoen en sojabone word geneties gemodifiseerd. Suid-Afrika is een van slegs 3 lande in Afrika wat GM-kosse vervaardig vir kommersiële gebruik, en die enigste land ter wêreld wat een van die land se stapelvoedsel, naamlik meliemeel, geneties verander.

**Moontlike ondersoek vrae:**

- Kan jy meer daaroor gesels?
- Help my om te verstaan wat jy daarmee bedoel?
- Kan jy dalk 'n voorbeeld noem?
- Kom ons kry 'n paar ander opinies?

## **ADDENDUM I: SOP FOR THE TRAINING OF FIELD WORKERS**

### **STANDARD OPERATING PROCEDURE FOR THE TRAINING OF FIELDWORKERS ON THE DATA COLLECTION PROCESS**

Compiled by: Kari Naude on the 29<sup>th</sup> of July 2014

First Version

Effective for the duration of the pilot study and data collection

Training date: June 2015

#### **INTRODUCTION**

This SOP is to be used during the training of all field workers on the procedures to be followed in the data collection process. This is important to remove any bias and to ensure that field workers are standardized on all levels, so that data collection is as accurate as possible.

#### **RESPONSIBILITY**

It is the responsibility of the researcher to ensure that all field workers are trained in a systematic manner, so as to rule out any bias in data collection.

#### **MATERIALS/EQUIPMENT REQUIRED**

Training materials required includes the informed consent form, the questionnaire that will be used during Phase One of data collection, as well as the informed consent forms and discussion guide, which will be used during Phase Two.

Each field worker will also be provided with this Standard Operating Procedure, as well as a copy of the study protocol.

#### **PROCEDURE:**

##### **Phase One**

#### **RECRUITING PARTICIPANTS FOR THE STUDY**

1. On the day of data collection, the fieldworkers will go to the selected supermarket at a specified time.
2. As shoppers exit the supermarket, they will be approached in a random manner. As many shoppers will be approached as possible in the time

allocated, given that every fieldworker, as well as the researcher will conduct interviews for the duration of the study time.

3. Once recruited and screened, continue on to obtaining informed consent and completing the questionnaire with the participant.
4. Should a participant not meet the inclusion criteria, thank them for their time and inform them that they do not meet the inclusion criteria for this study.

### **Phase Two**

1. Once participants have completed the questionnaire, research assistants will ask all participants whether they would be interested in participating in a focus group discussion on the same topic.
2. Should the participant be willing, the research assistant will record particulars of the participant on a designated form, together with the unique code on the participant's questionnaire. This information will include contact details and a suitable day, time and location for the FDG to take place. The research assistant should inform the participant that this information will be kept confidential, and that it will be used by the researcher for the sole purpose of contacting participants, after which it will be discarded in a confidential manner.
3. Once a list of willing participants have been obtained, the researcher will contact participants and make further arrangements for the FGDs.

### **PROCEDURE:**

#### **Phase One**

1. Field workers will be given all of the documentation required for the purpose of training, the pilot study and the main study.
2. The protocol and SOP will be provided in English, while the information leaflet, informed consent form and questionnaire will be provided in English, Afrikaans and Xhosa.
3. The researcher will begin by explaining the purpose of the study, providing background information, and highlighting different aspects of the protocol relevant to the fieldworkers.
4. The fieldworkers will then be trained on explaining the purpose of the study to the participants, by making use of the participant information leaflet. They

need to stress the importance voluntary participation, and that they can at any time decide not to participate any further.

5. The written, informed consent form will be explained in detail to the fieldworkers, and they will be requested to obtain this from all study participants.
6. The researcher will then go through the questionnaire with the fieldworkers in English, Afrikaans and Xhosa. Any uncertainties will be clarified during this time.
7. As the questionnaire is researcher-administered, the fieldworkers may in no way assist with the answering of any questions. They may explain what the question is asking, but may not give leading examples to participants, or provide them with any information which may affect their answer in the questionnaire.
8. Fieldworkers will be given a definition list to ensure standardization.
9. Once the fieldworker has completed the questionnaire with the participant, it should be double checked to ensure all questions have been answered. The participant should be thanked for their time, and the fieldworker needs to ensure that they have been given a copy of the information leaflet and informed consent form.
10. The completed questionnaire should be handed to the researcher, who will check the questionnaire and that all the answers have been completed. The forms will then be filed into the enclosed data collection box, which will be available at the site of data collection.

## **Phase Two**

1. The researcher will explain the purpose and format of a FGD, and the role of the researcher and research assistant.
2. All participants will be asked to give consent for the audio-recording of the FGD. Researchers will be asked to assist in distributing the consent forms, and obtaining informed consent.
3. Once signed, they will be collected and checked by the research assistant designated for this task.
4. The research assistant will be asked to take notes during all the FGDs in order to ensure standardization.

5. Procedures for conducting the FGDs, as outlined in the protocol, will be followed throughout.

## **ADDENDUM J: CONTENT VALIDITY QUESTIONNAIRE FOR EXPERTS IN THE FIELD**

Dear Sir/Madam

Thank you for your willingness to assist in the assessment of the validity of the questionnaire to be used in the research study on “Determining the knowledge, attitude, beliefs and practices of the adult consumer in the City of Cape Town in the Western Cape regarding the inclusion of genetically modified foods in the diet. “

Your input is greatly appreciated and valuable in assuring all aspects are covered and that the data collected is of a high quality.

### **Validity Of The Questionnaire In Assessing The Knowledge, Attitude, Beliefs And Practices Of The Adult Consumer In The City Of Cape Town**

**Name:**

**Qualification:**

The questionnaire consists of five sections, which correlate with the consumer questionnaire (Sections A – E). You are kindly asked to give feedback per section, with an overall feedback section at the end of this questionnaire.

#### **SECTION A: DEMOGRAPHIC INFORMATION**

1. Do you feel that the questions in this section are relevant?
  
2. Please indicate which questions in this section you would change, and explain your answer:

	Recommended Change
1. Age	
3. Gender	
5. Highest Education Level	
6. Current Employment Status	
Total Household Income	
7. Number of people groceries are bought for?	

3. Do you have any further feedback regarding this section?

**SECTION B: KNOWLEDGE**

1. Do you think that the manner in which these questions have been asked is appropriate (true/false/don't know)?
2. Please indicate which questions in this section you would change, and explain your answer

	Recommended Change
1. I have heard the term genetic modification before	
2. By looking at a food, one can see whether it is genetically modified	
3. By eating a genetically modified food, your genes could be changed	
4. It is impossible to transfer animal genes to plants	
5. Ordinary food does not contain genes, but genetically modified food does	
6. Genetically modified foods are available in South Africa	
The following genetically modified foods are available in South Africa	
7.1 No foods are genetically modified	
7.2 Fruit	
7.3 Vegetables	
7.4 Maize	
7.5 Corn	
7.6 Cotton	
7.7 Eggs	
7.8 Meat	

3. Do you have any further feedback regarding this section?

**SECTION C: ATTITUDE**

1. Do you think that the questions asked in this section are relevant? Please explain your answer.
2. Do you think that the questions have been asked in an appropriate manner?
3. Please indicate which questions in this section you would change, and explain your answer

	Recommended Change
Genetically modified foods are important for a healthy diet	
Genetically modified foods are acceptable if: <ul style="list-style-type: none"> <li>• It increases the nutritional value</li> <li>• It improves sensory properties</li> <li>• Increases food production</li> </ul>	
GM foods serve a good purpose	
A developing country such as South Africa could benefit from GM foods	
Who do you trust to give you adequate information about GM foods?	
Even if GM foods have health benefits, I still will not buy these products	

4. Do you have any further feedback for this section?

#### **SECTION D: BELIEFS**

1. Do you think that the questions asked in this section are relevant? Please explain your answer.
2. Do you think that the questions have been asked in an appropriate manner?
3. Please indicate which questions in this section you would change, and explain your answer

	Recommended Change
I believe the government will not allow the sale of foods which are harmful to consumers	
Food safety (that it is not harmful to me or anyone else in the short or long term) is more important than food price.	
I believe the risk of GM foods is low	
GM foods go against my beliefs and principles	
By developing GM foods, we are tampering with nature	
I am not concerned about the long-term health effects of GM foods	
I am not concerned about the long-term effects of GM foods on the environment	

4. Do you have any further feedback for this section?

**SECTION E: LABELLING**

1. Do you think that the questions asked in this section are relevant? Please explain your answer.
2. Do you think that the questions have been asked in an appropriate manner?
3. Please indicate which questions in this section you would change, and explain your answer

	Recommended Change
I believe the government will not allow the sale of foods which are harmful to consumers	
Food safety (that it is not harmful to me or anyone else in the short or long term) is more important than food price.	
I believe the risk of GM foods is low	
GM foods go against my beliefs and principles	
By developing GM foods, we are tampering with nature	
I am not concerned about the long-term health effects of GM foods	
I am not concerned about the long-term effects of GM foods on the environment	

4. Do you have any further feedback for this section?

**OVERALL**

1. Please comment on the level of difficulty, bearing in mind that this needs to be at the level of a Grade 9 learner.
2. Is this questionnaire appropriate for the general consumer?
3. Please add any other comments

**Thank you for your time!**

**ADDENDUM K: CODING OF DATA**

CATEGORY	THEME
Knowledge	KNW: Labels KNW: GM foods and development KNW: Long-term effects KNW: Control
Attitudes	ATT: GM foods ATT: Consumers ATT: Environment ATT: Economic ATT: Food security ATT: Health/Nutrition ATT: Research done ATT: Farmers ATT: Seed companies ATT: Politics ATT: Labelling/regulation/marketing ATT: Food wastage ATT: Organic foods ATT: Knowledge and information
Beliefs	BLF: Ethics BLF: Labelling BLF: Benefit to South Africa BLF: Control of GMOs BLF: Consequences
Practices	PRAC: Buying PRAC: Information sources PRAC: Food labels

## **ADDENDUM L: PERMISSION LETTER TO GROCERY STORES**

Division of Human Nutrition, Faculty of Medicine and Health Sciences  
Stellenbosch University  
Francie van Zijl Avenue  
Tygerberg  
7505

*Name of grocery store*

Dear Sir/Madam

### **Re: Request for permission to conduct research study**

I am a registered dietician currently completing my Masters of Nutrition degree through Stellenbosch University. As part of my studies, I am conducting a research project to assess the knowledge, attitude, beliefs and practices of the general adult consumer in the City of Cape Town in the Western Cape regarding the inclusion of genetically modified foods in the diet.

This study will be conducted at various supermarkets throughout the City of Cape Town, and will include a total of 200 participants.

Data will be collected by means of a researcher-administered questionnaire, which will take no longer than 15 minutes to complete.

Your grocery store was one of sixteen stores that were randomly selected in the City of Cape Town.

I would therefore like to request permission for a research assistant and myself, to conduct this research at your store. Shoppers will be approached as they exit the supermarket, and be asked to voluntarily participate. We will then complete the questionnaire with them. We are requesting to do research on the [date] from [time].

There are no risks associated with participating in this study, and the information obtained will be submitted for publication in a peer-reviewed journal, as well as it being disseminated to various governmental departments for further planning. All

information obtained will be completely confidential, and participants will be requested to give informed consent to participate.

The Health Research Ethics Committee of the Faculty of Health Sciences at Stellenbosch University has approved this study. (Reference number **S15/05/114**)

I would therefore like to request your permission to conduct this research at the grocery store during the time as indicated.

I look forward to your reply.

Yours sincerely

**Kari Naude,**

Principal Investigator

0720144839