INTERNATIONAL JOURNAL OF CURRENT NATURALSCIENCE AND ADVANCE PHYTOCHEMISTRY

journal homepage: www.ijcnap.com

INVESTIGATION OF CONSUMERS' KNOWLEDGE LEVELS AND CONSUMPTION BEHAVIORS REGARDING GMO PRODUCTS IN ŞANLIURFA PROVINCE, TÜRKIYE

Muhammed Ali PALABIÇAK[a1], Gülsüm URAL[a2*], Büşra PALABIÇAK[b3], Emine KELEKÇİ[a4]

[a]Department of Agricultural Economics, Faculty of Agriculture, Harran University, 63000, Sanliurfa, Türkiye
[b]Food Engineering Department, Engineering Faculty, Harran University,63000, Sanliurfa, Türkiye
[1]https://orcid.org/0000-0003-1382-5733
[2]https://orcid.org/0009-0006-9982-1854
[3]https://orcid.org/0000-0002-0983-8577
[4]https://orcid.org/0009-0009-5143-737X

Keywords

Genetically Modified Organism (GMO), Consumption, Consumer Behavior, Şanlıurfa

ABSTRACT

Genetically modified organisms (GMO), which started a new era in agricultural production and entered our lives with the use of advanced technology, have become one of the issues that are emphasized sensitively and widely discussed due to the fact that their biomedical risks and side effects are not fully known. This study aims to present consumers' perceptions, knowledge levels, attitudes and consumption behaviors towards GMO products. For this purpose, face-to-face survey was conducted with 299 households in the central districts of Şanlıurfa province. As a result of the surveys, it was determined that the participants' judgments about GMO products were negative. As a matter of fact, it would be correct to say that the ban on the production of genetically modified plants and animals in Türkiye reflects the general judgment of the society.

Introduction

The use of modern biotechnological methods in agricultural production to meet the rapidly increasing food demand in the world has witnessed significant developments in the 21st century. With the contribution of modern biotechnology, agricultural and food technologies have entered the development

*Corresponding author.
E-mail address: gulural63@hotmail.com (Gülsüm URAL)
Received 3 July 2024; Received in revised form 23 July 2024: Accepted 30 December 2024
Available online 31 July 2024

process and turned into practices that aim to provide people with clean environment, healthy and good nutritional conditions (Yalçın, 2019). Gene technology is one of these methods and is defined as the process of isolating genes using molecular biological methods and making targeted changes on these genes, then transferring these genes to either the isolated organism or a different organism (Bayraç et al., 2014; Tahmaz and Özkaya 2017). Organisms that emerge by changing the existing characteristics of the organisms or gaining new characteristics by making changes in the gene sequences of the organisms with these methods are called "Genetically Modified Organism (GMO)" (Kaynar, 2009; Tahmaz and Özkaya, 2017).

The first genetically modified DNA molecule was produced by Paul Berg in 1972 and the first genetically modified organism was produced by Stanley Cohen, Annie Chang and Herbert Boyer in 1974. In 1983, three independent research groups produced the first genetically modified plants by injecting bacterial genes (Korkut and Soysal, 2013; Zhang et al., 2016; Tahmaz and Özkaya, 2017). GMO production in the world is increasing rapidly every day and new agricultural products are undergoing genetic modification. Examples of agricultural products where genetic modification technology is used include cotton, tomatoes, soybeans, canola, corn, peanuts, papaya, pumpkin and cassava. As a matter of fact, among these products, the product to which the most genetic modification method was applied was soybean (Demir and Pala, 2007; Gürlek et al., 2007; Çiçekçi, 2008; Koçak et al., 2010; Özmert and Yaman, 2011).

As a result of the rapidly developing use of biotechnology, society is faced with more GMO products and is forced to enter the decision-making process (Hanegan and Bigler, 2009; Aktaş, 2020). Therefore, the use of GMOs in agricultural production has divided society into two groups. While those who support GMO claim its known positive effects, such as increased efficiency in agricultural production, those who oppose it express their concerns that the possible side effects of consuming GMO products on human health are not fully known (Çelik and Turgut-Balık, 2007 ; Aktaş, 2020). This study aims to present consumers' perceptions, knowledge levels, attitudes and consumption behaviors towards GMO products.

Material and Methods

In this study, the surveys prepared in accordance with the purpose of the study were carried out face to face with families determined by Proportional Sampling Method in the central districts of Şanlıurfa Province. According to the proportional sampling method, the p value was accepted as 0.5 as the maximum sample size in the finite universe would reduce the possible error (Newbold, 1995; Miran, 2003; İkikat Tümer et al., 2020).

$$n = \frac{N * p * q}{(N-1) * \sigma_p^2 + p * q} = \frac{232392 * 0.5 * 0.5}{(232392-1) * 0.000924 + 0.5 * 0.5} \cong 271 \qquad \text{(Eq. 1)}$$

$$\sigma_p^2 = \left(\frac{r}{Z_{\frac{\alpha}{2}}}\right)^2 = \left(\frac{0.05}{1.645}\right)^2 = 0.000924 \qquad \text{(Eq. 2)}$$

n: Sample size,
N: Population size,
σ_p^2: Variance of the ratio,
r: Allowable margin of error from the mean (%5),
Zα/2: z scale value,
p: prediction rate.

The number of households to be surveyed was calculated as 271, with a 90% confidence interval (z = 1.645) and a 5% deviation from the mean. In the study, more surveys were conducted to eliminate possible technical errors and a total of 299 surveys were evaluated.

Frequency tables, descriptive statistics, index method and independent two-sample t-test were used to evaluate the data obtained as a result of the survey. In applying the t test, it was aimed to reveal the possible effect of education level on opinions and attitudes towards GMO products. Statistical analyzes were performed with the help of IBM SPSS 25 program.

Result and Discussion

Results

It was determined that the average age of the individuals participating in this study was 39.75, the average household size was 5.46 people, the average number of employees in the household was 1.34 people, the average monthly income of the household was 591.88 $ and the average of the budget they allocated for monthly food expenditure was 170.16 $. Of the individuals participating in this study, 52.8% were women, 47.2% were men, 91.3% were married, 8.7% were single, 94.0% had a nuclear family and 6.0% had an extended family was determined. According to the education level of the participants, the largest group is high school graduates with 29.4%, while the smallest group is illiterate individuals with 4.0%. In terms of occupational groups, the largest group participating in the research is tradesmen-craftsmen with 45.8%, while the smallest group is individuals working in the food sector with 1.2% (Table 1).

Consumers who participated in the survey were asked "What does the term GMO mean to you?", 47.5% said "Storage of food products with short shelf life for a long time using different methods", 28.8% said "Products produced by gene transfer", 13.7% said "Food products subjected to heat treatment", 5.7% said "A breeding or hybridization method used to obtain better yields from plants or animals", and 4.3% of them used the expression "Organic agricultural products grown without the use of pesticides". Consumers participating in the research were asked to list the product groups they thought contained GMOs, and then the index method was used to determine the general judgment. When sorting according to the score as a result of the index method, legumes and grains ranked 1st, vegetables and fruits ranked 2nd, animal foods ranked 3rd and processed plant products ranked 4th (Table 2)

Consumers participating in the research were presented with some information/opinions regarding the characteristics of GMO products and were asked to answer whether this information/opinions were true or false for them. When the answers given by the participants to the information and opinions regarding GMO products are examined; It was determined that the rate of agreement with the statement "GMO products have both advantages and disadvantages" was 54.5% and the rate of agreement with the statement GMO products increase efficiency and reduce inputs in agricultural production" was at a medium level with 43.8%. As a matter of fact, the rate of

agreement with the statement that "GMO products are unnatural and threaten human health" is 99%, the rate of agreement with the statement that "GMO products increase the shelf life of foods" is 82.9% and the rate of disagreement with the opinion that "GMO products have the same properties as natural products." It was determined that the rate was very high at 97.7% (Table 3).

Table 1. Socio-economic attributes

		Min.	Max.	Mean	Std. Dev.
Age (year)		19	73	39.75	11.07
Household size		1	20	5.46	1.90
number of employees		1	5	1.34	0.62
Income ($/mth)		224.50	1924.31	591.88	284.76
Food expenditure ($/mth)		64.14	577.29	170.16	83.09
				N	%
Gender	Female			158	52.8
	Male			141	47.2
	Total			299	100.0
Marital status	Married			273	91.3
	Single			26	8.7
	Total			299	100.0
Family type	Nuclear			281	94.0
	Extended			18	6.0
	Total			299	100.0
Education	illiterate			12	4.0
	literate			13	4.3
	primary school			64	21.4
	middle school			75	25.1
	high school			88	29.4
	Associate or bachelor's deg.			43	14.4
	Postgraduate education			4	1.3
	Total			299	100.0
Occupational groups	Tradesmen – craftsmen			77	45.8
	Agriculture			31	18.5
	Services			22	13.1
	Health			13	7.7
	Construction and industry			11	6.5
	Education			6	3.6
	Security			6	3.6
	Food sector			2	1.2
	Total			168	100.0

Table 2. Questions regarding consumers' knowledge level about GMOs

		N	%
What does the term GMO mean to you?	Storage of food products with short shelf life for a long time using different methods	142	47.5
	Products produced by gene transfer	86	28.8
	Food products subjected to heat treatment	41	13.7
	A breeding or hybridization method used to obtain better yields from plants or animals	17	5.7
	Organic agricultural products grown without the use of pesticides	13	4.3
	Total	299	100.0

Product groups thought to contain GMOs	1st choice	2nd choice	3rd choice	Index Score
Legumes and grains (soybeans, corn, etc.)	104	181	77	751
Vegetables and fruits (tomatoes, pumpkins, etc.)	176	47	54	676
Food of animal origin (dairy products, etc.)	15	50	64	209
Processed plant-based foods (cornflakes, chips, etc.)	4	14	78	118

*Coefficient multipliers used when calculating the index score; 3 for 1st choice, 2 for 2nd choice and 1 for 3rd choice.

Table 3. Knowledge and opinion test regarding the characteristics of GMO products

	True		False		No idea	
	N	%	N	%	N	%
GMO products have both advantages and disadvantages.	163	54.5	55	18.4	81	27.1
GMO products have the same properties as natural products.	6	2.0	292	97.7	1	0.3
GMO products increase efficiency and reduce inputs in agricultural production.	131	43.8	142	47.5	26	8.7
GMO products increase the shelf life of foods.	248	82.9	14	4.7	37	12.4
GMO products are unnatural and threaten human health.	296	99.0	1	0.3	2	0.7

5-point Likert scale was applied to measure the level of agreement of the consumers participating in the research with the opinions and attitudes presented towards GMO products. Then, independent two-sample t-tests were conducted to examine the relationship between consumers' education levels (Secondary school and lower education level, High school and higher education level) and their opinions and attitudes towards GMO products.

Table 4. The relationship between opinions and attitudes towards GMO products and education levels (independent group t-test)

Opinions and attitudes regarding GMO	Education groups[a]	N	Mean[b]	sd	t	p
I think it is right to carry out agricultural production in Türkiye with GMO seeds.	MS	164	1.56	0.545	2.63	0.009 **
	HS	135	1.39	0.611		
I do not see any harm in the production and consumption of GMO foods.	MS	164	1.37	0.485	2.89	0.004 **
	HS	135	1.21	0.447		
I find it correct to use GMOs to meet the rapidly increasing food demand.	MS	164	1.91	0.704	1.88	0.061
	HS	135	1.75	0.826		
I find GMO studies to enrich the nutritional content of foods correct.	MS	164	1.54	0.590	1.96	0.051
	HS	135	1.39	0.681		
There is no harm in using GMO products in sectors other than the food industry.	MS	164	2.38	0.860	1.92	0.056
	HS	135	2.18	0.945		
I research whether the products I want to buy contain GMOs.	MS	164	2.34	0.831	-2.19	0.029 *
	HS	135	2.56	0.967		
GMO production is risky for all living things in nature.	MS	164	4.50	0.602	-1.46	0.146
	HS	135	4.61	0.670		
I think GMOs threaten the biodiversity in the ecosystem.	MS	164	4.65	0.549	-3.14	0.002 **
	HS	135	4.83	0.397		
I think that GMO products used as animal feed affect us indirectly.	MS	164	4.52	0.678	-1.18	0.238
	HS	135	4.61	0.635		
GMO foods threaten the health of future generations.	MS	164	4.65	0.478	-2.70	0.007 **
	HS	135	4.79	0.407		
GMO production does not comply with the rules of faith and morality.	MS	164	2.80	1.182	2.59	0.010
	HS	135	2.44	1.220		
I think GMOs support some companies' desire for monopolization.	MS	164	3.09	0.574	-1.82	0.069
	HS	135	3.24	0.803		

[a] MS = Secondary school and lower education level, HS = High school and higher education level

[b] Likert scale responses: 1=Strongly disagree, 2=Disagree, 3=Undecided or Neutral, 4=Agree, 5=Strongly Agree.

* p is significant at 0.05, ** p is significant at 0.01

According to the test results; It has been determined that there is a statistically significant ($p<0.05$) difference between education levels and the opinions and attitudes of "I think it is right to carry out agricultural production in Türkiye with GMO seeds", “I do not see any harm in the production and consumption of GMO foods”, “I research whether the products I want to buy contain GMOs” and "I think GMOs threaten the biodiversity in the ecosystem". To make a general conclusion, as the education level of the participants increases, their participation in positive items about GMOs decreases and their participation in negative items increases. (Table 4).

Discussion

Social acceptance of GMO is of great importance in terms of its applicability and continuity of its production. As a result of this study, it would be appropriate to say that GMOs are considered contrary to the moral and religious values that constitute the basic judgments of the society, are seen as a risk for the environment and human health, and their consumption is not accepted by the society. As a matter of fact, it would be correct to say that the ban on the production of genetically modified plants and animals in Türkiye reflects the general judgment of the society. Although the relevant regulations in country allow the use of GMO products in animal feed at certain rates, the society's concern about exposure to GMOs through animal products is once again highlighted in this study.

As a result, the existence of known and unknown risks of GMOs causes concern in their consumption directly or indirectly by the society. Based on this, it would be a correct inference to state that it is important to choose production methods that do not harm the environment and biodiversity in agricultural production methods and that will meet consumer demand not only physically but also mentally.

Acknowledgment

The data used in the preparation of this study was obtained from the project number 1919B012110255, supported by TÜBİTAK 2209/A program.

References

Aktaş, İ., (2020). "Öğretmen Adaylarının Gdo'lara Yönelik Bilgi, Tutum ve Kabul Etme Durumları Arasındaki İlişki". Trakya Eğitim Dergisi, Cilt 10, Sayı 3, s: 933-949. https://doi.org/10.24315/tred.663565

Arun, Ö.,Ö., Muratoğlu, K., & Eker, F., Y., (2015). "Genetiği Değiştirilmiş Organizmalar Kavramına Genel Bakış". İstanbul Üniversitesi Veteriner Fakültesi Dergisi, , 41 (1), 113-123. http://dx.doi.org/10.16988/ iuvfd.2015.03790

Bayraç, A. T., Kalemtaş, G., Baloğlu, M. C., & Kavas, M. (2014). Genetiği Değiştirilmiş Organizmalar (3. Baskı). Ankara: ODTÜ Yayıncılık.

Çelik, V., & Turgut-Balık, D. (2007). Genetiği değiştirilmiş organizmalar (GDO). Erciyes Üniversitesi Fen Bilimleri Enstitüsü Dergisi, 23(1-2), 13-23. https://dergipark.org.tr/ en/download/article-file/252290

Çiçekçi, O., (2008). "İlköğretim Okullarında Görevli Öğretmenlerin Transgenik Ürünler Konusundaki Bilgilerinin Ve Görüşlerinin Belirlenmesi". Yüksek Lisans Tezi, Gazi Üniversitesi, Eğitim Bilimleri Enstitüsü, Aile Ekonomisi ve Beslenme Eğitimi Anabilim Dalı, Ankara. https://tez.yok.gov.tr/Ulusal TezMerkezi/TezGoster?key=wBmNpkQ C9Nhi90NLW7E7- Ym2wQYZt0ZykUEiPXOvkw JDZ6B2o_tB-XIxkhOSnMij

Demir, A., & Pala, A., (2007). "Genetiği Değiştirilmiş Organizmalara Toplumun Bakış Açısı". Hayvansal Üretim, 48(1):33-43. https://der gipark.org.tr/en/download/article- file/850 97

Gürlek, M., Turan, F., & Turan, C., (2007). Genetiği Değiştirilmiş Organizmalar ve Hayvan Beslemede Kullanımı. Türk Sucul Yaşam Dergisi, 5(8):808-814. https://tudav. org/wp- content/uploads/2018/04/USG07 k.pdf

Hanegan, N.L., & Bigler, A. (2009). Infusing authentic inquiry into biotechnology. Journal of Science Education and Technology, 18(5), 393-401. https://doi. org/10.1007/s10956-009-9155-5

İkikat Tümer, E., Ağır, H. B., & Aydoğan, İ. (2020). Evaluating technical efficiency of hair goat farms in Turkey: the case of Mersin Province. Tropical Animal Health and Production, 52(6), 3707-3712. https://doi. org/10.1007/s11250-020-02407-2

Kaynar, P. (2009). Genetik Olarak Değiştirilmiş Organizmalar (GDO)'A Genel Bir Bakış. Türk Hijyen ve Deneysel Biyoloji Dergisi, 66 (4), 177-184. https://dergipark.org.tr/en/download/article-file/1871218

Koçak, N., Türker, T., Kılıç, S., & Hasde, M., (2010). "Tıp Fakültesi Öğrencilerinin Genetiği Değiştirilmiş Organizmalar Hakkındaki Bilgi, Tutum ve Davranışlarının Belirlenmesi. Gülhane Tıp Dergisi, 52,198-204. https://www.proquest.com/docview/2440171826?pq-origsite=gscholar&fromopenview=true&sourcetype=Scholarly%20Journals

Miran, B. (2003). Temel istatistik. Ege Üniversitesi Basımevi, ISBN 975-9308800 Bornova İzmir.

Newbold, P. (1995). Statistics for Business and Economics. Prentice-Hall International, New Jersey.

Özmert, S., & Yaman, H., (2011). "Tüketicilerin Genetiği Değiştirilmiş Gıdalara Karşı Tutumlarının ve Bilgi Düzeylerinin Belirlenmesi". Kocatepe Veteriner Dergisi, 4(1):31-41. https://dergipark.org.tr/tr/download/article-file/108833

Tahmaz, G. S. & Özkaya, F. D. (2017). Tüketicinin GDO Algısı: Ankara İli Örneği. Yönetim, Ekonomi ve Pazarlama Araştırmaları Dergisi, 4: 31-40. http://yepad.org/2017/cilt.1_sayi.4_makale03.pdf

Yalçın, E., M., (2019). "Adana İli Kentsel Kesimde Tüketicilerin Gdo'lu Ürünlere Karşı Tutum Ve Bakış Açılarının İncelenmesi", Çukurova Üniversitesi Fen Bilimleri Enstitüsü, Yüksek Lisans Tezi, Adana, s:1-115. https://tez.yok.gov.tr/UlusalTezMerkezi/TezGoster?key=Mir2lXQK1dkmQ9Ige3PZbmTgbzCS09M5GejlsHq7oErdYnVe_9xlZp6vf78nwUEX

Zhang, C., Wohlhueter, R., & Zhang, H. (2016). Genetically modified foods: A critical review of their promise and problems. Food Science and Human Wellness, 5(3), 116-123. https://doi.org/10.1016/j.fshw.2016.04.002