

AN INVESTIGATION INTO THE CONSUMER ACCEPTANCE OF GENETICALLY MODIFIED FOODS AT THE CHRIS HANI DISTRICT MUNICIPALITY, EASTERN CAPE, SOUTH AFRICA

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Abstract

Consumer acceptance of genetically modified odd food products remains a critical factor that will affect the future growth of agricultural biotechnology. Hence, the aim of this study was to investigate the consumer acceptance of GM foods in Chris Hani District Municipality. In this regard, a survey of 60 individual interviews (consumers) and 6 focus groups were conducted in Queenstown in August and September 2013, to determine consumer acceptance towards genetically modified (GM) foods.

Above a third (38%) of the respondents were aware of GM foods, mostly from newspapers, television and radio. Others had learned about GM crops at school, newspapers and television that were more important to more educated consumers. Consumers acknowledged the technology's potential positive impacts, with more than 80% (of those who know a lot) assenting that it increases productivity. Fifty one percent said they would buy GM foods at the same level as their favourite brands, although many had concerns; group discussion respondents feared that GM technology could lead to a loss of biodiversity and affect non-target insects, and had concerns about the effects of GM food on human health in the longer term.

It is concluded that GM technology has a role to play in food security in South Africa. However, consumers need more information about the technology, which can be provided through established sources of information. Finally, consumer acceptance should be studied regularly, and the survey population was broadened to include rural consumers.

Introduction and Background to the Study

With the advent of modern biotechnology, specifically genetic engineering, it has become possible to transfer a specific gene, called a transgene, from one organism to another across or

within species boundaries, through a process called gene transformation. Genetically engineered crops are referred to as GM (genetically modified), GMO (genetically modified organism) and GE (genetically engineered). Transgenic organisms able to replicate (seeds or living organisms) are referred to as LMOs (living modified organisms) (Uzogara, 2000). For example, according to Hinshaw (2010), crossing the species barrier, plants may be altered to produce pharmaceuticals (such as vaccines) and even glue. Fish genes may be found in tomatoes, viruses in fruits and human genes in tobacco. Uzogara (2000) stated that, genetic engineering has the potential to produce improved varieties in terms of quality and yield traits, more quickly than traditional breeding.

In 1996, the first genetically modified seeds were planted in the United States for commercial use. Ten years later, genetically modified crops were grown on 90 million hectares worldwide, an area nearly the size of France and Germany combined. The country with the most area of GM crops is the United States followed by Argentina, Brazil, and Canada. China is also high on the list with its rapidly expanding cultivation of GM cotton. In the EU, GM crops are not widely planted. They can be found only at a few test sites and on 48,000 hectares of commercial plantings in Spain (GMO compuss, 2006).

Field trials of Genetically Modified Organisms (GMO's) began in South African in 1992 (Philipp, 2002). In 1997, the Department of Agriculture issued the first conditional commercial release permits. Two genetically modified crops are currently approved in South Africa for planting and commercial release, two varieties of yellow maize and one of cotton (all are resistant to varieties of *Bacillus thuringiensis*) (GMO compuss, 2006). In 1999-2000 season, 163 000 ha of GM yellow maize and 18 000 ha of GM cotton were sown in South Africa (South African Journal of Science; 2003).

According to Vermeulen, Kirsten, Doyer and Schönfeldt (2005), South Africa is the only African country commercially producing GM crops. It is also the only country which is producing its staple food (maize) on commercial scale; this shows that South Africa is unable to feed its people when using the traditional methods of production. Science plays a crucial role in assisting South Africa to feed itself. This is confirmed by the National Department of Agriculture by saying that South Africa needs artificial assistance when it comes to growing crops, because the country itself does not have ideal growing conditions. Less than 15% South African land is arable and climatic conditions like periodical drought make natural growth too risky to ensure food security for its people.

All the nations of Africa (except South Africa) have been opposing Genetically Modified organisms since 1998, when they jointly signed a declaration Monsanto and its crops, entitled 'Let Nature's Harvest Continue (Woodward, Brink, and Berger, 1999). Meanwhile in Africa grassroots opposition to GM food and crops continues to grow amongst consumers and farmers. At the Earth Summit and since many joint statements condemning GM food aid have been signed by African Farmers groups, consumers groups and NGOS (Biowatch, 2004). South Africa is the only country in Africa that has approved transgenic crops for commercial purposes and is the leader in agricultural biotechnology research and development in the continent of Africa. In

1992, South Africa began the first controlled field trials and as a result, the Department of Agriculture issued the first conditional commercial release permits (Philipp, 2002).

However, there are also the vocal opponents to agricultural biotechnology in South Africa, and an on-going national debate is held on the potential risks and benefits of this new technology for farmers, consumers and the environment. Gosling (2002) found out that, during the survey in November 2000, 48 stakeholder representatives from 33 institutions completed a questionnaire on the potential risks and benefits of agricultural biotechnologies, public trust institutions, current bio-safety, and intellectual property rights regulations and influence of political stakeholders in South Africa.

The results of the survey show that the respondents generally expect agricultural biotechnology to have the potential to address agriculture, environmental and nutritional problems in South Africa. While most respondents do not consider genetically modified foods as a health risk for consumers, and expect agricultural biotechnology to make a contribution to future food security in Africa, they are concerned about the sustainability of Biotechnology (BT) crops and the proper implementation of national bio-safety regulations. Moreover, most respondents doubt that such crops would be appropriate for resource poor farmers.

Although South Africa adopted the GM technology, some people do not know what GM foods are, and those who know do not know which products contained GM ingredients and which one's do not (HRSC, 2004). The results of the survey conducted in the streets of Johannesburg by National Consumer Forum revealed that people in urban areas also have minimal knowledge of GMOs including professionals as some of them cannot even name any GM crop they can think of (National Consumer Forum, 2003). The major problem about GM is their unknown effects on human health, which also triggers the need for research studies to be undertaken around the issue of Genetically Modified Foods and Organisms.

Furthermore, as many researchers believe, genetic engineering of crops and food-producing animals can produce toxic and allergic reactions to humans (Batalion, 2000). Someone allergic to peanut or shellfish for example, would have no way of knowing if a tomato or other food had been altered with proteins from these substances and could have fatal reaction by eating such genetically altered foods. Imagine, genetically engineered foods can take proteins from bacteria they find in the soil, the ocean-any where- and incorporate with human food. Such substances have never been in the food supply before, so their toxic or allergic characteristics are unknown (Paul, 1999). In addition, the South African staple food (mielies or maize) which is also intended for animal use, have been modified with human or even animal, growth hormones. This can cause allergic reactions in people. A study in the New England Journal of Medicine (2001) concerned genetically engineered soybeans that contained Brazil nut genes. This caused potentially fatal allergies in people which are allergic to nuts. Also taking the example of tobacco mentioned previously, no wonder it is difficult to quit. Hence, this creates a dangerous food instead of a health food.

Objectives of the Study

The following are the objectives of this study:

- 1) To identify and estimate the importance of the various factors driving consumer perception of biotechnology and acceptance of GM food products;
- 2) To identify and characterize distinct consumer segments in terms of their acceptance of GM food products;
- 3) To identify consumers food demand for biotechnology information specifically, and for nutrition and food safety information in general.

Limitations of the Study

The first and most significant delimitation that the researcher places on the study is that the researcher will narrow the scope of the research to a specific District in the province (i.e. Chris Hani). It is necessary for the researcher to do this because; the researcher conducted a similar study in 2006 accessing consumer knowledge of GM foods in urban areas (excluding rural areas) with the case study of East London. The Province has two Metropolitan Municipalities, i.e. Buffalo City and Nelson Mandela, and they are excluded in the current research and the focus is in the new rural-urban setting. Chris Hani District was selected because; it is closer to the researcher's workplace.

One limitation that creates potential weakness for the study is the fact that only a small geographical area will be covered i.e. only Queenstown (the survey will not cover the whole District of Chris Hani because of budget and the time factor). This will limit the generalization ability of the findings to all Local Municipalities of the District (six Local Municipalities). Queenstown is located at Lukhanji Local Municipality and is the main economic setting for the whole District (Queenstown has two shopping Malls and there is no other Mall in the whole District). However, the findings can point the way to future research of a more expanded scope.

LITERATURE REVIEW

Introduction

This section studies the views of related literature regarding the consumer acceptance, attitudes and understanding of GM foods in South Africa and in developing countries. Some advantages and disadvantages of GM foods are also discussed, including the availability of GM foods in South African Marketing shelves.

Understanding Biotechnology, Genetic Engineering and Genetically Modified Organisms/Foods

Biotechnology can be defined in two different views. The first definition holds within new biological tools whereby, the second definition refers to new "high end" biotechnology. According to the first definition, biotechnology is the technique used to alter or make modification to living organisms, in order to improve and increase productivity or to develop microorganisms for specific usage. The second definition explains that biotechnology involves recombination of deoxyribonucleic acid (DNA), fusion of cell and new bio-process engineering techniques such as the transfer of gene and manipulation of embryo (Biotechcorp, 2008).

Genetic Engineering (GE) is a sub specialty of biotechnology which is concerned with the targeted modification of the genetic materials (Spangenburg and Moser, 2004). This selective breeding practice opted by farmers long ago (Conner and Jacobs, 1999; Fridell, 2006 and Stanley, 2000) and has been changed into GE for more effective and efficient results (Insel, Turner and Ros, 2009). GE was used widely in medicine but is in practice in agriculture and related industries (BASF, 2010). This is a concern for more food production which is not a novel idea yet, the development of more sophisticated and technology related processes to enhance and strengthen this activity have evolved with research and innovation.

Genetically Modified Foods (GMF) consists of the food producing plants and animals which have undergone gene manipulation. The theme behind GM Food is alteration of the traits of the animals or plants in some way so as to make it more productive. The term GM foods or GMOs (Genetically Modified Organisms) as persuasively defined by Whitman (2000), is most commonly used to refer to crop plants created for human or animal consumption using the genetic engineering techniques. These plants have been modified in the laboratory to enhance desired traits such as increased resistance to herbicides or improved nutritional content. The enhancement of desired traits has traditionally been undertaken through breeding, but conventional plant breeding methods can be very time consuming and are often not very accurate. Genetic engineering, on the other hand, can create plants with the exact desired trait very rapidly and with great accuracy.

For example, Lack (2002) stated that, plant geneticists can isolate a gene responsible for drought tolerance and insert that gene into a different plant. The new genetically-modified plant will gain drought tolerance as well. Not only can genes be transferred from one plant to another, but genes from non-plant organisms also can be used. The best known example of this is the use of B.T. genes in corn and other crops. B.T., or *Bacillus thuringiensis*, is a naturally occurring bacterium that produces crystal proteins that are lethal to insect larvae. B.T. crystal protein genes have been transferred into corn, enabling the corn to produce its own pesticides against insects such as the European corn borer.

As mentioned by Hug (2008), it is important to note that; GM crops, like non-GM crops, have a range of current and potential applications: human food, animal feed, textiles (e.g. cotton), and a range of industrial uses (e.g. to make pharmaceuticals or health products). Many crops are used for more than one purpose.

The Advantages of GM foods

The world population has topped 6 billion people and is predicted to double in the next 50 years. Ensuring an adequate food supply for this booming population is going to be a major challenge in the years to come. GM foods promise to meet this need in a number of ways:

Pest resistance: Crop losses from insect pests can be staggering, resulting in devastating financial loss for farmers and starvation in developing countries. Farmers typically use many tons of chemical pesticides annually. Consumers do not wish to eat food that has been treated with pesticides because of potential health hazards, and run-off of agricultural wastes from excessive use of pesticides and fertilizers can poison the water supply and cause harm to the environment. Growing GM foods such as B.T. corn can help eliminate the application of chemical pesticides and reduce the cost of bringing a crop to market (Hug, 2008).

Herbicide tolerance: For some crops, it is not cost-effective to remove weeds by physical means such as tilling, so farmers will often spray large quantities of different herbicides (weed-killer) to destroy weeds, a time-consuming and expensive process that requires care so that the herbicide doesn't harm the crop plant or the environment. Crop plants genetically-engineered to be resistant to one very powerful herbicide could help prevent environmental damage by reducing the amount of herbicides needed. For example, Monsanto has created a strain of soybeans genetically modified to be not affected by their herbicide product Roundup. A farmer grows these soybeans which then only require one application of weed-killer instead of multiple applications, reducing production cost and limiting the dangers of agricultural waste run-off (Lack, 2002; Hug, 2008).

Disease resistance: There are many viruses, fungi and bacteria that cause plant diseases. Plant biologists are working to create plants with genetically-engineered resistance to these diseases (Lack, 2002).

Cold tolerance: Unexpected frost can destroy sensitive seedlings. An antifreeze gene from cold water fish has been introduced into plants such as tobacco and potato. With this antifreeze gene, these plants are able to tolerate cold temperatures that normally would kill unmodified seedlings (Lack, 2002; Hug, 2008).

Drought tolerance/salinity tolerance: As the world population grows and more land is utilized for housing instead of food production, farmers will need to grow crops in locations previously unsuited for plant cultivation. Creating plants that can withstand long periods of drought or high salt content in soil and groundwater will help people to grow crops in formerly inhospitable places (Hug, 2008).

Nutrition: Malnutrition is common in third world countries where impoverished peoples rely on a single crop such as rice for the main staple of their diet. However, rice does not contain adequate amounts of all necessary nutrients to prevent malnutrition. If rice could be genetically engineered to contain additional vitamins and minerals, nutrient deficiencies could be alleviated. For example, blindness due to vitamin A deficiency is a common problem in third world countries (Lack, 2002).

Researchers at the Swiss Federal Institute of Technology Institute for Plant Sciences have created a strain of "golden" rice containing an unusually high content of beta-carotene (vitamin A). Since this rice was funded by the Rockefeller Foundation, a non-profit organization, the Institute hopes to offer the golden rice seed free to any third world country that requests it. Plans were underway to develop golden rice that also has increased iron content. However, the grant that funded the creation of these two rice strains was not renewed, perhaps because of the vigorous anti-GM food protesting in Europe, and so this nutritionally-enhanced rice may not come to market at all (Lack, 2002; Hug, 2008).

Pharmaceuticals: Medicines and vaccines often are costly to produce and sometimes require special storage conditions not readily available in third world countries. Researchers are working to develop edible vaccines in tomatoes and potatoes. These vaccines will be much easier to ship, store and administer than traditional injectable vaccines (Lack, 2002).

Phytoremediation: Not all GM plants are grown as crops. Soil and groundwater pollution continues to be a problem in all parts of the world. Plants such as poplar trees have been genetically engineered to clean up heavy metal pollution from contaminated soil (Lack, 2002).

The Criticism against GM foods

Environmental activists, religious organizations, public interest groups, professional associations and other scientists and government officials have all raised concerns about GM foods, and

criticized agribusiness for pursuing profit without concern for potential hazards, and the government for failing to exercise adequate regulatory oversight. It seems that everyone has a strong opinion about GM foods. Most concerns about GM foods fall into three categories: environmental hazards, human health risks, and economic concerns (Lack, 2002; Hug, 2008).

Environmental hazards

Unintended harm to other organisms: A laboratory study which was published in *Nature* showing that pollen from B.T. corn caused high mortality rates in monarch butterfly caterpillars. Monarch caterpillars consume milkweed plants, not corn, but the fear is that if pollen from B.T. corn is blown by the wind onto milkweed plants in neighboring fields, the caterpillars could eat the pollen and perish. Although the *Nature* study was not conducted under natural field conditions, the results seemed to support this viewpoint. Unfortunately, B.t. toxins kill many species of insect larvae indiscriminately; it is not possible to design a B.t. toxin that would only kill crop damaging pests and remain harmless to all other insects (Hug, 2008).

Reduced effectiveness of pesticides: Just as some populations of mosquitoes developed resistance to the now-banned pesticide DDT, many people are concerned that insects will become resistant to Bt. or other crops that have been genetically modified to produce their own pesticides (Lack, 2002; Hug, 2008).

Gene transfer to non-target species: Another concern is that crop plants engineered for herbicide tolerance and weeds will cross-breed, resulting in the transfer of the herbicide resistance genes from the crops into the weeds. These "super weeds" would then be herbicide tolerant as well. Other introduced genes may cross over into non-modified crops planted next to GM crops (Lack, 2002; Hug, 2008).

Human health risks

Allergenicity: Many children in the US and Europe have developed life-threatening allergies to peanuts and other foods. There is a possibility that introducing a gene into a plant may create a new allergen or cause an allergic reaction in susceptible individuals. A proposal to incorporate a gene from Brazil nuts into soybeans was abandoned because of the fear of causing unexpected allergic reactions (Lack, 2002).

Unknown effects on human health: There is a growing concern that introducing foreign genes into food plants may have an unexpected and negative impact on human health. A recent article published in *Lancet* examined the effects of GM potatoes on the digestive tract in rats. This study claimed that there were appreciable differences in the intestines of rats fed GM potatoes and rats fed unmodified potatoes (Lack, 2002).

Economic concerns

Bringing a GM food to market is a lengthy and costly process, and of course Agri-biotech companies wish to ensure a profitable return on their investment. Many new plant genetic engineering technologies and GM plants have been patented, and patent infringement is a big concern of agribusiness. Yet consumer advocates are worried that patenting these new plant varieties will raise the price of seeds so high that small farmers and third world countries will not be able to afford seeds for GM crops, thus widening the gap between the wealthy and the poor (Hug, 2008).

Patent enforcement may also be difficult, as the contention of the farmers that they involuntarily grew Monsanto-engineered strains when their crops were cross-pollinated shows. One way to combat possible patent infringement is to introduce a "suicide gene" into GM plants. These plants would be viable for only one growing season and would produce sterile seeds that do not germinate. Farmers would need to buy a fresh supply of seeds each year. However, this would be financially disastrous for farmers in third world countries that cannot afford to buy seed each year and traditionally set aside a portion of their harvest to plant in the next growing season (Agrifood Awareness Australia, 2004).

Consumer Acceptance of GM Food: The International Evidence

With reference to the Strategy Unit (2003), whilst GM crops and food have been particularly controversial in Europe, their take-up in other parts of the world has been rising rapidly. The total area planted with GM crops has grown by more than 10% every year since their commercialization in 1996. Between 2001 and 2002, the increase was 12%. Over 99% of the GM crops grown are varieties of maize, soybeans, cotton and oil seed rape. Over 99% of these GM varieties are herbicide tolerant and/or insect resistant.

In 2002, according to strategy unit of 2003, sixteen countries worldwide were growing GM crops commercially. Research indicates that, 66% of the global area of GM crops was found in the US. Nine developing countries also had commercial GM crops: Argentina, China, South Africa, India, Uruguay, Mexico, Indonesia, Colombia and Honduras. Of the area of crops grown in developing countries according to the 2003 strategy unit study, Argentina dominated with over 80% of the growing area. China was the next with about 13%, followed by South Africa with about 2%. The other countries (plus Romania and Bulgaria) all have less than 100,000 hectares.

Worldwide consumer response toward GM foods has been largely negative. However, the majority of the previous studies on consumer attitudes towards food products were conducted in

developed countries (Grimsrud, McCluskey, Loureiro, and Wahl, 2003; Burton, Rigby, Young, and James: 2001; McCluskey, Grimsrud, Ouchi, and Wahl, 2004). The small numbers of studies conducted in developing nations obtain different results from those of the developed world.

Li, Curtis, McCluskey, and Wahl (2003) concluded that Chinese consumers, on average, were willing to pay a 16% premium for GM soybean oil and a 38% premium for GM rice over the non-GM alternatives. Curtis (2003) found that Chinese consumers, on average, were willing to pay a 35% premium for GM processed potato products such as French fries, mashed potatoes, and potato chips. China, Pachico and Wolf (2002) found that 66% of the survey respondents in Colombia were willing to try GM foods, and the willingness to purchase GM foods was high among those who felt they did not have adequate or high quality foods available at home.

Studies in the United States find consumers to be more accepting of GM foods compared with consumers in Europe and Japan. The currently announced international labelling policies are relatively strict except in US and Canada, which coincides with the consumer acceptance in the two countries. Consumer surveys regarding the acceptance of GM foods have been conducted in the United States since the early 1990s. For instance, between 1997 and 2001, International Food Information Council Foundation (IFIC) surveys found that 51-77% of US consumers were willing to purchase GM foods (IFIC, 2001).

The Pew Initiative (2001) published results that suggested links between consumers' knowledge of GMOs, their socioeconomic status, and their attitudes toward acceptance of GM foods. Hamstra's results suggested that consumer acceptance of GMOs was influenced by consumers' subjective perceptions of improved product characteristics but found no link between knowledge of the technology and attitudes (Hamstra, 1995). Other studies indicated that two thirds to three quarters of US consumers were supportive of crop GMOs (Hoban, 1998). A study by Lusk, Daniel, Mark, and Lusk (2001) found that 70% of their respondents were not willing to pay a premium for non-GM corn chips. Under totally different GM food regulations, consumer attitudes are similar between China and US. Under stricter regulations, Chinese consumers treat GM food more positive than their US counterparts.

Public Perception of New Technologies in Developing Countries

Public perception of agricultural technology has been thoroughly investigated in industrialized countries. However, not much is known about public attitudes in developing countries (Phillip, 2001). According to Phillip (2002), this may be explained by the popular assumption that most people in these countries were hardly informed about the advent of biotechnology and probably more concerned about risks in every-day life rather than potential long-term hazards of new technologies.

Nevertheless, there are public interest groups in developing countries that oppose the introduction of agricultural biotechnology. Their protest events attract the attention of the mass

media and build up public pressure on politicians to respond to these concerns. It indicates that public opinions also matter in developing countries democracies, though it is the opinion of academic, economic and traditional elites rather than the public at large that counts.

The question, is why are there people opposing the introduction of new technologies in developing countries? After all these countries should have a strong design to get access to these technologies in order to increase productivity, relieve the pressure on natural resource and stimulate economic growth?

According to Phillip (2001) on the study on stakeholder perception toward agricultural biotechnology, the Philipppians in 1997 and Mexico in 2000 tended to confirm the importance of nationalist aspects in the public debate on agricultural biotechnology in these countries. Phillip (2002) also conclude that, it is factual knowledge, stakeholder interests and public/or consumer perception that shape political decisions on the adoption of high technology in developing countries. However, the blending of nationalist feeling with anti-biotechnology attitudes may easily turn out to be a trap in the fight against poverty, since it will most likely hamper the public sector support for technology transfer and, consequently, increase the socioeconomic gap between the rich and Western-oriented elites who have access to technology and the deprived poor masses.

Government, NGO's and the business country should therefore recognize the importance of technology for the provision of public goods that are particularly under-provided in developing countries. The under provision of national public goods in developing countries also affects the quality of public goods in industrialized countries and therefore increasingly assume the character of global public goods. The sustainable management of technology as a global public good is essential to make technology work for human development and to prevent it from further increasing social inequality due to unequal access (Shah, 2002).

Risks in social and cultural construction and its meaning may differ significantly among societies with different political and economic circumstances. Many people in developing countries face a wide range of everyday risks that were to a large extent eliminated long ago in industrialized countries, and thus have disappeared from the perception (Onyango, 2000). Ironically, these risks were reduced in affluent societies through the use of modern technology. The unintended side effect caused by new technologies are certainly a serious matter of concern in the present and the future, but, particularly in developing countries, these potential side effects of technology must be weighed against the potential gains from the appropriate use of technology to reduce existing risks.

In South Africa, government is fighting against poverty and inequality as a consequence of improvement in science and technology programs/policies and some poverty alleviation policies. Government is doing this through the improvement in science and technology departments at universities, this includes agricultural departments and the creation of academic environment that

encourages scientists to become innovators, and this is also done through the improvement in National Research Institutes (EcoBioregion, 2004).

Agricultural Biotechnology and Genetically Modified Foods in South Africa

This section explains the public knowledge and perception about the agricultural biotechnology and genetically modified food in South Africa. The following are the main areas that are discussed in this chapter: Marketing and trade policies, political stakeholders that are involved in public debate about GMOs in South Africa, religious problems, like how the different religions perceive the issue of biotechnology in the country, business and regulatory issues, that is how businesses see the technology and what are the regulatory measures that are taken by government to control production, distribution, marketing and consumption of GM food in South Africa, Agriculture and Environmental Policy that is how agricultural sector uses this technology for food security and how does it affect the environment, South African consumers and genetically modified food that is how much consumers know about GMOs and what are their perceptions, Foods that are produced with GM technology in South Africa.

Marketing and Trade Policies for Genetically Modified Products

As stated by Clive (2009), South Africa is the only country in Africa that has produced GM crops for more than 10 years and also has a functional Biosafety system to manage any risk related to the use of GM products. In addition, South Africa is one of the few countries that trades both GM and non-GM crops, despite being bordered by countries banning the use of GM products. For these reasons, South Africa's policies on GM products may be considered as relevant examples for other countries when creating their own bio safety systems. However, as GM production grows in South Africa, and as changes occur in political power and market conditions, the management of the marketing and trade of GM crops continue to evolve and the country's regulatory system is now facing challenges related to import, exports, and marketing.

In regulating imports of GM products; in the first years after the implementation of the GMO Act in 1997, South Africa successfully issued import approval (commodity clearance) for a variety of GM products after safety review. However, the regulations have been tightened. After rejecting importation of a GM maize event from the United States in 2004, based on an objection from a maize farmers' group, all new GM events have since had to pass the full approval procedure for environmental release. A rapid economic analysis of the reasons behind the measure points toward a non-tariff barrier to trade, unrelated to bio safety, which may have been costly for the animal feed industry, and for maize or meat consumers (Wynand, 2009).

Maintaining exports and GM production despite trade restrictions, of the 10 countries in the region with which South Africa trades the most, at least 7 have implemented restrictions on GM maize imports, but testing is not systematic in all countries. A rapid trade analysis shows that the South African industry has been able to adapt to each country's specific demands, successfully exporting both GM and non-GM products. However, the increase of alleged export risks needing

consideration in the decision making process may become problematic; rejecting any GM application because of possible export risk is likely to result in fewer applications and fewer new developments of potentially beneficial products (Clive, 2009).

Accommodating different demands: Segregation and labelling: Because of the demand for non-GM products by consumers in some countries, the current international marketing system for maize, soybeans, or canola distinguishes a mixed “GM/non-GM” market channel from a pure “non-GM” market channel. In South Africa, the marketing channels for cotton and soybeans are largely GM, but non-GM maize represents a significant share of the maize supply. The segregation is done via identity preservation. In 2007, the customer price premium for non-GM maize was about 5 percent of the total maize price of US\$200, or US\$10/ton, of which the farmer would get about US\$3 and the trader certifier US\$7, but these prices were likely to increase with GM maize adoption. So, the South African marketing system has been successful thus far in providing the types of products that are in demand, but it will face new challenges as GM production expands (Wynand, 2009).

Viljoen, Dajee, and Botha (2006) mentioned that, in 2004, South Africa introduced a labelling requirement for non-substantially equivalent GM products. As none of the current GM products in South Africa fits any of these characteristics, the only labelling used on GM products is based on private standards. A recent study showed, however, that many products with non-GM claims do in fact contain GM ingredients. Because of these limitations, the South African approach to GM food labelling is highly contentious. The main question relates to the use of voluntary versus mandatory approaches. Mandatory labelling would require food companies to label any GM products. Although largely applied, it may not be adequate in a country where most consumers are not aware of what “GM” or biotechnology means. Such a regulation could have the same effect as in OECD countries, where food processors and retailers have consequently avoided GM products altogether. In contrast, voluntary labelling would require rules to define non-GM products, and effectively discourage fraud for the benefit of consumers willing to pay to avoid GM.

Recent developments suggest that South Africa may be considering a strict, European-style, mandatory labelling approach. Such requirements could have significant economic impact on GM producers in South Africa. They could also result in price increases at a time where inflationary food prices are already largely constraining South African consumers.

RESEARCH METHODOLOGY

Introduction

On April 5th 2002, a joint research project of the Centre for International Development (CID), Harvard University, USA and the Southern Africa Labour and Development Research Unit (SALDRU), University of Cape Town, South Africa conducted market research into the public attitudes towards agricultural biotechnology in South Africa. The survey was undertaken to gain an understanding of public knowledge and attitudes with regard to food biotechnology.

Therefore, this proposed research study will be the follow-up with similar methodology. The survey will be designed with additional questions to provide an updated and more in-depth understanding of consumer perceptions and attitudes with regard to food biotechnology and Genetically Modified Foods in Eastern Cape urban-rural areas. Hence, the study will also look at the factors influencing attitudes and perceptions of consumers towards the use of GM foods and will interpret

RESULTS, FINDINGS AND DISCUSSION

PART A: Individual Interviews Results

4.1. Introduction

This section presents the results of the study and provides some insights about the consumers' knowledge and acceptance to GM Foods. The following issues are specifically addressed: knowledge about GM food, the understanding and awareness of the terminology "Biotechnology" and "Genetic Modification", Consumer acceptance of Biotechnology Food, Attitude towards buying GM food, consumer concerns about food eaten, Sources of information on food safety and nutrition issues. The sample was divided into three different segments i.e. according to the level of education, as this variable is likely to have more impact on the acceptance level and knowledge of respondents towards Genetic Modification.

This was because, educated people are more likely to get more information about new technologies as outlined in the literature, as compared to people with minimum levels of education. Secondly, the concept Genetic Modification is scientific in nature and hence, respondents' work environment and type of qualification were the supplementary variables to consider when assessing the level of knowledge and acceptance.

Knowledge and Awareness GM foods

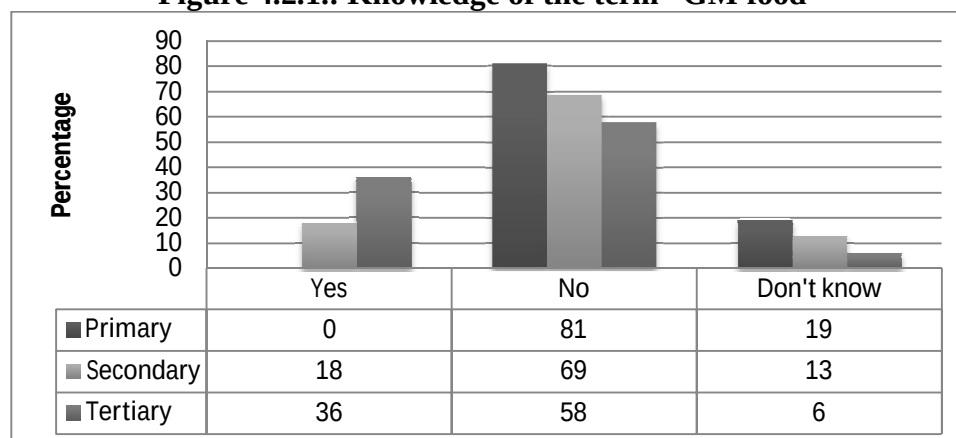
This section provides more information about consumer knowledge, understanding and awareness of GM foods and food products containing GM ingredients in three different segments in terms of Primary, Secondary and Tertiary education, occupation and gender will be the accompanying variables.

Understanding and Awareness of the term "Genetic Modification"

Awareness of terms such as Genetic Modification was found to be low according to Figure 4.2.1 below, 58% of respondents with tertiary education said they were "not at all aware" and 6% did

not know, and 36% of those with tertiary education said they were “very aware”. Respondents with secondary education had a very low awareness of 18% and none primary education respondents were aware.

Figure 4.2.1.: Knowledge of the term “GM food”



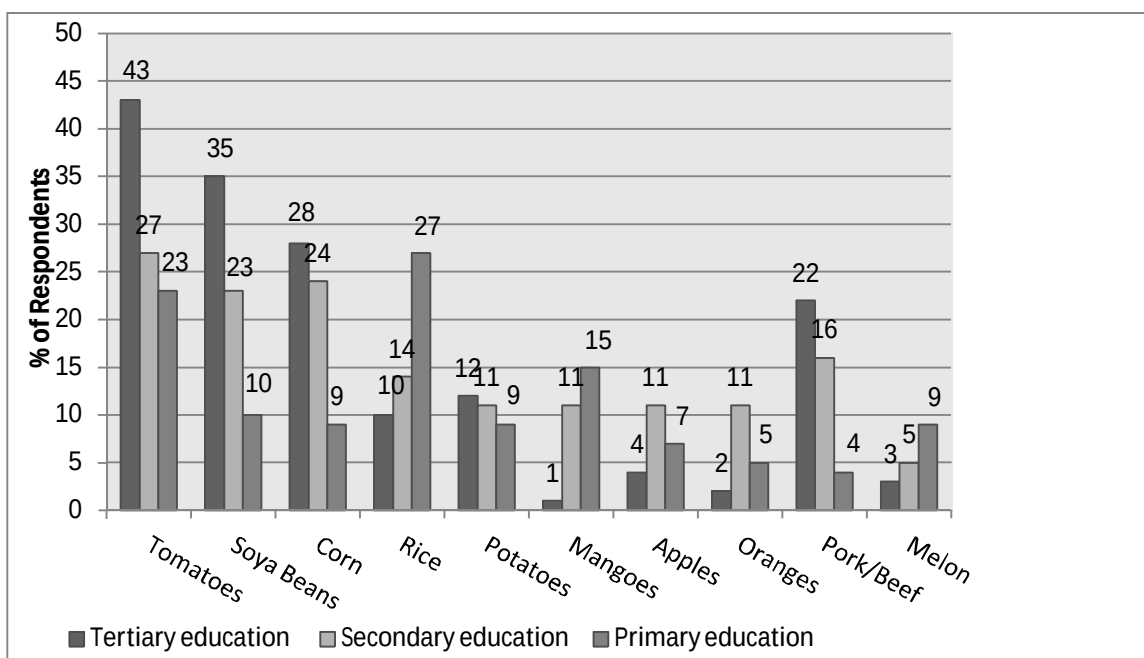
When considering the whole sample, 38% respondents were aware and have some understanding about the term Genetic Modification and Genetically Modified foods. The level of education and occupation contributed with higher percentage towards people who know a lot about GM foods. About 96% of respondents with agriculture related qualification and those working for the Department of Rural Development and Agrarian Reform (former Department of Agriculture); know a lot about Genetic Modification including respondents from Department of Health and with related qualifications.

However, those who reported that, they know what Genetically Modified foods are were asked to define. The most common definitions are described below:-

- “Foods that its genetic composition has been modified”.
- “Foods that are produced by that were modified at Gene level to withstand harsh conditions”
- “Improvement and additions of vitamins and nutrients on food”

Awareness of the Scope of GM foods

Since, survey respondents were also used to assess the awareness of the terms “Genetically Modified foods” and demonstrated a very low or nil for less educated respondents. Based on the Figure 4.2.2 below, consumers were asked to give examples of products they know to have Modified Genes in Queenstown retail stores or fast foods market. Considering the Figure 4.2.2 below:

Figure: 4.2.2.: Awareness of the term GM food or Biotechnology

Most respondents with tertiary education were able to mention products that are more likely to have Genetic ingredients as per literature survey i.e. tomatoes Soya bean products and animals fed by maize. Rice was mentioned by (27%) of those with primary education. Those respondents who provided examples predominantly suggested food stuffs which have indeed been modified, using Genetic Modification. Furthermore, the genetic modification of all the most popular examples given has all previously been the focus of media interest. The accuracy with which respondents were able to name high profile examples of biotechnology foods tuffs illustrates both the effectiveness of media in raising awareness, as well as its currently very limited role in improving understanding of the topic. Respondents were also presented with statements about the technology, and asked to identify if they were true or false.

Table: 4.2.2. Testing factual knowledge

	True%	False%	Don't know%
a. Ordinary tomatoes as well as GM tomatoes contains genes.	31	40	29
b. By eating GM fruit your genes could also become modified.	28	52	20
c. Yeast brewed for beer is also made up of living things.	17	43	40
d. It is possible to fig out in the first few months of pregnancy whether a child will have Down's Syndrome.	19	63	18
e. GM animals are always larger than ordinary animals.	65	15	20
f. It is impossible to put animal gene into plant.	62	10	28

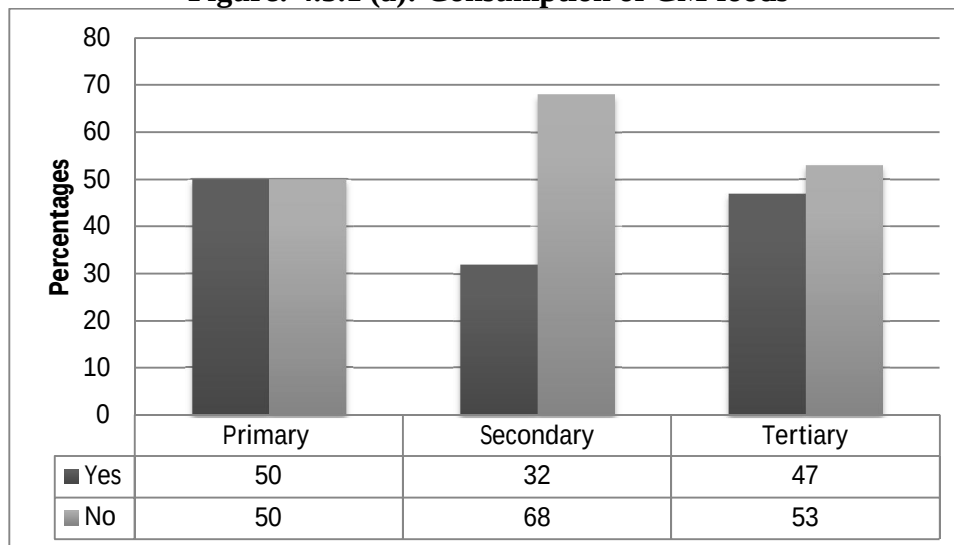
Respondents could also choose “don’t know” For example – “Ordinary tomatoes as well as GM tomatoes contains genes” Only 31% of respondents recognised this as true statement; More than half of the respondents with tertiary education (62%), secondary education (56%) and 29% of those with primary education erroneously believed this to be true; 32% indicated “Don’t know”. The large percentages of agreed statement came from respondents with tertiary education followed by secondary education. This means that as the level of education increases, the scientific knowledge generally increases confirming education as the key variable. But on average, 37% of all respondents agreed with the statements another 37.2% disagree and 25% don’t know, this means that there is still lack of knowledge about GM foods.

Acceptance and Attitudes of GM Foods

Consumer Acceptance

When respondents were asked whether they had ever eaten any GM foods, 43% of the whole sample correctly indicated “yes”, with high percentage of respondents with tertiary education, followed by secondary education. A large percentage of respondents 57% believed that they had never eaten any GMO food. Hence, there is a lack of knowledge and understanding concerning GM foods. Then, the respondents were divided into three segments and assessed as in Figure 4.3.1 below:

Figure: 4.3.1 (a): Consumption of GM foods



It was observed that, 53% of those with tertiary education they believed that they did not eat foods containing genetically modified ingredients. Slightly less than half of the respondents with tertiary education reported that they did eat GM food and those with primary education (50%) believed that they did actually eat Food containing GM ingredients and the other 50% did otherwise.

A large proportion in each level of education believed that they did not eat foods with genetically modified ingredients. The figures were 50%, 68% and 53% in those with primary, secondary and tertiary education respectively.

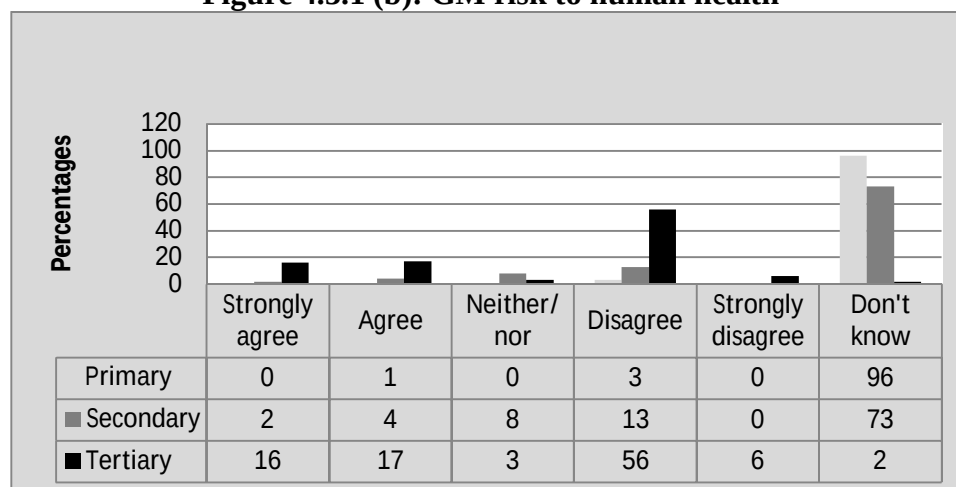
When asked if they would buy GM foods if were healthier 51% of all respondents agreed with the statement, while 37% disagree and 12% did not know, although more than 50% of those who agreed were educated (with tertiary education). This is shown by the table below:

Table: 4.3.1.: Testing acceptance of GM foods

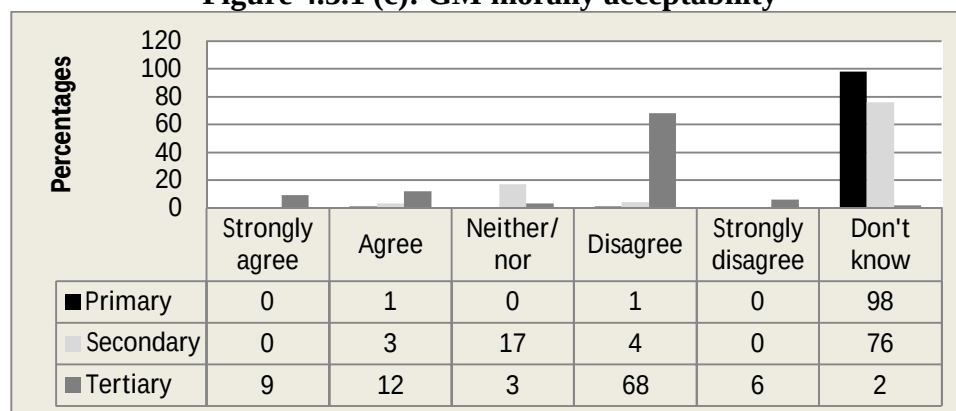
	Agree %	Disagree %	Don't know %
a. I would buy GM foods if were healthier	51	37	12
b. I would buy GM maize if it costs less than ordinary maize	41	49	10
c. I would buy GM maize if it were grown in a less damaging way to the environment	55	39	7
d. I would buy GM maize if it tasted better	43	49	8
e. I would support policy having access to every body's genetic information help some crime	48	42	10
d. I would be able to eat the eggs of a chicken fed on GM maize.	52	28	20

But when considering the second statement that says, "I would buy GM maize if it costs less than ordinary maize", the expected determining factor here was income as respondent (about 56%) with tertiary education (expected to have higher incomes) reported that they would not buy, and the ones with secondary education or less they would buy (43%) and the rest did not know. Hence, the overall response was 41% would by GM maize and 49% disagreed.

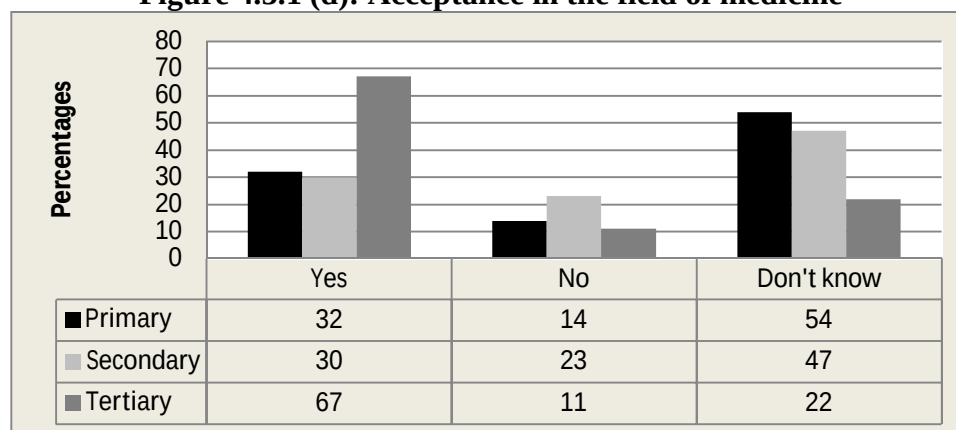
Respondents were specifically asked if they had any negative attitudes towards consuming or buying GM foods. Approximately 2/3 (64%) had no negatives and 1/3 (36%) did. Some of those with negative attitudes (most with tertiary education and their work environment and qualifications were closer to health and production industries) mentioned the most important factor that caused that, the following were the most common factors mentioned; is unhealthy for humans, is unhealthy for animals, changes the taste and nutritional value of food, violates religious/ethical principles, is unhealthy for the environment. Figure 4.3.1 (b) demonstrates the responses on GM risk to human health.

Figure 4.3.1 (b): GM risk to human health

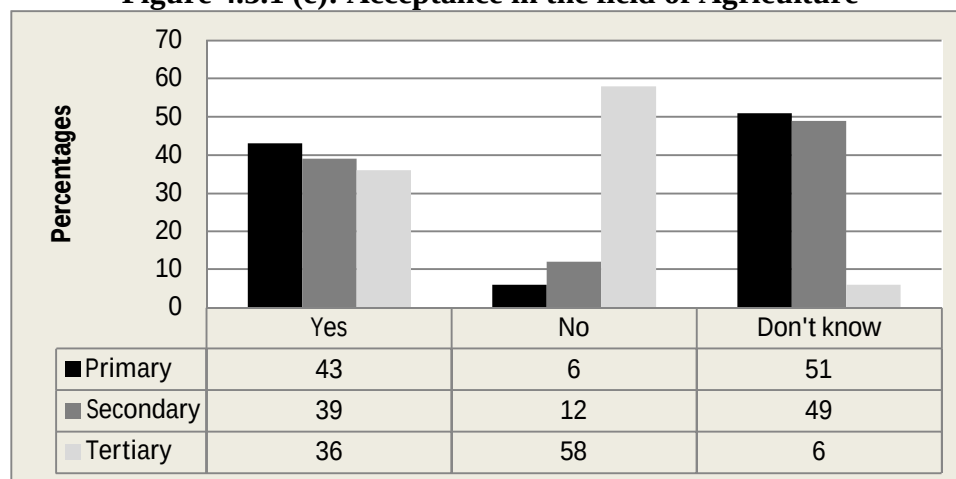
Although most did not know whether GM foods poses any risks to human health or not, but people with tertiary education disagreed to the statement that GM foods has no risks and agreed that they had some risks. 96% of respondents with primary education and 73% with secondary education know nothing about the GM foods and health risks. Figure 4.3.1 (c) yielded the similar results about the morally acceptability of GM foods with the majority not knowing. Respondents were asked, 'to what extent do you think GM foods are morally acceptable'? The following is the summary of their responses.

Figure 4.3.1 (c): GM morally acceptability

About 68% of respondents with tertiary education disagreed to the statement these foods are morally acceptable, and 98% and 76% of respondents with primary and secondary education were not well informed and did not know. Small percentages mostly from tertiary education agreed that GM foods are morally acceptable. Then the respondents were asked about their acceptability to the different fields as in Figure 4.3.1 (d) and Figure 4.3.1(e).

Figure 4.3.1 (d): Acceptance in the field of medicine

When asked about the field of medicine, most respondents did not know from primary and secondary education with 54% and 47% respectively. However, respondents with tertiary education accepted the application of biotechnology in the field of medicine with 67% and 11% did not accept. This means that, people who know about the technology trusted its application to this field. The results were not similar when they were asked about the application of biotechnology in the field of agriculture in the Figure 4.3.1 (e) below:

Figure 4.3.1 (e): Acceptance in the field of Agriculture

58% of respondents with tertiary education did not accept and amazingly, respondents with primary (43%) and secondary (39%) education accepted the technology application in agriculture. Although the majority of respondents did not know, people appear to biotechnology in agriculture with 36% of respondents with tertiary education.

Attitudes towards buying GM food

To measure which beneficial attributes (if any) of biotechnology foods were most highly valued by Respondents, a series of statements were read and respondents asked to choose one of 3 responses. This is represented by Table 4.3.1 above; it is clear from Table 4.3.1 that, most of

respondents are having positive attitudes towards buying and consuming GM foods. Although people are more concerned about their health safety first, they would buy and consume GM foods if their health won't be affected in the process. These survey responses indicate that respondents were positive about the broad range of potential benefits that biotechnology-derived foods may offer to consumers. Improved nutritional value and reduced cost appeared the most popular benefits.

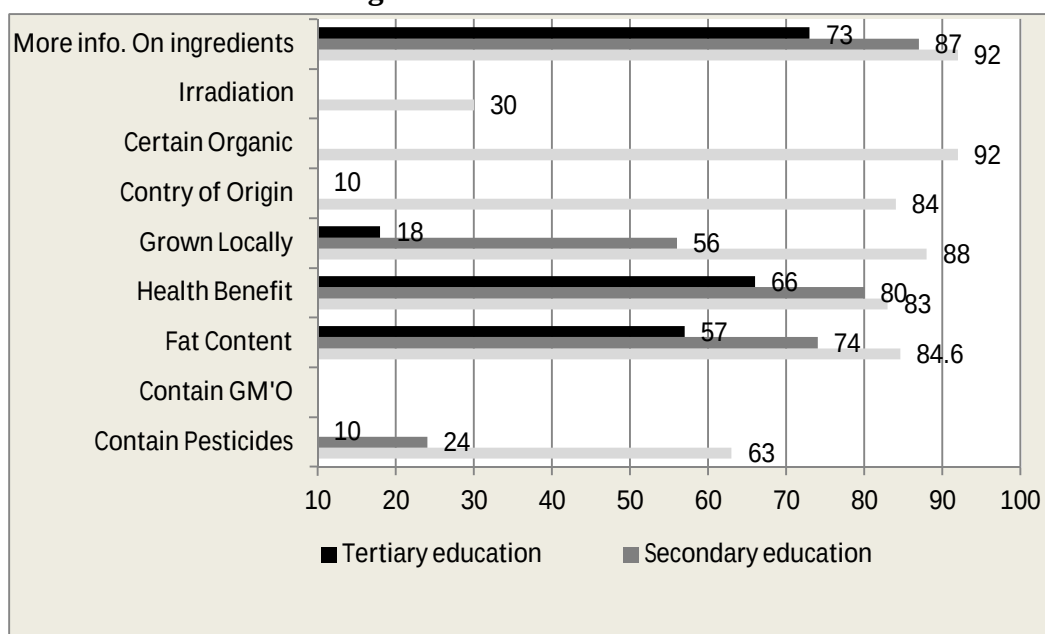
Consumer Concerns about Food Eaten

The vast majority of respondents interviewed were more concerned about what they eat. Respondents with tertiary qualifications expressed the greatest concern about the food eaten (99%), followed closely by those with secondary education (95%) and primary (51%).

As presented by the Figure 4.3 below, respondents were asked to spontaneously name their concerns. Main concern of all respondents (84%) was on ingredients. In particular, they wanted to know about the nutritional value of food. More specifically fat content and health benefits were mentioned by 72% and 76% respectively of respondents. Other significant concerns for high educated respondents were organic and country of origin 92% and 84%. Of those with tertiary qualifications 66% expressed most concern about the health benefits and safety of food eaten, especially if it was clean/hygienic, fresh and sanitary. Biotechnology was not mentioned spontaneously by any respondent with any level of education.

Respondents were then shown a list of factors relating to food and asked how concerned they were with each. Responses to this question are presented in Figure 4.4. Specifically, respondents were asked to outline the information they read about when buying foods, apart from food label. Hence none of the respondents mentioned GM ingredients.

From the list of attributes given, the most important concern was "ingredients" used in manufacturing the food (84% of all respondents). The second most important concern (76%) was "health". Both gender of respondents from male (70%) and female (78%) from those with tertiary qualifications. However, only 57% of respondents with tertiary education were concerned about fat content. The least important concern about food was 'Biotechnology or Genetically Modified Foods'.

Figure: 4.4. Concerns about food

Sources of Information on Food Safety and Nutrition

On questioning about preferred sources of information on food biotechnology, more than two-thirds of all respondents (70%) felt that information about genetically modified foods should be made available on TV, followed closely by newspapers at 64%. 52% of respondents with secondary education felt that information on genetically modified foods should come from the Department of Health. A further 49% of those with secondary education wanted such information to be in magazines while another 36% said supermarkets. 37% of respondents with tertiary education mentioned radio while a quarter of the Respondents with tertiary education (24%) highlighted the Internet.

When respondents were asked what they think in their opinion are the most important sources of information on any food-related health and safety matter. The following were the three most important sources of information on any food related health and safety matters mentioned by respondents:

Table 4.5.: Sources of Information on Food Safety and Nutrition

Tertiary education	Secondary education	Primary education
Newspapers (59%)	Department of Health (66%)	TV (74%)
TV (57%)	TV (30%)	Newspapers (56%)
Internet (35%)	Churches (27%)	Radio (46%)

It is clear from Table 4.4 that respondents with tertiary education preferred newspapers (59%) than TV (57%) and internet (35%). Contrary, respondents with secondary education preferred

Department of health (66%); TV (30%) churches (27%). But primary education respondents preferred TV (74%) than newspapers (56%) and radio (46%).

Sources of Information on Food Biotechnology

Newspapers appeared to be the most common source of information where respondents with high level of education (78%) and secondary education (75%) had heard or read about food biotechnology. On the other hand, the respondents with primary education gave a mix of media outlets, namely TV (43%), newspaper (38%) and magazine (34%). Conversely, few Respondents named government, department of health or consumer organisations as information sources.

Food Labelling

The respondents were asked about their use of food labels (apart from brand name), as a source of information on nutrition and food safety. Almost all respondents reported that they checked food labels at least sometimes. When probed further, 80% of all educated respondents reported that they always checked food labels, while at least half of respondents in the secondary (55%) and primary education (50%) did so. Then they were asked about the type of information they would like to read about on food labels:

The most common items would like to check for, on food labels was 'expiry date' by those with tertiary education (87%) the highest, primary with (88%) and secondary education (82%) the least. Following closely behind were 'ingredients' and 'nutrition value'. The least checked item was 'biotechnology or GM ingredients' with all three areas giving overwhelmingly low response for it: primary education (3%), tertiary (7%) and secondary (2%).

Most respondents felt that the level of information on food labels currently was about right. Respondents with tertiary education (87%), secondary education (78%) and primary education (71%). However, 23% of respondents with tertiary education said that there was not enough information. Conversely 11% of those with secondary education thought that there was too much information and others do not know. A third of respondents in each level of education felt that there was information currently not on food labels which they would like to see: Very few of those interviewed wanted to know more about GM food or Biotechnology additional items to be included on food labels.

PART B: Focus Group Discussions

The 6 transcripts were thematic analysis to determine consumers' understanding and acceptance of GM foods. The content analysis produced a broad categorisation scheme of the issues consumers addressed when they heard the word genetically modified foods or products as well as their response to the listed mentioned questions.

The findings are presented as a general impression of the consumers' opinion on GM foods. This impression is supported with examples of illustrative quotes that were extracted from the transcripts provided by the focus group sessions. The illustrative quotes give a true image of the

way in which GM foods are discussed, described and understood and are not the opinions of the researcher.

The purpose of the group discussions was to obtain information that is not easily obtainable on individual interviews. Through group discussions, different opinions are discussed and members of the group contribute equally and no one dominates the discussion. The research only guides the discussion with minimum instructions and no opinions on the subject matter. The information from each group was then captured during the discussion producing 6 different transcripts summarised below.

About the word "Genetically Modified food"

Most of group participants were doubtful about what exactly GM foods were or had never heard of it. Their understanding of the concept of GM foods, some thought that, it is food like soya bean, food from the field, vegetables that grow in our gardens, things like long life milk, big vegetables and fruit, Soya been products, things like long life products.

Consumers who had heard of GM foods described them as a product where certain genetic characteristics have been changed or high technology was used to make a product better; those are the pests or insects resistant crops, drought resistant crops, food produced from Biotechnology or Genetic engineering, foods that its characteristics has been changed or modified according to human requirements.

When it comes to other group participants, the notion of GM foods was not something that really concerned them and they were ignorant about it. Consequently, some focus group members pointed out that, they never thought about it, and remember that it was once at television news and never thought about it. Another member said, she read about it once on the Sunday Times (newspaper) and it was not clear why people are opposing it, and hence it was not an issue to her. Therefore, most people are ignorant even if they have had about it.

Would you buy GM foods?

On average, most group members were not against the purchasing of GM foods and only if the products is legally produced for human consumption and it is well known by the government. They would buy it, if most people are buying and it tasted better to them and will not care about what will happen in the future.

On the other hand, when consumers were asked during group discussion that, if they were given a chance to choose between GM food and non-GM food, what would be their response. Most prefer the GM free product as they said; it is better the GM free product if there are no doubts and discussions about it and if they see that GM product has better health advantages than the non-GM. Hence, they will take it to the counter and for it, but if the prices are not the same, they will take the cheaper one if it is healthy and save for consumption.

Therefore, when the consumers felt they were confronted with a choice between GM foods and a non- GM food, they bring the new concept 'price', and hence it would depend on such factors and difference in size, taste and other consumer acceptance factors in the products.

Do you think there are any GM foods on the market?

Even if consumers appeared to be familiar about GM concept, when they were confronted with this question, they were not completely confident. In a nutshell consumers were doubtful as to whether there are any GM foods on the markets or grocery stores, fast food retailers and retail stores in Queenstown. They thought of beef that has been treated with hormones, tomatoes that are weather proof, maize, cotton, lettuce, rice and fish.

But it was clear that, most of the group members were not able to mention or identify the GM products on the markets or the products that are more likely to have GM ingredients.

What are the advantages of GM foods (if any)?

A number of consumers were not conscious of any advantages; others were sceptic about proposed advantages. Therefore, most members of the groups were not able to mention any advantages. The following are advantages captured from those who know of have heard about GM foods, that is, crops that are resistant to harsh conditions can be produced out of season and this is possible by improving the genetic make-up. Improved health status of people, and can fight against poverty and under development. Can improve the economy through exports and positive contributions to the balance of payment, lead to higher productivity per hectare and better quality. Animals can be ready for consumption within a short period of time, hence cost efficiency in production.

Production efficiency will lead to cheaper products as there are bigger amounts produced. Better nutritional quality of food, as well as longer shelf life.

What are the disadvantages of GM foods (if any)?

Consumers have some fears about GM foods and biotechnology processes and in that regards, they pointed out the following disadvantages:

- GM foods are in the short run and we have fears about the future because, the long term effect of this technological is not clear.
- I am concerned about micro organisms during the decomposition process for the Genetically Modified crop plant and am intending to take Masters' research thesis on that majoring with crop science research.
- These modified seed are used for one season, and traditionally seeds are used for multiple seasons and that costs emerging farmers.
- These modified seeds are expensive and not affordable by emerging farmer and they benefit the rich and excluding the poor.

- The taste of GM foods is not the same as non GM food, non GM taste better especially in meat and fruit.
- Cross pollination between GM crops and other unmodified crops.

Is there any health risks involved in GM foods?

In fewest possible words, consumers were not aware of health risks associated with GM foods and the following were the few responses received; the development of foods allergies, concern for vegetarians that could unknowingly consume product with genes of animal origin, uncertain about the future application of this technology, unsure about any other health risks.

Should products containing GM material be branded?

Group members in this case were all in the agreement that government must impose labelling in order for consumers to be able to make choices and know what they are eating and they think it is their right as consumers to know what they eat and what he buy. They said, labelling is important to inform someone about GM products. Labelling is also important when it comes to the choice of the product and it will be the other way of informing the public about GM technology.

Do they think there is any control over GM foods?

The general consensus formed amongst the focus group participants was that there should be some form of control and that the Government should be responsible for overseeing the control of GM foods. However, the respondents were uncertain as to whether South Africa had any control over the implementation of GM foods for example:

“I don’t think so big in South Africa, but possible in foreign countries control would be bigger and they have underground factories where they do experiments and such things, that we don’t know about”.

Conclusion

Consumers demonstrate low technical knowledge especially those with lower levels of education. However, some consumers were found to have some awareness that biotechnology foods which have been approved as safe for human consumption are already extensively available, and which food crops biotechnology modified varieties may be found. The majority of consumers found this acceptable. Mass media sources appear to be by far the preferred sources of relevant information, both for nutrition and food safety topics in general and biotechnology in particular.

The mass-media are the primary communications specialists already well-positioned to provide relevant information. Scientific and public sector regulatory bodies are perceived as competent to assess health and safety risks and benefits. Information campaigns which draw on the expertise and collaboration of both of these groups could provide a very effective means by which to improve public understanding of this issue.

CONCLUSIONS AND RECOMMENDATIONS

Introduction

This section concludes with the research findings from the literature and includes the results of the field survey. The research findings do not contradict with other similar research studies conducted in South Africa. Hence, there are some recommendation from the study and identified areas of future research in the field of Genetic Modification and consumer acceptance.

Findings from Research

It is apparent that in general the South African consumer is not well educated with regard to GM foods. The lack of knowledge regarding GM exists on various levels and does not pertain to only a specific consumer segment of the study sample. This finding confirms the quantitative research report presented by Africa Bio which does point to a need for further consumer education on the topic of GM.

The study was to investigate the consumer acceptance of GM foods and the results show that consumers accept the GM foods but they have negative attitudes towards GM technology and its application in the field of agriculture. Consumers were willing to buy GM foods if were cheaper and taste better, meaning that their acceptance level depends on other consumers factors that influence their choices when making such decisions. The consumer knowledge and awareness about GM foods was the great concern in order to view the acceptance. The researcher believe that, the qualitative approach revealed more fundamental issues concerning the consumers' awareness and understanding of GM foods and products in contrast to quantitative methods using individual questionnaires. Hence, it was clear that people were not informed of what they are accepting, therefore, they have negative attitudes but they would buy GM products considering other consumer factor including price differences.

It is advised that, this method should be followed using a larger representative sample of South African consumers. The current case study of Queenstown, has given some indication of the valuable information retrieved from the consumers regarding the aspects that need to be addressed in further consumer educational programmes. Through this approach it is apparent that various fears and misconceptions about GM foods in South Africa exist and need to be addressed before the consumer will accept GM development. It is proposed that these concerns stem, in part, from a lack of knowledge about GM and that this lack of knowledge will significantly impact on any attempts to introduce GM foods into the food chain in South Africa.

Recommendations

The South African consumer needs to be informed and educated with basic information on GM products to enable the consumer to make an informed decision. It is necessary to understand that the South African consumer has formed certain ideas about what they consider GM foods and products are as well as the implications of GMO development. An education programme should focus on giving information free from bias to educate consumers and empower them to make

informed choices. The consumer would like to be informed as they also realise that they know too little to be a responsible consumer.

It is therefore urgent that government spends more money on research and on workshops that educate people about the presents of GM foods in the market that is awareness creation. If it is important to government to inform people about such food staffs, labelling of food can play a major role in an attempt to educate people. Consumers must also be encouraged to read food labels and any other information available, and must be concerned with their health benefits including nutrition status of food they consume. South Africa is one of the countries that respect human rights. By not telling or educating people about safety and benefits of food they eat, some of their rights are violated those are consumers rights therefore food must be labelled. All those actions are important in South Africa to debunk the myths that people have about GM foods. South Africa must effectively use its policy measures to control GM production and consumption as it is one of the country that adopted the environmental safety policies at the World Summit in Johannesburg 2002.

Areas for Future Research

A number of research opportunities were identified after considering the existing research on consumers and GM foods in South African context. Most of the current research considered South African consumers on the aggregate level and consequently a need was identified to identify groups of consumers with similar perceptions, attitudes and behavior towards GM foods. A need was also identified to estimate consumer's willingness to pay within the GM food context. The final research opportunity was identified, was the need to look specifically at consumers reactions to GM food based on specific product such as maize as the staple food of the country, South Africa.

NOTE: This study was presented by the principal author in 2013, to the Regent Business School, Durban, South Africa, in partial fulfillment for the award of the Master of Business Administration Degree (MBA).

The study was supervised by Professor Anis Mahomed Karodia, Senior Academic and Researcher, Regent Business School, Durban, South Africa. The paper was edited by Karodia, for publication as a Journal research article.

Kindly note that the entire bibliography is presented and cited and a few references were omitted in the preparation of the article, as a journal publication.

In the event that the entire dissertation is required, kindly apply to the following Email address, furnishing reasons for the request and the organization you belong to. The regent Business School Reserves all rights in respect of this study: akarodia@regent.ac.za

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