

## CONSUMERS' PERCEPTION ON FOOD FROM GENETICALLY MODIFIED ORGANISMS (GMO)

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### Abstract

*Even if genetically modified organisms (GMO's) brought many benefits like greater yields, foods with higher nutritional value, vaccines, resistant plants to diseases, there is a controversial discussion regarding its acceptation and welcoming. There is missing information in regard to this topic especially in developing countries. In this framework this study tries to analyse the controversions around the GMO and to evaluate the risks versus the benefits. There was also measured the level of knowledge or acceptance towards GMO's and GM biotechnology by students from the Faculty of Environmental Engineering and Biotechnology of the Valahia University Targoviste, Romania, which are themselves food consumers. The researchers used a survey that had been used with good results in other countries. The results of this study demonstrated that students as food consumers and further food processors are not enough or even misinformed about this topic. The analysed population demonstrated a good information on the risks of microbial contamination and pesticides than other topics.*

Keywords: Consumers Perceptions, Biotechnology, Genetically Modified Organisms, Transgenic Food, Survey, Acceptance

### 1. INTRODUCTION

Genetic modification is a kind of biotechnology that modifies the genetic makeup of some living organisms as animals, plants, or bacteria. An organism is considered modified genetically when the genetic material from another organism is introduced in its DNA sequence. Each inserted external gene, has a promoter, which is a protein that codifies the site and a terminator. The promoter acts as a "switch" to alert the cell to begin to produce the new protein. The terminator marks full stop for the transcription of the gene [8]. The resulting organism which develops from such a modified cell is a genetically modified organism (OMG).

The genetically modified organism, or transgenic organism, has in its genome the new genes which can induce some new characters. It is possible to introduce genes that codified for some economically usefull characters.

This technology is used from the beginning of the nineteen eighties to increase the vegetal production in order to assure a better food supply.

Until now there is a continuous controverse on producing and using genetically modified food according to its benefits and risks.

It is necessary to make an analyse on these risks and benefits and to analyse the consumers perception on these controverse.

The goal of this study is to measure the consumer's level of knowledge and perceptions of the terminologies and concepts of GMO's, and the feelings that were generated by this type of foods using a survey.

### 2. RISKS VERSUS BENEFITS OF THE GMO

Technologies for genetically modifying (GM) foods or transgenic foods offer dramatic promises to fulfil the great challenges of the 21st century. Like all new technologies, there are possible known and unknown risks. These risks raise controversies.

Potential benefits by using GMO can be considered:

- Improve health of human population by cheaply producing medicines (like insulin).
- Decrease use of pesticides, herbicides, and use of animals in testing product safety, or use of some animal products.
- Increase food production.

Potential risks by using GMO can be considered:

- Recombinant DNA may be spread to other plant species (via pollen or cuttings) with unknown effects.
- They may result in new transgenic products that may be harmful to humans or other species.
- They may have less economic benefit than desired when compared against the expense, need for initial startup capital and intercompany competition.
- Concerns that humans and animals will eat the transgenic DNA as part of their diet. Cooking degrades the DNA.
- Concerns the release of GMOs to the environment may be irreversible.
- Concerns that release of GMOs to the environment may be an evolutionary/ecological "timebomb".
- May make the transgenic animals unhealthy (animal welfare and ethical issues).
- May result in evolution of insects or bacteria resistant to current control methods.
- May create a monopoly and dependence on the companies that create these transgenic species. Such technologies are protected by patents.

Other important facts about genetically modified organisms:

- The recombinant DNA is found in all cells of the genetically modified organism.
- Transcription occurs only in specific tissues within the GMO.
- Although produced in certain tissues, the protein that results from the transgenic gene may circulate via sap, blood, or fluids through the body of the organism or may be secreted out of the body (as in milk).

- In animals, the transgenic gene is only passed from parent to offspring (via chromosomes). Viruses could accidentally transfer the recombinant DNA between individuals.
- The introduced gene may be spread from GMO plants to non-GMO plants (including different species) via pollen and cuttings.

### 3. CONTROVERSIONS AROUND THE GM FOOD

There are also controversions surrounding GM foods and crops commonly focus on human and environmental safety, labelling and consumer choice, intellectual property rights, ethics, food security, poverty reduction, and environmental conservation [4].

The transgenic foods production raises two concerns with respect to potential human safety or regards to health impact (the allergens) [2]:

- The first concern is in regard the fact that transferred genes should codify proteins, that are not commonly present in the original food and they could be allergens [5]. This arise the question: if the protein will continue being allergenic in the new food? [2].
- The second concern is in regards the possibility that a previously non-allergenic protein present in the food will be transformed into an allergen. In this case, due to the serum from this allergenic condition is not available, there is no appropriate immunological test designed to determine its potential allergenicity [2]. Moreover, the effect of the possible allergen is difficult to test because the vulnerable population is unknown and will not develop tolerance to the new product [5].

The acceptance of transgenic foods by the consumers of industrialized countries has been controversial as well as concerns for its security [3]. These consumers need to be sure and confident that the regulating authorities have studied the risks for health [6].

In contrast, consumers from developing countries are lacking the information on

techniques and terminologies used, because the biotechnology techniques are not common yet in these countries.

#### 4. MATERIALS AND METHODS

The best method to investigate the consumers' perception is the use of survey.

*Description of the Population.* There was analysed a population of consumers from Targoviste City, composed from 25 females and 15 males with age between 19-25. They were students from the Faculty of Environmental Engineering and Biotechnology from the local university.

*Description of the Sample.* The participants of this study were 40 consumers from the city of Targoviste, Romania. They were invited to answer a questionnaire. The questionnaire application was managed with instruction.

*Instruments.* As suggested by [7], a questionnaire of twelve questions was applied to consumers in order to measure their perception of the GM biotechnology and GMO's. The questionnaire was elaborated using an answering system of yes, not, and I don't know and also a grading scale from the 1 to the 10, where 1 is unacceptable and 10 are acceptable. This questionnaire analysed the perception of the GMO's in comparison with other usually food risks like pesticide residue, additives or preservatives, microbial contamination, antibiotics or hormones, irradiated foods.

*Statistical Analysis.* All the statistical analyses were made by means of program Microsoft Excel.

#### 5. RESULTS AND DISCUSSIONS

**Perceptions of Food Safety:** Two questions were asked to participants in regards to their knowledge on food safety.

• *First question:* What of the following items concerns you the most after you ingest food?

- Pesticides residues
- Additives or preservatives
- Microbial contamination
- Antibiotic or hormones
- Irradiated foods

- Biotechnology
- None
- Other.

**Table I. Consumers' perceptions of food safety risks**

Risk	(%)
Pesticide residues	13.0
Additives or preservatives	5.8
Microbial contamination	58.5
Antibiotics or hormones	5.7
Irradiated foods	5.7
GM food	0.0
None	9.2
Other	2.1

As it can be seen in Table I, none of the participants indicated that the food from GMO concerned them, being the microbial contamination (58.5%) the most important factor. Also, it could be noticed that consumers who answered "others" were referring to the food prices being the factor that they worried about the most.

• *Second question:* Could you please classify the following items using the following scale: serious hazard, slight hazard, It is not hazard and I do not know?

- Pesticide residues
- Additives or preservatives
- Microbial contamination
- Antibiotics or hormones
- Irradiated foods
- GM Food

**Table II. Consumers' perceptions of food safety hazards**

	Serious hazard	Slight hazard	It is not a risk	Don't know
Pesticide residues	68.22%	18.00%	6.28%	7.50%
Additives or preservatives	50.30%	38.60%	4.75%	6.35%
Microbial contamination	52.00%	18.30%	9.20%	20.50%
Antibiotics or hormones	21.83%	50.32%	19.60%	8.25%
Irradiated foods	75.70%	15.00%	1.50%	7.80%
GM food	16.00%	21.75%	20.75%	41.50%

As is shown in Table II, the great knowledge of the consumers was on the health risks that represented the pesticide. A great percentage of consumers recognized them as a serious hazard for their health. In addition, consumers were aware that they are misinformed about techniques such as GM food, irradiated foods, and a great percentage communicated being misinformed about the hazard this represents for their health.

**Knowledge of the GM biotechnology:** Five questions were asked to participants in regards to their knowledge about biotechnology:

1. Do you know what a genetically modified food (transgenic food) is?
2. Are there foods produced through GM biotechnology in supermarkets?
3. Are there foods produced through GM biotechnology in grocery stores?
4. Are there foods produced through GM biotechnology in restaurants?
5. Are there foods produced through GM biotechnology in the premises fast foods?

When consumers were asked about the meaning of genetically modify foods, or a transgenic food, as it is a 51.78% responded affirmatively. But, when consulting to their following question: Do you know if there are foods produced through the GM biotechnology in the supermarket, in stores, restaurants or in the premises of fast food? a mean of 97,34% indicated that they did not know, demonstrating the lack of information on the commercialization of these foods in their city in Romania.

In order to know what GM biotechnology represents for these individuals consumers were asked: Before today, had you ever talked about biotechnology with someone? A 35.92% responded affirmatively, whereas a 64.08% responded negatively.

Asking to the 35.92% of consumers that responded affirmatively in regard the frequency of talking about biotechnology a 2.32 % responded that they had talked frequently, while the other ones responded that they has talked only a few time.

**Acceptance of GM biotechnology:** Five questions were asked to the participants in regards to their acceptance of GM biotechnology:

1. Would you support the use of the GM biotechnology in the field of medicine?
2. Would you support the use of the GM biotechnology in the field of agriculture?
3. Could you please rank from (1-10) the following items: Think about what is your acceptance of the applications of biotechnology?
  - Crop breeding
  - Foods with lower fat or more vitamins
  - Crop plants that reduce the need for pesticides
  - Human insulin or other medicines
  - Farm animals that resist disease need for pesticides
  - Food ingredients like:
    - Plants or parts of plants that are used in the food elaboration (Exp.edible oils, into which biotechnology has been applied to protect the plants from pests or improve the yield.
4. Do you believe that the use of GM biotechnology into theses plants has on effect on the purchase of its products?
5. Would you agree, for this type of products, the application of a law that forced to indicate in the label that this food has been genetically modified or contains a genetically modified ingredient?

When consumers were asked: A) would you support the use of the GM biotechnology in the medicine field? B) would you support the use of the GM biotechnology applied to agriculture?, the results of the study indicated that 3.8% agreed the use applied to medicine and 12.8% agreed the use applied to agriculture. It is relevant to observe that the other 83.4% of responses answered "I do not know". This proportion could be due to the lack of trustworthy information on these products.

In order to discern consumers acceptance of the applications of GM biotechnology on specific uses, a scale from the 1 to the 10 (where 1 is unacceptable and 10 are acceptable) to describe what do they thought on the use of this

technology was used. The item "crops plants that reduce the need for pesticides" that profited the greatest acceptance with 6.9 points. On the other hand, values close to 5 points indicate the lack of knowledge on the subject from the consumers, which did not generate a rejection or a high acceptance.

It can be concluded that this lack of knowledge could be used by commercial groups, which should manipulate information move to the affection or rejection of these products to benefit their interests.

When consulting the consumers with this statement and question "Plants or parts of plants exist that are used in the food elaboration, for example edible oils, into which GM biotechnology has been applied to protect the plants from pests or improve the yield. Which effect would have the use of the biotechnology in your selection of purchase edible oil isolated from these plants?" A 39.2% answered that it would have a positive effect and a 48.2% indicated that this would have a negative effect on its selection of purchase. But, when it was creating the situation "If, the product (edible oil) have a mandatory label, where it is certify security for the health, would you acquire it", It was observed a great increase of selection of purchase, increasing acceptance at 69.2% and diminishing the rejection.

Finally, the following question was asked: "Would you agree, for this type of products, the application of a law that forced to indicate in the label that this food has been genetically modified or contains a genetically modified ingredient? In this case 75.5% of the students answered affirmative.

## 6. CONCLUSIONS

- After the performed analyse, it can be concluded that questioned consumers recognized the microbial contamination and pesticides as the most important safety risk.
- When consumers graded the food safety hazard, they scored pesticides as serious hazards followed by irradiated foods and microbial contamination.

- None of consumers were concerned with GM biotechnology and it was graded as serious hazard only by few students.
- A high proportion of consumers recognized pesticides and microbial contamination as serious hazards for their health because consumers own more information in regards to pesticide and microbial contamination, than in regards to GM biotechnology.
- The consumers has shown evident lack of information in regards to GM biotechnology, still more the genetically or transgenic foods and its marketing.
- A high score for acceptation of GM biotechnology application was reached for the statement "crops plants that reduce need for pesticides" and the less one was for the use of GMbiotechnology for food ingredients.
- The students as consumers have shown a high trend to prefer a mandatory label in the product which inform the presence of this technique and certified the product as a safe healthy product.

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