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Consumer Knowledge and Perceptions Regarding Genetically Modified Foods: A Case Study of Two Cities in Botswana

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ABSTRACT

The purpose of this study was to investigate the consumers' knowledge and perceptions regarding the availability, acceptance and consumption of Genetically Modified Foods in Botswana. The study used a questionnaire to collect quantitative data from 400 consumers at 10 supermarkets located in Francistown and Gaborone. Systematic random sampling technique was performed and consumer respondents were picked at the entrance of each supermarkets every day between 8 am to 5 pm in the month of June 2016. Data were analyzed computed for simple frequencies and percentages. The findings exposed that majority of the consumers were females (59 percent), slightly above half (54 percent) were aged between 21 and 30 years old with majority of them having tertiary education. The study also revealed that consumers seem to be knowledgeable about availability, seemed to accept and was positive about the genetically modified foods. The findings implied that genetically modified foods were deemed to be solving issues related to food shortage for the growing population globally. The study recommended that a national study be conducted to cover all regions and a mixed methodology be used to gather in-depth information.

Keywords: Consumers; Genetically modified foods; Knowledge; Perception

INTRODUCTION

The Genetically Modified Foods [GMFs) product technology is relatively new in Botswana and little research has been conducted (lethola and George, 2016). Although the concept of GMFs in developed countries is advanced and consumers are likely to be aware of GMF products availability in the market and their consumption, the same cannot be assumed about consumers in Botswana. According to Matshika, (2005) GMF products are available in Botswana markets but it is not known whether consumers have the knowledge about the products existence or not, and how they perceive the products. The author further indicated that, the fact that the products are available in the market cannot be denied since Botswana imports most of her agricultural products from all over the world including the neighbouring countries, which utilize biotechnology extensively. A study conducted by Oladele and Subair (2009) which compared the perceptions of university lecturers in Botswana and Nigeria revealed that lecturers in Botswana are more favourably willing to accept genetically modified foods as compared to those from Nigeria. However, despite this, there is not much research done to investigate knowledge level of consumers hence the importance of this study. This study examined consumers' knowledge level and perceptions of genetically modified foods (GMFs) in Botswana' food market in some cases research has shown that consumers were not aware about products containing genetically modified products whereas in some situations their knowledge level is also not known [1-3]. In addition, do consumers agree to take the genetically modified food products for consumption?

As found by Dibden, Gibbs and Cocklin (2013), the production and sale of GMF for human consumption has raised controversial issues globally. In the agriculture sector, there are both benefits and disadvantages of producing GMFs (Kruft, 2001) because engineered seeds and improved crops, livestock breeds, and also several other products enhance productivity and increase yield for food production. From the economic

perspective, GMFs are believed to support and promote the products that enhance sustainable production of food, and cash crops, thus ensuring food security (Qaim and Kouser, 2013). On the contrary, concerns are also raised about health and safety effects brought about by feeding on GMF products by both human and livestock. Among other factors raised as health issues are obesity, allergies and antibodies disease resistance (Bawa and Anilkumar, 2013) of people who consume GMFs. This debate is ongoing in developed countries whether or not the GMFs were good for human consumption and recently political leaders in the SADC region hooked up the discussion.

This study was therefore designed to solicit ideas of consumers so as to understand the knowledge level and perceptions of consumers regarding GMFs consumption in Botswana. The outcome of this study should educate stakeholders such as Trade and Consumer Affairs, agriculture industries, farmers and policy makers on whether or not to take a stance in growing, selling and marketing of GMFs for human consumption. The concern is, do people of Botswana accept the genetically modified foods or not? In addition, the study also examined the variables studied in relation to the theory and concepts existing [4-6].

Specifically the study to read investigated whether or not the residents' consumers of Gaborone and Francistown consumers accept GMFs. The study sought to;

Describe the demographic characteristics of consumers involved in the study

Describe the sources of knowledge (information) about GMFs

Determine the knowledge level of consumers with regard to genetically modified foods availability in Botswana market.

Describe the perception of consumers regarding the consumption of genetically modified foods.

LITERATURE REVIEW

Research studies by Mwamahonje and Mrosso, (2016); Tiana, Bryksa, and Yad; Oliver, (2014) have shown the need to increase in the use of genetically engineering technology probably to address food security period. This is so because the population is threatening to increase while on the other hand land is becoming small or scarce for food production small (Vass, 2001). Statistics also show that GM Foods are produced worldwide (ISAAA briefs, 2016, Traxler. 2016) by both developed and developing countries. For example, in developed world, the United States of America is the largest producer of GM products followed by Argentina, Brazil and India which are in the developing world (Traxler, 2006). The Food and Drugs Administration (FDA) of the United States Department of Agriculture (USDA) has also confirmed that forty plants varieties are genetically modified and commercialized. Some examples of such crop plants include tomatoes (Mehta, et al 2002) and cantaloupes (Flores, et al 2001) whose ripening characteristics have been modified as a result of the technology. In line with the technology, crop species such as sugar beets have improved resistance to herbicides, while corn and cotton have increased resistance to insect and pests (Whitman, 2000). Wide-reaching, the main GM crops cultivated are soybeans, maize,

cotton and oilseed (Areal, Riesgo and Rodríguez-Cerezo, 2013; (Bawa and Anilakumar, 2013). Given the availability of GM Foods in the world markets and liberalization of trade, it is important to investigate consumers' knowledge level and perceptions as well as attitudes towards these foods. According to Catacutan, Ajayi, Sileshi and Nieuwenhuis (2015) psychological factors such as perceptions and attitudes of the possible adopters towards an innovation would play a key role hence the need to study the scenario. According to Frewer, Scholderer and Bredahl (2003) attitudes tend to inform people's perceptions towards an innovation or technology [7-10].

In the SADC region, the use of GMFs has been understood with mixed feelings as some political leaders tend not to accept the consumption of the products while others do not believe the products even exist in the market. According to the United Nations (2005) 'the debate about biotechnology as applied to agriculture is one of the most voiced out and passionately been taking place in recent years. This could be so because different stakeholders appreciate differently the potential risks and benefits brought by the biotechnology products or genetically modified organisms (GMOs) in real life situations. Mwamahonje and Mrosso (2016) described the GMO technology to refer to a situation of incorporation of genetic engineering to improve crop and animal productivity'. This is done to address hunger and malnutrition (hidden hunger) issues especially with vitamin A, iodine and iron which are often associated or taken to be part of hunger (Alnwick, 1996; Global Hunger Index, 2014) more so that the population is due to increase (Vass, 2001).

According to Legwaila, et al (2013) Botswana's rainfall is erratic. Despite this, the country is capable of producing traditional food plants which contain vital nutrients and essential vitamins for maintenance of human health and for children who are often vulnerable to malnutrition and diseases (p. 028). In line with the issue of food security in the country through the adoption of new technologies, Lethola and George (2016) reported that the government of Botswana has also drafted a National Biosafety framework in partnership with the United Nations Environmental Programme-Global Environment Facility (UNEP-GEF) on policies for conservation and sustainable use of natural resources and protection of human health would anchor. To affirm the foregoing, Muzereku (2014) together with the Ministry of Agriculture through its former permanent secretary, Dr. Micus Chimbobi was quoted by Morula in the Sunday standard newspaper of 03 November 2014 stating that we are currently working with all stakeholders to develop a policy on genetically modified foods as we have realized the need for it [11].

According to Lethola and George (2016) biotechnology is globally recognized as a powerful tool of plant and animal genetic modification (GM) that holds promise of improving productivity, profitability and sustainability of farm production systems. This affirms the country's position and stance in using the GMFs including those existing in small and poor farming situations Cohen (2005); Lethola and George (2016). By developing the framework, the country further makes itself

readily available for biotechnology food engineering technology (Mazereko, 2014) [12].

Technology acceptance theory and concepts studied

Acceptance of any new product and or innovation is usually based on the knowledge, perception and attitude towards the phenomenon. This can be explained using the Technology Acceptance Model designed by Davis, Bagozzi, and Warshaw (1989). The model theorizes that in any society, acceptance of new technology is based on external factors which comprise of people's perceptions of an innovation or how they interpret the

technology in their lives. This occurs simultaneously with the influence from the way the technology is used and how easy it will be used. The people's perceptions will include how they perceive the usefulness of the technology in addressing their needs of food security and whether or not they see the technology to be easy to use. This technology adoption understanding of the process is explained through Figure 1, which illustrates human psychological variables to be taken into consideration as factors influencing the adoption of the new technology [13].
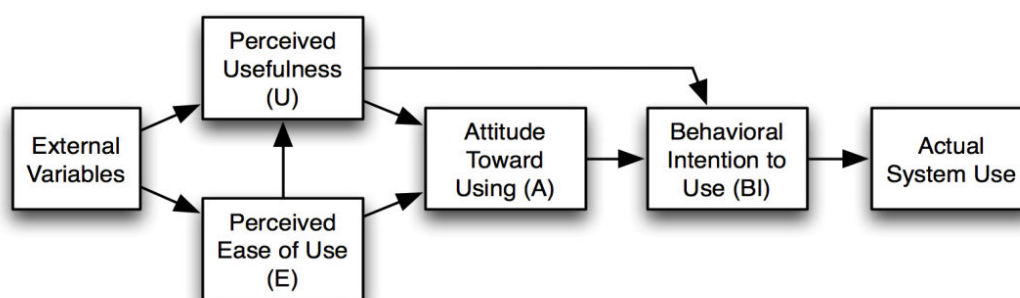

Figure 1: Technology Acceptance Model (Davis, et. al. 1989).

Knowledge of GM Foods enables consumers to be familiar with both the positive and negative consequences of these products on health, safety and the environment. According to Park et al., (1994) and Selnes and Gronhaug (1986) knowledge can be objective or subjective. Objective knowledge is the accurate information about the product while subjective knowledge refers to people's on their interpretation [14].

The availability of information such as that of benefits, health as well as ethical ones on GM Foods would help consumers to make informed food choices, (Dizon, 2015; Vermeir and Verbeke, 2008). Several researchers (Alba and Hutchinson, 1987; Brucks, 1985, Loader and Henson 1998 and Teisl, Fein and Levy, 2009) have noted that knowledge may be a key factor influencing consumer decision making and acceptance of GM Foods. According to Hoban (2004), the benefits of agricultural biotechnology can be comprehended well when stakeholders (consumers and manufacturers see the nee it safe and beneficial. On the contrary, Baker and Burnham (2001) and Cardello, Schutz and Lesher, (2007), reported that lack of information contributed to negative beliefs about genetic engineering. Other studies reported that the degree of awareness about agrobiotechnology varies across consumers within a country and between countries (Huang et al., 2006 and Frewer et. al., 2013). For example, research on biotechnology have been conducted in the USA and Europe for some times, but still differences among consumers in different countries do exist (Hoban, 2004).The lack of knowledge of GM Foods might be due to several factors, including limited consumer education and the complexity of biotechnology [15-17].

How consumers perceive biotechnology is vital to its acceptance. According to Arubayi, perception on any issue is very important. Perception is defined as "the process of acquiring, interpreting, selecting, and organizing sensory information" (**http://www.wordiq.com/definition/Perception**). The public's perception of GM Foods will also influence the reception or rejection of these foods. If consumers perceive GM Foods as healthy; without risks or nutritious, there are more likely to accept them. But, if GM Foods are perceived as unsafe, not providing any nutritive value, then people will reject them (Subrahmanyan and Cheng, 2000; Frewer et. al., 2011). Although studies on GM Foods in Botswana are scarce, a study by Oladele and Subair (2009) on perception showed some light on the topic for the target group studied compared to their Nigeria counterparts. The study was limited to Botswana College of Agriculture lecturers therefore might not represent the views and opinions of Botswana shoppers at large.

Another important variable in the acceptance of GM Foods is attitude but not discussed in this article. Attitude is defined as a tendency to evaluate something in a positive or negative way (Eagly and Chaiken, 1993). Literature has revealed that the acceptance of GM Foods depends on people's attitudes, which explains why some people support GM Foods, whilst others do not. Low familiarity with agrobiotechnology may encourage unfavourable attitudes toward GM Foods (Moon and Balasubramanian, 2004). Due to limited research in Botswana, consumers' attitude and perceptions towards GM Foods is unknown, hence the need for this study [18].

METHODS

Design of the study

The study used a descriptive design whereby a questionnaire was used to collect data with regard to availability of genetically modified foods in major chain supermarket stores, sources of knowledge and their consumption. According to Nassaji (2015) the purpose of descriptive research is to describe the phenomenon being studied and its characteristics without questioning why and how. The survey was conducted in Francistown and Gaborone food supermarket chain stores. These are the two cities in Botswana which have a human population of close to one million each and more than ten supermarkets selling foods [19].

Population and sample

The study used a sample of 400 consumers from the selected 10 supermarket categories in a 30 day period allocated to be surveyed everyday starting from June 1st to 30th 2016. The sample frame was a list of supermarkets obtained from Gaborone and Francistown City Councils in purposively selected supermarkets in two cities of Botswana. The ten chain supermarkets were namely; Spar Supermarket, Pick n Pay, Chopies, Woolworths, Payless, Shoprite, Checkers, Ok-Foods, Sefalana and Seferite. The number of supermarkets was guided by Krejcie and Morgan (1970) table for determining sample size from the ten categories of stores. The 400 consumers were purposively decided by the researchers based on the number of supermarket stores selected for the survey to have each store contributing 40 consumers.

Research assistants were placed at the entrance of each store to conduct the administration of the interviews. Two research assistants were engaged for this study to administer the interviews. On average, the research assistants spent at least two days at each store interviewing customers.

The study used a systematic random sampling when picking research participants at the entrance of each store. A systematic random sampling is a probability sampling technique whereby an assumption was made that for every buyer entering the store, the researcher would interview the nth person and end up getting a total of forty consumers at each store. On average the researchers estimated that at least ± 400 consumers would enter the supermarket in a day. Thus, for the 40 interviewees selected the first person is randomly picked followed by the nth until the number required is interviewed (Taherdoost, 2016).

The instrument

A questionnaire was designed by the researchers to collect data. The questionnaire was a modification of the previous instruments designed and used by the research studies about genetically modified foods. The contents of this research survey instrument were guided by **Wunderlich**, and **Gatto** (2015), Pattron, (2005), Vecchione, Feldman and Wunderlich (2014) research procedures. The questionnaire was a close ended with four parts.

Part 1 of the questionnaire was to measure the level of consumers' knowledge and awareness about GMFs consumption, food labelling when on supermarket shelves, risk and guiding regulations, as well as benefits. Statements were anchored on a 5-point Likert type scale requiring response to show 1=strongly agreed; 2=agreed; 3=not sure; 4=disagreed and 5=strongly disagreed. Part 2 of the survey instrument was to assess consumers' sources of knowledge about Genetically Modified Foods by inserting a tick to show Yes or No. To gather information about GMFs the deferent possible sources were listed. Part 3 determined consumer perceptions regarding Genetic Engineering (GE) technology in terms of benefits and risks. Part 4 was about demographic characteristics of the participants in this study [20-28].

The validity of the questionnaire was established through the use of a panel of three experts who reviewed the questionnaire to validate the face and content validity. The experts included a food scientist, a biotechnologist and a consumer specialist at the university of Botswana and the Botswana College of Agriculture (BCA). The panel considered the question items and checked if the items were clear and understood by all. A pilot study was conducted involving non-participating chain stores in Gaborone city whereby fifty (50) consumer participants were utilized. Data from the pilot survey was computed using Statistical Package for Social Sciences (SPSS). The Cronbach alpha coefficient values were computed to be 0.87 for part 1, 0.76 for part 2 and 0.85 for part 3. Appropriate changes were made on the questionnaire as a result of the findings from the piloting exercise [29].

Procedures for administration of the questionnaire

Arrangements were made between the researchers and the selected stores to administer the questionnaire to consumers as they entered the selected supermarket. The two research assistants were stationed at each store in Gaborone and Francistown starting from 8 am prior to the opening of stores to 5 pm in the evening when the stores were closing for the day.

On average, the research assistants were able to interview plus or minus seven (± 7) participants in one day. The procedures of interviewing participants involved randomly picking the first customer to arrive at the store when it opens at 8 am followed by the 10th person and end up getting on average seven (7) people in one day. A total of 40 consumers were interviewed at each store. All interviewees were informed about the importance of the study [30].

Those consumers who agreed to participate in the study were requested to complete a consent form. Forty (40) consumers completed the questionnaire in each of the 10 supermarkets sampled. The questionnaire was self-administered as participants were allowed to respond to the questions on their own. The participation was voluntary and each participant who agreed to participate in the study took on average forty-five (45) to fifty (50) minutes to complete the questionnaire. The processes included the first five minutes spent on informing the customer about the study, followed by requesting the consumer to participate in the study and to sign the consent form when agreed.

The survey started on the first day of the month and was set to complete data collection on the last day of the month. Majority of the organizations in Botswana start paying their employees from the 20th to 31st every month including government and non-governmental organizations. Thus contributing to variations on the number of shoppers on different days of data collection [31-33].

To control the participants from being interviewed twice the participants were made to sign a consent form to agree or not agree to participate in the study. The participants were also informed that their participation was voluntary, were free not to take part in the study and/or should feel free to withdraw if they wish to. The consumers who indicated to be in a hurry and were willing to participate in the study were allowed to take the questionnaire home and bring back the completed one to the store management or call for collection after completion. An insignificant number (5/400) of the population approached took the questionnaire to complete at home and all returned the questionnaire on the next day. A total of over fifty consumers turned down the request to participate on the premise of being in a hurry and were not able to spare time to participate in the study. For confidentiality, participants were requested not to write their names on the questionnaire [34].

Data analysis

To analyze data, simple statistics on frequencies and percentage were computed to establish the proportions of consumers who agreed and disagreed having knowledge about genetically modified foods, and were positive with the way they perceive GMFs. Frequencies and percentages were also computed for descriptive analysis of the variable studied using SPSS Version 21. To make meaning out of the simple statistics used, a 5-point Likert type scale was compressed into three levels to ease the interpretations of the consumers' responses. This was conceptualised as follows;

Strongly Agreed%+Agreed%=interpreted in combination to denote consumers are in agreement with the statements listed

Strongly Disagreed%+Disagreed%=interpreted in combination to denote consumers are in disagreement with statement listed

Not Sure%=interpreted to mean the consumer did not agree nor disagree/unsure with the statement

RESULTS AND DISCUSSION

The results of the study are presented in relation to the variables on demographic characteristics, sources of knowledge, consumers' knowledge and perceptions regarding the consumption of genetically modified foods as follows;

Objective 1: Demographic Characteristics of consumers' knowledge

Table 1 displays the demographic characteristics of consumers surveyed in ten (10) chain supermarkets located in Gaborone and Francistown cities of Botswana. The majority of the consumers in this study were females (59%), slightly above half (54%) were aged between 21 and 30 years old, followed by a

proportion of 27% who were between the ages of 31 to 40 years old. About 57% of the respondents held tertiary education and followed by 28% with secondary education, and 7% with primary school education. Majority (62%) of the respondents were single (not married) while 21% were married. Close to 50% of the respondents were from households with four or more occupants; 37% from household with two to three while 13% were from households with one occupant.

Half (50%) of the respondents indicated that they were earning a salary less than P20, 000 per annum followed by 43% who indicated earning salary between P21, 000 and P60, 000 per annum. Only 8% of the participants earned more than P61, 000 per annum. Results in Table 1 show that majority of the consumers surveyed were in their youthful age.

Table 1: Respondent's demographic characteristics.

Characteristics		n	%
Gender	Male	162	40.6
	Female	237	59.4
Age	21-30 years	217	54.5
	31- 40 years	109	27.4
	41- 50 years	56	14.1
	>50 years	16	4
Education Level	Primary Education	26	6.5
	Secondary Education	111	28
	Tertiary Education	225	56.7
	Vocational Education	24	6
	No formal education	11	2.8
Marital Status	Single	248	62.5
	Married	82	20.7
	Cohabiting	30	7.6
	Once married	37	9.3
Household Occupants	One person	53	13.4
	Two to three persons	149	37.5
	Four and more	195	49.1

Salary	Low salary ≤than P20,000	182	49.9
	Medium salary between P20,000 – P60,000	155	42.5
	High Salary ≥ P61,000	28	7.7

Objective 2: Sources of knowledge about genetically modified foods

The study was also set to determine the sources of consumers' knowledge about genetically modified foods. The results revealed that consumers selected more than one kind of media listed as sources of information on GMFs. Thus showing a variety of sources from which consumers learnt about the technology and the genetically modified foods products. The statement which had the highest proportion of consumers (75.4%) respondents is one that indicated the source of knowledge was television, followed by 71.2% where they indicated the source of knowledge to be radios. The third was 64.1% where respondents indicated that the source of knowledge was from newspapers, 49.6% of respondents indicated the internet as source of knowledge and last was where 42.8% respondents indicated school/colleges as platforms for sources of information. Thus, concluding that there are a variety of sources available for consumers [35-40].

Objective 3: Consumers knowledge level about GMFs availability in supermarkets

Table 2 presents results on consumers' knowledge and awareness about the availability of GMFs in supermarkets, labelling of GMFs on shelves, their risk and regulation, as well as their benefits. Results as shown in Table 2 were interpreted by combining the percentages of strongly agreed and agreed responses to demote respondents in agreement while the strongly disagreed and disagree demoted respondents are in disagreement with the statements. The phrase Not sure' on the measuring scale denoted that consumers in their responses did not agree nor disagree thus respondents were unsure with the statements about GMFs.

With regard to the knowledge and awareness about the availability of GMFs in supermarkets the higher percentage, 93.8% was on, I agree that consumers should be made aware of the availability of GMFs, followed by 85.1% on a statement which stated that, I Know about the existence of GMF, then 81.8% on a statement which stated that I am aware that GMFs are available in the market. The statement ranked forth had 78.8% respondents who said I am aware that some food products I buy from shops are genetically modified. On the contrary, a statement which stated that, I am aware of the ongoing debates taking place in our country regarding GMFs had the highest proportions of respondents indicating strongly disagreed and disagreed (47.5% among all. At least two cases of more than one quarter of the respondents have indicated 'not sure' and two cases of close to one quarter 23%) [41,42].

With regard to having knowledge on food labels, 92.1% of the respondents indicated agreed and strongly agreed that they find it important to read food labels, followed by 89% who indicated reading food labels when buying food products and 70% said they read the list of ingredients in food products before buying. The least rated statement in this category is where 59% consumer respondents agreed or strongly agreed that GMFs are supposed to be labelled before being made available to the market.

With regard to knowledge on risks and regulations associated with GMFs, close to half (47.5%) respondents agreed and strongly agreed to the statements which indicated that GMFs had side effects to human health, Close to one third (32.9%) indicated that I know GMFs have not been regulated in Botswana. At least, slightly below one third (31.1%) of the respondents indicated that I understand the risks of using GMFs. Based on this statistics, above half of the respondents (50.9%) strongly agreed and disagreed to the understanding of the risk of using GMFs an indication that would mean education for respondents.

Genetic modifications process was considered beneficial by 64% of the respondents who said that they were aware that genetic makeup of GMFs which allow crops to resist pests eliminate diseases and withstand harsh weather conditions. Thus, concluding that GMFs are available, perceived to be beneficial and consumers have knowledge and awareness.

Table 2: Knowledge about the existence of the Genetically Modified Foods in Botswana.

		Strongly agree (5)		Agree (4)		Not sure (3)		Disagree (2)		Strongly disagree (1)	
Variables	N	n	%	n	%	n	%	n	%	n	%
GMF Benefits											
I Know about the existence of GMF	397	208	52.4	130	32.7	26	6.5	13	3.3	20	5

Statement	N									
I understand that GMF contains genes transferred between species unrelated in nature	390	54	13.8	167	42.8	89	22.8	27	6.9	53	13.6
I can differentiate between conventional foods and genetically modified foods	396	55	13.9	138	34.8	111	28	65	16.4	27	6.8
I know about producing crops by the genetically modified technique	393	70	17.8	149	37.9	64	16.3	53	13.5	57	14.5
I am aware that some food products I buy from shops are genetically modified	396	146	36.9	169	41.9	45	11.4	26	6.6	13	3.3
I am aware that GMFs are available in the market	395	174	44.1	149	37.7	42	10.6	19	4.8	11	2.8
I agree that consumers should be made aware of the	397	265	66.8	107	27	17	4.3	7	1.8	1	0.3
I am aware that some local farmers grow genetically modified foods	395	50	12.7	132	33.4	119	30.1	57	14.4	37	9.4
I am aware of the on-going debates taking place in our country regarding GMFs	396	40	10.1	78	19.7	90	22.7	126	31.8	62	15.7
Food Labels Knowledge										
I find it important to read and understand food labels	390	30	58.2	134	33.9	14	3.6	8	2	8	2

Statement	N										
I read food labels when buying food products	389	182	46.8	164	42.2	34	8.8	17	4.41	11	2.8
I read the list of ingredients in food products before I buy	387	108	27.9	163	42.1	92	23.4	58	5	24	6.2
I know that GMFs are supposed to be labelled before being made available to the market/shops	393	110	28	123	30.8	14	3.6	48	12.2	20	5.1
GMF Risk and Regulation											
I understand the risks of using GMFs	392	44	11.2	78	19.9	71	18.1	110	28.1	89	22.7
I am aware that GMFs have side effects to human health	388	91	23.5	93	24	82	21.1	73	18.8	49	12.6
I know GMFs have not been regulated in Botswana	389	56	14.4	72	18.5	134	34.4	63	16.2	64	16.5
GMF Benefits											
I am aware that genetic makeup of GMFs allows them to withstand harsh weather conditions, pests and diseases and is tolerant to most soils compared to regular crops which use simple organic methods	377	117	31	125	33.2	58	15.4	35	9.3	42	11.1

Objective 4: Consumers perceptions regarding GMO technology

Table 3 presents results on consumers' perceptions regarding Genetic Engineering (GE) technology. The respondents were asked to rate their perceptions regarding the Genetic Engineering (GE) technology in terms of benefits and risks. With regard to benefits of GE, respondents rated high (82.9%) the statement which reads, GE technology increases productivity and offers solution to world food challenges, followed by 68.8% of the respondents indicated strongly agreed and agreed that GE can create foods with improved nutritional value and 31.8% strongly agreed and agreed that GE can reduce pesticides on food crop plants and 26.7% for the environment.

At least 41.3% 52.7% indicated strongly disagreed and disagreed with statements which stated that GE produces products that benefit internationals only, 68.8% strongly agreed and agreed that GE produces products that benefit the foreign policies for donor countries and one that states that GE produces products

that benefit the foreign policies for donor countries. The results also show that 47.5% respondent indicated 'not sure' for that which states that, GE has the potential to reduce pesticide residues in the environment, followed by 44.4% who indicated that GE can reduce pesticides on food crop plants. Noted also is that 44.4% disagreed and strongly disagreed that GE produces products that benefit internationals only [43-45].

With regard to risks that are posed by genetically engineered technology the participants indicated as follows; 57% indicated producing foods that are not naturally but are artificial, followed by 50% respondents who indicated that GE produces products that could cause people to suffer allergic reaction after consuming. The results show that 42.4% indicated not sure on statement that states that GE threatens the environment. Followed by 37.8% who indicated that GE produces foods that hamper with nature. 14.7% respondents indicated that the developed countries used this technology to produce foods only for developing nations markets [46].

Table 3: How do consumers perceive benefits and risks of GMFs?

		Strongly agree (5)		Agree (4)		Not sure (3)		Disagree (2)		Strongly disagree (1)	
Variables	N	n	%	n	%	n	%	n	%	n	%
Benefits											
GE can create foods with improved nutritional value	388	104	26.8	163	42	72	18.6	26	6.7	23	5.9
GE technology increases productivity and offers solution to world food challenges	385	155	40.3	164	42.6	49	12.7	10	2.6	7	1.8
GE can reduce pesticides on food crop plants	387	60	15.5	63	16.3	172	44.4	75	19.4	17	4.4
GE has the potential to reduce pesticide residues in the environment	379	34	9	67	17.7	180	47.5	84	22,2	14	3.7
GE produces products that benefit internationals only	385	27	7	29	7.5	159	41.3	126	32.7	44	11.4
GE produces products that benefit the foreign policies for donor countries	388	104	26.8	163	42	72	18.6	26	6.7	23	5.9
Risk											

GE produces products that could cause people to suffer allergic reaction after consuming GI foods	382	60	15.7	131	34.3	134	35.1	48	12.6	9	2.4
GE produces foods that are not naturally but are artificial	375	64	28.5	107	28.5	110	29.3	82	21.9	12	3.2
GE threatens the environment	387	40	10.3	69	17.8	164	42.4	94	24.3	20	5.2
GE produces foods that hamper with nature	373	47	12.6	94	25.2	139	37.3	76	20.4	17	4.6
GE produces food products that are being forced on developing countries by developed nations	384	25	6.5	50	13	140	36.5	127	33.1	42	10.9

Discussion/Implications/Recommendations

Based on the results, consumers surveyed regarding their knowledge on existence of GMFs, results seemed agreed to strongly agree to the fact that consumers have knowledge and awareness, labels but having mixed feelings when it comes to risk and regulations as well as benefits. The study found that majority of the consumers were females (59 percent), slightly above half (54 percent) were aged between 21 and 30 years old with majority of them holding Bachelor's degree in different fields of education. Furthermore, the study revealed that consumers were positive about the genetically modified foods and perceived the technology to be solving issues related to food shortage in a growing population globally. However, consumers had mixed feelings with regard to their knowledge about existence of GMFs in the market and also get information from difference sources. Since this study was based in the two cities, there is need to conduct a comprehensive study covering other areas in the country. A qualitative research would do to cover all regions and a mixed methodology be used to gather an in-depth information.

Consumers were not against the consumption of GMFs nor the adoption of the technology. This is close to the findings of a study by Wunderlich and Gatto (2015) which reported that consumer knowledge about GMOs has not grown much like it happened with the adoption rate of GMO crops. The authors found that globally people have shown not much understanding, misconceptions, and even unfamiliarity with GMO food products. It is therefore not shocking that the study found mixed feelings about the knowledge regarding GMFs [47-50].

In terms of the demographic characteristics, the participants were more of youth consumers as majority of them are within the age ranging between from 21 years-40 years old, in terms of salaries were termed low salaries which may mean these were more of the youth population. One would thus consider a more comprehensive study to include all categories of ages and life styles.

It is however clear that the position of the country in adoption of the technology needs to be defined with regard to policies and strategies guiding the availability of the product in the market. With regard to the knowledge and awareness levels the results show that consumers seem to be knowledgeable but it can be concluded that their knowledge is at a level of satisfactory. This is so because on the other hands some proportions of consumers indicated not sure about the risks that are associated with genetically modified foods and the technology itself. That proportion of consumers who say not sure is worth noting particularly for policy makers and food industries. That being the case, there is need to consider educating people about technology in general and how it influences the world including genetically modified foods.

The study also noted that there are different sources through which consumers get information about genetically modified foods. Consumers were in agreement with the sources such as television, radio, internet and newspapers and education (schools and colleges) as presented. Wunderlich and Gatto (2015) revealed that the knowledge from sources about GMFs is an important education. Studies in Asian countries such as Pakistan have shown effective use of mass media to disseminate new technology (Chhachhar, 2012) thus supporting the outcome of this study [51-53].

CONCLUSION

The study revealed that consumers seem to be knowledgeable about availability, seemed to accept GMFs and was positive about the genetically modified foods and perceptions as deemed to be benefiting.

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