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EVALUATION OF LITHUANIAN CONSUMERS' ATTITUDES TO GENETICALLY MODIFIED FOOD

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Abstract. The aim of this investigation is to present the results obtained during the survey of Lithuanian consumers in order to identify their attitudes towards food with genetically modified organisms (GMO). Investigating the consumers approach to genetically modified (GM) food, the following were considered: consumers' opinions on GMO were analyzed, their knowledge about the presence of food containing GMO on the Lithuanian market, the mandatory GM food labelling, the behavior to a transgenic product while shopping, as well as consumers' willingness to purchase such products. Data were gathered through a survey of 1000 Lithuanian residents. The empirical results indicated that the majority of the respondents' attitudes towards food containing GMO are negative. The older consumers with less income are more against GM food compared to younger, wealthier households. 72% of consumers know that if the food contains GMO it must be indicated on the label. However, many consumers who oppose GMO do not try to avoid paying attention to the components of the product listed on its label. Only about a quarter of consumers while buying a product look for such information. This indicates that consumers are not really interested in whether or not the product contains GMO.

Keywords: genetically modified organisms, genetically modified food, consumers' attitudes

INTRODUCTION

The use of biotechnology for food is rapidly expanding in the world. Biotechnological crops areas increased almost twice in a decade: in 2005 there were 90 million ha in the world, while in 2015 – there were already 179.7 million ha. The largest genetically modified plant growers in 2015 were USA (70.9 million ha), Brazil (44.2 million ha), Argentina (24.5 million ha), India (11.6 million ha) and Canada (11 million ha) (James, 2015). It is foreseen that the crops will continue to expand in the future.

Genetic modification in food and agriculture has become the focus of a "global war of rhetoric" (Herdt, 2005; Stone, 2002). Biotechnology is being used in all areas of agricultural production and processing. It is widely recognized as one of the most innovative technologies with promise that GM food will solve many of the world's hunger and malnutrition problems, preserve the environment, and enhance food security, economic growth, human health (Al-Khayri, 2012; Kramkowska et al., 2013; Pandey et al., 2010; Rao, 2013).

Manufacturers use genetic engineering in food production due to economic objectives. Plants, microorganisms, and animals with the help of gene engineering acquire new qualities which are not typical or naturally occurring. Genetic engineering encourages progress and brings about a wide range of benefits. In recent years with a host of new applications in agriculture, gene engineering has seen rapid advances. Research suggests that biotechnology offers unlimited possibilities, including increased yields, improved resistance to abiotic stresses such as drought and cold, resistance to diseases and pests, resistance to substances contained in pesticides, replacing toxic chemicals that harm the environment

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and human health, improved nutritional quality of staple foods and creates new products for health and industrial uses (Al-Khayri, 2012; Azadi et al., 2010; Herdt, 2005; Gilbert, 2013; Kramkowska et al., 2013; Pandey et al., 2010). Klümper and Qaim (2014) puts forward that, on balance, herbicide-resistant GM crops are less damaging to the environment than conventional crops grown at an industrial scale. The average agronomic and economic benefits of GM crops are significantly large.

The genetically modified food market is growing and its volumes are becoming more significant. Despite the potential benefits of gene engineering in agriculture, public and scientific concerns about the environmental, health and social impact of genetically modified crops have been raised (Azadi and Ho, 2010; Barrows et al., 2014; Rao, 2013; Sisea, 2010). Some assess the additional features of GMO, like Klümper nd Qaim (2014) highlights evidence of GM crop benefits for farmers in developed and developing countries. But others have doubts about the risks that they pose. Opponents claim that genetic engineering will wreak environmental catastrophe, worsen poverty and hunger, and lead to a corporate takeover of traditional agriculture and the global food supply (Herdt, 2005). However, in spite of the notable increase in the available information, there is no scientifically confirmed evidence of GMO's harmful impact on human organisms or the environment. European science academies took several years to study the impacts of GMO crops on human health and the environment, but negative effects of transgenic food have not yet been documented or that approved GMO's have posed new risks either to human health or the environment (Kramkowska et al., 2013; Paarlberg, 2010). However, Hilbeck et al. (2015) see a narrow scientific debate and the currently unresolved biosafety research agendas. Barrows et al. (2014) and Domingo (2016) argue that studies on the long-term health effects of GM plants clearly seem to still be necessary.

While GMO-containing food assortment introduced to the market is increasing, like other new products, the success of GM products is subject to consumer perception and acceptance (Al-Khayri, 2012). In the EU, the labelling of genetically modified products is mandatory and the consumers themselves must decide whether or not to purchase transgenic food (Aleksejeva, 2014; Kramkowska et al., 2013). In many countries worldwide, public attitude towards GMO is studied as the public opinion in many cases is very important for acceptance of policy directions towards production, consumption, and labelling of GMO food (Wesseler, 2014). The literature indicates that consumers' awareness and attitudes towards GM food vary among nations. Food products containing GMO's are controversial and are evaluated by customers not only in the EU, but globally. Consumers in Japan and European countries are less accepting of GM food compared to consumers in the US (Al--Khayri, 2012). In the EU, country surveys were conducted to determine consumers' views on the approach to GMO and food with GMO repeatedly. Citizens in the different Member States vary widely in their attitudes. People in Central Europe (Austria, Germany, Hungary, and Slovenia) tend to be very antipathetic. In Western Europe (France, Portugal, Spain, The Netherlands and the United Kingdom) opinions are more balanced, although many people are in principle against (Moses, 2012). Respondents also displayed negative perceptions about GM food in Arab countries (Bakr and Ayinde, 2014). In general, although the majority of consumers have typically heard of GM food technology, there is limited knowledge and understanding about it and most of consumers express a negative opinion about food with GMO, it is formed a negative opinion in society (Aleksejeva, 2014; Moses, 2012).

MATERIALS AND METHODS

The study investigated the consumers' attitudes to food products containing genetically modified organisms in Lithuania in 2015. The investigation aimed to identify Lithuanian consumers' attitudes towards food products with GMO. In order to achieve this aim and collect data, a survey method was used. A direct interview at the respondent's home was conducted. A standardized questionnaire was employed as the main instrument of the survey. To find out Lithuanian consumers' attitudes to food containing GMO, a representative survey of Lithuanian population (applied multi-stage, random sample of respondents, that every resident of Lithuania should have an equal opportunity to express their views) was used. A total of 1000 consumers of age from 18 and older, residents from all Lithuanian administrative regions, and prorated to the population living in a particular region of Lithuania were interviewed. This approach enabled the preservation of the proportions of respondents by place of residence and increased the reliability of the obtained data. The results reflect the opinions of

Table 1. Characteristics of the investigated population (%)
Tabela 1. Charakterystyka badanej populacji (%)

Specification Wyszczególnienie		Percentage Odsetek (%)
Total – Razem		100
Gender Płeć	woman kobieta	53
	man mężczyzna	47
Education level Poziom wykształcenia	basic podstawowe	11
	secondary średnie	29
	vocational zawodowe	13
	pre-tertiary policealne	22
	higher wyższe	25
Age (years) Wiek (lata)	18–30	14
	31–45	22
	46–65	35
	> 65	29
Monthly household income per person (EUR) Miesięczny dochód na członka gospodarstwa domowego (euro)	< 250	50
	251 < 500	42
	501 < 750	5
	> 751	3

Source: own elaboration.
Źródło: opracowanie własne.

all Lithuanian residents and distribution by gender, age, education, and income per family member. The survey took place from July 2 to 12 in 2015.

The first survey question aimed at identifying Lithuanian consumers' opinions about food containing GMO. In addition, the level of self-evaluation of consumers' knowledge on GMO was examined and information about the use of GMO in food and feed production. As the attitude to GMO comes from common knowledge, the consumers' knowledge about the presence of GM food on the Lithuanian market was also examined. After identifying respondents knowledge level, Lithuanian consumers were questioned about what kind of information they look for on the food label most frequently. Next, it was examined if Lithuanian consumers know that GMO labeling is mandatory and their willingness to buy or to avoid GMO products was established. All of these issues were analysed in relation to gender, age, education level, and personal income, applying mathematical-statistical methods. Respondents in the sample were representative, random, probabilistic, and stratified. The survey is statistically significant and representative of Lithuanian public opinion, its reliability is 95%.

Women were slightly more than men in the sample of respondents, but according to official Lithuanian data, women accounted for 54% (and men for 46%) of the total Lithuanian population in 2015. So the survey shows the general public opinion. The majority of respondents were between the ages of 31–45 years old. Regarding monthly household income per person, the majority of respondents indicated an income of less than 250 EUR and an income between 251 and 500 EUR. With regards to education level, 60% of respondents had higher than secondary education, so most responses were given from more educated consumers.

Several surveys (Lithuanian…, 2007; Public… 2007; 2009; 2010; 2012) aimed to find out Lithuanian consumers views on GMO, find out how many people are aware of GMO, or consuming genetically modified foods and etc., have been carried out during 2004–2012. In order to analyse changes of consumers' attitudes towards food with GMO, the results of previous 2004–2012 surveys were used. Although questions were not identical of previous surveys and this investigation, some of the answers were comparable and provided tendencies of consumers' attitudes toward GM food.

RESEARCH RESULTS

The opinion of Lithuanian consumers towards GMO and use of GMO in food was investigated in the survey in 2015 firstly (Table 2). Majority of respondents (93.2%) in Lithuania had heard about genetically modified products, but three-quarters of the respondents tend to think negatively about food with GMO. The survey results showed the decrease of undecided consumers and consumers which had no opinion about GMO and food containing GMO. But the share of consumers with

Table 2. The opinion of Lithuanian consumers towards GMO and use of GMO in food (%)
Tabela 2. Opinie konsumentów litewskich wobec GMO i stosowania GMO w żywności (%)

Answers to the question Odpowiedzi na pytanie	Survey in 2007 (1) Ankieta z 2007 r. (1)	Survey in 2007 (2) Ankieta z 2007 r. (2)	Survey in 2009 Ankieta z 2009 r.	Survey in 2010 Ankieta z 2010 r.	Survey in 2015 Ankieta z 2015 r.
Negative Negatywne	29.8	49.9	51.0	58.0	58.9
Positive Pozytywne	4.0	1.6	3.0	1.0	1.8
More positive than negative Bardziej pozytywne niż negatywne	–	–	–	–	3.4
More negative than positive Bardziej negatywne niż pozytywne	–	–	–	–	15.9
Neither positive nor negative Ani pozytywne, ani negatywne	31.7	9.4	14.0	12.0	–
Hard to say/No opinion Trudno powiedzieć/brak opinii	–	26.0	20.0	26.0	13.2
I have not heard about GMO Nie słyszałem(-am) o GMO	34.5	13.1	12.0	4.0	6.8

Sources: Lithuanian..., 2007; Public..., 2007; 2009; 2010; 2012; own research.
Źródło: Lithuanian..., 2007; Public..., 2007; 2009; 2010; 2012; badania własne.

the negative opinion about GMO and food containing GMO has increased significantly – more than twice in the decade. And just 5.2% respondents' opinion about foods with GMO tilted to the positive side.

Majority of respondents expressed negative views about food with GMO. The survey results showed that 76% of women and 73% of men tend to think negatively about the food with GMO. There were no statistical differences in gender and education, but specifically, there was a significant difference between the age groups and monthly household income per person (Table 3). The empirical results indicated that the older consumers with less income are more against GM food compared to younger and wealthier households. Majority of respondents expressed negative views about food with GMO. The survey results showed that 76% of women and 73% of men tend to think negatively about the food with GMO. There were no statistical differences in gender and education, but specifically, there was a significant difference between the age groups and monthly household income per person (Table 3). The empirical results indicated that the older consumers with less income are more against GM food compared to younger and wealthier households. Although a negative opinion about the food with GMO have majority of respondents according to their age and income, it was found, that the majority of respondents with the positive opinion towards foods with GMO were in the group of 18–30 age and these with wealthier household.

Then, to measure the level of subjective knowledge, respondents were asked to rate their knowledge about the use of GMO in food and feed production. Women show a higher awareness level of the use of GMO in food and feed production (34% of women responded that they know a lot/enough or on average) than men (30%) and 22% men did not know anything, while such women accounted for 17%.

About half of the respondents in all age groups assessed their knowledge as "little". But of older respondents, more of them did not know about GMO use in food, or had no opinion about the food with GMO. And vice versa – knowledge of younger consumers was higher – at average level or they knew "a lot/enough".

Table 3. Socio-demographic characteristics of respondents with positive and negative opinion about foods with GMO
Tabela 3. Cechy społeczno-demograficzne respondentów, wyrażających pozytywne i negatywne opinie na temat żywności z GMO

Socio-demographic characteristics Cechy społeczno-demograficzne	Respondents with positive opinion about foods with GMO Respondenci pozytywnie nastawieni do żywności zawierającej GMO (%)	Respondents with negative opinion about foods with GMO Respondenci negatywnie nastawieni do żywności zawierającej GMO (%)	p-value Wartość p	χ^2
Gender – Płeć				
Women – Kobiety	8	92	0,172	1,87
Men – Mężczyźni	5	95		
Age group Przedział wiekowy				
18–30	21	79	0,00	47,1
31–45	4	96		
46–65	4	96		
> 65	4	96		
Monthly household income per person Miesięczny dochód na członka gospodarstwa domowego				
<250	5	95	0,00	196,1
251<500	6	94		
501<750	16	84		
>751	21	79		
Education level Poziom wykształcenia				
Basic – Podstawowe	4	96	0,779	1,77
Secondary – Średnie	7	93		
Vocational – Zawodowe	5	95		
Pre-tertiary – Policealne	5	95		
Higher – Wyższe	9	91		

* Statistically: $p < 0,05$ (chi-square test).
Source: own research.
* Statystyka przy $p < 0,05$ (test chi kwadrat).
Źródło: badania własne.

The assessment of consumers' knowledge about GMO according to their educational level showed that respondents with lower education knew less about GMO use in food than others. Most respondents, which knew nothing about GMO use in food, had basic education. The higher respondents' education level, the more of them knew enough or on average. Respondents with lower income, the more among them knew nothing or little about the

Table 4. The level of knowledge about GMO (%)
Tabela 4. Poziom wiedzy na temat GMO (%)

Answers to the question Odpowiedzi na pytanie	Survey in 2004 Ankieta z 2004 r.	Survey in 2007 Ankieta z 2007 r.	Survey in 2009 Ankieta z 2009 r.	Survey in 2010 Ankieta z 2010 r.	Survey in 2012 Ankieta z 2012 r.	Survey in 2015 Ankieta z 2015 r.
A lot/enough Szeroka/wystarczająca	3.6	8.0	9.0	4.0	1.8	6.4
On average – Średnia	20.9	–	–	–	20.9	25.9
Little – Niewielka	35.4	34.7	36.0	37.0	–	48.4
I am informed insufficiently Nie jestem wystarczająco poinformowany(-a)	–	43.9	43.0	50.0	44.2	–
I do not know, it's hard to say Nie wiem, trudno powiedzieć	–	–	–	–	21.0	–
Nothing/Such information is not interesting to me Brak/Takie informacje mnie nie interesują	40.2	12.9	9.0	7.0	12.1	19.3

Sources: Public..., 2007; 2009; 2010; 2012; own research.
Źródło: Public..., 2007; 2009; 2010; 2012; badania własne.

use of GMO in food and feed production. Besides, 46% of consumers with a positive opinion on GMO indicated that their knowledge is the average, 33% know little, but mostly the respondents with negative opinions rated their knowledge as "a little" and 30% as "average".

Similar questions about the abundance of knowledge about GMO respondents were asked in surveys in previous years. Aggregated data in Table 4 shows that the knowledge about GMO of Lithuanian consumers changed slightly. The majority of respondents (80.7%) claimed they know about the use of genetic modification in food or food production. However, the respondents were critical enough to assess the level of their knowledge. When asked about their knowledge of genetic modification in food or food production, the majority of respondents (60%) (those who had heard of the use of GM) assessed their knowledge about GMO at level "little". 32% of those respondents, who had heard about use of GM in food, assessed their knowledge about GMO at average level.

59.8% of respondents knew that food with GMO has been sold in Lithuania. However, almost every third respondent did not know or doubted. This indicates that a piece of information is missing or it does not matter to consumers. Considering the age of consumers, the most familiar with the situation of food with GMO existing in commercial markets had respondents from 31 to 45 years old (65% of them knew that the food with GMO is being sold in Lithuania). The oldest respondents from 65 years old were at the least aware (51% of them) that food with GMO has been sold in Lithuania. This showed the lack of information. Higher education level of consumers is associated with a greater number of respondents aware that food containing GMO has been sold in Lithuania. And the more respondents had income, the more among them knew about the situation in the market (more than 76% respondents with 501 and more Euro monthly household income per person).

In 2004, survey respondents were asked whether they know that it must be indicated on food labels if food contains GMO. At that time, about half (50.8%) population of Lithuania knew about such requirement. In 2015, again the consumers were asked whether they know that if a product is genetically modified or contains GMO it must be indicated on the food label. The answers showed that residents of Lithuanian gained

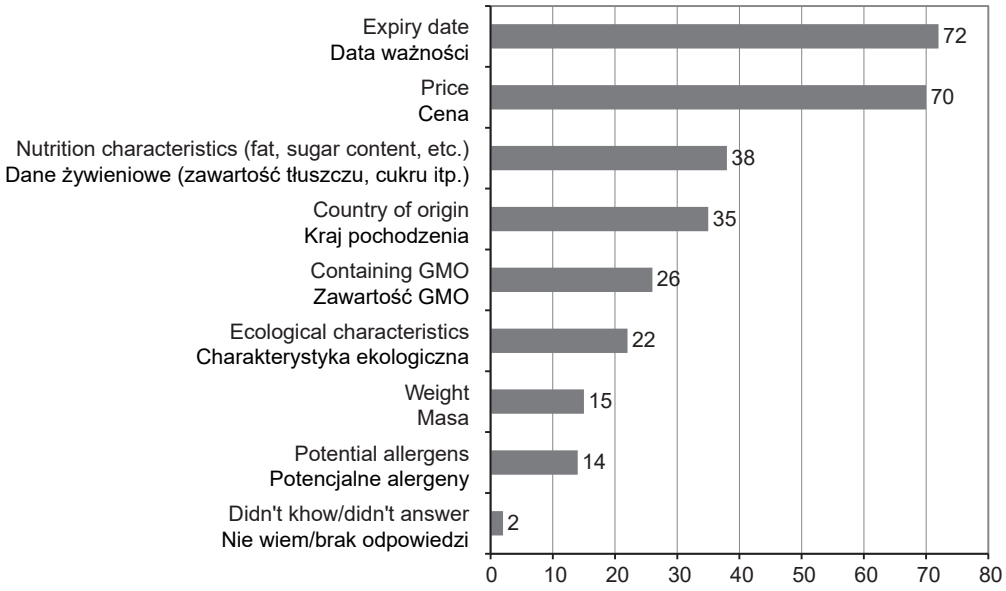

Fig. 1. Most frequently sought information on the product label by the Lithuanian consumers (%)
Source: own research.
Rys. 1. Najczęściej poszukiwane informacje na etykiecie produktu przez konsumentów litewskich (%)
Źródło: badania własne.

more knowledge about the labeling during the decade – about this mandatory GMO labeling on food packaging above 72% of consumer were aware, and the share of consumers, which did not know about this dropped to 27%. Only respondents of the oldest age group were those who were more uninformed on the matter. The survey results showed that the lower the level of education of respondents, the more of them did not know the current GM food labeling requirements.

Respondents were asked what kind of information they are usually looking for when buying food. The answers showed that validity and price of the product are the most important information for Lithuanian customers. Approximately one third of respondents are interested in the nutritional characteristics of the product and the country of origin. And only a quarter of respondents are looking for information about GMO (Fig. 1).

Pricing information is particularly important for the oldest respondents. The oldest customers are the least interested in information about GMO, besides, as mentioned above, they know the least about GMO. The greatest interest of information about GMO while buying showed respondents from 31 to 65 years old. Respondents with higher levels of education, more than others, draw attention to the nutritional characteristics of the product, country of origin, and the use of GMO in food and greening.

According to the monthly household income per family member, the amount of shelf life is most important information for all surveyed. However, respondents whose monthly household income per person does not exceed 500 EUR remains the price in the second place of importance, then follow the nutritional properties of the product, country of origin, and only a quarter of respondents of this income group are concerned about information on GMO. For the respondents in group of 501–750 EUR monthly household income per person, information on the nutritional qualities is as important as the price and the information on GMO is only slightly more important than for lower-income consumers. However, for respondents with the highest income per person, information about GMO are more important than price or nutritional characteristics.

Also Lithuanian consumers were asked whether they purchase products produced with GMO and take notice

while buying. Residents of Lithuania were asked a similar question in survey 2007. Then 69.9% of consumers stated that they wouldn't purchase such products, and the remaining 30.1% responded that it would have no impact on the decision to buy this product. In 2015, a similar proportion of respondents reported that they would buy such product (63%). A quarter of consumers had no opinion and 5% of Lithuanian population would purchase such products. The remaining 7% of consumers said that the labeling of GMO is totally irrelevant for them.

It was found that 78% of respondents who have a negative opinion about GMO would not purchase product containing GMO. Only a third of respondents with a positive view would buy, as well as nearly one–third would not buy, and for 29% of them the GMO labelling is completely irrelevant.

More men than women would purchase products with GMO. The younger were respondents, the more among them said they would purchase product containing GMO or GMO labeling was completely irrelevant for them. Among the respondents, who said they would purchase GMO food, most were those individuals with a higher level of education. Among the respondents, who said that the GMO labeling is unimportant for them, most were individuals with a basic education.

CONCLUSIONS

This paper represents the research investigating the level of knowledge of Lithuanians in the field of genetically modified organisms in food production. The results of the survey showed a decreased number of the population who do not know what GMO is. A decade ago, only half knew about GMO compared with now more than 93% of the country population. The level of consumers' knowledge about GM food also rises. The younger population, the higher educated, and the greater their income per family member, the more they know about GMO.

The empirical results indicated that the majority of the respondents' attitudes towards food containing GMO are negative. In 2007, nearly a third of users expressed negative opinions about GMO, and in 2015 there were more than half. There were no statistical differences in gender and education. But the older consumers with less income are more opposed to GM food compared to younger and wealthier households. According to age groups, it was indicated that amongst older respondents, there were more individuals that did not know about GMO, or had no opinion about the food with GMO. However, almost every third respondent did not know or doubted if food with GMO is being sold in Lithuania. This suggested that consumer's attitudes toward genetically modified foods could be influenced by new information supplied and knowledge gained.

72% of consumers know that if the food contains GMO, the following information must be included on the label, but only about a quarter of the consumers look for such information on the label while buying a product. About these labeling requirements, younger consumers that are have higher levels of education and who have higher income per one family member are more aware. Most customers, while purchasing food, are interested in food expiry date and price. However, 63% of consumers say that if they saw that the food contains GMO, they would refuse to buy it.

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OCENA POSTAW KONSUMENTÓW LITEWSKICH WOBEC ŻYWNOŚCI GENETYCZNIE MODYFIKOWANEJ

Streszczenie. Celem niniejszego opracowania jest przedstawienie wyników badań na temat nastawienia litewskich konsumentów do żywności genetycznie modyfikowanej (GMO). W ramach powyższych badań przeanalizowano opinie konsumentów na temat GMO, wiedzę o dostępności artykułów spożywczych zawierających GMO na litewskim rynku, znajomość obowiązkowych etykiet na żywności modyfikowanej genetycznie, zachowanie wobec produktów transgenicznych podczas zakupów oraz chęć nabywania takich produktów. Dane zgromadzono na podstawie ankiety przeprowadzonej wśród tysiąca mieszkańców Litwy. Z wyników empirycznych można wnioskować, że większość respondentów jest negatywnie nastawiona do artykułów spożywczych zawierających GMO, przy czym osoby starsze oraz konsumenci o niższych dochodach częściej odnoszą się niechętnie do takiej żywności niż osoby młodsze z bardziej zamożnych gospodarstw domowych. Grupa 72% konsumentów wie, że na opakowaniu żywności zawierającej GMO musi znajdować się etykieta z informacją na ten temat. Wielu konsumentów niechętnych wobec GMO nie stara się jednak unikać takich artykułów i nie zwraca uwagi na składniki wyszczególnione na etykiecie. Tylko jedna czwarta badanych sprawdza takie informacje przy zakupie. Oznacza to, że ewentualna zawartość GMO nie jest przedmiotem szczególnego zainteresowania ze strony konsumentów.

Słowa kluczowe: organizmy genetycznie modyfikowane, żywność genetycznie modyfikowana, postawy konsumenckie

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