
ANNALES
UNIVERSITATIS MARIAE CURIE-SKŁODOWSKA
LUBLIN – POLONIA

VOL. XXX (4)

SECTIO EE

2012

Department of Biological Bases of Animal Production, University of Life Sciences in Lublin,
Akademicka 13, 20-950 Lublin
e-mail: sylwia.nisztuk@up.lublin.pl

SYLWIA NISZTUK, MONIKA JANKOWSKA,
BRYGIDA ŚLASKA, GRZEGORZ ZIĘBA

**Knowledge and opinions of Poles on genetically
modified organisms (GMOs)**

Stan wiedzy i opinia Polaków na temat organizmów genetycznie
zmodyfikowanych (GMO)

Summary. The aim of this study was to investigate the knowledge and opinions of Poles about genetically modified organisms (GMOs). The study was conducted using a questionnaire of our own design. In this study a total of 282 respondents participated, belonging to three age groups. All of them live in the south-eastern part of Poland. The analysis of research material showed that most of the respondents, despite their knowledge of the term GMO, have only little knowledge about the effects of genetically modified products on the human body. The respondents notice the benefits of the practical use of genetic modification in medicine and pharmacy, but due to the lack of knowledge about GMOs they are fearful of the impact of GM products on the functioning of the body and the environment. Most controversies concern the use of genetic engineering techniques in food production. Despite many advantages of the GM products, many respondents said they would never buy this kind of food. About half of the respondents of each group are aware of their lack of knowledge of GMOs. They also showed interest in acquiring knowledge of genetically modified organisms.

Key words: genetically modified organisms (GMOs), knowledge, opinion, questionnaire, survey

INTRODUCTION

GMO is an organism in which genome a new gene derived from another organism is artificially introduced. Introduced genes confer new properties of the modified organism, which those organisms previously did not have [Bieniek 2009, Foss and Rogne 2003, Miraglia *et al.* 1998]. Obtained in this way transgenic organisms are programmed to produce a variety of substances, such as enzymes, monoclonal antibodies, hormones and pharmaceuticals. This technique may be currently also use to modify plants and animals for food production [Uzogara 2000]. GMOs cause both enthusiasm and a lot of concern. On the one hand, GM products are an opportunity for more rapid development of medi-

cine, pharmacy, agriculture and environmental protection, and on the other hand, society is concerned that GMOs are a threat to their health and the environment [Costa-Font *et al.* 2008, Wrześniewska-Wal 2009, www.idt.mdh.se].

The use of genetic modification in various areas of life is the subject of discussion in the community and causes a lot of controversy. The negative attitude of society to use the genetic modification is not the same for all sectors of the economy. It depends primarily on the type of modified organism and changes caused in this way. It seems that the genetic modification of plants and microorganisms are much more easily accepted by the society than the modification of animals. Also, the use of genetic engineering techniques in medicine, pharmacy and environmental protection is more positive for all people than using them in food production [Costa-Font *et al.* 2008, Grunert *et al.* 2001, Mehta and Gair 2001, Wrześniewska-Wal 2009].

Many scientists and manufacturers see a great potential in the use of genetic engineering in food technology. The benefits include primarily lower costs of production and improvement of appearance, taste and health characteristics of GMO food. On the other hand, consumers are very sceptical about the genetic modification of food. They fear the risks associated with the consumption of manufactured in this way food. Although the experts prove no threat from the use of genetic modification, many people still did not convince to GM products. In addition to the potential risks associated with GM food consumption and impact on the environment, the public has many concerns about the ethical aspects which are always associated with the practical use of genetic engineering techniques [Gachet *et al.* 1999, Grunert *et al.* 2001, Lähteenmäki *et al.* 2002, O'Fallon *et al.* 2007].

The aim of the study was to analyze the level of knowledge of Poles on genetically modified organisms (GMOs) based on research material - surveys completed by individuals belonging to three age groups: high school students, university students and adults over 28 years.

MATERIAL AND METHODS

The study was conducted using a questionnaire of survey of our own design, consisting of 15 questions. The survey consisted of 11 questions with one answer allowed and four multiple-choice questions. Most of the questions were closed questions. Only one question in the questionnaire were partially open (except the choice of answers it was possible to add own proposals). The first part of the survey (5 questions) concerned the basic personal information and education. The research material was collected in years 2011/2012.

The study involved a total of 282 people living in south-eastern Poland. Respondents were divided into three groups (depending on the age and education) – 94 people in each study group. Survey results were collected and analyzed. Data were presented as the percent for each test group separately.

The first group consisted of high school students in Lublin. Among the respondents 68% were women and 32% were men. Most of people in the survey aged > 18 years (85%). 53% of respondents live in large cities (with population greater than 100 000 residents).

The second test group consisted of 94 students from the universities in Lublin. 70% of them were woman. Almost half of the respondents (45%) live in rural areas. The others live in cities to 50 000 residents (19%), in cities from 50 000 to 100 000 residents (14%) and in cities of more than 100 000 residents (22%).

Adults over age 28 were the third group of study. 73% of 94 respondents were women and 27% were men. The highest percent of respondents were aged 18–50 (77%). The remaining 23% were over age 50. Most of the respondents live in rural areas (43%) and cities of more than 100 000 residents (32%). More than half of respondents (53%) in this group graduated high school and the remaining 47% have the higher education.

In each study group, most of respondents did not have education in the field of biological sciences.

RESULTS AND DISCUSSION

How would you define genetically modified organisms?

Most of respondents (regardless of age) defined the genetically modified organism (GMO), as organism to which a foreign gene was inserted. This response was marked by 56% of high school students, 64% of university students and 47% of adults. However, more than 20% of respondents in all study groups think that the genetically modified organism is an organism obtained by inducing mutation in it. This is probably due to the definition of mutation which is often cited on the Internet, television, and popular science press. Students also know the definition of GMO from lessons of biology, where it was discussed in the section of genetics.

From what sources do you acquire knowledge about GMOs?

A large numbers of respondents are not interested in issues related to the genetic modification of organisms (33% in the group of high school students, 23% of students and 34% of adults). The lowest percent in the group of university students was noted. Maybe it is because some of respondents have subjects at university including issues related to genetics and molecular biology. In addition, this group the most often reads articles on the internet, where the GMO is discussed quite frequently. High school students often perceive issues related to genetics as complex and difficult to understand. Therefore, they are reluctant to improve the knowledge of genetic modification. Also GMOs issues are not widely discussed during biology lessons at school. Lack of desire to improve the knowledge on GMOs in the group of adults may be due to the low popularity of the issues related to genetics, during their study when people are most interested in news in the world of science.

The most common source of information about genetically modified organisms in all studied groups is the internet, television, radio and newspapers (respectively for the group of pupils, students and adults – 33%, 39% and 48%). It is probably caused by the easiest and the most popular access to information from the world, including science information. Most of the high school students (20%) indicated that they acquire knowledge about GMOs from biology lessons. 19% of university students marked that the current information about genetic modification get from books, scientific journals and popular science press.

Would you buy genetically modified food if it were widely available, have better nutritional properties, more attractive look and a lower price?

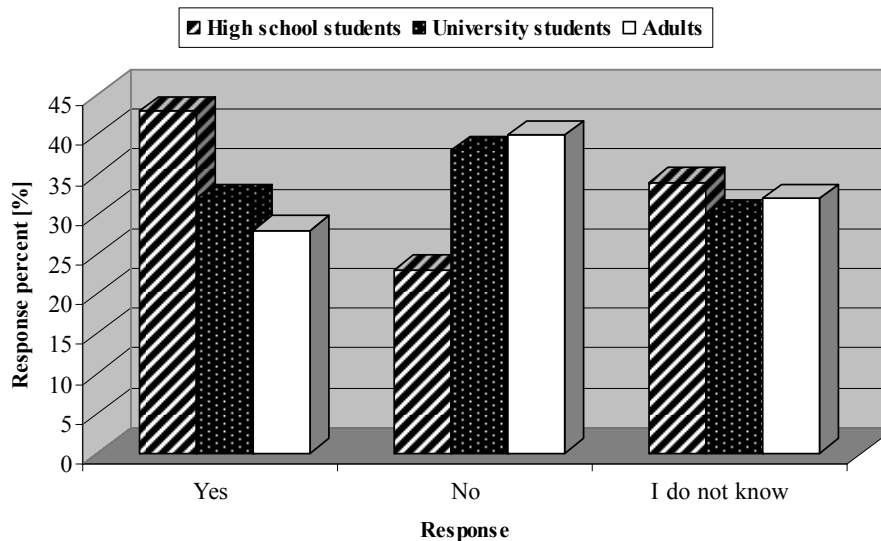


Fig. 1. Research results; Would you buy genetically modified food if it were widely available, have better nutritional properties, more attractive look and a lower price?

Rys. 1. Wyniki ankiety; Czy kupiłbyś żywność genetycznie zmodyfikowaną, jeżeli byłaby powszechnie dostępna, miała lepsze właściwości odżywcze, atrakcyjny wygląd i niższą cenę?

Nearly half of high school students would be willing to buy GM food provided that it will be widely available, have better nutritional properties, attractive appearance and a lower price. Over 30% of respondents in this group was not able to answer this question. This may be due to lack of knowledge about the benefits and side effects of consuming GM foods. No reliable information can cause concerns among young people. Almost 40% of university students decided not to buy GM products even if they would have better nutritional properties and lower price. As in group of high school students, about one third of the university students had no opinion in this topic. The highest percent of respondents among adults said they would never buy genetically modified food, even if this products would have better nutritional properties. Despite the availability of information about the GM food, many people are still not convinced of the safety of genetic modification. Even scientifically proven no risk of consuming genetically modified products can not convinced potential customers to buy GM food (fig. 1).

Do you pay attention (read the label) if the product contains GMOs when you buy food?

Respondents were asked if they check whether products which they buy contain GMOs. The most responses of each group (42–56%) was negative. Similarly about 25% of respondents of all ages do not know how the GM food is labeled. About 30% of university students and adults read labels to check if the product contains genetically modified organisms. High school students are group which the least pay attention to the content of GMOs in food (only 19%). The results suggest that consumers rarely pay attention to the composition of food products they buy.

What kind of GM food are you willing to buy?

Most of respondents in the group of high school and university students are able to buy a GM product, provided that it will be a plant product (respectively 41 and 49%). 31% of adults are also able to buy only the genetically modified plant product. In this group, most of respondents said they would never buy any GM product (46%). Probably due to the lack of knowledge about the production of this kind of food and its impact on the human body. Many people also believe that only natural food is healthy and safe for them. A large part of the population having a choice between GMO food with proven beneficial effects on the body and plants grown with fertilizers and pesticides, still would never make a decision to buy products made by genetic engineering. All studied groups were consistent in case of buying a genetically modified animal products. Only 4% of respondents in the group of high school and university students and 5% of adults is willing to buy GM food from animals. It follows that less people are afraid to consume genetically modified plant products than animal products. Most consumers know such modified products, as corn, soy and tomatoes from the TV, newspapers or internet. The presence of these products in the market may induce greater confidence to the genetic modification of plant products in the society.

Do you have any knowledge on effects of GM food on human body?

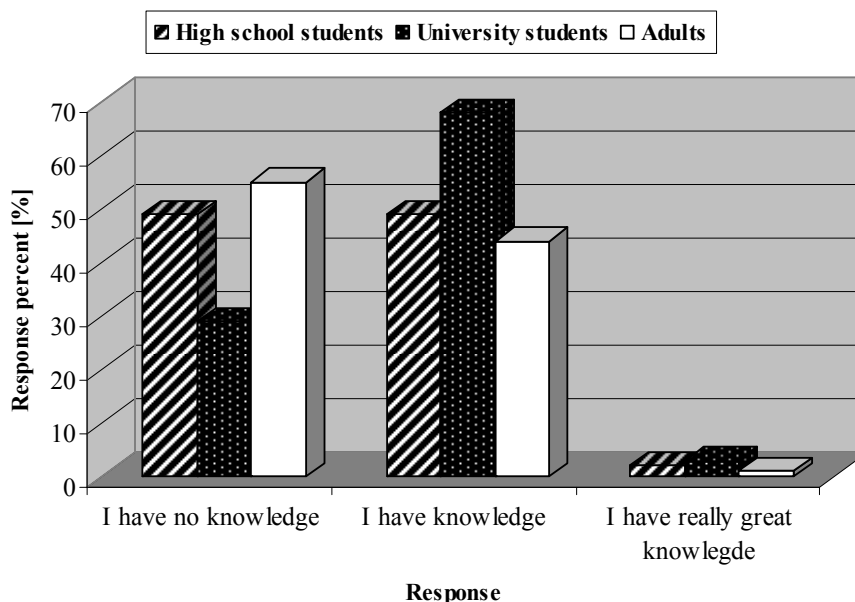


Fig. 2. Results of research; Do you have any knowledge on effects of GM food on human body?
Rys. 2. Wyniki ankiety; Czy masz wiedzę na temat wpływu żywności zmodyfikowanej genetycznie na organizm człowieka?

This study showed that about half of respondents from the group of high school students and adults do not have the knowledge on the impact of GM foods on the human body. This number is much lower among university students. May be due to their greater willingness to acquire knowledge about the genetic modifications. Many young people

(especially students of biological studies) gain knowledge about GMO on subjects related to genetics, biotechnology and *in vitro* cultures. This is why they have knowledge about the positive and negative aspects of transgenic organisms. It should be noted that as many as 68% of university students and almost half of high school students and adults have only little knowledge about the effects of modified food on the functioning of the human body. Such low percent of people who have great knowledge about GMO products and their impact on the functioning of the body is probably due to the lack of willingness to acquire knowledge on the genetic engineering and its application in practical use. Many people believe that genetically modified food can not be healthy and even scientifically proven beneficial effects on the human body is not able to compensate their negative feelings about this kind of food (fig. 2).

What might encourage you to buy a GM product?

Respondents were also asked about the characteristics of the GMO products that would encourage them to buy this kind of food. Results were different in each study group. Respondents were unanimous only in case when the manufacturer can ensure the safety of genetically modified products (27–30%). Over 20% of high school students, a better nutritional value, longer fresh and greater nutritional value can convince them to buy GMO products. Only 6% of respondents from this group answered that more attractive appearance of food can convince them to buy genetic modified food. The university students said that higher nutritional value of genetically modified product can convince them to buy it. Only about 10% of respondents in this group said they could buy a GMO food characterized by better taste (11%), longer fresh (12%) and more attractive appearance (9%). About 20% of the respondents aged over 28 could decide to buy GMO products if this kind of food will have better taste or nutritional value. In this group noted the lowest percent of people whose nothing can convince to buy GMO food (only 6%). Results may indicate that for consumers their health and safety associated with the consumption of naturally derived products is much more important than attractive appearance or even better taste and nutrition value of food.

What kind of organisms in your opinion were genetically modified for practical use by genetic engineering techniques?

Analysis of the study material showed that Poles of all age groups think that tomatoes, potatoes, corn, soy and rice are genetically modified products (about 40% of each group). Only about 10% of respondents of each study group marked animals (horse, cow, ostrich, pig) and *Escherichia coli*. In 2007, the global area of transgenic crops exceeded 114 million of hectares. Thus, it was only 6 million hectares less than the area of field crops in the EU. The structure of transgenic crops is dominated by soy, corn, canola, white beets, potatoes and other crops used as animal feed [Franks 1999, Zduńczyk and Jankowski 2009]. Responses indicate that most of respondents have knowledge about organisms which are currently modified by genetic engineering. Probably it is due to access to information that the production of GM food (soy, corn, rice) can be helpful for reducing hunger in the world [Miraglia *et al.* 1998, Pan 2002].

For what organisms are genetically modified?

Almost half of adults (47%) believe that organisms are genetically modified to increase the efficiency of production or animal breeding. This response was the most often in the group of high school students (36%) and university students (39%). Nearly 20% of respondents of each group think that organisms are genetically modified to improve the appearance and taste of food and to obtain new solutions in medicine (drugs, vaccines, etc.). Least of respondents from all studied groups suppose that organisms modified by genetic engineering techniques are used to environmental protection (3–8%) and the protection of endangered species from extinction (5–9%). Currently, the main direction of transgenesis is the production of recombinant human proteins for the production of biopharmaceuticals. Attempts of genetic modification of animals, so that they are able to produce the recombinant proteins in their blood, milk, urine, sperm and egg protein are made [Wrześniewska-Wal 2009]. The most commonly used in medicine human proteins obtained by genetic engineering techniques are insulin, growth hormone, interferon and antibodies [Mehta and Gair 2001]. In 2007, a product called ATryn®, containing recombinant human antithrombin, produced in the mammary gland of transgenic goats also appeared on the pharmaceutical market [Smorağ *et al.* 2009]. The analysis of the research material showed that the respondents of different age groups are agree about the purpose of the genetic modification of organisms. Responses also suggest that some of the respondents have knowledge about the practical use of transgenic organisms.

What kind of potential risk to humans and the environment can cause GMOs?

Respondents from all studied groups agree also about the opinion of the potential risks to humans and the environment posed by genetically modified organisms. Almost half of the respondents think that GM organisms can cause mutations and spread in uncontrollably way (23–30%). Respondents also said that GMOs can cause cancers and allergy (23–25%). These responses were most commonly chosen. Only about 10% of the respondents (respectively for pupils, students and adults – 9%, 6%, 9%) believe that genetically modified organisms are not dangerous for people and the environment. The analysis of the research material showed that Poles do not believe in the safety of organisms modified by genetic engineering. They also have a lot of doubts in relation to the possible presence of this kind of products on the market. Despite many opportunities posed by genetic modifications, many people do not have confidence to their impact on the functioning of the human body and the environment. Many scientific studies excluded the possibility of allergenicity by recombinant proteins responsible for resistance to antibiotics, insects and herbicides of GM plants. Of course there is not possible to completely exclude the possibility of causing allergies by GMO products, but similar risk occurs when people eat only conventionally grown plants [Bieniek 2009]. Answers of respondents indicate a lack of reliable information about the potential risks of GMOs. This may be due to acquire knowledge about GM organisms from unreliable sources. It can not be forgotten that everyone's body reacts differently to different food components. Therefore, many years are needed to accurately determine the impact of genetically modified food on the human body. Therefore, components of GM food, as well as components of not modified food can affect positively or negatively.

Are you interested in deepening knowledge about GMOs?

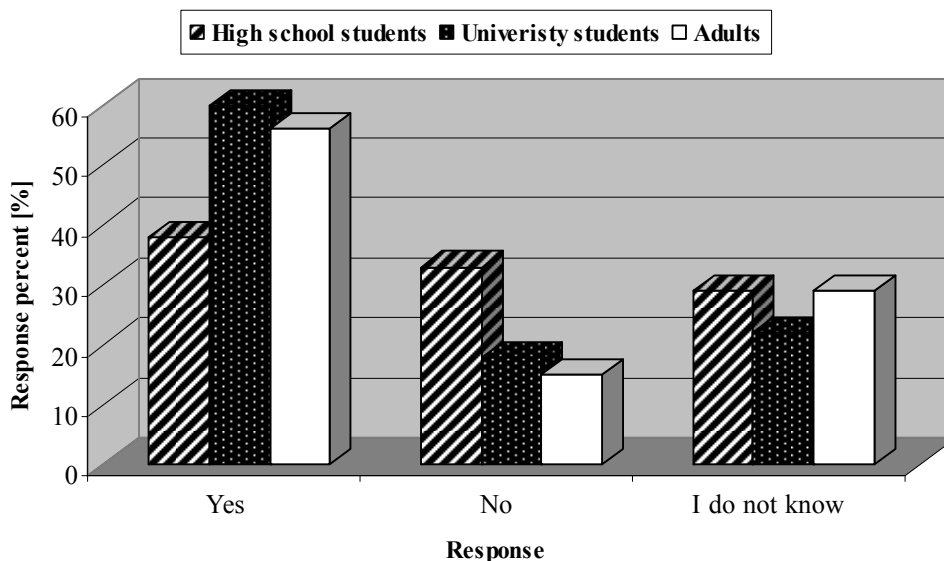


Figure 3. Result of the research; Are you interested in deepening knowledge about GMOs?
 Wykres 3. Wyniki ankiety; Czy jesteś zainteresowany pogłębieniem swojej wiedzy na temat GMO?

Analysis of the research material showed that most of respondents of each studied group are interested in learning about genetically modified organisms. The highest percent of people who are not interested in the genetic modification was observed in the group of high school students. This may be due to the difficulty of understanding topics related to genetics on biology lessons. Probably, the lack of accurate information about the way of obtaining GM products, cause the reluctance of Polish society in relation to transgenic organisms (Fig. 3).

CONCLUSIONS

1. The proven beneficial effects on the body could convince the potential customer to buy GM products.
2. Poles indicated soy, corn, rice, potatoes and tomatoes, as genetically modified products. This indicates the awareness of Polish society of the current use of genetic engineering techniques to produce food.
3. According to respondents, genetic modifications contribute to improve the efficiency of crops and animal breeding. They also said that genetic engineering can improve the appearance and taste of food and accelerate the development of medicine and pharmacy. This is consistent with reports in the scientific literature, thus respondents have some knowledge about the practical use of GMOs.

4. Respondents are agree that GMO products can cause mutations, spread in uncontrollably way and contribute to cancerogenesis and trigger allergies. This indicates that Poles acquire the knowledge about the effects of GMO products on the functioning of the body and the environment with unreliable sources, so they have unreliable information about it.

5. Most respondents see benefits of the genetic modification of organisms, but they are not able to compensate their negative feelings in relation to GMOs.

REFERENCES

- Bieniek J., 2009. Modyfikacje genetyczne – stan i perspektywy zastosowań w hodowli zwierząt gospodarskich. *Post. Nauk Rol.* 3–4, 40, 45–47.
- Costa-Font M., Gil J. M., Traill W. B., 2008. Consumer acceptance, valuation of and attitudes towards genetically modified food: Review and implications for food policy. *Food Policy* 33, 99–111.
- Foss G.S., Rogne S., 2003. Gene medication or genetic modification? The devil is in the details. *Nature Biotechnol.* 21 (11), 1280–1281.
- Franks J.R., 1999. The status and prospects for genetically modified crops in Europe. *Food Policy* 24, 565–584.
- Gachet E., Martin G.G., Vigneau F., Meyer G., 1999. Detection of genetically modified organisms (GMOs) by PCR: a brief review of methodologies available. *Trends Food Sci. Technol.* 9, 380–388.
- Grunert K.G., Lähteenmäki L., Nielsen N.A., Poulsen J. B., Ueland O., Åström A., 2001. Consumer perceptions of food products involving genetic modification – results from a qualitative study in four Nordic countries. *Food Qual. Pref.* 12, 527–542.
- Lähteenmäki L., Grunert K., Ueland O., Åström A., Arvola A., Bech-Larsen T., 2002. Acceptability of genetically modified cheese presented as real product alternative. *Food Qual. Pref.* 13, 523–533.
- Mehta M.D., Gair J.J., 2001. Social, political, legal and ethical areas of inquiry in biotechnology and genetic engineering. *Technol. Soc.* 23, 241–264.
- Miraglia M., Onori R., Brera C., Cava E., 1998. Safety assessment of genetically modified food products. An evaluation of developed approaches and methodologies. *Microchem. J.* 59, 154–159.
- O’Fallon M.J., Gursoy D., Swanger N., 2007. To buy or not to buy: Impact of labeling on purchasing intentions of genetically modified foods. *Hospit. Manage.* 26, 117–130.
- Pan T-M., 2002. Current status and detection of genetically modified organism. *J. Food Drug Anal.* 10 (4), 229–241.
- Smoraż Z., Słomski R., Jura J., 2009. Transgeniczne zwierzęta w hodowli, farmacji i biomedycynie. *Post. Nauk Rol.* 3–4, 24–30.
- Uzogara S. G., 2000. The impact of genetic modification of human foods in the 21st century: *Rev. Biotechnol. Advan.* 18, 179–206.
- Wrześniewska-Wal I., 2009. Prawne aspekty wprowadzania do obrotu żywności genetycznie zmodyfikowanej. *Post. Nauk Med.* 4, 310–316.
- www.idt.mdh.se/kurser/cd5590/Archives/07_11/GenEngineering.pdf
- Zduńczyk Z., Jankowski J., 2009. Bezpieczeństwo stosowania genetycznie modyfikowanych roślin w żywieniu zwierząt w świetle wyników dotychczasowych badań. *Post. Nauk rol.* 3–4, 55–57.

Streszczenie. Celem pracy było zbadanie wiedzy oraz opinii Polaków na temat organizmów genetycznie zmodyfikowanych (GMO). Badania przeprowadzono metodą sondażu, wykorzystując kwestionariusz ankiety własnej konstrukcji i objęto nimi łącznie 282 osoby, należące do 3 grup wiekowych, zamieszkujących południowo-wschodnią część Polski. Analiza materiału badawczego wykazała, że większość badanych osób pomimo znajomości terminu GMO posiada jedynie niewielką wiedzę na temat wpływu zmodyfikowanych genetycznie produktów na organizm ludzki. Ankietowani dostrzegają korzyści płynące z praktycznego wykorzystania modyfikacji genetycznych w medycynie i farmacji, jednak ze względu na niedostateczną wiedzę na temat GMO obawiają się ich wpływu na funkcjonowanie organizmu i środowiska naturalnego. Najwięcej kontrowersji budzi wykorzystanie technik inżynierii genetycznej do produkcji żywności. Pomimo wielu zalet tak otrzymywanych produktów wielu respondentów nigdy nie zdecydowałoby się na ich zakup. Około połowa badanych z każdej grupy zdaje sobie sprawę z niewystarczającej wiedzy na temat GMO i wykazała zainteresowanie jej poszerzeniem.

Słowa kluczowe: organizmy genetycznie modyfikowane (GMO), wiedza, opinia, kwestionariusz, badanie