Attitude and Consumer Behavior on Consumption of Genetically Modified Foods (GMF)

Emeritus Professor: John Chalikias

Project Team: Maria Vretta, Maria Georgakopoulou, Panagiota Gousia, Maria Zapounidou, Maria Silaidi, Tania Tatsika, George Tsipas

International Hellenic University
June 2018

Contents

1. Introduction 3
2. Materials and methods 4
2.1. Survey Data Collection 4
2.2. Identity of research and demographic information 4
3. Results 6
3.1. Analysis of Results 13
4. Conclusions 16
5. References 17
6. Annex I 18

1. Introduction

There has been significant advancement in modern biotechnology worldwide in the past ten years. Current biotechnology products mostly focus on the commercialization of biopharmaceuticals followed by genetically modified (GM) crops (Walsh, 2010).

Genetically modified (GM) foods have begun to invade in our diet; therefore there are concerns and debate about their safety. Toxicity studies of certain GM foods have shown that these foods may have a toxic effect on various organs and systems. Also, results of more studies indicate that GM foods can cause some common toxic effects on the liver, pancreas, kidneys and reproduction problems, as might may alter hematological, biochemical and immunological profile, in experimental animals (Lodish et al, 1995). However, a study is required to determine the safety of GM foods toxicity in laboratory animals for several years, as well as clinical trials. It has been around 15 years since genetic modifications have applied to food and to the existing one list of foods are constantly being added to new GM foods. The present report intends to investigate the Greek public opinion on GM food. We turned to consumers in order to ascertain whether they are informed about transgenic products and the various advantages and disadvantages that accompany them, as well as what is ultimately their attitude towards GM food. The project team wanted to know whether consumers buy or not such products, as well as what are the market criteria.

The present study is conducted in the contexts of the course of Marketing of Bio-products. This study concerns genetically modified organisms (GMOs) and in particular, genetically modified food. The issue about GM food, concerns consumers and has serious environmental and economic consequences. Also, the importance of this matter, includes the fact that genetic modified organisms are more likely to threaten public health, as well as to affect the ecosystems. According to many experts on GM food, no full risk assessment control can be achieved.

2. Materials and methods

2.1. Survey Data Collection

A survey was carried out between April 2018 and June 2018. Greek citizens questioned were chosen as the targeted and their economic and social status was also determined, as well as the respondents met the requirement of being adults. The age of the target group was chosen, since adults presumably are the most active buying product group. It was considered appropriate, in the context of this research, to collect information about consumer's general attitudes towards the consumption of GM food, in order to draw conclusions as to relate the purchases that consumers make. Whether they are satisfied with the various companies who are supplying with GM food on the market shelves. Finally, given that various products are consumed directly or indirectly how much are related to their health.

Moreover, the team wanted to know how much they are sensitive in the issue, on GM food. To explore the above issues, we used the survey method of questionnaires. Drafted questionnaires with 20 questions, survey type Likert, which we distributed 212 copies. The questionnaires were handed out personally to respondents. The sampling was performed by the convenience method. Having collected the answers, the team worked with the SPSS, statistical program to measure frequencies and averages used to export survey findings.

2.2. Identity of research and demographic information

The answers of the respondents to the questionnaire are shown in Table 1. The answers to questions is with the Likert type and are rated from 1 to 5, where 1 is located the "completely disagree" and 5 "strongly agree." In the tables below, the first column shows the question, the second averaged responses and in the third the standard deviation. The average vary from 1 to 5, following the corresponding score. For the average values, they are close to full disagreement, while corresponding values for near five are close to full agreement. The absolute average "neither agree

nor disagree" is in three. The questionnaire which distributed to the respondents is available at Annex I.

3. Results

In total, 212 questionnaires were distributed to adult men and women.

Questionnaires Number: 212

Table 1: Main results of the survey

Gender	Male:	74 (35, 2%)
	Female:	136 (64, 8%)
Age	<25:	29 (13, 7%)
	26-40:	66 (31, 1%)
	41-55:	95 (44, 8%)
	56<:	22 (10, 4%)
Place of living	City:	179 (85, 6%)
	Village:	30 (14, 4%)
Education	1st grade:	7 (3, 3%)
	2nd grade:	64 (30, 2%)
	3rd grade:	141 (66, 5%)
Profession	Civil servant:	89 (42, 4%)
	Private employee:	41 (19, 5%)
	Freelance:	19 (9%)
	Student:	6 (2, 9%)
	Household:	7 (3, 3%)
	Unemployed:	11 (5, 2%)
	Retired:	12 (5, 7%)
	Other:	25 (11,95)
Monthly family income	0-500€:	24 (11, 5%)
	501-700€:	23 (11, 1%)
	701-1000€:	44 (21, 2%)
	1000< €:	117 (56, 3%)
Shopper	Me:	134 (63, 8%)
	Other:	76 (36, 2%)
Number of family members	1:	20 (9, 7%)
	2:	31 (15%)
	3:	54 (26, 2%)
	4:	65 (31, 6%)
	5:	22 (10, 7%)
	6:	7 (3, 4%)
	7:	5 (2, 4%)
	8:	1 (0, 5%)
	12:	1 (0, 5%)

Table 2: Consumers' awareness		
	Mean	**Std. Deviation**
Q1.Consumers are well informed about GMF	2,26	1,000
Q3. GMF are different from conventional food	3,76	0,918
Q4. Genetic modification contributes to the improvement and production of new plant and animal varieties	3,08	0,987
Q5. Genetic modified plants could contribute to greater harvests and larger quantities of food and in that way solve the hunger problems in malnourished countries	3,24	1,048
Q6. Genetic modified plants could be used to produce healthier food	2,45	1,005
Q7. Due to their minimum need of pesticides, genetic modified plants could contribute to the environmental protection	2,92	0,945
Q8. Due to their greater resistance to disease, genetic modified plants produce safer products (e.g. less antibiotics included)	2,48	0,948
Q9. The development of GM cultivation could have an impact to biodiversity, nature balance and the environment	3,92	0,938
Q10. Genes in GMF could be responsible for allergy or other disease appearance	3,93	0,683
Q11. European tests for the GMO's safety are sufficient	2,58	0,842
Q12. I would buy GMF if its price was lower than that of the conventional food	2,13	0,927
Q13. If I heard that a food that I consume is GM then I would change it regardless of its price	3,58	1,086
Q14. GMF's production and marketing should be permitted only after long term and full control	4,22	0,950
Q15. On the package/label of GMF it should be written that it is GM	4,53	0,691

Q16. I would use a pharmaceutical product such as an edible vaccine even if I knew it is a GM product	2,41	1,045
Q17. Production and marketing of all GMF should be banned	3,04	1,084
Q18. The wide production of the GMF would result to food's price reduction	3,05	1,025
Q19. The wide production of GMF would have no impact to prices	2,69	0,928

Q2. Which of the following food is more likely to be GM according to your consideration?

Table 3: Question 2 analysis

Food products		Responses		Percent of Cases
		N	Percent	
	Soya	133	36,9%	63,3%
	Corn	113	31,4%	53,8%
	Potato	19	5,3%	9,0%
	Rice	16	4,4%	7,6%
	Tomato	73	20,3%	34,8%
	Peas	6	1,7%	2,9%
Total		**360**	**100,0%**	**171,4%**

Q20. In which of the following issues is the questioning upon the use of GM cultivations and the GM products consumption <u>mainly</u> focused on?

Table 4: Question 20 analysis

		Responses		
Issues		N	Percent	Percent of Cases
	Consumer's health and safety	176	44,0%	83,0%
	Environment and biodiversity	116	29,0%	54,7%
	Structure and future of agriculture	16	4,0%	7,5%
	Control of world trade and global economy	28	7,0%	13,2%
	Local societies of developing and underdeveloped countries	10	2,5%	4,7%
	Bioethics and societal role of science and technology	17	4,3%	8,0%
	Taking responsibility in case of unpredictable adverse effects	17	4,3%	8,0%
	Tagging and control legislation of GMOs	20	5,0%	9,4%
Total		**400**	**100,0%**	**188,7%**

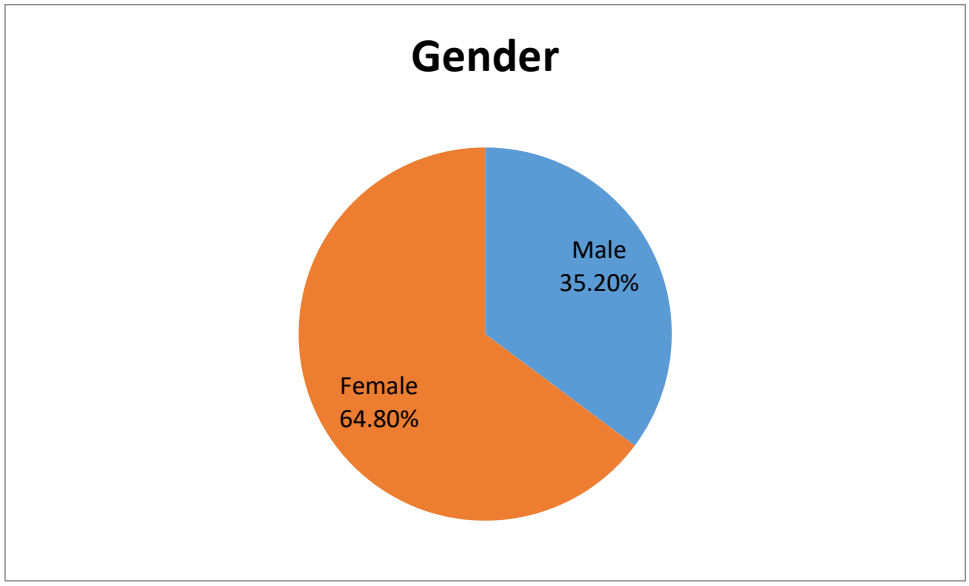

Figure 1. Gender frequencies

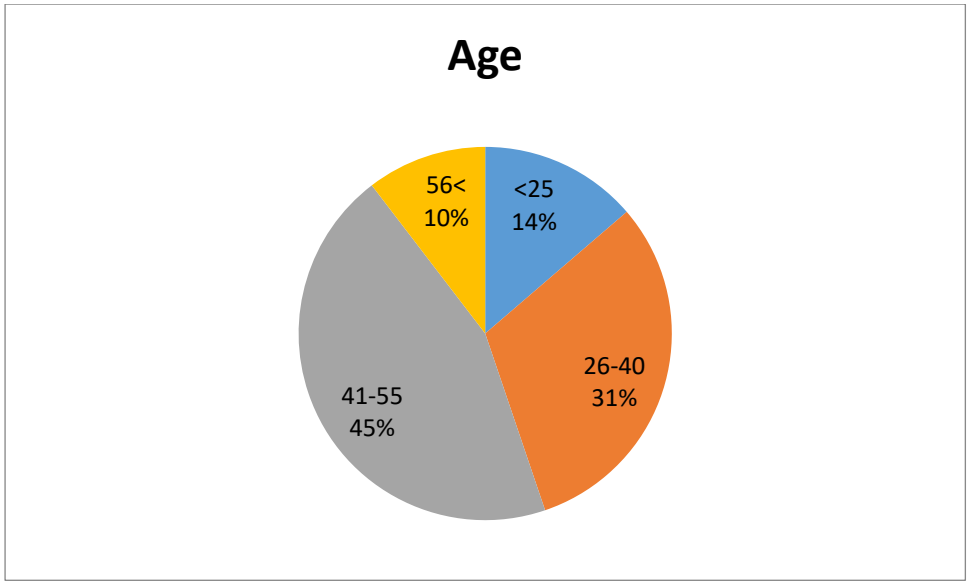

Figure 2. Age frequencies

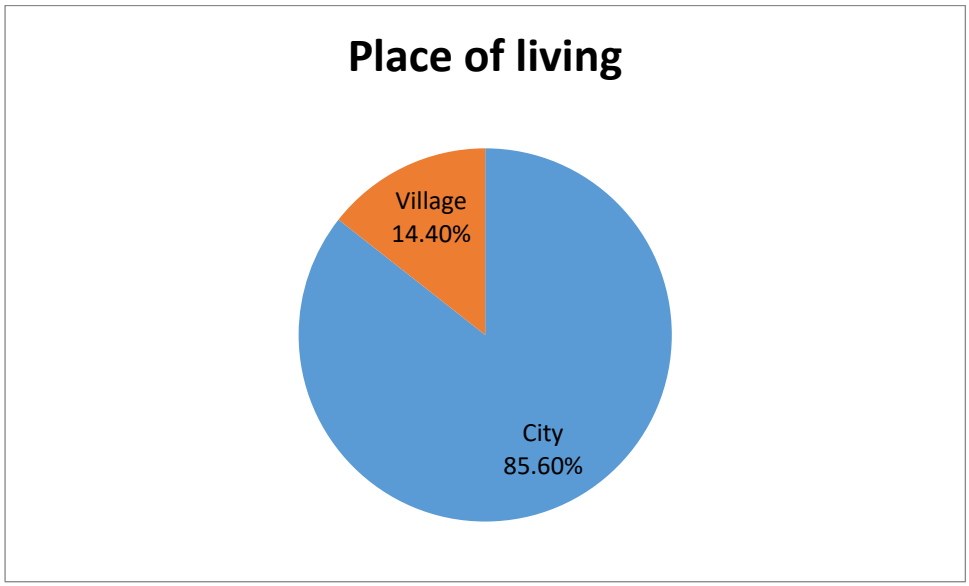

Figure 3. Place of living frequencies

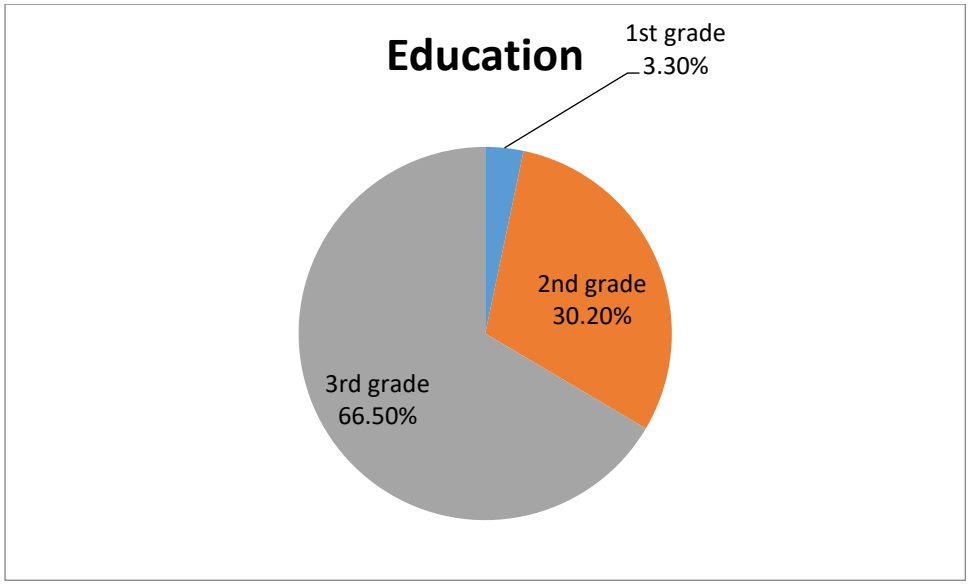

Figure 4. Education frequencies

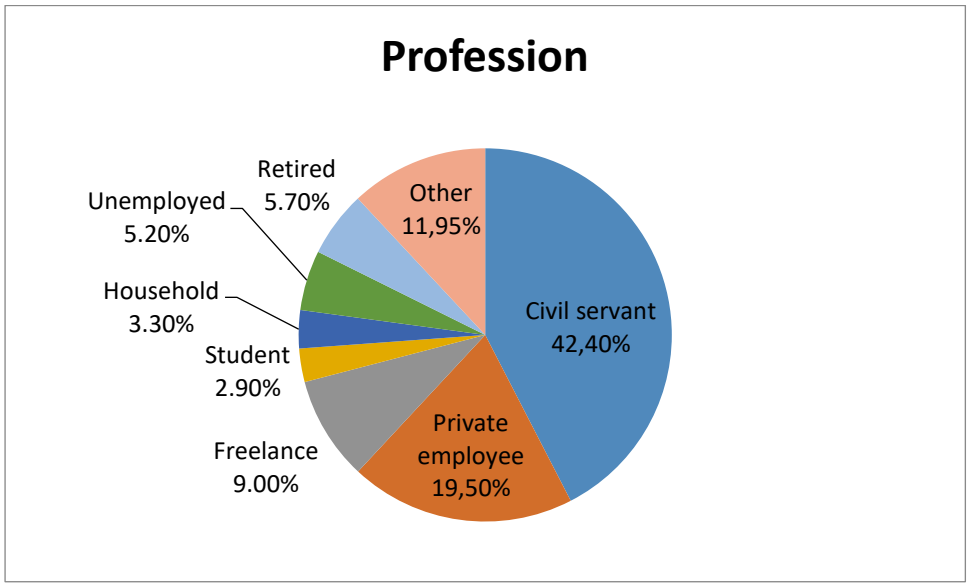

Figure 5. Profession frequencies

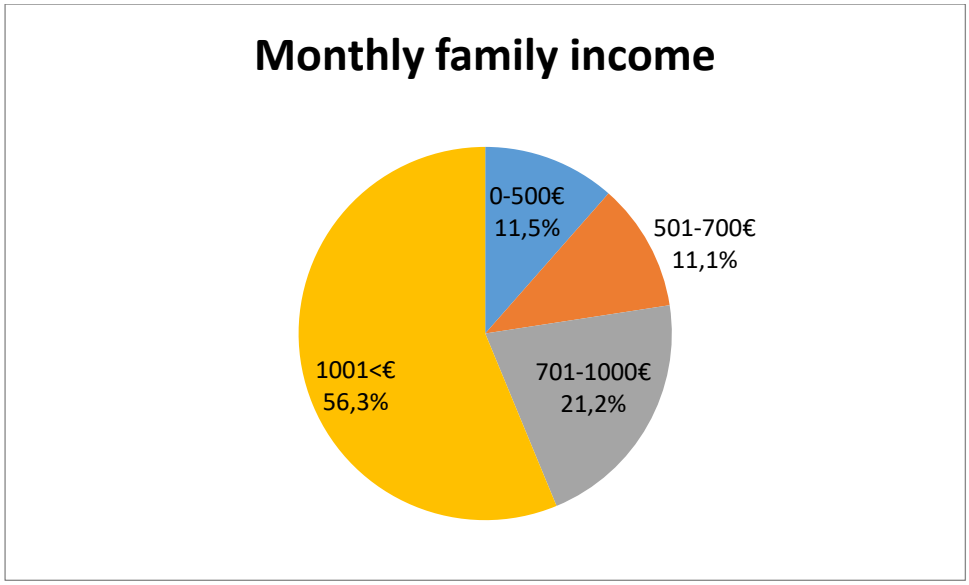

Figure 6. Monthly family income frequencies

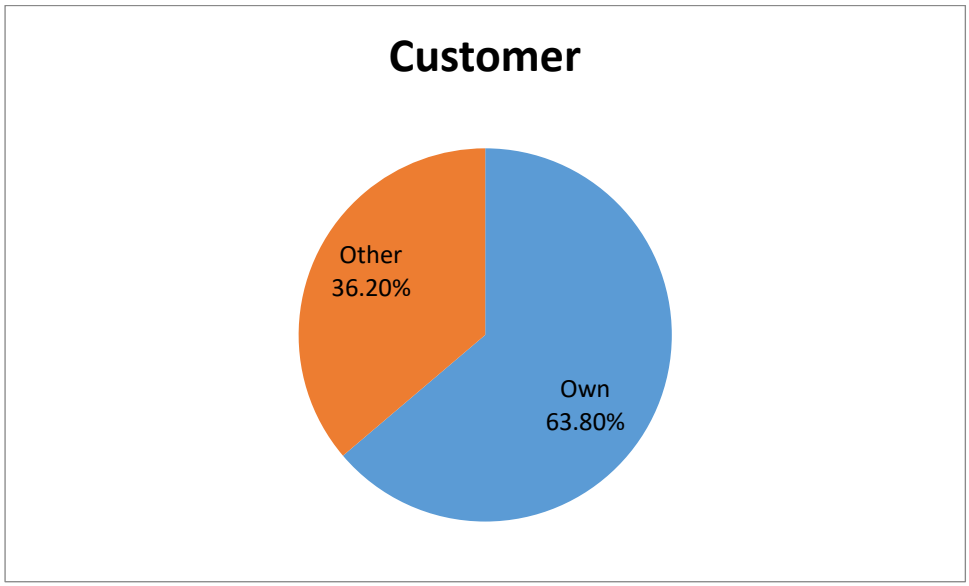

Figure 7. Customer frequencies

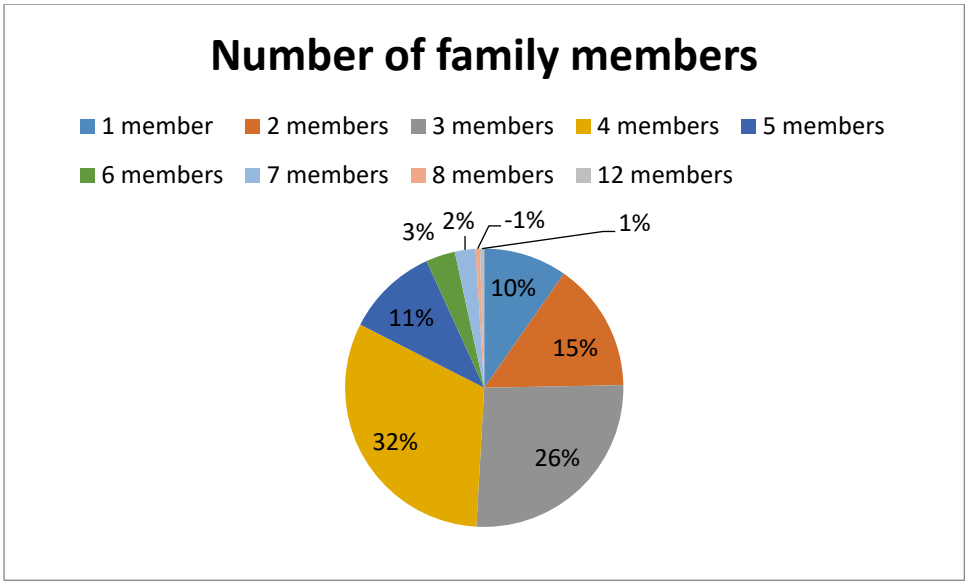

Figure 8. Number of family member's frequencies

3.1. Analysis of Results

Consumers seem to disagree as far as how well informed they are about GMF (2, 26). They also seem to agree that GMF is different than conventional (3, 76). They tend to have a neutral attitude upon the contribution of genetic modification to the improvement and production of new plant and animal varieties (3, 08).

Responders do not agree or disagree if genetic modified plants could contribute to greater harvests and larger quantities of food and if in that way solve the hunger problems in malnourished countries (3, 24).

There is a disagreement if genetic modified plants could be used to produce healthier food (2,45) but there is noted a neutral attitude, to the case that genetic modified plants could contribute to the environmental protection due to their minimum need of pesticides (2,92). They also disagree if genetic modified plants produce safer products due to their greater resistance to disease although there is an inclination to neutral attitude (2, 48).

They agree that the development of GM cultivation could have an impact to biodiversity, nature balance and the environment (3,92) as well as that genes in GMF could be responsible for allergy or other disease appearance (3,93). However, they are

rather neutral with a tendency for disagreement about the sufficiency of the European tests for the GMO's safety (2, 58).

They do not agree of buying GMF if its price was lower than that of the conventional food (2,13) but they keep neutral attitude in changing a food they consume if they heard that it is GM regardless of its price (3,58) with a trend to agree. They also agree that GMF's production and marketing should be permitted only after long term and full control (4,22) and on the fact that on the package/label of GMF it should be written that it is GM, too (4,53).

It is observed that people of the sample disagree to use a pharmaceutical product such as an edible vaccine even if they knew it is a GM product (2,41) but they appear neither to agree not to disagree that production and marketing of all GMF should be banned (3,04). It is also noticeable that they keep neutral attitude to the cases that the wide production of the GMF would result to food's price reduction (3, 05) and that the wide production of GMF would have no impact to prices (2, 69).

They consider soya as the food that it is more likely to be GM (63, 3%). Second more likely in this category is noted to be the corn (53, 8%) followed by the tomato (34,8%).

The questioning upon the use of GM cultivations and the GM products consumption is focused on consumer's health and safety above all (83%) and then on biodiversity and environmental issues (54,7%) when a percentage of 13, 2% is focused on the issue of world trade's control and global economy.

By applying t-test control for independent samples, it has been indicated that there is no significant statistical difference between genders' beliefs as far as the contribution of genetic modification to the improvement and production of new plant and animal varieties (p=0,771>0, 05 Sig (2-tailed)). Additionally, due to p=0,443 it cannot be concluded that there is significant statistical difference for people aged below 40 years and those aged above 41 about genetic modified plants' ability to produce healthier food.

It is also not rejected that between people of first and third educational level the means of their answers for solving hunger problems in malnourished countries could be contributed by genetic modified plants are the same (p=0,492). The same applies for people living either in city or village about the ability of genetic modified plants to produce healthier food (p=0,236) as well as people working in public or private sector on the issue of GM cultivation having on biodiversity and environment (p=0,463).

The hypothesizes that the answers' means for the question of buying GMF if its price was lower than that of the conventional food and that one of people buying on their own food or somebody else does it could not be rejected for family incomes beneath and above 700€ monthly since p=0,334 and p=0,809 respectively.

4. Conclusions

Following processing on the consumer responses to the questions and the processes using the SPSS program, the following conclusions are appropriate. Generally consumers lack sufficient information on the GM food. Also, a conclusion is that GM food generally applies to new or innovative products, as these are considered to have aim of maximizing the profits of enterprises which produce or possess, despite the offer a superior product. For this reason they are particularly sensitive to the adoption and acceptance of these strict product control rules, which will ensure their own protection.

Furthermore consumers find themselves not ultimately benefit from lower production costs on GM food. Moreover, the prevailing view, which indeed occurs extensively in the media, is that Greek consumers are negative as very negative regarding the Genetic Modified food. The findings of the research shows a relative consumer confusion about the benefits of GM food and a rather clearer picture to identify their shortcomings, but that does not clearly lead us to such a negative image as the one displayed. We would even add that the GM food treated by Greek consumers with the same skepticism that generally address the new / innovative products.

Benefits of GM food (such as solving the problem of hunger in malnourished countries, producing more nutritious and healthy food, contributing to health; the production of edible vaccines) respondents appear not sure. On a scale of one to five, where one corresponds to fully disagree and five on totally agree, the vast majority replied that neither agrees nor disagrees response which is in the middle end of the scale. A slight trend appears to "agree" as an average of responses ranges from 3 to 3.24. The average of 2.48 we found they reply that the transgenic plants are more durable, thereby reducing the use of pesticides and herbicides in crops. A possible explanation for this neutrality could be the lack of adequate information or even some reluctance to answer, since many things still have not been scientifically confirmed.

5. References

1. Walsh, G, 2010. “Biopharmacetiucal approval trends in 2009,” Nature Biotechnology, vol. 28, pp. 917–992
2. Callon, M. 1998, The laws of the Market, Blackwell Publishers, Oxford
3. Lodish, H., Baltimore, D., Berk, A. et al 1995, Molecular Cell Biology, Scientific American Books
4. Mader, S. 1994, Introduction to Biology, WCB Publishers
5. Mittelstrass, J. 2002, The Impact of the New Biology on Ethics, Journal of Molecular Biology, vol.319, s.901-905, EMBL
6. Rabinow, P. 2002, Life Sciences: Discontents and Consolations, Journal of Molecular Biology, vol.319, s.947-955, EMBL

6. Annex I

ATTITUDE OF CONSUMERS ON THE CONSUMPTION OF GENETICALLY MODIFIED FOOD

Dear Madam / Sir,

As part of the Master's program on "Bio-economy and Law, Regulation and Management" implemented by the International Hellenic University, you are kindly asked for your opinion on this investigation.

Your contribution is very important in terms of completing the questionnaire, listed below. The answers to the questions only takes a few minutes.

The answers will be used exclusively for the needs of the Course «Marketing of Bio-Products».

Thank you very much for your cooperation,

The Research Team

Maria Vretta, Maria Georgakopoulou, Nota Gousia Maria, Zapounidou, Maria Silaidi, Tania Tatsika, George Tsipas

Socioeconomic and Demographic Characteristics

1. Gender:

□ Man

□ Woman

2. Age:

□ <25

□ 26-40

□ 41-55

□ > 56

3. Where do you live?

□ In town

□ In village

4. You are a graduate of:

□ Primary Education (Primary, Secondary)

□ Secondary education (High School, Vocational training, Private schools)

□ Higher Education (Universities / TEI)

5. Occupation:

□ State employee

□ Private employee

□ Freelance

□ Student

□ Retired

□ Household

□ Other

□ Unemployed / a

6. Which of the following categories belongs your monthly family income:

□ 0 € - 500 €

□ 701 € - 1000 €

□ 501 € - 700 €

□ 1001 € and above

7. Who buys mostly food products to your family?

□ Myself

□ Other family member

8. How many members composed your family?

.....

Genetically Modified Food

General information:

Genetically Modified Foods are characterized those foods containing or produced from genetically modified organisms.

According to the Law, "genetically modified organism" means any organism, other than humans, in which the genetic material has been altered in a way that does not occur naturally, using genetic techniques.

This technology allows at selected individual genes to be transferred from one organism to another, even among species which are not related to each other (e.g. Transfer of genes between human-plant).

QUESTIONS

Where:

GMF: GENETICALLY MODIFIED FOOD

GM: Genetically modified

GMOs: Genetically Modified Organisms

1. Consumers are informed in connection with the GMF.

Strongly disagree	**Disagree**	**Remain completely neutral**	**Agree**	**fully agree**
1	2	3	4	5

2. Which of the following foods do you consider that are more likely to be genetically modified?

□ Soy

□ Corn

□ Potato

□ Rice

□ Tomato

□ Peas

□ Dairy products

3. The GMF is different than conventional foods.

Strongly disagree	**Disagree**	**Remain completely neutral**	**Agree**	**fully agree**
1	2	3	4	5

4. The Genetic Modification contributes to improvement and production of new varieties of plants and animals.

Strongly disagree	**Disagree**	**Remain completely neutral**	**Agree**	**fully agree**
1	2	3	4	5

5. The GM plants could produce larger harvests, and thus more food in order to solve the problem of hunger in malnourished countries.

Strongly disagree	**Disagree**	**Remain completely neutral**	**Agree**	**fully agree**
1	2	3	4	5

6. GM plants could be used to produce healthier food.

Strongly disagree	**Disagree**	**Remain completely neutral**	**Agree**	**fully agree**
1	2	3	4	5

7. GM plants due to less need to use pesticides and herbicides can contribute to environmental protection.

Strongly disagree	**Disagree**	**Remain completely neutral**	**Agree**	**fully agree**
1	2	3	4	5

8. GM plants due to increased resistance to diseases produce safer products (e.g. having less antibiotics).

Strongly disagree	**Disagree**	**Remain completely neutral**	**Agree**	**fully agree**
1	2	3	4	5

9. The development of GM crops can impact on biodiversity in the balance of nature and the environment.

Strongly disagree	**Disagree**	**Remain completely neutral**	**Agree**	**fully agree**
1	2	3	4	5

10. Genes containing GM foods may be responsible for the appearance of allergy or other diseases.

Strongly disagree	**Disagree**	**Remain completely neutral**	**Agree**	**fully agree**
1	2	3	4	5

11. The controls in Europe for the safety of GMOs is sufficient.

Strongly disagree	**Disagree**	**Remain completely neutral**	**Agree**	**fully agree**
1	2	3	4	5

12. I would buy GMF if the price was lower than that of traditional food.

Strongly disagree	**Disagree**	**Remain completely neutral**	**Agree**	**fully agree**
1	2	3	4	5

13. If I learn that a food is GM, I will change it regardless of the price.

Strongly disagree	**Disagree**	**Remain completely neutral**	**Agree**	**fully agree**
1	2	3	4	5

14. The production and circulation of GMF should be allowed only after long-term out and complete audits.

Strongly disagree	**Disagree**	**Remain completely neutral**	**Agree**	**fully agree**
1	2	3	4	5

15. The packaging-labeling of GM food should be indicate that it is genetically modified.

Strongly disagree	**Disagree**	**Remain completely neutral**	**Agree**	**fully agree**
1	2	3	4	5

16. I will use a pharmaceutical composition as an edible vaccine, even if I knew the genetic modification product.

Strongly disagree	**Disagree**	**Remain completely neutral**	**Agree**	**fully agree**
1	2	3	4	5

17. It should be banned both the production and circulation of all GMF.

Strongly disagree	**Disagree**	**Remain completely neutral**	**Agree**	**fully agree**
1	2	3	4	5

18. The widespread production of GMF will result in a reduction on food prices.

Strongly disagree	**Disagree**	**Remain completely neutral**	**Agree**	**fully agree**
1	2	3	4	5

19. The widespread production of GMF will have no impact on prices.

Strongly disagree	**Disagree**	**Remain completely neutral**	**Agree**	**fully agree**
1	2	3	4	5

20. In which of the following issues are mainly focused on the use of genetically modified crops and the consumption of products derived from GMF:

□ Health and consumer safety

□ The environment and biodiversity of the planet

□ Structures and the future of agriculture

□ Control of international trade and the global economy

□ Local communities in developing and underdeveloped countries

□ The social role and bioethics science and technology

□ Accountability if unforeseen adverse effects

□ Marking and GM organisms control legislation.