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Perceptions and Attitudes of Riyadh University Students towards Products Derived from Genetically Modified Crops in Saudi Arabia

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Abstract: A survey was conducted during 2008 to assess the attitudes and perceptions of the Riyadh University students towards genetically modified crops and foods. Using descriptive analysis, it was found that the majority of surveyed students had good knowledge of genetic modifications, but lack knowledge about Genetically Modified Organisms (GMO) values. Most respondents would not purchase clearly labelled GMO products, though considerable number of the respondents was ready to taste or try the products. It is evident from these results that majority of university students who participated in this survey, in general had very little information or didn't know the genetic engineering technology e.g., gene therapy, fingerprinting, role in reducing pesticide application etc., as appeared in the results, therefore, most of the participants did not know or thought GM foods are harmful and could not be easily detected. The implication of this result is that majority will not support GM products.

Key words: GMO, survey, perceptions, attitudes, students

INTRODUCTION

An organism is considered Genetically Modified Organism (GMO) if its gene(s) or genetic materials are modified by introducing a novel genetic element using *in vitro* techniques. The products of the process have potential to offer many improvements in the quality and quantity of the world's food supply, provided that genuine concerns regarding safety, environmental impact, information and ethics are satisfactorily addressed (Roller, 2001). The safety concern of the products has been lamented by various bodies. The modified animal or plant during its development may express the proteins of the inserted genes, leading to changes in the organism's molecular, physiological and biochemical structures, hence, resulting in the creation of a new living entity not found in nature. Such changes are usually uncontrolled and may result into the creation of highly unpredictable organisms (Oxfam, 1999).

Since, the adoption of genetic modified products in the early nineties, yields have continued to increase geometrical every year encouraging planting of more than 102 million hectares of GM varieties worldwide (James, 2006) due to their agronomic and economic values. This geometrical increase was greatly contributed to by farmers in the North America and other developing nation e.g., Brazil and India who devotes annually a vast land for growing GM plants.

Nowadays, GM foods and crops are flowing into almost all countries of the world including Saudi Arabia. The influx of GM foods and crops into the kingdom of Saudi Arabia historically started in the last century. Today, it is very easy to find such products in Saudi supermarkets, hyper markets and various selling and buying outlets. The wide availability of GM foods has promoted a concern among the indigenes about the impacts of the genetically modified food on health. Debate and discussion were held in different places e.g., public lectures, media, schools, houses etc., but there were no consensus on the real effects of the products on human well being.

In spite of the wide presence and the endless discussion, information on Saudi national's attitudes, opinions, knowledge, views and acceptability of the products is still lacking. A little is known on the type of information about GM products getting to the real Saudi market shoppers.

Unlike in the Kingdom of Saudi Arabia several surveys of consumer knowledge of GM products have been conducted in Europe and America. For example, Doering (2005) reported that 58% of Americans were unaware of the difference between GM and conventional foods. Huang *et al*. (2006) reported that although, less information on GM foods publicly available in China, more than two thirds of consumers in urban areas have heard of GM foods, but their knowledge on biotechnology was limited. Pattron (2005) observed that the majority of

consumers in Trinidad (90%) knew very little about genetically modified food and most suppliers (67%) were unaware that they were selling genetically modified foods to the public.

In most cases, proper information about the GM products has a valuable role in people attitudes. Bánáti and Szabó (2006) reported that the opinion of consumers and professionals about gene technology is mostly negative as far as 35% of the consumers can recall more negative than positive information about GM foodstuffs and 13% can recall negative ones. However, in few cases, consumer's acceptance for GM food can be due to certain conditions, e.g., poverty or lack of adequate knowledge of the products. Pachico and Wolf (2002) linked the high willingness (66%) to purchase and try of GM foods in Colombia with an inadequate of high quality foods at home. Curtis *et al.* (2004) concluded that the generally positive perception towards genetically modified foods in developing nations stems from more urgent needs in terms of food availability and nutritional content. Earlier, Matthew and Huffman (2001) stated that there are four reasons why one could oppose GM foods: ethical reasons, environmental concerns, health concerns and trading worries.

However, negative reaction to GM products has been related to risk of the adverse effects of consuming GM foods. Onyango (2004) reported that once the consumers were well informed of the risk, their willingness to consume such products greatly diminished. Baker and Burnham (2001) investigated US consumer acceptance of GM corn flakes and found that 30% of US consumers surveyed based their purchasing decisions on GM content. Their analysis shows that cognitive variables (e.g., opinions, beliefs and knowledge) have a great influence on consumer preferences. The opposition to GM foods also varies from one country to another. In a research aimed at explaining the differences between the United States and Europe, Gaskell *et al.* (2004) concluded that European consumers generally focused on the unknown risks associated with genetically modified products, not the benefits, whereas US consumers generally evaluated neither the risks nor the benefits. Further, Kushwala *et al.* (2004) reported that 90% of research sample in Nigeria aware of GM products but were concerned about the ethics of genetic transformation.

When it comes to price preference, consumers are always ready to pay a premium for non-GM foods. Lusk *et al.* (2003) estimated consumer willingness to pay for beef in France, Germany, the United Kingdom and the United States using a variety of quality variables, including whether the cattle were fed GM corn. Their results suggested that compared with US consumers, European consumers placed a much higher value on beef from cattle that have not been fed genetically modified corn.

Labelling of GM foods is voluntary in USA but in Japan and Europe it's mandatory. The impacts of labeling of GM, which is consumer demand (Abdel-Mawgood, 2006) may lead to high rejection of GM food by consumers. In Taiwan where labeling is compulsory, Ganiere *et al.* (2004) observed high opposition to and grouped consumer attitudes to GM products into four which are: proponents, 52%, moderate opponents, 32.5%, extreme opponents, 12.5% and those with no opinion, 5.5%. It is very essential to indicate the GM content on the packaging (Bánáti and Szabó, 2006) to enable consumers take proper decision on buying the products or not.

Understanding Saudi Arabian consumers' attitudes toward GM foods is important not only for the decision makers, but also for the growing biotechnology industry, food manufacturers and food retailers. In view of the scanty information on Saudi Arabian consumer attitudes to GM foods, the present survey was designed and aimed at revealing the level of awareness, readiness to consume and price acceptability.

MATERIALS AND METHODS

In this study, a questionnaire containing 17 questions was distributed to a sample of 250 university students to assess their attitudes and perceptions of GM foods and crops. Four questions out of seventeen focused on the characteristics of research sample while the remaining questions determined the extent of student knowledge of genetic materials; fingerprints; genetic characteristics; gene therapy as well as their knowledge of genetically modified food; methods of testing such crops; purchasing; handling and prices.

The participant's knowledge of GM was tested by the questions about the nature of genetic materials, the responsible element for genetic characteristics in an organism and whether or not the genetic materials in humans similar to that in animals and plants. On the other hand, the participants knowledge of GM was examined by questions about what is meant by genetic fingerprint, gene therapy and their knowledge about genetic modified food. Moreover, the participants knowledge about the advantages of GM foods was evaluated questions about whether or not genetic engineering could help in reducing the use of pesticides, the means, if any present for the detection of genetically engineered crops and foods and whether or not genetically modified foods harmful for human. The participant's readiness to purchase, consume

and accept of GM food price was evaluated by questions whether or not they have ever purchased genetically modified foods or crops, will they consume it if they know in advance and their perception on the price of genetically modified food compared to non-GM food.

The results were analyzed using descriptive statistic of percentages and graphs.

RESULTS

Demographics: The present study surveyed 250 students, the large proportion 165 (66%) of the research sample is in the age group 20-50 years. Next in size was age group of 20 years or less with a rate of 34% of the participants as indicated in Table 1.

The participants were at different levels of education as follow: 60 first level; 65 second level; 65 third level and 60 fourth year level of the total sample as shown in Table 2.

Predomination of consumers of less than from 25-50 years age (66%) and less than 20 (34%) in this research indicated that these age groups are more concern for the foods bought from market, this is normal in Saudi Arabian, mostly because these are the most educated group and the most self shopping too.

Awareness of principles of genetically modified foods:

The participant's knowledge of GM was tested by the following questions:

- What are genetic materials?
- What is responsible for genetic characteristics in an organism?
- Are genetic materials in humans similar to that in animals and plants?

Concerning the nature of genetic materials, most respondents (77.6%) gave correct answer, while 7.2% gave wrong answers and the rest has no idea. Concerning the genetic traits in orgamisms, majority of respondents (91.6%) gave correct answers, while the remaining either selected wrong answer or have no idea. In contrary, majority of the respondents 76% do not know the correct answer or of the opinion that genetic materials in human are different from other living things (plant and animals), only 24 participants gave correct answers as indicated in Table 3-5. This result indicated that university students in this survey were well informed about the principles of GM foods and crops. Such knowledge is very vital in appreciating this controversial technology.

Table 1: Relative distribution of participant age

Age	Number	Percentage
Less than 20 years	78	34
20-50 years	159	66
Total	234	100

Table 2: Relative distribution of respondent educational levels and replications

Education level	Replications	Percentage
First year	60	24
Second year	65	26
Third year	65	26
Fourth year	60	24
Total	250	100

Table 3: Relative distribution and replication of answers to question on genetic materials

Answers	Number	Percentage
DNA	194	77.6
RNA	18	7.2
Protein	4	1.6
Unknown	24	9.6
Cancelled	10	4.0
Total	250	100.0

Table 4: Relative replications and percentages of answers to question on genetic traits in an organism

Answers	Replications	Percentage
Genes	229	91.6
Cells	5	2.0
Enzymes	3	1.2
All Answers	10	4.0
No response	3	1.2
Total	250	100.0

Table 5: Relative replication and percentages of answers to questions on whether genetic materials in humans are similar to that in animals and plants

Response	Replications	Percentage
Different	110	44
Similar	60	24
Unknown	80	32
Total	250	100

Awareness of GM applications: Most respondents 65.2% to question 4 had heard about genetic fingerprint, but few respondents 11.6% heard and knew it very well. Majority of respondent to both question 4 (34.4%) and 5 (62%) haven't heard or didn't know about gene therapy and genetic modified foods and crops at all while, only few respondents 4.8 and 37.2% to questions 4 and 5, respective actually had good knowledge as indicated in Table 6 and 7. The participants who claimed their knowledge of GMO products were further asked to write on what is or genetically modified crops and foods and the reason why did scientists resort to produce them. The 77 yes respondents (82.8%) give details, while 16 yes respondents (17.2%) did not as indicated in Table 8.

Table 6: Relative distribution and Replications of responses to the question on the extent of knowledge of genetic fingerprint

Response	Replications	Percentage
I know it well	29	11.6
I heard about it only	163	65.2
I know nothing about it	58	23.2
Total	250	100.0

Table 7: Relative distribution and replication of responses to the question on gene therapy

Response	Replications	Percentage
I know it well	12	4.8
Little information	71	28.4
Hearing only	80	32.0
Never heard about	86	34.4
No response	1	0.4
Total	250	100.0

Table 8: Relative distribution and replication of response to the question on genetically modified crops and foods and answers to what is genetically modified crops and food and why did scientists restore to produce them

Response	Replications	Percentage
I know it well		
Respondent	77	82.8
Non respondent	16	17.2
Total	93	37.2
I don't know	155	62.0
No responsed	2	0.8
Total	250	100.0

Table 9: The relative distribution and replication of the answers to the question on the possibility that genetic engineering will help in reducing the use of pesticides

Response	Replications	Percentage
Yes, It can	98	39.2
No, It can't	26	10.4
I don't know	125	50.0
No response	1	0.4
Total	250	100.0

Awareness of GM foods and crops advantages: The awareness to the advantage of the GM food was examined by asking three questions. The first was whether or not genetic engineering will help in reducing the use of pesticides, the second was if there is ways help us detect genetically engineered foods and crops and the third was whether crops and genetically modified food is useful or harmful. The answer to these questions was 50, 59.6 and 44.4%, respectively. This indicated that most participants didn't know the role of genetically modified products in pesticides reduction neither the possibility of detecting GM in foods nor if GM foods were useful or harmful. Moreover, nearly 40, 36.4 and 31.2% attested to the positive role of GM in reducing pesticides use, possibility of detecting GM in foods and its usefulness, respectively as indicated in Table 9-11.

Purchase, Consumption and Price of GM foods: Regarding if the participants had ever bought genetically modified foods or crops, most respondents (70%) hadn't buy a GM food, while 28% of the respondents had bought it. Answers to the question 11 showed that majority of respondent (42%) are ready to try GM foods followed by those that will not consume it all (34.8%), less participants will consume GM products if they were informed as indicated in Table 12. However, 23% only would buy GM products knowing it, 33 would not and 42 would give it a try (Table 13) shows the relative distribution and replications of the answers to the questions on the possibility of consuming or genetically modified crops or foods after knowing that they were modified.

The expectation of the majority of the participants 34.8 showed that price of GM food should either be the same or greater than non-gm foods, while few respondents thought that it should be less as shown in Table 14.

Table 10: The relative distribution and replications of the answers to the question of whether there are ways to help us detect genetically engineered food and crops

Response	Replications	Percentage
Yes	91	36.4
No	10	4.0
I don't know	149	59.6
Total	250	100.0

Table 11: The relative distribution and replication of answers the question on whether crops and genetically modified food is useful or harmful

Response	Replications	Percentage
Useful	78	31.2
Harmful	59	23.6
I don't know	111	44.4
No response	2	0.8
Total	250	100.0

Table 12: The relative distribution and replications of the answers to the question on if the participants had ever bought genetically modified food or crops

Response	Replications	Percentage
Yes	70	28
No	175	70
Invalid	5	2
Total	250	100

Table 13: The relative distribution and replications of the answers to the questions on the possibility of consuming or genetically modified crops or food after knowing that they were modified

Response	Replications	Percentage
Yes, I will	58	23.2
No, I will not	87	34.8
Give a trial only	105	42.0
Total	250	100.0

Table 14: The relative distribution and replications of the answers to the question on price of genetically modified crops or foods

Response	Replications	Percentage
Should be greater	87	34.8
Should be less	74	29.6
Should be the same	87	34.8
No response	2	0.8
Total	250	100.0

DISCUSSION

Present survey indicated that knowledge is an important determinant of Saudi students acceptance of GM food; the more they are informed, the more likely they may refuse it. It appears that providing students with information is likely to increase the students acceptance of GM foods.

In this study, it is clearly indicated that labeling of GM foods will not improve its acceptability in Saudi market. Nonetheless, Saudis appears to be much more divided regarding the price they are ready to pay of GM products: 35% consider GM foods price should either be higher or lower than non-GM foods.

The success of GMOs in Saudi markets will be influenced by proper information about the benefits and positive advantages of GM technology on life. The food industry should highlight the benefits brought by the added GM ingredients and government through the relevant agencies such as the ministry of Agriculture, Ministry of Education and Ministry of Health should contribute to informing the public and consumers about genetically modified foods.

It is evident from these results that majority of university students responded to this survey in general had very little information or didn't know the usefulness of GM technology e.g., gene therapy, fingerprinting, role in reducing pesticide use etc., as appeared in the results, therefore, most of the participants did not know or thought GM foods are harmful and could not be easily detected. The implication of this result is that majority will not support GM products. In another survey of consumers in Beijing, China, Quan *et al*. (2002) reported that the majority of surveyed consumers had little or no knowledge of biotechnology. However, their attitudes toward Genetically Modified (GM) foods were generally positive. Consumers are also willing to purchase GM rice and GM soybean oil. Hansen and Laureni (2003) studied the attitudes of Brazilian undergraduate students towards genetic engineering and genetically engineered products. They found that students tend to reject transgenic products for human consumption. Moreover, 56% of the student was very concerned that genetically modified plants could spread in an uncontrolled way and 77% that genetically modified food might cause danger to human health.

From the above results, it is clear that if university students are well informed or the products are well labeled, they will not buy it. Moreover, prices will not be a determinant factor to accepting GM foods. In addition, these results imply that, unlike Europe and Japan, there is a potential market for GM foods in Saudi Arabia. GM food producers and exporters can use this information to design effective marketing strategies.

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