International Journal of Agricultural and Life Sciences- IJALS (2017), Volume 3 (1) pp.136-146
http://dx.doi.org/10.22573/spg.ijals.017.s12200078
© Skyfox Publishing Group
All Rights Reserved
Available online at http://www.skyfox.co
ISSN: 2454-6127

RESEARCH ARTICLE

Determination of Opinions and Level of knowledge of Culinary Program Students about Genetically Modified Organisms (GMO's): Istanbul

Seydi Yıkmış *[1], Levent Gülüm[2], Harun Aksu[3] & Mehmet Alpaslan[1]

[1] Namık Kemal University, School of Health Sciences, Department of Nutrition and Dietetics, Tekirdağ, Turkey
[2] Abant İzzet Baysal University, Mudurnu Süreyya Astarcı Vocational High School, Poultry Farming Program, Bolu, Turkey
[3] Istanbul Üniversitesi, Veterinary Faculty, Department of Food Hygiene & Technology, Istanbul, Turkey
*Author to whom correspondence should be addressed/E-Mail: syikmis@hotmail.com
Received: Mar 2017 / Accepted: Mar 2017/ Published: Mar 2017

ABSTRACT: This study is conducted to investigate knowledge, attitudes and behavior of university culinary program students about genetically modified organisms (GMOS). The study is carried out among 214 university students aged (99 female, 115 male). Demographic characteristics of students, their knowledge, attitude and behavior of Genetically Modified Organisms (GMO) are taken into consideration in the data collection process. 10 open-ended questions and an attitude scale questionnaire which consists of 30 questions was applied. The data obtained with the SPSS 20.0 program by using frequency (F), percent (%), t-test and one way analysis of variance (ANOVA). For the question "Have you ever heard of the term GMO?" 32 students (15%) stated that they never heard of the term. Students from the culinary program, replied the question "In your opinion, is GMO beneficial or harmful? '' 95, 8% replied as harmful. According to replies of culinary program 1. and 2. year students there was no significant difference between their answers to the question ($p > 0.05$). For the question '' If it is harmful, why?'' students stated that GMO causes cancer. The average of female students answer is 3, 40, while the average of male students is 3,42. T test conducted to these averages gives the result of $p=0.389$ ($p > 0.05$). The averages of their responses to the items and the number of male and female students have been very close to each other. But there is statistical difference to the reply of 28. Question which is $p=0.02$ ($p<0.05$). The analysis demonstrates that students have enough basic knowledge about genetically modified organisms, but it was observed that they experience conceptual confusion. Most of the students believe that GMO technology is harmful, and there are some conceptual mistakes. It was concluded that the concept of the course will increase knowledge and awareness about GMOs in the curriculum topics that will help to eliminate confusion.
Keywords: Genetically Modified Organisms, Culinary, Label

INTRODUCTION

The world's population is increasing day by day. Developing countries are leading this increase. By the year 2025 it is expected to be 8 billion. With this rapid increase in the population, the number of hungry people will increase, the composition of the adverse environmental conditions will change in various countries, the unit data area in agriculture will reduce, the quality of products will decrease, pesticides and artificial fertilizers will threaten to destroy the ecosystem and human health. Also, malnutrition problems can face human beings. But new studies are to be done in the areas of biotechnology and reducing the use of pesticides and nutritional problems (Babaoğlu, Gürel, & Özcan, 2001; Butler & Reichhardt, 1999; Erdogan, Özel, Uşak, & Prokop, 2009). Biotechnology is described as prioritizing human and environmental health methods, recombinant DNA (rDNA) technology with the help of using all or part of living organisms that can not be achieved or cannot be reproduced through natural means (Dawson, 2007; Dawson & Schibeci, 2003). In recent years, with the development of genetics and molecular biology in connection with the development of "genetically modified organism" (GMO) became the most discussed topic in the public and among scientists (Chen & Raffan, 1999; V. Çelik & Balık, 2007; Massarani & Moreira, 2005).

The concept of GMO is defined as biotechnological methods that's join the foreign genes to change genetic structures. These foreign genes are transferred to this genome as a constant property and thus represent plants, animals and microorganisms. Genetically modified organisms is expressed in different ways, such as genetically modified products, genetically modified organisms, gene transmission organisms, transgenic organisms, bio-engineered organisms (Bozcuk, 2005; Ahmet Demir & Pala, 2007; Erbaş, 2008; Özdemir, Handan Güneş, & Demir, 2010).

In recent years, the number and diversity of the GMO products increased significantly on the market (Stella G. Uzogara, 2000; Zhang & Guo, 2011). The main usage of genetically modified products in the fields of agricultural purposes are; increasing the amount

Copyright © 2017 Skyfox Publishing Group

International Journal of Agricultural and Life Sciences- IJALS (2017), Volume 3 (1) pp.136-146
http://dx.doi.org/10.22573/spg.ijals.017.s12200078
© Skyfox Publishing Group
All Rights Reserved
Available online at http://www.skyfox.co
ISSN: 2454-6127

of products obtained from unit area, to reduce the use of pesticides along with the aroma and nourishing properties of agricultural products, to intensify taste, beautify and improve the durability of the crop. The physical views are listed in the form of increase. In line with these aims, some of the manufactured products around the World that consist GMO are; corn, soybean, cotton, canola, potato, tomato, rice, wheat, sunflower, peanut and papaya (Hallman *et al.,* 2003; Haspolat, 2012; Hilbeck *et al.,* 2015; Kaynar, 2009; Qin & Brown, 2007; S G Uzogara, 2000).

The rice is a source of essential nutrients for people who live in the countries of the Far East, for more than 200 million years. The rice doesn't contain provitamin A. Therefore, due to the lack of vitamins millions of children are going blind or die in every year. For this reason, it was thought that, in countries which main nutrient is rice, gene transfer have seen as a possible solution for illnesses that are caused due to the lack of vitamin A. It is stated that they had achieved a great progress in the name of eliminating this problem (Kıyak, 2004; Turkmen & Darcin, 2007; Tüysüzoğlu & Gülsaçan, 2004). In this study, there are four genes encoding enzymes leading to formation provitamin A Narcissus pseudo narcissus plant and Erwinia uredovora bacteria isolated was transferred to the rice (Özmert Ergin & Yaman, 2013). The product occurred after gene transfer is named as 'golden rice' because the leaves are bright yellow-green color (Dubock, 2014; Zülal, 2003).

Some positive opinions about genetically modified organisms are also mentioned; on the other hand negative characteristics are defended. The food produced by gene technology, will increase allergic reactions seen in society, which may have harmful effects, will be developed in a short period of resistant microorganisms to antibiotics, the world will reduce genetic diversity over time, from an ecological point of view, will increase dependence on foreign economy and especially small farmers will suffer from that (Eser, 2000; Kulaç, Ağırdil, & Yakın, 2006; Sökmen, 2005; Temelli & Kurt, 2011). It's also mentioned that in the products that are produced from them, there is a risk of not containing genetically modified organisms. Especially for products that are produced mainly from corn and soy; oil, flour, starch, glucose syrup, sucrose and fructose biscuits, coated cookies, carbonated soft drinks, puddings, vegetable oils, baby food, confectionery, chocolate waffles, soup, such as foods with corn and soybeans in animal food consumption as bait is reported to be at risk to include transgenic product (Erkmen, 2010; Jurkiewicz, Zagórski, Bujak, Lachowski, & Florek-Łuszczki, 2014; Prokop, Lešková, Kubiatko, & Diran, 2007). When soy and corn are thought to be used in many products, it is mentioned that products obtained from these transgenic food will be consumed in an indirect way. Placed in the organism by gene transfer technology specifications of the new genes are thought to cause allergic reactions to humans (Kıyak, 2004; Kidman, 2010; Kulaç *et al.,* 2006). In a study done on the Brazilian nuts, it has been determined that when Brazilian nuts gene is transferred to soy caused allergic reactions to consumers who are allergic to Brazilian nut (Klop & Severiens, 2007; König *et al.,* 2004; Kulaç *et al.,* 2006; Massarani & Moreira, 2005; Nordlee, Taylor, Townsend, Thomas, & Bush, 1996). The risks that are posed to the environment directly or indirectly by GMO are being widely discussed. Gene escape between species and between plants is thought to carry a significant risk of gene flow (Özmert & Yaman, 2015). Because of these reasons, there are various academic studies to increase the usage of GM crops or to prohibit. But in any case, knowledge and attitudes about society's issues also can be made to give direction to academic studies. However, it is unknown whether they have enough information about the society GDOs or not. For this purpose, various surveys are organized and important findings were obtained. It is stated that consumers have a noticeable connection towards information, attitude and behavior in genetically modified organism; however, according to domegrams it is informed that the consequences of its difference take attention (Saldamlı & Uygun, 2000). From elementary school to university, researches have investigated students' information about biotechnology. Most of the students have deficient or wrong information about biotechnology (Marques, Critchley, & Walshe, 2015a; Murrell & Fran, 2013; Nelson, Poorani, & Crews, 2003; Nordlee *et al.,* 1996). In a study conducted by a group of students over 1000 in Western Australia, about one in four of the students do not give importance to biotechnological developments, do not know the differences between genetic engineering and cloning, do not have sufficient knowledge about fools with GMO (Dawson & Schibeci, 2003). A questionnaire was conducted among 8821 people, about the attitudes of the media on public opinion during the debate (Murrell, 2014). In the US a survey was conducted on 1203 people. In 2002, it is declined that when the participants are forced to think about GMO's they both answer optimistically and they feel anxious (Schilling, Hallman, Adelaja, & Marxen, 2002). It is determined that the diversity between expert scientist and the general public opinion showed up in the research survey about GMO nutrition security (Funk & Lee, 2015). In the recent research, 57% of US public find it insecure to consume GMO's, but 88% of experts who are the members of US most important science association; generally find it secure to consume GMO. According to this survey, it is determined that there is a diversity of views between the scientist and public (Hilbeck *et al.,* 2015). A study that was conducted by American consumers about the perception of agricultural biotechnology and changes in consumer's behavior over time. 1200 consumers were interviewed and a little more than one third of consumers were discussing biotechnology and about 10% were found to be unstable in the flow of food with GMO (Hallman *et al.,* 2003). The result of studies involving 919 people in order to determine the viewpoint of the GMO society; The majority of customers are negative about GMOs and some consumers are more positive than others in their viewpoints, influenced by factors such as age, knowledge level, and education level (A. Demir & Pala A., 2007). Another research on secondary school students has come to the conclusion from students' perspective. GMO's are more likely to earn economic income from disease reduction or hunger reduction (Schilling *et al.,* 2002). In Australian community (N=8221) surveys, they talked about the importance of the media's role in

Copyright © 2017 Skyfox Publishing Group

International Journal of Agricultural and Life Sciences- IJALS (2017), Volume 3 (1) pp.136-146
http://dx.doi.org/10.22573/spg.ijals.017.s12200078
© Skyfox Publishing Group
All Rights Reserved
Available online at http://www.skyfox.co
ISSN: 2454-6127

ethical surveys (Marques, Critchley, & Walshe, 2015b). In a study conducted in Sweden, it is indicated that about 20% of the population is willing to buy GMO and 80% are skeptical (Lehrman & Johnson, 2008).

It has been observed that the vast majority of studies investigating students' knowledge and attitudes towards biotechnology are based on students from the developed countries, and these students are mostly from high school students (Chen & Raffan, 1999; Venhar Çelik & Balık, 2017; Dawson & Schibeci, 2003; Erdogan *et al.,* 2009; Klop & Severiens, 2007; Massarani & Moreira, 2005; Nordlee *et al.,* 1996). There are only a few studies in the literature investigating the knowledge and attitudes of university-level students towards biotechnology. This study aims to reveal the knowledge level of the students of the culinary program.

1.1. Sample

The sample of this research constitutes a total of 214 first and second year university students studying in the Culinary Program of a Foundation University in the province of Istanbul during the spring semester of 2014-2015 academic year. The demographic data for the students participating in the study are presented in Table 2.1.

Chart 2.1. Demographic data relating to sample

Demographic data's	Category	Total
Gender	Getting in female	99
	Male	115
Class	First year	114
	Second year	100
The school that originate from	Vocational high school	102
	Anatolian high school en	29
	Religious high school	11
	Technical high school	2
	Other	70
Mother's educational status	Uneducated	13
	Primary school	89
	Secondary school	82
	Undergraduate	22
	Masters	8
Fathers educational status	Uneducated	3
	Primary school	87
	Secondary school	87
	Undergraduate	26
	Masters	11
Family's average monthly income	1500 TL and less	49
	1501-3000	101
	3001-4500	28
	4501-6000	13
	6001-7500	11
	7501 and more	12
Do you benefit from Internet to search for information?	Yes	205
	No	9

Copyright © 2017 Skyfox Publishing Group

International Journal of Agricultural and Life Sciences- IJALS (2017), Volume 3 (1) pp.136-146
http://dx.doi.org/10.22573/spg.ijals.017.s12200078
© Skyfox Publishing Group
All Rights Reserved
Available online at http://www.skyfox.co
ISSN: 2454-6127

1.2. Gathering and Analysis of Data

In the study designed according to descriptive scanning model (Karasar, 2000), a three-step scale (Personal Information, Knowledge Level and Attitude) was used as a data collection tool. The first part consists of 8 open-ended questions prepared to determine the school, the gender, the education level of the mother, the educational status of the father, the monthly income of the dynasty and the way of accessing information.

The second part consists of 8 open-ended questions prepared to measure the level of knowledge of students about GMOs. The final and third sections of the questionnaire form out of 30 Likert-type attitude items with the form of "Never Participate", "Partially Participate", "Participate in Less Than", "Participate in Middle Grade" and "Absolutely Participate" to determine the attitudes of the students to the GMO; The reliability of the measurement tool was calculated (Cronbach-Alpha) and the reliability coefficient of the test was found to be 0,791. The data were analyzed using frequency (f), percentage (%), independent groups t-test and one-way analysis of variance (ANOVA) with SPSS (Statistical Package for Social Sciences) 20.0 program.

2. Findings and Results

The results of the frequency (f) and percent (%) values obtained as a result of the analyzes related to the questions in the GMO Knowledge Test prepared in the first part of the study are given in Table 3.1.

Table 2.1: Open Ended Question Analysis

NO	Open Ended Questions	Reply	f	%
1	Have you ever heard about the term GMO? If yes, which source of sources did you learn?	Yes	182	85,0
		No	32	15,0
2	Do you think you consume any food that consists GMO? If yes, with which products you are concerned?	Yes	142	66,4
		No	72	33,6
3	According to you, is GMO beneficial or harmful? If it's beneficial why? If it is harmful why?	Beneficial	9	4,2
		Harmful	205	95,8
4	Does genetically modified organisms make any chance to foods?	Yes	153	71,5
		No	61	28,5
5	Have you got any information about ministries prevention policy about genetically modified organism? If yes is it enough?	Yes	115	53,7
		No	99	46,3
6	Do you check label information of food product before you buy it? If yes, which characteristics do you take into account?	Yes	138	64,5
		No	76	35,5
7	Do you think GMO warnings on food labels are reliable? If no, why?	Yes	96	44,9
		No	118	55,1
8	Do you know where to apply when you think that the product you have bought consists GMO? If yes which are these organisations?	Yes	37	17,3
		No	177	82,7

When chart 3.1 is investigated "Have you ever heard the term of the GMO? If yes did you learn from sources? These questions asked to the students of the cooking program. And answers of them respectively (97) from TV, (42) internet, (15) book, (7) teacher, (6) newspaper and magazine, (5) other sources and 32 (15 %) students never heard the term. It is also seen that girls and boys have similarities in terms of the sources they heard the term GMO. There was no statistically significant difference between the responses of students in the first and second classes of the culinary program to the question.

Copyright © 2017 Skyfox Publishing Group

International Journal of Agricultural and Life Sciences- IJALS (2017), Volume 3 (1) pp.136-146
http://dx.doi.org/10.22573/spg.ijals.017.s12200078
© Skyfox Publishing Group
All Rights Reserved
Available online at http://www.skyfox.co
ISSN: 2454-6127

" Do you think you are consuming any food product with GMOs? If yes, what foods are you worried about?
These questions asked to the students and answers of them respectively; fruits (108), vegetables (77), tomato (48), cucumber (34), pepper (33), corn (75) and chocolate (23) and 72 (34%) of 214 students did not answer this question at all. It is also seen that girls and boys have similarities in terms of the sources they heard the term GMO. It was seen that there was no significant difference between the responses of the students in the cooking program to whether or not they would benefit from the Internet.

"Do you think GMO is beneficial or harmful? If so, why? If they are harmful, why?" These questions asked to the students of the culinary program and answer of them 95.8% of harmful. It was seen that there was no significant difference between the answers of the first and second year students in the cooking program. And they answered the question of " If it is harmful? " Makes cancer.

153 people (73%) answered yes to the question "Do GMO's change produce ion anyway? If yes how could this change be?" Moreover there was a similarity between the sources which boys and girls heard the term GMO. Statistically the gender difference was apparent among culinary program students, where it was seen that boys have an increased perception ($p< .05$). As for the question of what kind of change, the students mostly replied with "change in shape". 53.72% of the culinary students replied "I am aware" to the question" Are you aware of the measures the Ministry has taken against products with GMO's? If so do you think it they are enough?" 115 students whom answered, "I am aware" said that they were not sure when it came to the question of them being enough. It was seen that there was not a significant difference between the responses of 1. grade and 2. grade students in the culinary program ($p> .05$).

Statistically the gender difference was apparent in the answers of the culinary program students, where it was seen that boys have an increased perception ($p< .05$).

For the question "Do you check the label information when you buy a food product? If yes, which features do you consider first?" 76 people (35.5%) replied "no". It was seen that there was a statistical difference between the answers given by the students in the culinary program, to the question of gender differences and male perceptions, which were higher. It was seen that there was no significant difference between the answers of the first and second year students in the culinary program. 138 (64.5%) students who answered "yes" used the phrase "they check the last consumption date".
To question "Do you think GMO warning on food labels are reliable? If no, why?", 118 (55.1%) students of culinary program replied "no". It was seen that questions answered with "no" by participants, to question of "why". They weren't clear with their answers. It was seen that there was a statistical difference between the answers of the first and second year students in the culinary program and perception of males were higher. It was seen that there was no meaningful difference when the responses of students of culinary program are compared to gender differences.

To question "Do you know where you will go when you have a doubt that a food you buy contains a GMO? If yes, where are these institutions and organizations?", 177 (82.7%) students of culinary program replied "no". 37 participants replied "yes", 14 people in the ministry of food, 11 people in the municipality and 12 people did not answer. It was seen there was no statistical difference between the responses of the students of culinary program to gender, class and internet use.

Chart 2.2. Student's relation to biotechnology scores and average attitude scale items

NO	Students GMO related Attitude Scale Items	Average
1	GMO is appropriate to ethic rules.	2,05
2	Risks related to GMO can be expected, in order to benefit from its advantages.	2,30
3	GMO is harmful for animals in the nature.	3,83
4	GMO causes cancer.	4,33
5	Products containing GMO, causes people to die in the short run.	3,94
6	GMO can cause illnesses for the next generation.	4,50

Copyright © 2017 Skyfox Publishing Group

International Journal of Agricultural and Life Sciences- IJALS (2017), Volume 3 (1) pp.136-146
http://dx.doi.org/10.22573/spg.ijals.017.s12200078
© Skyfox Publishing Group
All Rights Reserved
Available online at http://www.skyfox.co
ISSN: 2454-6127

7	GMO is a way of gaining commercial for people.	4,34
8	Effects of GMO will gradually increase.	4,25
9	Nowadays GMO causes undetected effects.	4,12
10	GMO will result in irreversible adverse effects.	4,15
11	In plants one area of gene transformation usage is to obtain more resistant breeds against diseases.	3,08
12	With the change of plants genetic structure, plants need for fertilizer and medicine will be decreased.	3,46
13	It is not safe to consume GMO products.	4,33
14	I do not consume GMO tomatoes.	4,02
15	GMO disrupts food chain in nature.	4,35
16	GMO foods are major developments that cause a new breakthrough.	3,41
17	I can consume GMO rice.	2,76
18	GMO products increase shelf life of the products.	3,70
19	GMO products' production is free in our country.	3,41
20	GMO products have same features with natural products.	2,36
21	Gene transfer is fast and low cost method.	3,56
22	I approve changing the genes fof fruits and vegetables, in order to keep them for a longer peiod of time.	2,27
23	GMO products increase the food's nutritive value.	2,43
24	Environmental organizations exaggerate dangers about GMO products.	2,52
25	I consume the genetically modified corn and oil that is produced from corn.	2,58
26	GMO causes allergic reaction on human body.	3,43

Copyright © 2017 Skyfox Publishing Group

International Journal of Agricultural and Life Sciences- IJALS (2017), Volume 3 (1) pp.136-146
http://dx.doi.org/10.22573/spg.ijals.017.s12200078
© Skyfox Publishing Group
All Rights Reserved
Available online at http://www.skyfox.co
ISSN: 2454-6127

27	I think that International brand products' GMO content is possibly more than domestic ones.	3,25
28	GMO can prevent starvation.	2,37
29	GMO products show toxic effects on human body.	3,52
30	GMO products have an effect on ecosystem's species distribution and balance.	3,69

In order to examine the effect of GMO attitudes on students, independent samples t-test have been used depending on their genders. This test has been carried out according to the average rates of answers the students replied to the GMO attitude scale. While the number of female students are 99, male students are 115. As the average of the answers the female students gave to the GMO attitude scale is 3,40, the males' are 3,42. P has been found as 0.389 as the result of t-test which has been conducted. According to this result, p is greater than 0,05 value. This value shows that GMOs doesn't have a significant impact on the attitude of the students. The reason for this value is that the number of male and female students and their average responses are close to each other. But in their answers to 28th question, there is a statistical difference as p has been found 0.02 ($p<0.05$).

In order to examine the effect of GMO attitudes on students, independent samples t-test have been used depending on their class differences. While the average of the answers the female students gave to the GMO attitude scale is 3,47, the males' are 3,34. P has been found as 0.358 as the result of t-test which has been conducted. According to this result, p is greater than 0,05 value. In general, this value shows us that GMOs doesn't have a significant impact on the attitude of the students ($p>0.05$). But in their answers to the 9th, 13th ,16. and 27th questions there is a statistical difference as p value has been found as 0.032, 0,017, 0.049 and 0.029. ($p<0.05$).

In order to examine the effect of GMO attitudes on students, independent samples t-test have been used depending on their usage of internet. While the average of the answers the female students gave to the GMO attitude scale is 3,42, the males' are 3,14. P has been found as 0.418 as the result of t-test which has been conducted. According to this result, p is greater than 0, 05 value. In general, this value shows us that GMOs doesn't have a significant impact on the attitude of the students.($p>0.05$) But in their answers to the 7th.,8th ,9th , 18th and 30th questions there is a statistical difference as p value has been found as 0.00, 0,03, 0.042, 0,02 and 0.03. ($p<0.05$).

One way analysis of variance test to determine the impact of GMO on students' attitudes based on graduation status (ANNOVA) is used. According to these test results, $p=0.198$, respectively. So $p>0.05$ there is a significant difference between the groups for that. In their response to the students' attitude inventory item as result of the differences in statistical ANNOVA Turkey test. "Genetically Modified Organisms are in accordance with moral rules." In this statement to graduates of technical high school and Islamic religious high school graduates vary statistically ($p<0.05$)." GMO is harmful for animals in the nature." Vocational high school graduates and Islamic religious high school graduates with a statistical significant difference between ($p<0.05$)." GMO can cause illnesses for the next generation" and "expressions in the effects of GMOs will increase' have increased the differences between Vocational high school graduates, Anatolian high school and other high school graduates ($p<0.05$). "GMO nowadays leads to effects that cannot be detected. 'The expressions in Anatolian high school, vocational high school graduates and other differences between high school graduates ($p<0.05$). "The production of GMO products is free in our country" in this statement have increased the differences between graduates and other Anatolian high school and vocational high school graduates ($p<0.05$). "GMO products have the same features with natural products' 'In Islamic religious high school, vocational high school and Anatolian high school graduates vary statistically ($p<0.05$). "Fruits and vegetables stay fresh for a long time in order to see the appropriate modification of the gene' this expression have increased the differences between vocational high school graduates, technical high school, and Islamic religious and other high school graduates ($p<0.05$). "GMOs increases the nutritional value of food" this statement has increased the differences between graduates with vocational high school and Islamic religious high school graduates ($p<0.05$). "I think that International brand products' GMO content is possibly more than domestic ones" has increased between Islamic religious high school graduates ($p<0.05$).

According to maternal education level, used to unidirectional variance analysis test to determine the effect of GMO on students attitudes. $P=0.197$ were found as a result of this test. So, there is no big difference between these groups because the result is $p>0.05$. There were statistically significant differences in the result of the ANNOVA turkey test, according to answers given by the students to attitude scale items. "GMO damages the animals in the nature" in the answers of this statement, there were statistical differences between uneducated people and graduated people ($P<0.05$). "The consumption of GMO-containing products causes people to die in a short time" in the answers of this statement, there were statistical differences between uneducated, primary school graduate, secondary school graduate, undergraduate and postgraduate people ($p<0.05$). "GMO is one of the easy things in which people earn commercial income"

Copyright © 2017 Skyfox Publishing Group

International Journal of Agricultural and Life Sciences- IJALS (2017), Volume 3 (1) pp.136-146
http://dx.doi.org/10.22573/spg.ijals.017.s12200078
© Skyfox Publishing Group
All Rights Reserved
Available online at http://www.skyfox.co
ISSN: 2454-6127

in the answers of this statement, there were statistical differences between primary school graduate, undergraduate and postgraduate people (p<0.05). "The effects of GMO will gradually increase" in the answers of this statement, there were statistical differences between uneducated, primary school graduate, secondary school graduate, undergraduate and postgraduate people (p<0.05). "GMO leads to undetectable effects at the present time" in the answers of this statement, there were statistical differences between uneducated, primary school graduate and postgraduate people (p<0.05). "By changing the genetic makeup of a plant, the need for that plant's medicine and fertilizer is reduced" in the answers of this statement, there were statistical differences between uneducated, secondary school graduate, undergraduate and postgraduate people. "GMO products have the same properties as natural products" in the answers of this statement there were statistical differences between primary school graduate and secondary school graduate people (P<0.05). "I think the products of international brands are more likely to be free of GMO than domestic products" in the answers of this statement, there were statistical differences between primary school graduate and postgraduate people (p<0.05). "Hunger can be prevented with GMO products" in the answers of this statement, there were statistical differences between primary school graduate, uneducated and postgraduate people (p<0.05). "GMO products show toxic effects in the human body" in the answers of this statement, there were statistical differences between undergraduate and postgraduate people (p<0.05).

In order to decide students GMO attitudes, depending on their fathers' education, one-way variance analysis test is conducted. According to the results of this test p=0.141 has been found. So p>0.05 because there is no significant difference between the groups. The scale of the students attitude to their answers to ANNOVA Turkey test is statistically different "For the future generations, GMO can cause disease in children" there is statistically significant difference in their answers to this question among secondary school, undergraduate and graduate alumni (p<0.05). "GMO is a way to achieve commercial gain" according to primary, undergraduate and graduate alumni answers, there is statistically significant difference (p<0.05). "Nowadays GMO leads to effects that cannot be detected." In their answer primary, undergraduate and graduate alumni have a statistically significant difference (p<0.05). "I cannot consume genetically modified tomatoes" in their answers there is statistically significant difference between answers of uneducated people, primary school, secondary school, undergraduate and postgraduate alumni (p<0.05). "I prefer to consume genetically modified rice" there is a significant difference in the answers of secondary education and postgraduate alumni. (p<0.05). "Production of GMO products is free in our country" and "GMO products have allergic effect in human body" primary school and postgraduate alumni have statistically significant difference in their answers. (p<0.05). "GMO products have the same features with natural products" in their answers postgraduate, illiterate, secondary school graduates, undergraduates and primary school graduates' replies are statistically very different.(p<0.05). "Hunger can be avoided with GMO products" postgraduate, illiterate, secondary school graduates, undergraduates and primary graduates alumni gave statistically different replies (p<0.05).

One-way variance analysis test was applied to determine the effect of students on GMO attitudes according to average monthly income level of the household. According to this test result, p=0.171 was found. That is, p> 0.05, so there is no significant difference between the groups. The ANNOVA Turkey test showed statistically significant differences in the responses of the students to attitude scale items. "Consumption of products containing GMOs will cause people to die in the short term" in their response to the statement 7501TL and above 1500TL and below, statistically, there were differences between 1501-3000TL, 3001-4500TL, 4501-6000TL and 6001-7500 TL average monthly income holders (p<0.05). "It leads to effects of GMO today that cannot be determined" in their response to the statement 7501TL and above 1500TL and below statistically, there were differences between 10501-3000TL, average monthly income holders (p<0.05). GMO will lead to irreversible effects, statistically differences between 7501 and over and between 6001-7500TL average monthly household income (p<0.05). "One of the areas where gene transfer is used in plants is to obtain more resistant strains of disease" statistically differences between the answers they gave to the statement are 1500TL and below, 1501-3000TL and 4501-6000TL average monthly household income (p<0.05). "The GMO products have the same characteristics as the natural products" the average monthly household income between 6001-7500TL, 1500TL and below, 1501-3000 and 3001-4500TL is statistically different (p<0.05). "Gene transfer is a fast and cost-effective method" in their response to the statement the average monthly household income between 3001-4500TL, 1501-3000TL and 1500 and below is statistically different (p<0.05). There was a statistically significant difference between the average monthly income of TL 7501 and TL 1,500 and below, TL 1501-3000, TL 3001-4500 and TL 6001-7500 in the answer to "the hunger can be prevented with GMO products" (p <0.05). "The GMO products have toxic effect on the human body" showed that a statistically significant difference between the average monthly income of TL 7501 and TL 3001-4500 and TL 4501-6000 (p <0.05). A statistically significant difference was found between the ones whose incomes are 7501 TL and over, 1500 TL and below, 1501-3000 TL, 3001-4500 and 6001-7500 (p<0.05). They have answered the question '' Can starvation be prevented with GMO products?" A statistically significant difference was found between the ones whose incomes are 7501 TL and over, 3001-4500 TL and 4501-6000 TL. They have answered the question 'GMO products show toxic effects on human body" statistical difference between the monthly income of TL 7501 and above, TL 3001-4500 and TL 4501-6000 was found to be statistically different (p<0.05).

DISCUSSION AND SUGGESTIONS

When literature studies are examined, we see that university students are not studied much about GMO Knowledge Levels and Biotechnology Attitudes. When the similar studies are examined, in the findings of this research it was seen that students did not have

Copyright © 2017 Skyfox Publishing Group

International Journal of Agricultural and Life Sciences- IJALS (2017), Volume 3 (1) pp.136-146
http://dx.doi.org/10.22573/spg.ijals.017.s12200078
© Skyfox Publishing Group
All Rights Reserved
Available online at http://www.skyfox.co
ISSN: 2454-6127

enough knowledge about GMO and Biotechnology. This result is similar to the other studies in the literature. Nowadays developments in biotechnology are multiplying rapidly, for this reason it is quite effective in our everyday life. The Genetically Modified Organisms that we review in this article also occupy an important place in our daily lives. As these issues directly affect our daily lives, these issues need to be examined more. The public should be informed about these issues. It has been seen that students have sufficient basic knowledge of genetically modified organisms, but they have conceptual misconceptions and that a large majority think that genetic material replacement technology is harmful. The vast majority of students believe that GMO technology is harmful and that they have some conceptual mistakes. It has come to the conclusion that the inclusion of knowledge and awareness in the curriculum of GMOs will help to overcome the confusion of concepts.

REFERENCES

1. Babaoğlu, M., Gürel, E., & Özcan, S. (2001). Bitki Biyoteknolojisi Doku Kültürü Ve Uygulamaları - M.Babaoğlu, E.Gürel, S.Özcan | Nadir Kitap. Konya: Selçuk Üniversitesi.
2. Bozcuk, N. A. (2005). Genetik (1st ed.). Ankara: Palme Yayıncılık.
3. Butler, D., & Reichhardt, T. (1999). Long-term effect of GM crops serves up food for thought. Nature, 398(6729), 651–653. https://doi.org/10.1038/19381
4. Chen, S.-Y., & Raffan, J. (1999). Biotechnology: student's knowledge and attitudes in the LJK and Taiwan. Journal of Biological Education, 34(1), 17–23. https://doi.org/10.1080/00219266.1999.9655678
5. Çelik, V., & Balık, D. T. (2007). Genetiği değiştirilmiş organizmalar (GDO). Erciyes Üniversitesi Fen Bilimleri Enstitüsü Dergisi, 23(1–2), 13–23. Retrieved from http://fbedergi.erciyes.edu.tr/index.php/fen-bilimleri-dergisi/article/view/460
6. Çelik, V., & Balık, D. T. (2017). Genetiği değiştirilmiş organizmalar (GDO). Erciyes Üniversitesi Fen Bilimleri Enstitüsü Dergisi, 23(1–2).
7. Dawson, V. (2007). An Exploration of High School (12–17 Year Old) Students' Understandings of, and Attitudes Towards Biotechnology Processes. Research in Science Education, 37(1), 59–73. https://doi.org/10.1007/s11165-006-9016-7
8. Dawson, V., & Schibeci, R. (2003). Western Australian high school students' attitudes towards biotechnology processes. Journal of Biological Education, 38(1), 7–12. https://doi.org/10.1080/00219266.2003.9655889
9. Demir, A., & Pala, A. (2007). Genetiği Değiştirilmiş Organizmalara Toplumun Bakış Açısı. Hayvansal Üretim, 48(1), 33–43.
10. Demir, A., & Pala A. (2007). Genetiği Değiştirilmiş Organizmalara Toplumun Bakış Açısı. Hayvansal Üretim, 48(1), 33–41.
11. Dubock, A. (2014). The politics of Golden Rice. GM Crops & Food, 5(3), 210–222. https://doi.org/10.4161/21645698.2014.967570
12. Erbaş, H. (2008). Türkiye'de Biyoteknoloji ve Toplumsal Kesimler (4th ed.). Ankara Üniversitesi Biyoteknoloji Enstitüsü. https://doi.org/10.1501/ankara-3464
13. Erdogan, M., Özel, M., Uşak, M., & Prokop, P. (2009). Development and Validation of an Instrument to Measure University Students' Biotechnology Attitude. Journal of Science Education and Technology, 18(3), 255–264. https://doi.org/10.1007/s10956-009-9146-6
14. Erkmen, O. (2010). Gıda kaynaklı tehlikeler ve güvenli gıda üretimi. Çocuk Sağlığı ve Hastalıkları Dergisi, 53, 220–235.
15. Eser, V. (2000). Modern Biyoteknolojideki Gelişmelerin Işığı Altında Dünya ve Türkiye'de Tarım. In Küreselleşme Sürecinde Biyogüvenlik Sempozyumu Bildiri Özetleri. Ankara.
16. Funk, C., & Lee, R. (2015). Public and Scientists' Views on Science and Society. Retrieved March 26, 2017, from http://www.pewinternet.org/2015/01/29/public-and-scientists-views-on-science-and-society/
17. Hallman, W. K., Hebden, W. C., Aquino, H. L., Cuite, C. L., Lang, J. T., Hallman, W. K., … Lang, C. L. (2003). Public Perceptions of Genetically Modified Foods: A National Study of American Knowledge and Opinion. Food Policy Institute, CookCollege, Rutgers - TheStateUniversity of New Jersey. Retrieved from http://www.foodpolicyinstitute.org
18. Haspolat, I. (2012). Genetiği değiştirilmiş organizmalar ve biyogüvenlik. Ankara Üniv Vet Fak Derg, 59, 75–80. Retrieved from http://dergiler.ankara.edu.tr/dergiler/11/1614/17387.pdf

Copyright © 2017 Skyfox Publishing Group

International Journal of Agricultural and Life Sciences- IJALS (2017), Volume 3 (1) pp.136-146
http://dx.doi.org/10.22573/spg.ijals.017.s12200078
© Skyfox Publishing Group
All Rights Reserved
Available online at http://www.skyfox.co
ISSN: 2454-6127

19. Hilbeck, A., Binimelis, R., Defarge, N., Steinbrecher, R., Székács, A., Wickson, F., … Wynne, B. (2015). No scientific consensus on GMO safety. Environmental Sciences Europe, 27(1), 4. https://doi.org/10.1186/s12302-014-0034-1
20. Jurkiewicz, A., Zagórski, J., Bujak, F., Lachowski, S., & Florek-Łuszczki, M. (2014). Emotional attitudes of young people completing secondary schools towards genetic modification of organisms (GMO) and genetically modified foods (GMF). Annals of Agricultural and Environmental Medicine : AAEM, 21(1), 205–11. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/24738526
21. Karasar, N. (2000). Bilimsel Araştırma Yöntemi-Kavramlar, İlkeler, Teknikler (10th ed.). Ankara: Nobel Yayınevi.
22. Kaynar, P. (2009). Genetik Olarak Değiştirilmiş Organizmlar (GDO)'a Genel Bir Bakış. Türk Hijyen ve Deneysel Biyoloji Dergisi, 66(4), 177–185. Retrieved from http://www.journalagent.com/turkhijyen/pdfs/THDBD_66_4_177_185.pdf
23. Kıyak, S. (2004). Genetik Olarak Değiştirilmiş Gıdalar, Cartagena Biyogüvenlik Protokolü ve Türkiye'de Durum (1). Çevreye Genç Bakış, 4, 14–22.
24. Kıyak, S. (2004). Genetik Olarak Değiştirilmiş Gıdalar, Cartagena Biyogüvenlik Protokolü ve Türkiye'de Durum (2). Çevreye Genç Bakış, 5, 1–20.
25. Kidman, G. (2010). What is an "Interesting Curriculum" for Biotechnology Education? Students and Teachers Opposing Views. Research in Science Education, 40(3), 353–373. https://doi.org/10.1007/s11165-009-9125-1
26. Klop, T., & Severiens, S. (2007). An Exploration of Attitudes towards Modern Biotechnology: A study among Dutch secondary school students. International Journal of Science Education, 29(5), 663–679. https://doi.org/10.1080/09500690600951556
27. König, A., Cockburn, A., Crevel, R. W. R., Debruyne, E., Grafstroem, R., Hammerling, U., … Wal, J. M. (2004). Assessment of the safety of foods derived from genetically modified (GM) crops. Food and Chemical Toxicology, 42(7), 1047–1088. https://doi.org/10.1016/j.fct.2004.02.019
28. Kulaç, İ., Ağırdil, Y., & Yakın, M. (2006). Sofralarımızdaki Tatlı Dert Genetiği Değiştirilmiş Organizmalar ve Halk Sağlığına Etkileri. Türk Biyokimya Dergisi , 31(3), 151–155.
29. Lehrman, A., & Johnson, K. (2008). Swedish farmers attitudes, expectations and fears in relation to growing genetically modified crops. Environmental Biosafety Research, 7(3), 153–162. https://doi.org/10.1051/ebr:2008012
30. Marques, M. D., Critchley, C. R., & Walshe, J. (2015a). Attitudes to genetically modified food over time: How trust in organizations and the media cycle predict support. Public Understanding of Science, 24(5), 601–618. https://doi.org/10.1177/0963662514542372
31. Marques, M. D., Critchley, C. R., & Walshe, J. (2015b). Attitudes to genetically modified food over time: How trust in organizations and the media cycle predict support. Public Understanding of Science, 24(5), 601–618. https://doi.org/10.1177/0963662514542372
32. Massarani, L., & Moreira, I. de C. (2005). Attitudes towards genetics: a case study among Brazilian high school students. Public Understanding of Science, 14(2), 201–212. https://doi.org/10.1177/0963662505050992
33. Murrell, F. (2014). What is genetically modified food, why is it controversial and how do I know if I'm eating it? Journal of the HEIA, 20, 1–8.
34. Murrell, & Fran. (2013). What is genetically modified food, why is it controversial and how do I know if I'm eating it? Journal of the Home Economics Institute of Australia, 20(3), 2.
35. Nelson, R. R., Poorani, A. A., & Crews, J. E. (2003). Genetically Modified Foods. Journal of Foodservice Business Research, 6(4), 89–105. https://doi.org/10.1300/J369v06n04_05
36. Nordlee, J. A., Taylor, S. L., Townsend, J. A., Thomas, L. A., & Bush, R. K. (1996). Identification of a Brazil-Nut Allergen in Transgenic Soybeans. New England Journal of Medicine, 334(11), 688–692. https://doi.org/10.1056/NEJM199603143341103
37. Özdemir, O., Handan Güneş, M., & Demir, S. (2010). Üniversite Öğrencilerinin Genetiği Değiştirilmiş Organizmalara (GDO'lara) Yönelik Bilgi Düzeyleri-Tutumları ve Sürdürülebilir Tüketim Eğitimi Açısından Değerlendirilme. Ondokuz Mayıs Üniversitesi Eğitim Fakültesi Dergisi, 29, 53–68.
38. Özmert, S., & Yaman, H. (2015). Tüketicilerin Genetiği Değiştirilmiş Gıdalara Karşı Tutumlarının ve Bilgi Düzeylerinin Belirlenmesi. Kocatepe Veteriner Dergisi, 4(1), 31–34.

Copyright © 2017 Skyfox Publishing Group

International Journal of Agricultural and Life Sciences- IJALS (2017), Volume 3 (1) pp.136-146
http://dx.doi.org/10.22573/spg.ijals.017.s12200078
© Skyfox Publishing Group
All Rights Reserved
Available online at http://www.skyfox.co
ISSN: 2454-6127

39. Özmert Ergin, S., & Yaman, H. (2013). Genetiği Değiştirilmiş Gıdalar ve İnsan Sağlığı Üzerine Etkileri. Gümüşhane Üniversitesi Sağlık Bilimleri Dergisi , 2(2), 261–274.
40. Prokop, P., Lešková, A., Kubiatko, M., & Diran, C. (2007). Slovakian Students' Knowledge of and Attitudes toward Biotechnology. International Journal of Science Education, 29(7), 895–907. https://doi.org/10.1080/09500690600969830
41. Qin, W., & Brown, J. L. (2007). Public reactions to information about genetically engineered foods: effects of information formats and male/female differences. Public Understanding of Science, 16(4), 471–488. https://doi.org/10.1177/0963662506065336
42. Saldamlı, İ., & Uygun, Ü. (2000). Genetik Modifikasyon Teknolojisi ve Uygulanabilirliği. Gıda, 61, 95–96.
43. Schilling, B. J., Hallman, W. K., Adelaja, A. O., & Marxen, L. J. (2002). Consumer Knowledge Of Food Biotechnology: A Descriptive Study Of U.S. Residents. Working Papers.
44. Sökmen, A. (2005). Genetik Yapısı Değiştirilmiş Bitkiler ve Bitki Koruma Amaçlı Kullanımı. J. of Fac. of Agric, 2020(33).
45. Temelli, A., & Kurt, M. (2011). Üniversite Öğrencilerinin Transgenik Ürünler (GDO) Konusundaki Bilgi ve Görüşlerinin Belirlenmesi. Kuramsal Eğitimbilim Dergisi, 4(2), 247–261. Retrieved from http://www.keg.aku.edu.tr/arsiv/c4s2/c4s2m16.pdf
46. Turkmen, L., & Darcin, E. S. (2007). A Comparative Study of Turkish Elementary and Science Education Major Students' Knowledge Levels at the Popular Biotechnological Issues. International Journal of Environmental and Science Education, 2(4), 125–131. Retrieved from https://eric.ed.gov/?id=EJ901276
47. Tüysüzoğlu, B. ., & Gülsaçan, M. (2004). Türkiye'de GDO. Bilim Teknik, 443, 36–43.
48. Uzogara, S. G. (2000). The impact of genetic modification of human foods in the 21st century. Biotechnology Advances, 18(3), 179–206. https://doi.org/10.1016/S0734-9750(00)00033-1
49. Uzogara, S. G. (2000). The impact of genetic modification of human foods in the 21st century: a review. Biotechnology Advances, 18(3), 179–206. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/14538107
50. Zhang, D., & Guo, J. (2011). The Development and Standardization of Testing Methods for Genetically Modified Organisms and their Derived ProductsF. Journal of Integrative Plant Biology, 53(7), 539–551. https://doi.org/10.1111/j.1744-7909.2011.01060.x
51. Zülal, A. (2003). Gen Aktarımlı Tarım Ürünleri. Bilim Teknik, 426, 38–43. Retrieved from http://bilimteknik.tubitak.gov.tr/node/51572

How to cite this article
Yıkmış, S., Gülüm, L., Aksu, H., & Alpaslan, M. (2017). Determination of Opinions and Level of knowledge of Culinary Program Students about Genetically Modified Organisms (GMO's): Istanbul. Int.J. Agr. Life. Sci, 3(1), 136-146. doi: 10.22573/spg.ijals.017.s12200078.

CONFLICTS OF INTEREST
"The authors declare no conflict of interest".

© 2017 by the authors; licensee SKY FOX Publishing Group, Tamilnadu, India. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution license (http://creativecommons.org/licenses/by/4.0/).

Copyright © 2017 Skyfox Publishing Group