

Consumers and Genetically Modified Foods: Attitudes, Willingness to Purchase, and Necessity of Product Labeling

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ABSTRACT

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Background: Introduction of genetically modified foods could be a potential solution for poor nutrition and poor health. The purpose of this study was to determine the consumers' attitude toward and willingness to purchase genetically modified foods (GMFs), and their opinion about the necessity of labeling these products.

Methods: This cross-sectional study was conducted among 203 employees of Iran University of Medical Sciences in 2018. A research-made instrument was used to measure consumers' attitude toward and willingness to purchase GMFs. Data analysis was performed by SPSS.

Results: The results of this study showed that 11.3% of the participants had a good, and 37.9% had a weak attitude toward GMFs. Out of all the participants, 81.7% completely agreed on the labeling of GMFs, 13.3% tended to buy these products, and 49.3% were unwilling to purchase these foods. There was a significant difference between gender and attitude ($p=0.005$), and also a significant difference was seen between gender and the necessity of labeling ($p=0.050$). There was a statistical difference between the history of food intolerance in the participants and the necessity of labeling GMFs ($p=0.040$). Also, there was a significant relationship between the attitude and the willingness to buy GMFs ($p<0.001$, $R=0.368$).

Conclusion: The participants of this study have a low willingness to buy GMFs. Therefore, if the individuals' awareness of the benefits of GMFs is increased, they will show a tendency for purchasing these products.

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Introduction

With the rapid growth of population and hunger worldwide, the need for food production, especially in developing countries, and consequently, the production of genetically modified foods (GMFs) is increasing (1, 2). These products are plants and microorganisms that have had changes in

their genes. Soybeans were the first GMFs to be produced (3, 4). The complications associated with these products include the possibility of allergenicity, environmental pollution, toxin production, and biodiversity decline. The World Health Organization,

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however, reported that biotech foods are not harmful to the environment and humans (4). Results of a study showed that consumers were worried about the long-term effects of GMFs such as cancer and allergy (5). Acceptance of novel foods such as GMFs plays a role in determining individuals' consumption behavior (6). Countries have different orientations toward GMFs. Some countries, such as Canada and the US, tend to export these foods because of their economic benefits. Demand for GMFs, however, has decreased in Japan and the European Union (7). Results of studies revealed that consumer attitude toward and willingness to purchase GMFs vary across countries and also change during the time in the same country (3). Various factors, such as psychological and behavioral economics, make the difference between individuals to form beliefs. The media and social networks are efficient in shaping people's attitude and beliefs (8). Attitude toward GMFs may affect willingness to purchase and can also influence government policies (1). The gaps between public attitude and science always exist, and these gaps are rising (7). So, for better realizing the factors that influence these gaps; studies are necessary (9). Women and older consumers are less likely to purchase GMFs. The correlation between income levels and the purchase of non-GMFs isn't strong (10). The labeling of GMFs became mandatory in Europe in 2003 (11). Labeling of GMFs is one of the principal issues in this industry, especially from a policy perspective (12). Most of the GMFs are produced in the United States. More than 40 countries have accepted the labeling laws with various characteristics (13). In many countries, labeling does not mean the food is safe, but it contains information for consumers. The mandatory labeling of GMFs allows consumers to opt for GM or GM-free foods (14). According to the literature, there is concern about the side effects of GMFs products, and this concern is higher in

women than men also prices of GMFs products affect the willingness to purchase these products (15-17). This study aims to investigate the attitude, the willingness to purchase, and the opinion about the necessity of labeling GMFs among medical staff consumers.

Methods

Participants and Setting

This cross-sectional study was conducted, using simple random sampling among 203 employees of the Iran University of Medical Sciences, Tehran, Iran from June-July 2018. Three administrative departments and three colleges of the Iran University of Medical Sciences were randomly selected based on the estimated sample size, and the instruments were distributed among the employees. The inclusion criteria of the study were: being an employee of the Iran University of Medical Sciences and agreeing to participate. Written consent was obtained from all participants. The ethics committee of the Iran University of Medical Sciences approved the protocol of the current study (IR.IUMS.REC1396.32122).

Procedure

Demographic information, attitude, willingness to purchase, and the necessity of labeling were measured by a researcher-made instrument. The initial items of the instrument were developed based on literature review (1-7) and 5 interviews with employees in Iran University of Medical Sciences with similar characteristics to the target population of the present study. Then, the content validity of the items of the instrument was examined by a panel of 10 experts in the food industry, agriculture, nutrition, health education, and biotechnology. The panel judged about the relevance and necessity of the items for calculating CVI (Content Validity Index) and CVR (Content Validity Ratio) of it. In the study, items having CVR less than 0.62 and

CVI less than 0.79 (18, 19) should be deleted. No items were deleted at this stage. In the next stage, ten employees commented on the clarity, simplicity, and readability of the items (qualitative face validity). According to their comments, some ambiguous items were edited. To test the reliability of the item's willingness to purchase GMFs and opinion about the necessity of labeling GMFs subscales, 20 employees in Iran University of Medical Sciences with similar characteristics to the target population of the present study completed the instrument twice at 2-week intervals (test-retest method). Values ≥ 0.61 correlation coefficient was considered acceptable (20). Cronbach's alpha (by using data of 30 employees) was used to assess the internal consistency of items of attitude toward GMFs. Cronbach's alpha greater than or equal to 0.70 was regarded as acceptable (21). No item was deleted at this stage. The final instrument was made up of 18 items divided into three sections to measure participants' attitude, willingness to purchase, and the necessity of labeling GMFs.

Attitude towards GMFs

Five items were used to measure this subscale. The items were measured by a 7-point Likert scale.

Participant's attitude was divided into three categories: low, moderate, and good. A score from 5 to 11 was considered as weak attitude, from 12 to 23 as moderate, and 24 to 35 as good.

Willingness to purchase GMFs

Nine items were used to measure this subscale. The items of these two parts were measured on Agree/Disagree/I don't know. Participant's willingness to purchase GMFs was divided into low, moderate, and good levels. A score from 0 to 3 was considered as the willingness to purchase low, from 4 to 7 as moderate, and from 8 to 10 as good.

Opinion about the necessity of labeling GMFs

Three items were used to measure this subscale. The items of this subscale were measured on a Likert scale ranging from "strongly agree" to "strongly disagree". Participant's opinion about the necessity of labeling was divided into three levels: low, moderate, and good levels. A score from 0 to 3 was considered as the necessity of labeling low, from 4 to 11 as moderate, and from 12 to 15 as good.

Statistical analysis

Data were analyzed using SPSS (Statistical Package for Social Sciences, Version 20.0). The relationship between the mean score of quantitative demographic variables, attitude, willingness to purchase GMFs, and the necessity of labeling GMFs was analyzed by the Pearson correlation coefficient test. One-way ANOVA was used to examine the significance of differences between the multistage demographic variables and mean scores, attitude, the willingness to purchase, and the necessity of labeling GMFs. The independent samples T-test was used to examine the significant differences between the demographic variables, such as marital status, gender, food intolerance, history or family history of allergy and cancer, and the attitude, the willingness to purchase, and the necessity of labeling GMFs.

Results

Results of validation

Cronbach's α value for attitude towards GMFs subscale was 0.938. The test-retest correlation coefficient for an opinion about the necessity of labeling GMFs subscale was 0.960 (P-value = 0.001).

The test-retest correlation coefficient for willingness to purchase GMFs subscale was 0.884 (P-value = 0.001).

Table 1: Demographic characteristics of the participants and their relationship with the mean score of attitude, willingness to purchase, and the necessity of labeling about GMFs (n=203)

Variables	N	%	P -value ^{A**}	P- value ^{W**}	P- value ^{N**}
Gender			.005 †	.252 †	.050 †
Female	126	62.1			
Male	77	37.9			
Age					
≤ 30	33	16.3	.134 *	.183 *	.325 *
31-40	85	41.9			
41-50	58	28.6			
≥51	27	13.3			
History of food intolerance					
Yes	41	20.2	.170 †	.503 †	.040 †
No	162	79.8			
History of allergy			.864 †	.893 †	.502 †
Yes	79	38.9			
No	124	61.1			
History of cancer in the family			.381 †	.417 †	.901 †
Yes	50	24.6			
No	153	75.4			
Marital status			.098 †	.613 †	.778 †
Single	64	31.5			
Married	139	68.5			
Level of Education			.232 ‡	.443 ‡	.476 ‡
Diploma and less	27	13.3			
Associate degree	21	10.3			
Bachelor	77	37.9			
Master	69	33			
PhD	9	4.4			
Number of children			.109*	.981*	.419 *
0	88	43.3			
1	53	26.1			
2	55	27.1			
3 and more	7	3.4			

P-value ^{A**}: Attitude, P- value ^{W**}: Willingness to purchase, P -value ^{N**}: The necessity of labeling GMFs.
P -value ^{*}: Pearson Correlation. P- value [†]: Independent-samples t-test. P- value [‡]: One-way ANOVA

Table 2: The frequency of participants' willingness to purchase GMFs (n=203)

Items	Agree	Disagree	Don't know
1. I willingness to purchase GMFs.	20 (9.9)	120 (59.1)	63 (31)
2. If GMFs are cheaper than non-GMFs, I would like to products.	26 (12.8)	115 (56.7)	62 (30.5)
3. I want to buy GMFs if they are healthier than non- GMFs.	104 (51.2)	55 (27.1)	44 (21.7)
4. If the flavor and taste of the GMFs are better than non- GMFs, I would like to buy them.	53 (26.1)	103 (50.7)	47 (23.2)
5. If the GMFs have fewer pesticides and chemicals, I would like to buy them.	90 (44.4)	65 (32)	48 (23.6)
6. I will buy GMFs if they have a longer storage time.	45 (22.2)	104 (51.2)	54 (26.6)
7. If the GMFs have a label and have the right to choose, I will buy them	62 (30.5)	72 (35.5)	69 (34)
If the GMFs have more nutritional value, I will buy them.	95 (46.8)	63 (31)	45 (22.2)
8. If the nutritionists and health professionals confirm the GMFs, I will accept and buy them.	117 (57.6)	36 (17.7)	60 (24.6)
9. If my information increase about the benefits of GMFs, I will buy them.	110 (54.2)	37 (18.2)	56 (27.6)

Number (percent)

Table 3: The frequency of participants' opinions about the necessity of labeling GMFs.

Items	Strongly disagree	Disagree	No idea	Agree	Strongly agree
1. Is labeling necessary to recognize GMFs?	6 (3)	2 (1)	24 (11.8)	68 (33.5)	103 (50.7)
2. Is labeling necessary to Determine nutritional value of GMFs in comparison with other foods?	9 (4.4)	3 (1.5)	26 (12.8)	62 (30.5)	103 (50.7)
3. Is labeling necessary to Determine Prohibition of the use of GMFs for specific people (the risk of certain diseases, such as allergies, cancer, etc.)?	7 (3.4)	1 (0.5)	21 (10.3)	56 (27.6)	118 (58.1)

Number (percent)

The average age of the respondents was 39.98 (± 9.23) years old. About 62% of the respondents were female. Other demographic characteristics of the participants are shown in Table 1. The mean and standard deviation of the respondents' attitude score was 14.7 (± 7.8), the willingness to purchase GMFs was 3.5 (± 3.1), and the necessity of labeling GMFs was 12.8 (± 2.7). About 11.3% of the participants had a good attitude, 50.7% did not have a moderate attitude, and 37.9% had a weak attitude toward GMFs. Out of all the participants, 81.7% completely agreed, and 3% disagreed on the labeling of GMFs,

13.3% tended to buy, and 49.3% had a low willingness to purchase these products. Extra analyses were accomplished to examine any significant relationships among the attitude, the willingness to purchase, the necessity of labeling, and between these variables and demographic characteristics. The result of our study showed that there was not a significant difference between the attitude and demographic variables, except for gender ($p = 0.005$). A significant relationship was found between attitude and willingness to purchase ($p < 0.001$). There was a significant difference between gender and the necessity

of labeling ($p= 0.050$). Tables 2, 3, and 4 demonstrate the frequency of participants' willingness to purchase GMFs, their opinion about the necessity of labeling these foods, and their attitude toward these products, respectively.

Discussion

This study has provided an examination of the attitude toward, the willingness to purchase, and the necessity of labeling GMFs in Iran. In the present study, a low percentage of participants had a good attitude toward GMFs, and more than one-third of participants had a weak attitude toward these products. Out of all the participants, 81.7% completely agreed on the labeling of genetically modified products, and 13.3% tended to buy these products. The results of our study showed that there was a significant difference between attitude and gender ($p= 0.005$), but there was not a significant difference between the other demographic variables and attitude. A study among American and Korean college students demonstrated, with similar results, that there was a significant relationship between attitude and gender; females were more concerned about the harmful effects of GMFs on health (15). Vecchione et al., however, showed that there was no significant relationship between demographic characteristics and attitude (10). The reason for the discrepancy may be that the current study and the studies of American and Korean college students were conducted among educated individuals, while the study by Vecchione et al. was performed among supermarket customers, and nearly 80% of the participants were females. In our study, more than half of the respondents were concerned about consuming GMFs. Results from a similar study have been observed in Mexico; 45.8% of the respondents were worried about the effects of GMFs on the environment, and 35.1% believed GMFs were harmful for consumption (3). The study

by Indian students showed that 56.71% of respondents believed that GMFs have destructive effects on the environment, and 38.93% believed that these products were harmful to human health (12). Another study showed that there was a strong relationship between gender and individuals' concerns about the risks of GMFs (15). The reason for the weak attitude of the participants in our study toward GMFs could be the lack of awareness among them or the negative coverage in the media and on the internet. In the present study, 13.3% of the participants were willing to purchase GMFs, and 49.3% had a low willingness to buy these products. In contrast to our finding, the study in Kenya showed that more than half of the consumers tended to purchase GMFs even at the same price as non-GMFs, and were more willing to buy these products at a cheaper price (17). The discrepancy between the results is due to the difference in participants' attitude; Kenya's participants had a positive attitude towards these products. In our study, in response to the question "If GMFs are cheaper than non-GMFs, I would like to buy them", 12.8% of the participants agreed, and 56.7% disagreed; "If GMFs were healthier than non-GMFs", 51.2% of the respondents tended to buy them. About 30% of the respondents believed that "If GMFs had a label and consumers had the right to choose, they would purchase these products", and 35.5% refused to buy, 46.8% of the respondents were willing to buy GMFs if these products had more nutritional value, and 31% disagreed. The results of a study in England, Norway, and Italy showed that up to 15% of the subjects would certainly buy GMFs, and 40% of the participants claimed that they would buy these products if they were available (22). Results of another survey showed that 35% of the subjects refused to buy GMFs, and 65% of the participants were willing to buy these products at a cheaper price. This study revealed that previous information about

GMFs had a low influence on the consumers' willingness to purchase (23). Cook et al. reported that public points of view were found to be in contrast to purchasing GMFs, but males and older people were more willing to buy these products (24). We found a significant relationship between attitude and willingness to purchase. Attitude and gender were the two factors affecting our subjects' willingness to purchase. Participants were asked, "Is labeling necessary to determine prohibition of the use of GMFs for specific people (the risk of certain diseases, such as allergies, cancer, etc.)?" 58.1% of the respondents in our sample strongly agreed, and 50.7% agreed labeling is necessary to recognize GMFs. The difference between the necessity of labeling and gender was found to be significant; also, there was a significant difference between the history of food intolerance and the necessity of labeling. A study in the United States examined the relationship between the attitude and the mandatory labeling of GMFs and demonstrated that labeling would reduce the opposition of individuals to these products (25). The results of a study in India indicated that there was no significant relationship between any of the demographic variables and mandatory labeling GMFs, except the income level of the family. Students from higher-income families were more supportive of mandatory labeling. Also, men were more likely to support the mandatory labeling of these products (12). The results of a study in Turkey indicated that there was a significant difference between label reading and age, education level, gender, and income levels. Also, in this study, 98% of the subjects agreed that labeling was necessary for GMFs (26). According to the results of previous studies and the current study, gender is an important factor for the necessity of labeling, which can be due to a different level of knowledge between men and women and also different attitude and concerns between them (15, 26). The limitation of the present

study was that our sample consisted of medical university employees and we are not able to generalize our results to the community. University employees might have a higher level of education compared to other people in society, so we suggest that this study be conducted at the community level.

Conclusion

Our results revealed that 11.3% of the participants had a good, and 37.9% had a weak attitude toward genetically modified products. Out of all the participants, 81.7% completely agreed on the labeling of genetically modified products, 13.3% tended to buy GMFs, and 49.3% did not tend to buy these products. Individuals' awareness about GMFs would improve their attitude, and a good attitude can increase willingness to purchase these products. Therefore, the authors suggest that educational programs be developed by health care providers, the education system, and the mass media to increase public awareness. Also, these products must be labeled to preserve the consumer's right to choose.

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