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GENETICALLY MODIFIED FOODS VS. ORGANIC FOODS: IS THERE A CONFLICT BETWEEN HEALTH AND PROFIT?

Abstract: Since it has appeared, GM food does not cease to intrigue the scientific community. Although the science has advanced in this field over the years, there is a widespread debate around using genetically modified organisms in food products. Specifically, the issue of genetically modified food is one area where health, ethics and economics have merged. Consistent with this, health, ethics and economics are portrayed as elements of a conflict between commercial and consumer interests. They pointed out that both sides have developed strong positions to defend their interests. In this context, the authors stressed that scientists have an ethical and moral duty to explore genetically modified (GM) foods in the interest of the health of future and present generations. Additionally, they underlined that governments in each country must have responsibility for food standards and safety and must focus primarily on the well-being of consumers, and not on the profits of producers or suppliers. Finally, the authors presented some proposals that could decrease conflict of interest between producers of GM food and its consumers, considering that the focus must be less on profit than on the health of consumers.

Key words: *Food, genetically modified food, food production, health risk, ethics, consumers*

INTRODUCTION

Contemporary biotechnologies are considered the key technologies in 21st century. These modern technologies, such as genetic engineering, manipulate living organisms with the intention to produce new genetically modified cereal, cattle, food, medicines, vaccines and other commodes. Therefore they have found a wide application in medicine, pharmacy, agriculture, food industry and other domains. Although the application of genetic technologies in medicine and pharmacy, in the last decade, is worldwide accepted, we cannot state the same for the application of

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genetic technologies in agriculture and food production. The reason for this is the fact that people accept the usage of new technologies in the food production with far more skepticism than in biomedicine.

Numerous studies of health risk have shown the inconsistency of the risk assessments that underlie them. Since 1980, in the scientific and expert public arena, we can find numerous criticisms directed towards the specific aspects of biotechnologies, which are used in various countries in Europe and the USA [1]. However, greater attention has been dedicated to this area since 1997. This occurred when the activists of some non-governmental organizations in the European Union tried to ban the import of greater amount of genetically modified soy, which drew the attention of many news media in Europe and the States [2]. Since the beginning of this world campaign against genetically modified food, many criticisms were directed towards the political, socio-economic, ecological and ethical aspects of the application of the genetic engineering in the food production. Those in the campaign (scientists and lay individuals) believed that regardless of where the research was conducted (i. e. in the various EU countries or in the States, which constituted differences in the economic level of development, cultural political, national, religious and other aspects) there is still the need to point out the degree to which the application of biotechnology and genetic engineering in the food production contribute to disease development and to what extent it is harming the population's health. Researchers must therefore focus their attention upon the safety of genetically modified food, the ethic of its usage as well as on its price and availability to the consumers.

In that context much research point to alarming facts about genetically modified food, such as [2]:

- Animals get serious diseases and die because of GM food.
- Top world scientists have confirmed that the genetic engineering is not safe and that its consequences are often unpredictable. Recently, 37 people in the USA, who were taking a weight reduction food which was genetically modified, died of potential consequences.
- In the USA, Canada and many other countries this food is not even marked by special labels or identifying marks. Despite the warnings about its harming effect, it is still sold in shops around the world.
- In the developing countries there are no legal regulations about the import of genetically modified products.
- The interests of the producers and the high profit generated by selling the GM products are far above the interests of its consumers.
- One group of scientists considers that until safety of the biotechnologies used in production of GM food is examined, there is nothing that is absolutely safe in the arena of fast scientific and technological development.

The debate will continue between GMO supporters, claiming there's no scientific proof the technology is unsafe and others who argue the GMO technology must be proven safe before its products are released into the marketplace. There is an opinion that this debate will never end as long as each party represents their in-

terests. In addition, knowledge about the safety of GM food is incomplete which extends the debate and contributes to controversial opinions. The authors of this article tried to contribute to the topic with their original research and to point out that governments in each country must have responsibility for food standards, and safety must focus primarily on the well-being of consumers, and not on the profits of producers or suppliers. They also argued that a label is needed to identify genetically altered foods. In other words, companies should tell consumers what they're eating. Finally, the authors presented some proposals as to how conflicts of interest between producers of GM food and its consumers could be reduced when the focus is less on profit than on the health of consumers.

1. APPEARANCE OF THE NEW GENERATION OF GENETICALLY MODIFIED FOOD

There are many kinds of genetically modified products. According to the findings so far, products that are genetically modified are the following: soy, corn, tomato, potato, papaya, rice, clover, sugar beets, beet and wheat. Besides the mentioned products, their number and characteristics are changing rapidly, so there are constantly new kinds of genetically modified food on the market. Recently, there has appeared the sensational news in a few American scientific magazines, that a new generation of the genetically modified food is being produced, which will largely contribute to the substitution of organic food because of its nutritional and other characteristics. We are talking about "meat from the laboratory" and "calorie free potato," as well as about many other products which has divided the opinions of the scientific public by their appearance and opened new various dilemmas among the potential buyers.

Among the supporters, a certain number of experts for genetic engineering and producers of this food, we could hear the claims that we are talking about food that has many advantages. These advantages include:

- the use of a single cell to produce the annual needs of the world population;
- mass and cheaper production;
- a decline in the number of the hungry; and
- a decline in the number of obese individuals (considering that we are talking about food with less calories and more nutritional value).

On the other hand, there are numerous opinions that such products may seriously harm people's health. The greatest critics of GM food have said that we are not supposed to wait for the testing of this food and connecting it with the consequences on the human health, but we should ban it immediately and stop any kind of similar research. This stand was explained by the claim that genetically modified food has to have an effect on genetic changes in its consumers, which is unacceptable. One of the recent examples which divided public opinion is the genetically modified corn under the name of "Starlink." Soon after the appearance of this product, it was determined that it is not suitable for human usage. Because of that, there have been suggestions made by some non-government organizations that the

corn should be withdrawn from sales. Despite warning, this kind of corn can still be found on the market, regardless of all the warnings about its harmful effect. Besides this example, there are many other examples based upon scientific evidence and experiments that point to the harmful effect of the genetically modified food. We will take for example the scientist Árpád Pusztai (8 September 1930), who while doing an experiment, gave genetically modified potatoes, containing the GNA lectin gene, to one group of rats, and the regular potatoes to another group. Rats from the GM group died in a short period of time and their stomachs were completely destroyed [14]. Great pressure was put on Pustaly and his results were never published.

Besides the aforementioned items, like in the case of genetically modified corn and potato, as well as other experiments, these products were not withdrawn from the market. The reason for this lies in the fact that producers still guarantee the safety of their food and they have the support of various government agencies. Therefore, until national and regional institutions, as well as private testing agencies ensure the safety of GM foods to be on the market, and until the producers show proof of their safety, we should consider that certain GM foods are harmful and we should avoid them whenever possible. This opinion can be heard in organizations which are sided with the protection of the consumers' interests and who constantly provoke debates about the GM products.

Among the many new debates led in the EU countries, there is one that is really important and was led by the Ministry of Trade and Industry in Denmark. This debate emphasized the fact that the production of GM food has only commercial significance for its producers, so that was the main aspect of this discussion. The Ministry gathered experts from different areas of study – doctors, biologists, agronomists, economists, philosophers and theologians – so that this question could be considered from various aspects. Their aim was to design the working material which would be used as the foundation for determining the ethical standards in this area as a platform for further discussion. The aim of this action was to protect the consumers' interests when speaking of GM food. Similar proceedings are led in other countries of EU, which create reports, every year, based upon the research they conducted. One of those research projects was held in 2002 in Great Britain and was comprised of 300 participants, mainly young people and individuals with low income. This research showed that compared to men, women take more care of food safety (72% women and 62% men), and they were between 36 and 65 years old [2].

Particularly interesting is the research done in Romania about the relation of the consumers towards GM food. It showed that more than 98% of consumers in Romania do not know anything about this kind of food and has problems understanding what GM food really means [4]. It also showed that there is a very low level of knowledge about biotechnologies in Romania and that it is one of the main reasons why individuals in this country neither accept nor reject the products based on gene technology.

Regardless of the negative attitudes, the producers kept producing the genetic goods, motivated, first of all, by the high profit and expansion of their market.

Therefore, in the total structure of offered food on the American market, genetic goods take up about 34%. Also in the USA around 80% of soy was produced by genetic modifications, in Argentina up to 90%, and it was proven that this soy had ten times lower nutritional value than the regular one [13]. Many supermarkets in the USA and other developed countries are packed with these products and the buyers usually have a difficult time discerning GM foods from the organic ones. But those who do know how to understand the differences between these two kinds of food often cannot afford to buy organic food, considering that it is significantly more expensive than genetically modified. Therefore, we can conclude that the food choice is not just a matter of the people's affinities, but also it is determined by the financial conditions and economic standard of the citizens. That is why we can often hear from the experts that the organic food is only for the upper classes.

2. DIFFERENT ASPECTS OF HARMFUL EFFECT OF GENETICALLY MODIFIED FOOD

Any consumption of GMO products is basically a smorgasbord of disaster, according to more than 800 global scientists [7]. The negative effect, which GM products can have, can be seen from several of the most critical aspects of their harmful effects:

- **Medical aspect** – Genetically modified food and its usage in people's diet can lead to antibiotic resistance. This can have a very negative effect on human health. Also the consummation of this food can lead to numerous diseases with deadly outcome or permanent disability. Recently, it was discovered that pregnant women who consumed GM food during pregnancy, experienced birth defects of a child. In 1989, L-tryptophan produced by GM microorganisms, was associated with over 30 deaths and nearly 1,500 myalgias and peripheral blood eosinophilia related health issues [8, 9, 10]. A most recent defect that has been noticed is known under the name of Hypospadias (defects in male reproductive organs). This defect has significantly increased in the last ten years, since GM food started being massively used. There is also the possibility that this defect is related to one-carbon metabolism (1-carbon transformations require two cofactors especially: folic acid and vitamin B_{12}) [11]. Despite these statements by scientists, there are still no statistical indicators, which would document the above mentioned statements of the scientists in the most effective manner.
- **Economy and ecological aspect** – The doubts of GM foods having a harmful effect do not end only with the medical aspects. For example, the genes that are related to resistance to chemical herbicides can be transferred from GM plants to neighboring weeds. By covering larger surfaces with GM crops, negative implications in biodiversity may be caused.

Considering the topic of this paper, we will now focus on the socio-economic dimension of this potential concern.

3. ECONOMIC AND SOCIAL ASPECTS OF PRODUCTION AND THE USAGE OF GENETICALLY MODIFIED FOOD – POTENTIAL CONFLICT OF INTERESTS BETWEEN DEVELOPED AND DEVELOPING COUNTRIES, VIA PRODUCERS AND CONSUMERS OF GM PRODUCTS

Modern biotechnologies have been announced as a "miracle", which can solve social and economic problems, improve the health of people and stop the degradation of the environment. Many companies, major corporations and scientists are advocates of biotechnologies. However, in order to understand better the purpose of modern biotechnologies, it is necessary to put this controversial issue into a wider context of consideration – economic, medical, ecological, ethical and political.

Developing countries are faced with the challenge to rapidly increase agricultural productivity to help feed their growing populations, without depleting their natural resource base [6]. According to the United Nations Millennium Project (2005), the number of undernourished people in the world has fallen from approximately 1.5 billion in the early 1970 s to around 850 million by the 1990's [12]. This is a result of increased food production. However more than 200 million of the world's hungry are children, and at present at least 5 million die each year from malnutrition [5]. Despite that there is an increase in the world food production, thanks to the Green Revolution (research initiatives between 1940 s-60 s to increase worldwide agricultural production), the safety of agricultural products is still not achieved, nor is the issue of hunger in the world solved. Specifically, there are hardly any success stories relating to the application of biotechnology in the improvement of African livestock production.[6] The reason for this should be pursued, since world hunger is not caused by the inadequate level of production, but by the lack of land, capital and other resources. Introducing new technology without solving the structural issues, which are the basis of this problem, will not resolve the concerns of hunger, nor the safety of food products. In an economic and social sense, the usage of new biotechnologies can have, besides the aforementioned, more negative implications such as:

- *Increase of debt and socio-political tensions* – Innovative technologies are usually directly connected to new loan packages. By introducing the Green Revolution, many small producers have taken loans, which they could not repay. Because of this their land was forfeit or bought and then sold to richer farmers, which caused social tensions. The same can happen with the introducing of biotechnologies and genetic engineering in food production. Even if genetically modified seed was given for free, the prices of implementation of GM food production would be far beyond the financial means of small and medium producers.
- *Ethics of the usage of genetic engineering and the right to choose* – Using the genes to get the genetically modified plants, cattle and food, can be unacceptable for a large number of people. Using the genes of some animals is also offensive to many religions. It is moreover important to mention that GM products

have not been labeled in the correct manner, which denies the buyer's right to choose while purchasing. Genetically modified products, which have similar features to organic food, may actually have different characteristics and are produced in various ways. Therefore they should be appropriately labeled, in order for the buyers to know what they are purchasing. Unfortunately, many countries often accept aid in the form of food without necessary information about the ingredients [3]. Having this in mind, scientists in many developing countries, together with their ministries for agriculture, advocate a more careful approach to the transfer of technologies. The first principle of caution is seen in encouraging scientific knowledge and gathering data connected to the ecological, health and socio-economic risks of GM food. In this respect the EU countries are leading, because their laws are in accordance with the potential concerns and cautions relating to new modified foods.

We should also mention that the transfer of technologies is currently not being implemented on a large scale by the industrial sections to underdeveloped parts of the world, despite the promises given by the highly developed countries at the Earth Summit of 2002 (World Summit on Sustainable Development) [15]. The main reason is that large multinational companies control, to a large extent, modern biotechnologies. They only transfer knowledge and products relating to the direct usage (i. e. seeds, etc) of the GM goods. However, in Indonesia, some transnational corporations provide scholarships to national institutions and their scientists for studying genetically modified products, which are produced by these companies. Therefore, Indonesia has less negative attitudes against these companies when it comes to GM products.

Developing countries that currently do not have laws which regulate the safety of GM products, can obtain benefits from the Cartagena Protocol on Biosafety and the experiences of other countries that utilize GM foods, in order to formulate their own laws. Developing countries should take the following steps:

1. Analyze the socio-economic implications of GM products on the national level and exchange this information with others scientists, politicians and scholars.
2. Develop their own regulations on the national and regional level according to the Cartagena Protocol.

4. RESEARCH METHODOLOGY

Our research was conducted in the United States, on a random sample of 100 managers in the field of GM food production who were asked twelve questions. The primary goal of the research was to learn about the managers' own attitudes towards GM food as regards economic, ethical and health aspects of the production of this particular type of food. Our target group was the GM food production managers as we started from the premise that they are well familiar (at least better than general customers) with its quality and safety. Female respondents made up 7.5% of the sample, whereas male ones were a majority, 92.5%. In terms of age, the structure of

the sample was as follows: 69% of respondents of both genders were older than 31, while 31% were below 30 years of age.

The research was an attempt to test four hypotheses:

H1 GM food is not safe to consume since it is injurious to health.

H2 People below 30 years of age are more interested in the safety of food and fear that consuming the GM food will endanger their health.

H3 The interests of GM food producers differ from those of GM food consumers.

H4 Despite being more expensive that GM food, organic food is worth its price.

4. 1. KEY FINDINGS

The first hypothesis is not confirmed in our research. As many as 76% of respondents maintain that GM food is not dangerous to health, while 24% are of the opinion that consuming GM food has negative effects upon health (Fig. 1). The research findings point to the fact that as many as 53% of respondents are not concerned with food safety issues, while only 4% are (Fig. 2). According to the research, there aren't differences in GM food concerns between men and women (Fig. 3).

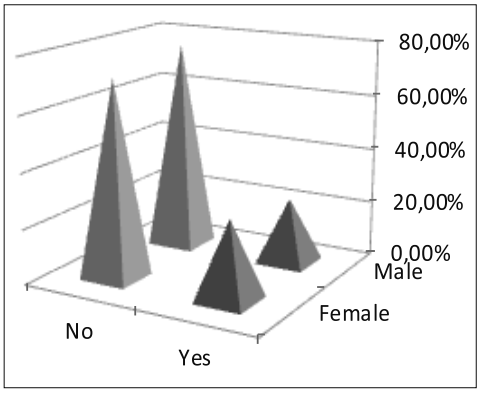

Fig. 1. Do you think GM foods have a potential risks to human health?

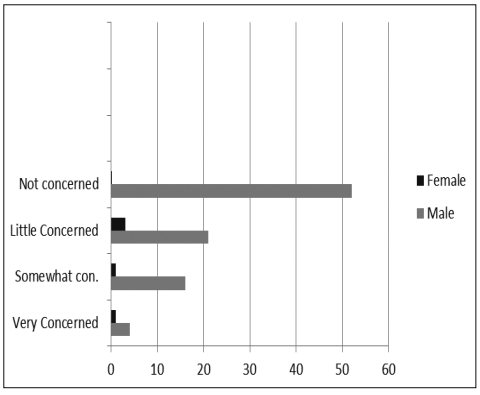

Fig. 2. Are you concerned about health risks from GM foods?

The research findings point to the fact that as many as 53% of respondents are not concerned with food safety issues, while only 4% are. Our research has also shown that a majority (43%) of our respondents consumes GM food 3 – 5 times a month, 23% of respondents consume it 2 – 3 times per week, 17% of them consume GM food on a daily basis, while 10% of respondents do not consume this food at all (Fig. 4).

Our hypothesis that people younger than 30 are more concerned with what they eat and pay more attention to food safety is rejected, the results of the research have shown. Namely, the results have shown that as many as 75% of the respondents do not agree with the statement, and 25% maintain that the young are more interest-

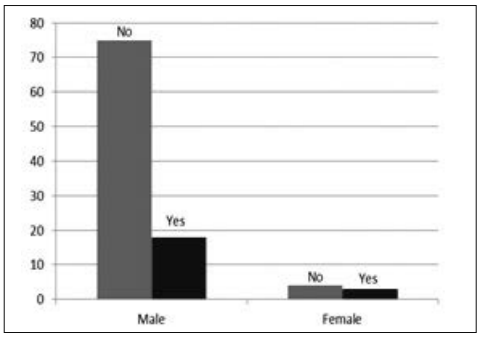

Fig. 3. Do you believe there are possible differences in GM food concerns between men and women?

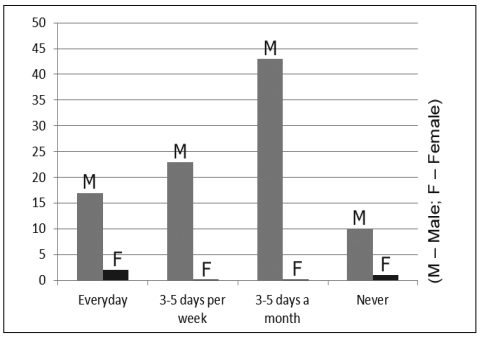

Fig. 4. How often do you eat GM food?

ed in food safety. The analysis conducted as regards gender, however, has shown that it is women rather than men respondents that believe young people are more interested in food safety.

A large percentage (79%) of our respondents has confirmed our hypothesis H 3 that there is a difference in the interests of GM food producers and those of GM food consumers. Thus, the answers to our question, "Do you believe there are differences among some public interest groups, producers and consumers regarding GM food"? are "strongly agree" by 70%, while a very small number of respondents disagree (5%) (Fig. 5).

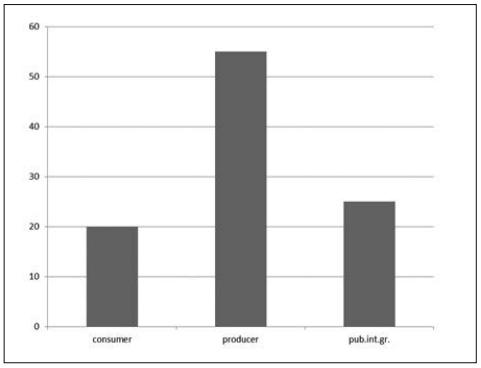

Fig. 5. Who do you believe benefits from GM crops?

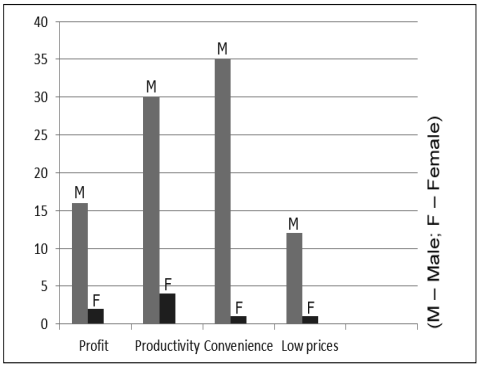

Fig. 6. What is the current benefit of having foods made from GM crops?

Our research has also shown that the major benefits of GM food production are practicality of production (35%), followed by higher productivity (30%) and rise in profits (16%), the low price being at the bottom of the list (12%) (Fig. 6).

The fourth hypothesis is confirmed in our research. Namely, 87% of respondents agree that organic food is worth its price although it is more expensive than GM food (Fig. 7).

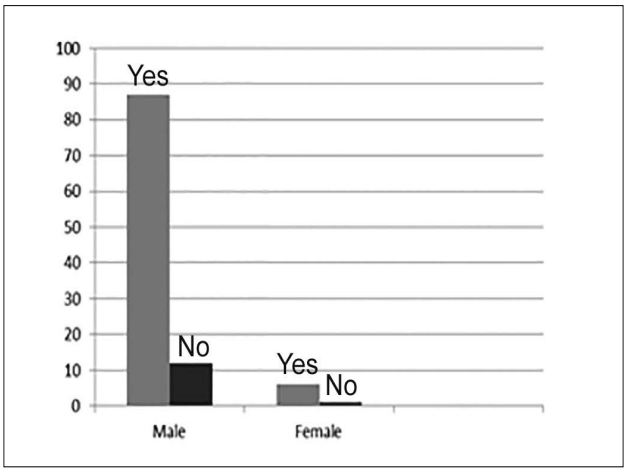

Fig. 7. Do you believe that organic food is worth the price?

CONCLUSION

This research has, in our opinion, led to new conclusions and refuted some already well rooted attitudes. In the first place, it has shown that there are no age differences as regards the consumers' attitudes towards the kind of food they eat. Namely, in choosing their food, neither the older nor the younger generations are really concerned about health. This is corroborated by the facts according to which as many as 52% of the respondents do not really care about what kind of food they eat and are not concerned with the potential risks of GM food to their health, while only 4% of them give it a serious thought. Only 10% of our respondents claim that they never consume GM food, whereas a majority does, of whom 17% consume it on a daily basis. Given that our respondents are not concerned about the choice of food they consume, a conclusion can be drawn that their consumption of GM food can be explained by their attitude to their diet and health, rather than by their assurance that GM food is safe. Therefore, the fact that our respondents are GM food production managers has not raised their awareness, nor has it contributed to our insight into the extent to which this food is safe.

To sum up, we can conclude that the results of the research apply to the United States and cannot be generally accepted for other countries. This is corroborated by our respondents, the majority of whom (76%) point out the fact that the differences in the extent to which GM food is accepted depend on cultural, social and economic circumstances in different parts of the world.

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