



Genetic modified food: Distribution, consumption, problems and future in Saudi Arabia

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Abstract

Genetic modified (GM) food spreading, distribution, consumer information and adversely and positive effects were studied in the 4 main regions of Saudi Arabia. The highest number of GM food consumers was in West region followed by both Center and North regions and lowest was found in East Saudi region. The main significant factors positively affecting the GM food spreading were controlling the markets, positive propaganda, support of the local producers of GM food products and the high educational level. The main reasons for rejection of the GM food were detrimental effect on health, adverse effect on the environment, bad propaganda and high price of the GM food.

Key words: Consumption, environment, genetic modified food, health, regression, markets, producers, Saudi Arabia.

Introduction

Production and consumption of genetically modified foods (GM) meet a big debate in most countries now. This debate is due to its effects on health and environment, besides the social, economic and political aspects of these foods ⁴.

Genetically engineered food is not harmful to consumers, but it must continue to develop controls ¹⁰ and evaluating these genetically engineered food, because consumers are generally still fear from the genetically engineered food ¹⁶. GM crops are spreading more significantly than other agricultural technologies in the recent years ^{1,2}. The main factors affecting GM distribution are trade regulations ^{8,14}, input markets ⁹, scientific research ³ and rights of the intellectual property ¹⁷.

Different researches suggested that there are adverse effects of GM foods on health, the environment and social and economic centre ^{2,7,12,13}. On the other hand different authors revealed that the GM foods are safe and not cause food and nutrition problems ^{6,7,9,15}.

This study aimed to identify the spread, problems, advantages and disadvantages of GM food as well as to identify the most important factors affecting significantly in spread of the GM food in Saudi Arabia.

Materials and Methods

The study was conducted on a sample of 1200 people in four major regions in Saudi Arabia (around 92% from the total population of Saudi Arabia) through stratified random sampling. The four regions were East, West, North and Center (Najd) of Saudi Arabia. Sample units were 240, 360, 200 and 410 in the four regions, respectively.

The sample size consisted of 43% female and 57% male, and included the different categories of the population. Questionnaire design and personal interviews were used in this study.

The obtained data were statistically analyzed after applying the statistical analysis assumptions ⁵ using SAS program ¹¹.

Results and Discussion

GM food consumption: Percentage of the different population categories in the four regions of Saudi Arabia concerning the GM food consumption are presented in Table 1. The highest no. of consumers of GM products was found in West region (50%), followed by both Center and North regions (34 and 30%, respectively), while the lowest GM consumption rate was in East region (20%). These results may be due to the population diversity and the high educational level in West region besides. Also, Jeddah (the main city in West region) lies on the Red Sea and has the largest seaport, which reflects the big trading with other countries.

Reasons of GM food rejection: Generally, the main reasons of GM food rejection in Saudi Arabia were detrimental effect on health, adverse effect on the environment, bad propaganda, high price and shortages in markets (Table 1).

Means of the reasons of GM products rejection allover Saudi Arabia were 56, 15.5, 13, 11.25 and 9.75% for detrimental effect on health, adverse effect on the environment, bad propagation, high price and shortage in markets, respectively.

Statistical comparisons between the four Saudi regions (Table 1) showed that in the East Saudi region sample the detrimental effect on health was the main reason of GM food rejection, and

Table 1. Means of consumption and reasons of GM food rejection in Saudi Arabia.

Saudi region	Consumption (%)	Detrimental effect on health	Reasons rejected GM food (%)			
			Adverse effect on environment	Bad propaganda	High price	Shortages in markets
Center	34 b*	56 b	16 b	11 b	19 a	19 a
East	20 c	66 a	20 a	12 b	9 b	4 c
West	50 a	48 c	12 c	3 c	4 c	3 c
North	30 b	54 b	14 bc	26 a	13 b	13 b
Mean	33.5	56.0 A**	15.5 B	13.0 BC	11.25 CD	9.75 D

* Means of the 4 regions in each column followed by the same letter are not significantly different according to BLS D at $P \leq 0.05$. ** Means of reasons overall the 4 regions followed by the same capital letter are not significantly different according to BLS D at $P \leq 0.01$.

the range was 65% (East region) to 50% (West region) as shown in Table 1.

Knowledge about GM food: The obtained results showed that the study sample had advanced information about the GM food through reading (40%), knowledge of determinants of the use of GM products (29.75%) and knowing the types of the GM food (44%) overall the 4 regions (Table 2).

Statistical comparisons between the 4 regions revealed that West region occupied the 1st rank in the three information sources with values of 78, 68 and 69% for reading, GM determinants and types of the GM food, respectively, followed by the Northern, Centre and East regions (Table 2).

The positive effects of the GM food: Overall the tested combined sample, the results showed that the most important advantages of GM food were the positive impact on health (27.5%) and food security (39.5%) as shown in Table 2. The percentages from support of the positive effects of GM food on food security ranged from 56% (Centre region) to 19% (East region). The health features of GM ranged from 33% to 14% for Centre and East regions, respectively (Table 2). The high educational level of West region, besides the different nationalities in West and Centre regions, reflected their high information and the positive view of the tested individuals concerning the GM food more than the other regions. These findings were in agreement with other studies^{6, 7, 9, 15}.

Significant factors affecting the GM food spreading: Regression equation was calculated to determine the main significant factors affecting the GM food spreading in Kingdom of Saudi Arabia as a result of the questionnaire results of 1200 random people. After fitting and significantly tests of 12 variables, the main significant variables affecting the GM food spreading in Saudi Arabia were:

I. The positive factors: Controlling the markets concerning the GM distribution, standards and price and positive propaganda about GM food, support the local GM food from the national related ministries and sectors and high education level.

Table 2. Consumer information about GM food and their positive effects.

Saudi region	Consumer information's (%)			Positive effects (%)	
	Reading	GM determinates	GM types	Food security	Health
Center	30 b*	14 c	39 b	56 a	33 a
East	18 c	9 d	26 c	19 c	14 b
West	78 a	68 a	69 a	42 b	32 a
North	34 b	28 b	42 b	41 b	31 a
Mean	40.0 A**	29.75 B	44.0 A	39.5 A	27.5 B

* Means of the 4 regions in each column followed by the same letter are not significantly different according to BLS D at $P \leq 0.05$. ** Means of reasons overall the 4 regions followed by the same capital letter are not significantly different according to BLS D at $P \leq 0.01$.

II. The main significant factor negatively affected the GM food spreading is the negative propaganda about the GM food, especially, adversely effects on health, environment, and the national agricultural and food.

Regression equation:

$$Y = 27x_1 + 38x_2 + 13x_3 - 42x_4 + 9x_5$$

$$R^2 = 0.862$$

where:

Y = Spreading GM food.

x_1 = Controlling the markets.

x_2 = Positive propaganda about GM.

x_3 = Support the local producers.

x_4 = Negative propaganda about GM.

x_5 = Education level.

These results about the main factors affecting the spreading, distribution and the future of GM food in Saudi Arabia were similar with the results of previous studies^{2, 4, 7, 12, 13, 16}, concerning the negative and adverse effects of GM food through the negative propaganda.

The effect of market controlling and GM trade regulations was in agreement with previous studies^{3, 8, 14}.

Conclusions

The highest GM food consumers were found in West Saudi region followed by both Center and North region and then East region. The main reasons rejected the GM food in Saudi Arabia were detrimental effect on health, adverse effect on the environment, bad propaganda and high price of the GM food. The main significant factors positively affected the GM food spreading were controlling the markets, positive propaganda, support the GM food local producers and the high educational level of the consumers.

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References

- Byerlee, D. and Fischer, K. 2002. Accessing modern science: Policy and institutional options for agricultural biotechnology in developing countries. *World Dev.* **30**:913-948.
- Carman, C. 2004. Is GM food safe to eat? In Hindmarsh, R. and Lawrence, G. (eds). *Recoding Nature: Critical Perspectives' on Genetic Engineering*. UNSW Press, Sydney, pp. 82-93.
- Cohen, J. 2005. Poorer nations turn to publicly developed GM crops.

- Nat. Biotechnol. **23**:27-33.
- ⁴Dixon, B. 1999. The paradoxes of genetically modified foods. *BMJ* **318**:547-548
- ⁵El-Nakhlawy, F. S. 2010. Statistical Design and Analysis of the Experiments in Scientific Research. Sci. Pub. Center, King Abdulaziz Univ., Saudi Arabia, 284 p.
- ⁶FSANZ 2007. New analysis of rat feeding study with genetically modified maize reveals signs of hepatorenol toxicity. Food standards Australia New Zealand, <http://www.criigen.org/SiteEn>.
- ⁷Martineau, B. 2001. First Fruit: The Creation of the Flavr Savr Tomato and the Birth of Biotech Foods. McGraw-Hill, 269 p.
- ⁸Pray, C., Bengali, P. and Ramaswami, B. 2005. The cost of biosafety regulations: The Indian experience. *Q. J. Int. Agric.* **44**:267-289.
- ⁹Qaim, M. and Matuschke, I. 2005. Impacts of genetically modified crops in developing countries: A survey. *Q. J. Int. Agric.* **44**:207-227.
- ¹⁰Raney, T. 2011. Economic Impact of Transgenic Crops in Developing Countries. www.agbioworld.org/biotech-info/articles/...art/raney.html
- ¹¹SAS 2000. SAS/STAT. User's Guides. SAS Institute Inc. SAS Circle, Cary, NC, USA.
- ¹²Seralini, G. E., Cellier, D. and Devendomois, J. S. 2007. New analysis of rat feeding study with genetically modified maize reveals signs of hepatorenol toxicity. *Arch. Environ. Contam. Toxicol.* **52**:596-602.
- ¹³Seralini, G. E., Devendomois, J. S., Cellier, D., Sultan, M., Gallagher, L., Antoniou, M. and Dronamraju, K. R. 2009. How subchronic and chronic health effects can be neglected for GMOs, pesticides or chemicals. *Int. J. Biol. Sci.* **5**:438-443.
- ¹⁴Sobolevshy, A., Moschini, G. and Lapan, H. 2004. Genetically modified crops and product differentiation: Trade and welfare effects in the soybean complex. *Am. J. Agric. Econ.* **87**:621-644.
- ¹⁵Stanley, J. R. and Strom, S. 2010. Quantification of the Impacts on US Agriculture of Biotechnology-Derived Crops Planted in 2006. National Center for Food and Agricultural Policy, Washington DC.
- ¹⁶WHO 2002. Food questions on genetically modified foods. World Health Organization. www.who.int/foodsafety/publications/biotech/20questions/en
- ¹⁷Zilberman, D. and Graaf, G. 2005. IPR innovation and the evolution of biotechnology in developing countries. *Q. J. Int. Agric.* **44**:247-266