

Academicans' Perceptions and Attitudes toward GM-Organisms and –Foods

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Abstract— Data were collected by using CATI (computer assisted telephone interviewing) and face-to-face interview techniques to determine tendency and attitudes about the subject of academicians, who worked for departments, which were foreseen that they could be associated with genetically modified (GM)-organisms and foods, of various universities, which were active in Turkey, and who conducted studies in different disciplines. Only 90 of 486 persons working for the specified academic departments answered the questions under the study. Significant part of the respondents (63.3%) opposed to consumption of these foods because advantages and disadvantages had not been stated at the beginning (64.9%) and they considered these foods as harmful to health (19.4%). Furthermore, they are hesitant whether the products are risky or not from the point of view of especially consumers' health, bio-diversification and environmental safety although they believe that an increase in efficiency (48.9%) and a decrease in the use of agricultural pesticide (20.0%) have occurred with the use of GM-organisms. It has been determined that the academicians have hesitant and deliberate approach by considering scientific considerations and the existing data and it has been seen that they have a negative attitude for consumption of these products because the risks have not been evaluated completely yet.

Keywords— GMO, gene technology, food safety, biotechnology

I. INTRODUCTION

GENETIC modification (GM) is described by Hautvast and van de Wiel [1] as the transmission of characteristics of an organism (microorganism, plant or animal) to another organism with genetic material exchange. Various components derived from these organisms developed/ changed as a result of the studies ongoing since 1970 can be found in many foodstuffs [2], the products derived from various plant and animal sources underwent GM such as corn, tomatoes, potatoes, soy, rice, sunflower, peanuts, some fish species, oilseed rape, are still consumed in the world [3]. However, Discussions and disagreements between different social layers and groups are experienced within the framework of the "uncertainty" risk "and doubts" about these products and technologies. Contents and reached results (if there are) of

these discussions and disagreements vary according to the reference point taken. The main reference points taken are economic, social, ethical, and theological values and scientific data and principles.

The consumers' opinions about gene technology and products derived from using this technology vary according to regions and countries, show periodic change especially with the development of communication channels. For example, European consumers' attitudes towards GM are showing changes on the basis of countries [4], it has been determined that, the direction of these behaviors varied in time [5]. However, it has been determined that, the general skepticism towards gene technology and GM foods were derived from consumer health, environmental safety, biodiversity, religious rules and ethical values [6, 7, 8]. As a result, the adoption of GM foods of consumers is associated with the trust levels of the benefit / loss relationship of biotechnology [9, 10, 11, 12, 13, 14, 15, 16].

The researches were conducted to determine the attitude and trends of the various groups, especially consumers for the GM organism and foods in both developed countries and regions such as the United States, Canada and Europe as well as [17, 18, 19, 20, 21, 22, 23, 24], and as well as developing countries such as Argentina, Taiwan, South Africa, Kenya, Chile, Mexico, Philippines [10, 25, 26, 27, 28, 29, 30, 31]. In the studies carried out in Turkey, the number of studies reflecting the whole country is very limited, especially the attitudes and trends of individuals and groups in the various regions, or task / positions (students, employees of relevant ministries, etc.) were tried to determine. As a result of these studies, it has been reported that, there was a positive and significant correlation between the perceptions of consumers about biotechnology applications and their opinions about the safe use of this technology [32], in general, although their level of willingness to buy GM foods was low, in future, generally they were agree with becoming widespread of the gene technology.

As a result of some research carried out, it has been emphasized that, the majority of consumers had negative perspective about GM organisms and unwilling to buy [33, 34], the attitude became positive when the genetic changes were done for humanitarian purposes such as feed the poor people by increasing or enriching products but the current attitude became negative when genetic engineering applications were performed due to change the product life and content. In a result of another research, it has been determined that, nearly half of the participants did not have

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interest on GM organisms, 69% of them worried about the reliability [35].

In this study, it has been aimed to obtain descriptive information about attitude, tendencies and confidence of the academics about GM- organisms and foods, by using data obtained the techniques of disciplines CATI (computer aided telephone interviews - computer-aided telephone interview) and face-to-face interviews, with the academics in charge in different disciplines of the universities in Turkey.

II. MATERIAL AND METHODS

A. Sampling Method and Sample Selection

The study population consisted of individuals forming by academics (total n = 486) working in engineering, agriculture, veterinary and health sciences faculties of different universities in Turkey; departments of food engineering (n = 258), nutrition and dietetics (n = 43), dairy technology (n = 16), food hygiene and technology (n = 6), agricultural biotechnology, (n = 16) and field crops (n = 93) and zootechnical and animal feeding and nutrition sections. The contact details of those people that make up the data source of the study were reached through the web pages in universities where they are working. The necessary data were obtained using CATI and face-to-face interview techniques. A total of 90 individuals of academics contacted answered the questions in the questionnaire, the level of participation in the study was at the level of 18.5%.

B. Questionnaire Design

A questionnaire was created to achieve the objectives of the study, and a pre-test was applied to this form with academics, technologists in the food industry and consumers. In the next stage, a pilot study with a total of 5 academics from engineering, health sciences and faculties of agriculture was carried out in March 2012. As a result of the pilot field study, the need for modification in the form of a questionnaire was not determined. Main study was conducted using the CATI and face-to-face interview techniques during April and May 2012.

The questionnaire which was used to collect research material was prepared in a comprehensive way by using

Sources about the subject and some of the studies carried out before. This form consists of five sections including; quota (3 questions), GM-organisms and-food perception (3 open-ended, 2 closed-ended questions), GM-food consumption (7 quintet Likert system and 2 open-ended questions), the attitude towards GM-organisms and- food (32 quintet Likert system questions), and biotechnology policies and application (question 13 quintet Likert system questions).

C. Statistical Analysis

The collected data was summarized using descriptive statistics. To determine the significance of differences between the sub-groups in the same consumer groups, t-test was applied by using SPSS Quantum programme (IBM, New York US).

III. RESULTS

The data was obtained with very low level (18.5%) in comparison to the level targeted in the study design constructed due to the attitude of academics consisting of study population about to answer questions or to participate the research. As a result of this low level, the number of contribution base for each group with the smallest value of 30 could not be reached except the breakdown in the academic title as professor (46 people) and the breakdown of academic mission as faculty member (68 people), in the realization of statistical evaluation in order to compare the groups. Therefore, these findings were presented by taking into account the overall average of the responses to the questions.

A very important part of academics (86.7%) determined that the acronym GMO was meant for them "genetically modified organism" and some participants used some expressions emphasizing their approach / attitude for the subject (Table 1). As a positive examples in these statements; process performing due to increase the product "efficiency" (11.1%) or "resistance" (10.0%) and as a negative examples; "naturalness modified products" (10.0%) and "unhealthy products" (7.78%) were remarkable. However, the question setting out the attitude towards GM foods and products more clearly was the one which had a purpose to determine the approach for consume this kind of product. 25.6% of the participants were agree with to consume and 11.1% of them were uncertain. The main reason of the participant who did not want to consume (63.3%) and who were uncertain was a reason which did not include a positive or negative attitude, such as not being explained the benefits of these products (64.2%), but also some negative reasons such as "harmful to health" (19.4%) and "not to be natural" (14.9%) were indicated.

The participants thought that the most important economic benefits of the products (Table 1) were; "increase in productivity" (48.9%) and "reduction of the use of pesticides" (20.0%), determined especially "product yield with desired properties" (53.3%), and "be cheap" (23.3%) as introduction of these products to our lives. In addition, while the main institutions that academics trusted about GM-foods (Table 2) were the universities (27.8%), the European Union Food Safety Authority (EFSA) (24.4%) and the World Health Organization (WHO) (15.6%), the rate determined for Food, Agriculture and Livestock Ministry of Turkey which is the main legal responsible for the subject, was only 5.56%.

Academics think that many of the food contains genetically modified organisms (Table 3). These foods include corn and corn products (85.6%), soy and soy products (85.6%), snack foods, chips, and cookies (72.2%), cereals (68.9%), grains, legumes and pasta (67.8%). In addition, participants think that, in rate of 78.9%, animal feed may contain genetically modified organisms. The rate of 5.56% of participants stated that no food would be concerned of this situation.

The attitudes of the participant academics about GM-foods were tried to determine by 7 questions prepared to answer and evaluate with quintet Likert system, as a result of the evaluation of responses, it has been thought that, consumers should be informed about the products but it did not take

place, so these products were consumed without information, but if the consumer learn the GM ingredients in food, they can give up use of them. They are uncertain about the need for the production of these foods and whether there is harm for consumption of them. However, they think that there is harm for infants and children if they consume.

The perception on foods containing GM ingredients was tried to determine with 32 questions prepared in quintet Likert scale, directed to academics who are the data source of the research (Table 5). When the responses were analyzed; it has been observed that, academics thought that consumption of GM- foods had significant risks in terms of consumer health, bio-diversity and pollution, but also had positive characteristics in terms of productivity, durability, shelf life, level and residue of pesticide / insecticide use. However, the increase in nutrient enrichment and sensory qualities do not take place among these positive properties. The belief, that technological applications are monopolized, was observed. The differences in participation levels of the statements about both the risks and disadvantages and the benefits have been concerned. Especially about the risks, wide range change was observed depending on the type of the risk (4:01 to 2:24). It has been concluded that, this situation occurred due to the failure of a perception with a sufficient clarity about the subject, the level of the participation rate to the statement of "genetically modified products harmful to human health" was determined as 2.90 ± 0.92 , and this rate is less than many risk issues, it has been concluded that, this situation was a data supporting the conclusion reached. Again, being not to indicate an opinion about "antibiotic resistance", "allergy" and "organ damage" with a high level such as 16.7%, 20%, and 16.7%, respectively, was also remarkable.

When the responses given to 8 questions in quintet Likert scale about use of gene technology in food production were analyzed (Table 7), it has been determined that, the use of this technology due to reduce the pesticide use (3.84 ± 1.18), and the rate of fatty in foodstuffs (3.53 ± 1.22) were supported. However, the indecisive was observed for the issues such as the transfer of genes for the creation of microbial enzymes (3.45 ± 1.08), the extension of the shelf life of fruits and vegetables (2.89 ± 1.22), and the development of flavors (2.55 ± 1.12), vitamin content enrichment (2.81 ± 1.14), nutrient enrichment (2.73 ± 1.13).

IV. CONCLUSION

An important part of academics are in the negative attitude towards products containing genetically modified organisms. The source of this negative attitude is uncertainty of the presence potential risks of the technology and the products which are the output of this technology on issues such as especially consumer health, biodiversity and environmental safety. There is a tendency about the need of performing assessments for these risks and technology with using the results of the studies conducted by related with the subject international organizations (e.g. EFSA, WHO), not only the results of universities. It has been thought that, in particular, technology and inputs using in the aquaculture and the production of soy, corn, fruits and vegetables had the

economic and technical advantages as well as the risk whose presence cannot be proved. As a result of these advantages, there is a common idea about to obtain a large amount and more resistant and advantageous products in terms of chemicals risks such as pesticide residues. However, as an individual, an important part of academics do not want to consume these products without obtaining adequate and reliable data on the potential risks of them. It has been emphasized that, gene technology-related policies should be undertaken with the joint of the law-makers and the common studies of scientific community and society should be informed correct and complete about the relevant regulations and current products. In addition, it has been thought that, this technology should not be used for all food production areas. This approach can be read as, the use of this technology for food supply whose supply problem is or will be able to be more intense can be considered as a more accurate approach followed by clarification of the safety and risks of gene technology. When all the attitudes and perceptions were examined, it has been observed that, academics had cautious and hesitant attitude by taking into account the scientific concerns and data, and it can be determined that, due to be a customer as an individual, they were under effect of negative attitude about the consume of products with possibility of the risk.

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TABLE I AWARENESS TOWARD GMO

Question / Answer	(%)
Could you identify GMO/GMO product? * (n=90)	
Genetically modified organism	86.7
Treatment in order to increase productivity	11.1
Products that are modified in terms of originality	10.0
Treatment in order to increase durability of a product	10.0
Unhealthy products	7.78
Treatments at the level of molecular biology	7.78
Treatment of increasing product quality	4.44
Unreliable products	3.33
Treatment of increasing nutritional value	2.22
Products that should not be used	2.22
Treatments for enhancing features of products	2.22
No idea	1.11
Would you like to consume a product known as GM at market? ** (n= 90)	
Yes	25.6
No	63.3
Hesitant	11.1
What is the reason of your negative attitude? * (n= 67)	
Uncertainty in benefits and harms	64.2
Unhealthy	19.4
Not natural	14.9
Not reliable	7.46
Genetically modified	7.46
Other	5.97
Not tasty	2.99
Carcinogenic	1.49
Prohibited/limited in a few countries	1.49
Harmful to the children	1.49
Having side effect	1.49
Allergic	1.49
What are the most important economic benefits of products with GMO? **	
Increase in productivity	48.9
Decrease in usage of pesticides	20.0
Improvement in product quality	6.67
Harvesting in adverse conditions	10.0
No idea	14.4
What is the main reason why products with GMO got into our lives? **	
Cheap	23.3
High nutritional value	1.11
Long shelf life	7.78
Harvesting products with desired features	53.3
No idea	14.4

*: Açık uçlu soru, **: Kapalı uçlu soru

TABLE II

RELIABLE INSTITUTIONS REGARDING GM FOODS (N= 90)

Institutions	%
Universities	27.8
European Food Safety Agency	24.4
World Health Organization	15.6
Independent laboratories	10.0
Ministry of Food, Agriculture and Livestock	5.56
Food and Drug Administration	4.44
Other	4.44
Ministry of Health	3.33
Institutions of cancer research	2.22
NGOs concerning health or food	1.11
United Nations	1.11

TABLE III FOODSTUFFS CONCERNED THAT INCLUDING GMO

Foodstuffs	%
Corn and corn products	85.6
Soy and soy products	85.6
Animal feeds	78.9
Snacks	72.2
Breakfast cereals	68.9
Grain, legume and pasta	67.8
Soupmix, sauces and canned foods	58.9
Sugar, chocolate and sweeteners	54.4
Oil and salad sauces	53.3
Fruit and vegetables	51.1
Potato and potato products	51.1
Bakery products	50.0
Frozen foods	43.3
Margarines	43.3
Infant foods	41.1
Meat products such as salami, sausages	41.1
Dairy products	33.3
Meat, fish and eggs	30.0
Sodas, fruit juices and the other beverages	26.7
Sugar beet	18.9
All	5.56
None	5.56

TABLE IV ATTITUDE TOWARD GENETICALLY MODIFIED FOODS OF ACADEMICS

Statement	n*	Level of agreement
We're left uninformed about GM products	2 (%2.22)	4.06 ± 1.04
We don't know whether the product we consume is GM	0 (%0.0)	3.77 ± 1.15
I'd quit consuming a product if i found out it's GM	4 (%4.44)	3.72 ± 1.36
Producing GM products is necessary	1 (%1.11)	2.80 ± 1.23
I don't see any harm in consuming GM products	1 (%1.11)	2.51 ± 1.24
Consumption of GM products by children and babies are not harmful	2 (%2.22)	2.05 ± 1.20

TABLE V PERCEPTION TOWARD GENETICALLY MODIFIED FOODS OF ACADEMICS

Statement	n*	Level of agreement
There should be indicators on labels whether a product is GM or not	2 (%2.22)	4.27 ± 0.98
GM plants are more resistant to pesticides and insects	1 (%1.11)	4.01 ± 0.93
There are monopolies that cause dependence in GMO industry	2 (%2.22)	3.91 ± 0.94
GM products makes pesticides less necessary	5 (%5.56)	3.77 ± 0.97
GM products are dangerous for biological diversity	2 (%2.22)	3.60 ± 1.13
GM products ensures harvesting more	2 (%2.22)	3.57 ± 1.07
GM products are more durable	4 (%4.44)	3.54 ± 1.03
It's not possible to harvest again with the seed derived from GM products, you have to buy seed every year	8 (%8.89)	3.53 ± 1.03
There're hundreds of GM products in the market	5 (%5.56)	3.50 ± 1.09
GM fruits and vegetables have longer shelf life	4 (%4.44)	3.49 ± 1.03
Even we're not presented to GM products directly, it affects us via animals	0 (%0.00)	3.40 ± 1.19
GM seeds harm natural products, pose a threat to environment	5 (%5.56)	3.27 ± 1.15
GM products cause infertility	4 (%4.44)	3.27 ± 1.23
GM products cause biological pollution	1 (%1.11)	3.26 ± 1.10
GMOs increase the antibiotic-resistant	15 (%16.7)	3.15 ± 1.06
It's possible to harvest more than once in a year with GM products	8 (%8.89)	3.11 ± 1.09
GM products are allergic	18 (%20.0)	3.10 ± 1.09
I trust indications on a label about GM products	4 (%4.44)	2.98 ± 1.05
GM products are unhealthy	2 (%2.22)	2.90 ± 0.92
Thanks to GM products, it will be possible to buy products cheaper	2 (%2.22)	2.85 ± 1.15
GM products are carcinogenic	7 (%7.78)	2.78 ± 0.91
GM products are proved to be safe	3 (%3.33)	2.65 ± 1.07
GM products cause harms in organs	15 (%16.7)	2.64 ± 0.96
GM products are the solution for hunger in the world	1 (%1.11)	2.59 ± 1.12
Organic products are free of GMO	18 (%20.0)	2.57 ± 1.02
GM products could only be used as animal feed	1 (%1.11)	2.29 ± 0.89
It's impossible to make analysis for determining whether a product is GM in our country	4 (%4.44)	2.29 ± 1.01
GM products cause poisoning	14 (%15.6)	2.24 ± 0.99
GM products have higher nutritional value	2 (%2.22)	2.21 ± 0.93

It's forbidden by islam to consume GM products because it's blended with the genes of pig 14 (%15,6) 2.04 ± 1.05
 GM products are more tasty 5 (%5.56) 1.89 ± 0.71

Prepared by using 5 Likert scale. All data reported as mean ± SD. 1: Absolutely disagree, 2: Disagree, 3: neither agree nor agree, 4: Agree, 5: Absolutely agree, n*: Number and percentage (in parenthesis) of "no idea"

TABLE VI LEVEL OF AGREEMENT TO EXPRESSIONS REGARDING GENE TECHNOLOGY

Statement	n*	Level of agreement
Government should allocate more resources for gene technology for having potential benefits for food supply	0 (%0.00)	4.00 ± 1.08
Government should take society's opinion regarding gene technology more into account	0 (%0.00)	3.80 ± 1.03
Only producers that produce GMO containing products will benefit from gene technology	6 (%6.67)	3.35 ± 1.14
Citizens should have a say regarding whether gene technology is going to be used in food supply	1 (%1.11)	3.30 ± 1.22
Consumers will benefit from gene technology in 5 years	8 (%8.89)	3.23 ± 1.06
Gene technology should be avoided for having potential threats to environment	1 (%1.11)	2.92 ± 1.09

Prepared by using 5 Likert scale. All data reported as mean ± SD. 1: Absolutely disagree, 2: Disagree, 3: neither agree nor agree, 4: Agree, 5: Absolutely agree, n*: Number and percentage (in parenthesis) of "no idea"

TABLE VII APPROVAL LEVEL OF PRACTICES IN FOOD PRODUCTION

Statement	n*	Level of agreement
Producing plants that are resistant to insects in order to decrease the use of pesticides	3 (%3.33)	3.84 ± 1.18
Producing foodstuff with reduced fat presence	2 (%2.22)	3.53 ± 1.22
Generating microbial enzyme in order to be used in food production	4 (%4.44)	3.45 ± 1.08
Extending the time that fruits and vegetables remain fresh	1 (%1.11)	2.89 ± 1.22
Producing foodstuff containing more vitamins	2 (%2.22)	2.81 ± 1.14
Transferring genes between plants in order to have high nutritional value	1 (%1.11)	2.73 ± 1.13
Enhancing the flavor of fruits and vegetables	2 (%2.22)	2.55 ± 1.12
Transferring genes from other species to chicken in order to produce latter containing less fat	1 (%1.11)	2.30 ± 1.00

Prepared by using 5 Likert scale. All data reported as mean ± SD. 1: Absolutely disagree, 2: Disagree, 3: neither agree nor agree, 4: Agree, 5: Absolutely agree, n*: Number and percentage (in parenthesis) of "no idea"