Genetically modified maize: exploring consumer acceptance

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Abstract. *Recent EU regulations have imposed mandatory labelling of all food products that consist of or contain genetically modified organisms (GMOs). Labelling should state that "this product contains genetically modified organisms". This study examines how different label messages may affect the attitude of consumers in tasting a specific food product (corn chip) derived from maize presented with five different labels ("organic corn", "conventional corn", "product that contains genetically modified corn", "product that contains genetically modified corn approved by EU", "non-classified corn"). Results of 100 Greek young students show that the label claiming that the product contains genetically modified corn, evokes a deeply rooted negative attitude as more than half of participants (59%) refused to taste even a single piece of the product. The label claiming that the product is genetically modified but approved by EU is viewed as more credible but still 29% refuse to sample. The conclusion is that although the feeling of trust increases considerably when the label message is supported by a certifying agency, still a large proportion (almost one third) of participants of technological level education refuse to taste a product that has been approved by the EU for almost a decade. This result demonstrates with an emphatic way the phobia surrounding genetically modified food. On the contrary, products labelled as "organic" were tasted by the majority of participants, even without any kind of certification.*

Key words: Genetically modified maize, labelling, acceptance

1. Introduction

Genetically modified (GM) maize is the second most important transgenic crop globally, planted in 2005 on 21.2 million hectares (an area that accounts for 24% of global biotech crop area and about 14% of total maize grown globally) (James, 2005). The major trait of genetically modified maize is insect resistance (this variety, also called *Bt* maize, has inserted genes from the bacterium *Bacillus thuringiensis* and produces its own bioinsecticide). However, almost a decade after genetically modified plants have expanded all over the world, the European Union is still engaged in an ongoing debate about the safety of the genetic technology applied to foods (Gaskell et al., 2003, Arntzen et al, 2003). Supporters of the technology state that there are significant benefits from biotech crops in productivity, economics, health and society (James 2005). GM foods

currently available on the international market have undergone risk assessments and are not likely to present risks for human health in any other form than their conventional counterparts (WHO, 2005). As the moratorium imposed on 1998 is coming to an end, more GM varieties are being approved by EU authorities (Europa, 2006a). Moreover, the EU has applied the strictest rules on GM labeling for all GM food products which have been authorized in order to allow consumers to make an informed choice (Europa, 2006b). According to the recent Regulations No 1829/2003 and No 1830/2003, all food products consisting of or containing GMOs should have a label stating that "this product contains genetically modified organisms", although it has been argued that labelling may unfairly stigmatize GM foods undermining their negotiated levels of market access and hence free trade (Sheldon, 2001). European consumers are still very untrusting of statements by scientists and government about GM food issues, due mainly to highly publicized recent food scares in Europe (Bonny 2003, Braun 2002). Several surveys have documented this negative attitude of European people through questionnaires (Gaskell et al., 2003, Grunert et al. 2003, Hursti & Magnusson 2003, Bauer & Gaskell 2002) but the attitudes of consumers after direct experience with a GM food product have been only reported by Lähteenmäki et al. 2002. This study examines the attitudes of young students when asked to taste a specific food product of maize (corn chip) presented with five different labels: organic, conventional, GM, GM approved by EU and non-classified.

2. Methodology

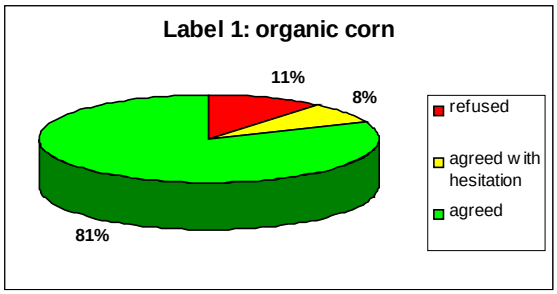
During the academic year 2004-2005, a survey was performed among students of the Technological Educational Institute of Athens (Food Technology Department) to identify their attitudes and acceptance towards maize products that may contain genetically modified ingredients. Participants attended personal interviews in which they were asked whether they would accept to taste five specific types of corn chips. Five non-branded plastic transparent bags of tortilla-type corn chips were presented to the participants, each one having a label specifying the kind of maize that was used as raw material: 1) organic corn, 2) conventional corn, 3) genetically modified corn, 4) genetically modified corn but specifying that the product is approved by the European Union since 1997, Directive 90/220/ EC and finally 5) non classified corn. Types 3 and 4 in reality contained conventional corn chips because GM products were not available in the Greek market. Participants had to fill a relevant questionnaire, by ticking a box for each type of corn chip with a "yes", "no" or "yes with hesitation" answer according to whether they actually tasted at least one piece of the specific corn chip or not or they tasted it but with hesitation. In case that they refused to taste the product they had to fill a multiple choice question, selecting the main reason(s) for not accepting to taste the specific type of corn chip. All data were collected and processed with SPSS 13.0. Corn chips were selected for this trial as a good candidate to investigate the attitudes and acceptance of participants towards a typical genetically modified food, as corn chips are a popular snack in younger ages and also a processed food almost entirely made of maize.

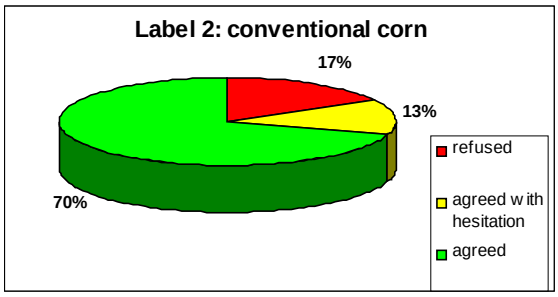
3. Results and Discussion

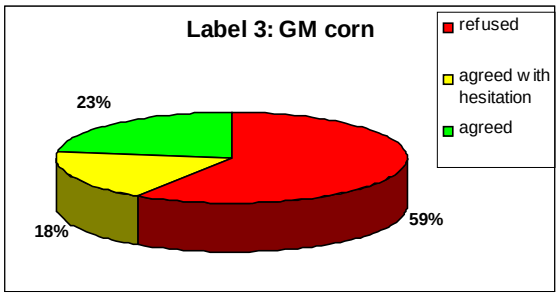
A total of 100 persons (average age 21.2 ± 1.7 years, 39% males, 61% females) participated in the trial. Results are summarized in Figure 1 and Table 1. As shown in Figure 1, organic corn had the highest acceptance as 89% of participants (positive attitude represented by the combination of "agreed to taste" and "agreed with hesitation") actually tasted at least one piece of the product. This result is in agreement with previous studies that have revealed that organically grown food products are trusted by consumers who believe that they are more "natural" and "healthy" than other food products produced with different methods (Hursti & Magnusson, 2003). However, there is a small percentage (11%) that refuse to sample the organic product (the reasons

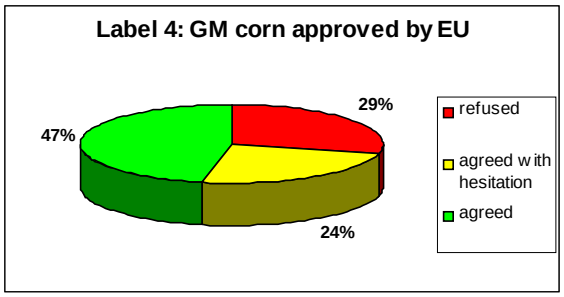
for that attitude are analysed in Table 1). The conventional product also has a relatively high percentage of acceptance (83%), although lower than the organic product. After tasting the organic and conventional product, the participants were asked to taste two genetically modified labelled products. The first GM corn chip was simply labelled as "genetically modified corn", a phrase that is imposed by the EU to be included in labels of all food products that contain or consist of genetically modified organisms. In the second GM product, the certifying agency and date of approval were added to the label as follows: "genetically modified corn, product approved by EU since 1997, Directive 90/220/ EC". It is interesting to note that there was a clear difference observed in the negative attitude towards these two GM labels. The first represented as "GM corn" in Figure 1 had a significant high negative attitude (59%). This means that more than half of the participants refused to taste even a single piece of a snack that is labelled simply as "genetically modified". In the second GM label which was more informative (represented as "GM corn approved by EU" in Figure 1), the negative attitude (participants that totally refused to sample) decreased by 30 percentage units. These results show that the GM label that contains more adequate information creates a feeling of greater trust and this is translated to an increase in the positive attitude among participants in this trial. Therefore, the issue of labelling and the information that includes may greatly influence the attitudes of consumers especially towards food produced through genetic modification which is considered a controversial method of food production.

Figure 1: Results of corn trial with 5 different labels (Label 1 to Label 5). The percentages of participants that a) refused to taste even a single piece of corn chip, b) agreed to taste at least one piece but with hesitation and c) agreed to taste at least one piece of corn chip, are shown for each label. The five labelled products of corn chips were presented with the same order to the participants (first the organic and last the non- classified).


Label 1: organic corn
11%
8%
81%
refused
agreed with hesitation
agreed


Label 2: conventional corn
17%
13%
70%
refused
agreed with hesitation
agreed


Label 3: GM corn
23%
18%
59%
refused
agreed with hesitation
agreed


Label 4: GM corn approved by EU
29%
47%
24%
refused
agreed with hesitation
agreed

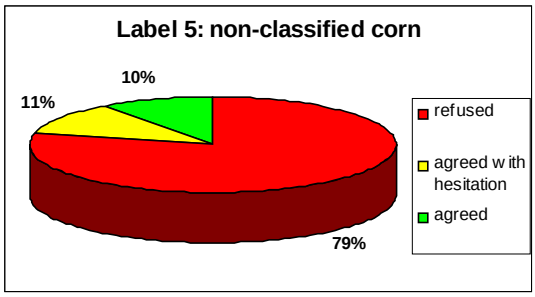

Label 5: non-classified corn
10%
11%
79%
refused
agreed with hesitation
agreed

Table 1: *Main aetiology of refusal (no) and agreement with hesitation of 100 participants to taste the various types of corn chips*

	Organic corn		Conventional corn		GM corn		GM corn approved by EU		Non-classified corn	
	Refuse	Yes with hesita-tion	Refuse	Yes with hesita-ion	Refuse	Yes with hesita-tion	Refuse	Yes with hesita-tion	Refuse	Yes with hesita-tion
Number of participants (N)	N=11	N=8	N=17	N=13	N=59	N=18	N=29	N=24	N=79	N=11
No trust	9.1%	25%	23.5%	7.7%	20.3%	22.2%	41.4%	29.2%	15.2%	-
Do not know what it is	36.4%	62.5%	47.1%	76.9%	10.2%	11.1%	6.9%	-	50.6%	27.3%
Dangerous	-	-	-	-	18.6%	11.1%	10.3%	4.2%	6.3%	-
I am afraid	9.1%	-	-	-	23.7%	5.6%	24.1%	8.3%	20.3%	18.2%
Need more explanations	27.3%	37.5%	23.5%	23.1%	37.3%	44.4%	24.1%	29.2%	39.2%	9.1%
Do not like corn chips	27.3%	-	17.6%	-	5.1%	-	10.3%	-	3.8%	-
Allergy to corn	-	-	-	-	-	-	-	-	-	-

The relatively small percentage (11%) that refused to taste the organic corn chip did so mainly because they were unaware of what exactly is an “organic” product as it is shown by the percentage of respondents that chose “do not know what it is” (36.4%). A limited 9.1% only declared that they do not trust these products and 9.1% that they “are afraid”, but it is interesting to note that these feelings were strong enough to make them refuse to eat the specific corn chip. Conventional corn had a similar answer profile as more than half of the respondents that refused to try it or tried it with hesitation stated that they had this attitude because they did not know what it is. This may be justified by the fact that the term “conventional” which was selected because it is the standard term used to discriminate from organic and GM crops, is not commonly used by consumers in Greece, whereas the term “traditional” may have been more representative. However, none of the participants consider either the organic product or the conventional product as “dangerous”. This is not the case with GM corn which had a large negative percentage (59% of refusals) and is regarded by participants that refused to taste it as “dangerous” (18.6%) or “fearsome” (23.7%). It is interesting to note that in some cases the negative feeling was so strong that participants refused not only to taste the product presented to them but even to touch it, as if it was something highly toxic. Lack of trust was also stated as a main reason for refusing to taste the GM corn chip but surprisingly the “do not know what it is” feature had low percentages. A similar trend is evident for answers concerning the corn labelled as “GM approved by EU” even if the negative percentage is overall much lower compared to that of GM corn (29% compared to 59%). Percentages of participants that consider the product dangerous or that were afraid are relatively high (10.3% and 24.1% respectively) and also there is a large increase in the percentage of participants that “have no trust” compared to GM corn (41.4% for GM approved by EU and 20.3% for GM). This indicates that the group of persons that insisted not to try the product even if it was labelled as “approved by EU since 1997” had a clear belief that the authorities that had approved this product were untrusting. Finally, in the non-classified corn almost all aetiologies had relatively high percentages. This type of corn chip was presented last and it is characteristic that most participants after encountering four different labelled bags of corn chips and after undergoing dilemmas on whether to taste

or not, when they finally reached the last bag which was labelled as "non-classified", they were really reluctant to accept it, even if some of them had earlier tried the GM corn. That is the main reason that the non-classified corn had the highest negative percentage (79%).

4. Conclusions

Stating that a food product "contains genetically modified ingredients" (a label imposed by the EU) still provokes a very strong negative reaction as more than half (59%) of participants, involved in a relative technological subject, refused to taste even one piece of the product stating as main reasons (Table 1) that "more explanations are needed" (37.3%) or "I believe it is dangerous for the health" (18.6%) or even "I am afraid" (23.7%). Of the 41% of participants who agreed to taste it (positive attitude), 18% did so "with hesitation" (Fig.1). Adding to the same statement that "the GM product has been approved by the EU since 1997, Directive 90/220/ EC" clearly creates a more positive attitude: 71% agreed to taste the product (47% agreed and 24% agreed "with hesitation") and the negative attitude dropped by 30 percentage units compared to the previous statement, as only 29% of the participants refused to taste the product. This result indicates that a) consumers may not realize that when a label states that a product is "Genetically Modified", it actually means that this particular GM product has been approved by the strict regulatory authorities of EU but when this information is clearly communicated to them then the feeling of trust increases, b) still the refusal of 29% of participants to taste and the hesitation of 24% to taste a genetically modified product that contains an ingredient that has been approved by the EU for almost a decade demonstrates with the most emphatic way the deeply rooted "phobia" that exists among consumers in a European country and the fact that they do not trust the authorities (Table 1). Corn chips of organic origin or from conventional maize were tasted by the majority of participants (>70%) without hesitation or without requesting certification. Some participants, however, (19% for organic and 30% for conventional) did not actually taste these types of chips or tasted with hesitation stating as main reason that they were unaware of what is "organic" or "conventional".

References

[1] Arntzen C.J., Coghlan A., Johnson B., Peacock J. and Rodemeyer M. (2003), "GM Crops: Science, Politics and Communication", Nature Review Genetics 4: pp.839-843

[2] Bauer, M.W. and Gaskell, G. (2002) Biotechnology-the Making of a Global Controversy, Cambridge University Press, Cambridge, UK

[3] Bonny S. (2003) "Why are most Europeans opposed to GMOs? Factors explaining rejection in France and Europe", (on line) Electronic Journal of Biotechnology, 6 (1) (cited at 27/1/2004), http://www.ejbiotechnology.info/content/vol6/issue1/full/4/

[4] Braun, R. (2002) People's concerns about biotechnology: some problems and some solutions, *Journal of Biotechnology, 98*, 3-8

[5] Europa (2006a) http://europa.eu.int/comm/food/food/biotechnology/authorisation/list_author_gmo_en.pdf

[6] Europa (2006b), http://europa.eu.int/comm/food/food/biotechnology/etiquetage/index_en.htm

[7] Gaskell G., Allum N. and Stares S. (2003) Europeans and Biotechnology in 2002, Eurobarometer 58.0. A report to the EC Directorate General for Research from the project "Life Sciences in European Society", QLG7-CT-1999-00286, March 2003

[8] Grunert, K.G., Bredahl, L., Scholderer, J. (2003) Four questions on European consumers' attitudes toward the use of genetica modification in food production. *Innovative Food Science & Emerging Technologies, 4*, 435-445.

[9] Hursti, U.K., Magnusson, MK (2003) Consumer perceptions of genetically modified and organic foods. What kind of knowledge matters ? *Appetite, 41*, 207-209.

[10] James, C. (2005) Preview: Global Status of Commercialized Biotech/GM Crops: 2005. ISAAA Briefs No.34. ISAAA: Ithaca, NY

[11] Lähteenmäki, L., Grunert, K.G., Astrom , A., Ueland, O., Arvola, A. Bech-Larsen, T. (2002) Acceptability of genetically modified cheese presented a real product alternative. *Food Quality and Preference, 13*, 523-534

[12] Sheldon, I.M. (2001) Regulation of Biotechnology: will we ever "freely" trade GMOs?, *77th EAAE Seminar/ NJF Seminar, August 17-18, Helsinki* No. 325, 2001,.

[13] WHO (2005) Modern food Biotechnology, human health and development: an evidence-based study, Food Safety Department, World Health Organization, 23 June 2005, http://www.who.int/foodsafety