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**IMPACT OF INFORMATION ON BIOTECHNOLOGY PERCEPTION BY
UNIVERSITY STUDENTS**

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Abstract:

This study was aimed to evaluate the potential of scientifically based information on GMO perception considering the prior beliefs and learning effects. This study was carried out during the two days Symposium “*Role of media press in public transgenic debate*” UCM, 2003. To evaluate the possible impact of information we considered the same 81 persons that attended the 2 days conferences. After listening to the speakers, the percentage of respondents who didn't know what to answer diminished in almost 10%, with a decrease of risk perception to 33%. Therefore an impact of information on biotechnology perception was observed.

Keywords

Biotechnology, public perception, GMOs.

Introduction

GM foods acceptance issues, can be based on cognitive processes (influenced by the information received) as well as on affective reactions based on individual emotions, without an agreement between authors related to which is the critical one (Huffman, et al. 2004; Morrow, et al. 2004).

During the last years, governments, political and social organizations have recognized the necessity to transmit the scientific knowledge to the citizens (Rodríguez et al., 2000). Similar recommendations have been formulated by international organisms and cooperation programs in science and technology (FECYT, 2003).

Following this, the Article 23 of the of Cartagena Protocol is dedicated to the understanding and public's participation. The text establishes that the countries members will promote and facilitate the understanding, education and public participation, regarding to the security in the transfer, manipulation and use of GMOs in relation with the preservation and sustainable use of the biological diversity, keeping also in mind the potential risks for human health. Governments, according with their polices and respective regulations, will celebrate consultations with the public in the process of taking decisions related to GMOs and they will transfer to the public the results of those decisions (with the preservation of the confidential information as it is refereed in the article 21), (CDB, 2000).

As Muñoz (2001) mention in his work "Biotechnology and Society", the paper of the information in our society is of great importance, and this should be accessible for all those interested on it and it should be presented in a comprehensible way on the appropriate context. We have to admit that the scientific terminology necessary to explain the process to obtain GM foods is not easy and usually just the mention of the terms "genes" and "genetics" produce rejection (Camara *et al.*, 2002).

Although the development of the biotechnical sector can suppose an economic impact of great potential, its succeed will depend on its social acceptance, and the modification of the social perception is a process that takes time and efforts (ASEBIO, 2004, Marris *et al.* 2001; Monsalve and Camara, 2002).

As we consider that GMO information is important to consumer decision making and considering that the potential economic and social benefits of modern biotechnology may not be reached if consumer perception issues are not adequately addressed, and one of the main factors that can influence on consumers perception is the received information related to this topic; the present work is aimed to evaluate the possible influence of the information received by university students in their agrobiotechnology perception. This study was carried out during the two days Symposium "*Role of media press in public transgenic debate*" on April, 2003, organized by the Journalism Faculty of the Complutense University of Madrid. To evaluate the possible impact of information on risk/benefits perception we considered the same 81 persons that attended the 2 days conferences. Their answers to the survey questions, before and after listening to the speakers, were crossed and analysed.

- MATERIAL AND METHODS

– Surveys description

Two surveys were designed, one for each day. The attendants were asked to complete the survey before and after listening to the speakers.

First day survey consisted on 8 questions related to different issues as previous knowledge on biotechnology, their information sources commonly used, the risks/benefits perception of GM food and the willingness of the assistants to attend to other scientific events. Second day survey consisted on 7 questions which addressed the same first day topics and other new queries that asses the reliability of the students on the information sources as well as the intention of improving their knowledge.

Different types of questions were included in the two surveys:

- Unique answer: Questions 1, 2, and from 4 to 8 of the first day survey and the questions 1, 2, 3, 5, 6 and 7 of the second day survey.

- More than one answer: Questions 3, 6a and 7a of the first day survey, and 5a and 6a of the second day survey. In these questions it was possible to mark more than an answer, according to the approaches of the assistants.

- Scalable punctuation: Question 4 of the first day survey. In it several concepts are offered and assistant was asked to punctuate them from very not to very trustworthy.

- Sample size and distribution

The conferences were attended by 81 persons the first day (32% men and 68% women) and 115 the second with a similar sex distribution, 29.5% men and 70.5% women. For statistical analysis, surveys with more than a question not answered were discarded. From all the attendants 81 were coincident both days and performed the survey appropriately, those were considered as the specific population for the comparative study.

With the purpose of identifying the age of the assistants, and taking into account that the symposium was free, attendants were asked to write their date of birth on the surveys completed. According to this, and considering that it takes 5 years to finish the university studies, attendants were divided in two population groups (older and younger than 23 years)

The first day more than a half of the assistants (64%) were younger than 23 years and we consider them as university students, while the second day this percentage was increased until 70%.

- Statistical analysis

SPSS and SPAD programs were used for the analysis and interpretation of the obtained data. The analyses applied were the following:

- Frequencies: The frequencies were obtained with the program SPSS. The objective is to analyze the distribution of the answers of each variable of the questionnaire.

- Multivariable analysis: In order to evaluate the influence of the age and the sex in the population, two-dimensional analyses were carried out, crossing the two variables respectively with each question. After the application of the chi-square tests, the contingency charts were obtained. A $p < 0.05$ data shows a statistically significant among the different groups.

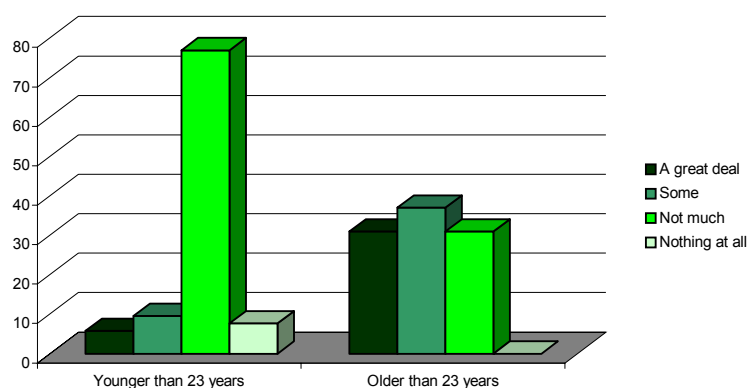
- Non parametrical methods: It was also looked for to be able to value the evolution during the two days of the congress. Common questions included in day 1 and 2 questionnaires were crossed. Different studies were carried out, according to the case, the test of the ranges with sign of Wilcoxon, the test of the signs, and the test of McNemar, with their corresponding contingency tables.

(Cody and Smith, 1997; Everitt, 1992; Lebart *et al*, 1997; Spiegel, 2001; Ward, 1963).

- RESULTS AND DISCUSSION

Attendants were asked about the previous knowledge on biotechnology as well as the sources of information mainly used. More than a half of respondents (60.5%) said to know or to have heard something about biotechnology while only a 4.9% express to heard nothing about it. With significant differences ($p > 0,000$) between the two group of age considered (Figure 1).

Figure 1 – How much have you heard o read about biotechnology?. Differences among ages.

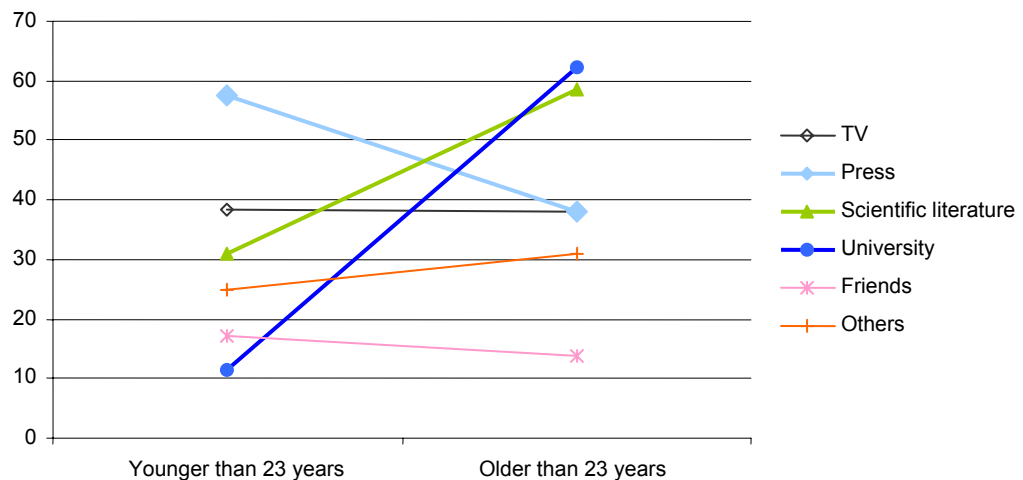


Considering the age, 31% of those older than 23 years said to know a lot, being this percentage ostensibly lower in those younger than 23 years (5.8%). Also this difference is patent in people that express to know enough, with 37% in the case of those older than 23 years, being to 9.6% in the case of those younger than 23 years.

A high percentage of respondents (91.4%) said to know what genetically modified foods were, although almost three thirds of them (72.8%) are considered not enough informed. With significant differences among the different groups of age, since 58.6% of those older than 23 considered themselves as well informed in opposition with most of the university students (90.4%), that express their lack of information.

From the different possible sources to obtain nutritional information, our population is characterized mainly by using the media press (50.6%), followed by the scientific magazines with 40.7% and the television with 38.3%. Other options pointed out were Internet and nutritional information showed in food labels.

Figure 2 .- Where do you obtain your nutritional information? Differences among ages



As it is shown in figure 2, there were significant differences ($p < 0.05$) on sources of information used by the two age groups considered. Scientific magazines were mainly used by those older than 23 years. In contrast students under 23 used mainly the media press (58.6% and 62.1% respectively). The university, is only used as a source of information by the population older than 23 years in contrast with 88.5% of the university students that don't use it.

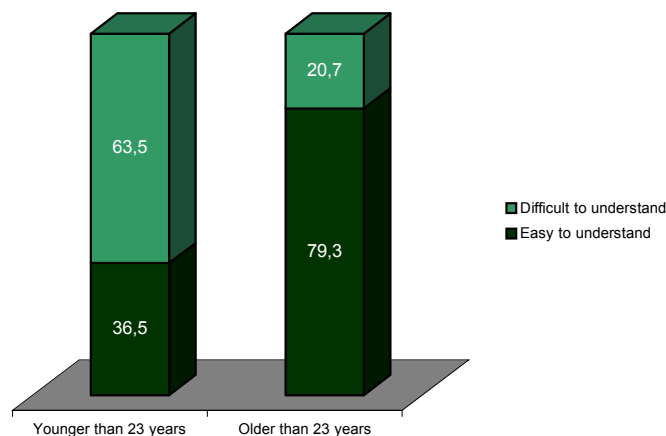
Considering the different issues of trust on information sources, around 80% of respondents expressed to have confidence in scientific societies and 45% in medical profession. On the other hand respondents don't trust in environmental groups (77%), farmers (64.9%) or pharmaceutical industry (54.8%), and less of 50% have confidence in their own government (Table 1).

Table 1.- Ranking of trustworthiness related to organism who inform about biotechnology.

	Not Trustworthy	Trustworthy	Very Trustworthy
The medical profession	16.7	37.7	45.6
National government	48.2	34.2	17.5
Scientific societies	4.3	16.5	79.1
Media press	44.7	31.6	23.7
Environmental groups	77	15	8
Pharmaceutical industry	54.8	29.6	15.7
Farmers	64.9	25.4	9.6

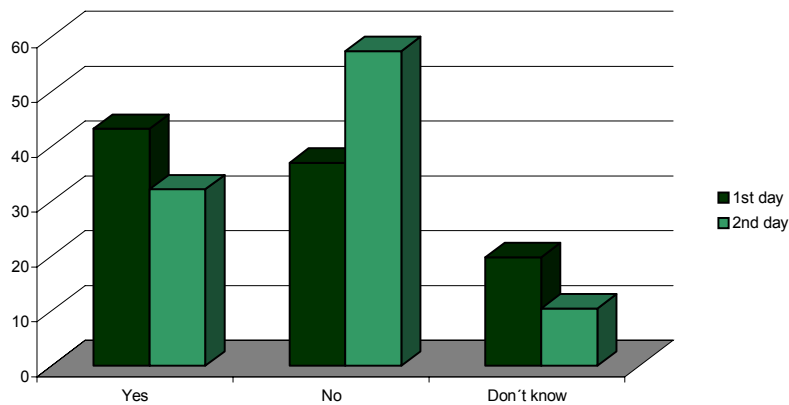
Their main source of information is the press but the sources that offer them higher trustiness are the scientific societies and the medical community. In opposition, the sources that they find less reliable they are the environmentalist organizations and the farmers. One of the factors that can determine the use of a specific source of information or another is the understanding of the language used, generally scientific. The obtained results showed that half of the interviewed population's (51.9%) understood the scientific terminology, while the other half (48.1%) expressed that the terminology related to biotechnology was difficult to understand, with significant differences on the answers of the two groups of age as it is shown in Figure 3.

Figure 3.- Understanding of scientific terminology depending of the age.



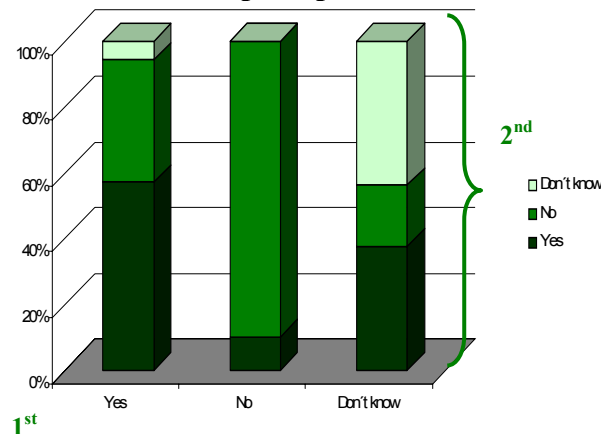
In recent years there have been increasing concerns about potential health risks of GM foods. To evaluate the possible impact of information on risk/benefits perception we considered the same 81 persons that attended the 2 days conferences. Their answers to the survey questions, before and after listening to the speakers, were crossed and analysed. Among the first day respondents, 43.2% of them considered that GMOs bear risks. After listening to the speakers, there was a significant change in respondents opinion about the safety of GM food. The percentage of respondents who didn't know what to answer diminished in almost 10%, with a decrease of risk perception to 33%, and it was also observed an important increase of those who considered that GM food had no risks (Figure 4).

Figure 4 – Respondents risk perception, 2 days survey.



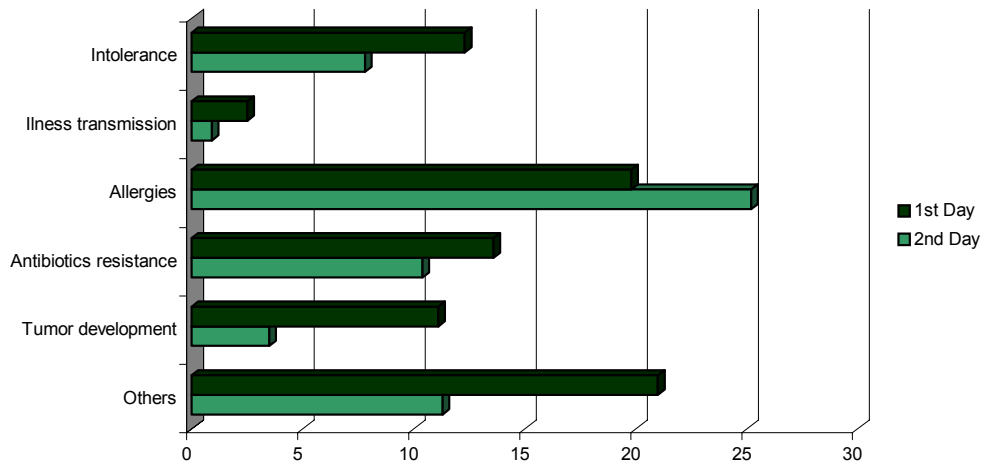
The McNemar test ($p=0.021$) showed that 37.1% of those who initially considered that GMOs have risks, changed their mind after listening to the speakers, while 57.1% maintained their position. From those who didn't have a defined position, 37.5% changed to consider GMOs have risks and 18.8% to “no risk” option (Figure 5).

Figure 5 – Changes on risk/benefits perception of GM food after listening to the speakers.



From the list of potential risk offered, respondents considered allergies (with an increase after listening to the speakers), followed by the possible resistance to antibiotics, as the most significant (Figure 6).

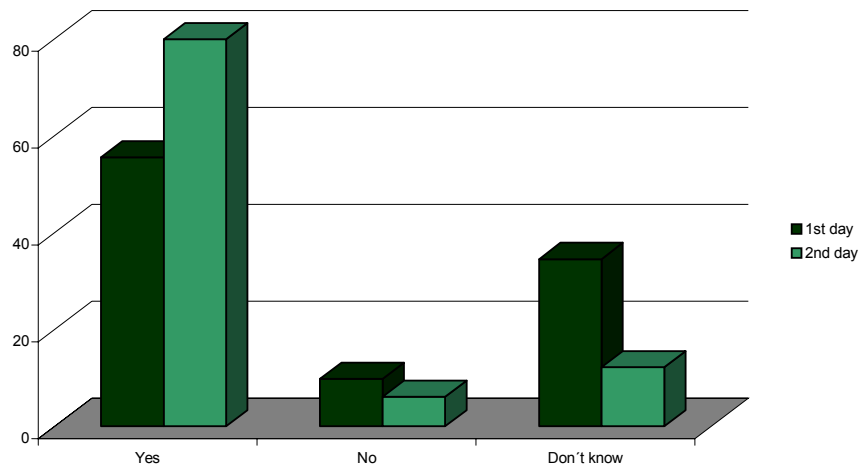
Figure 6. – Potential risk of GM food considered by respondents.



Considering the different aspects of GMOs safety, attendants were also asked about GMOs benefits. Although 34.6% didn't have a defined position, 55.6% of respondents considered that GM food will report benefits to them.

After listening to the speakers, respondents' opinion turned into a more positive position (an increase of 26%). Also the percentage of respondents that didn't know what to answer was reduced in a remarkable way (34.6% to 12.2%). And the percentage of respondents that continued believing that GMOs didn't have benefits was reduced to 6% (Figure 7).

Figure 7 – Do you consider that GM foods will report you benefits?



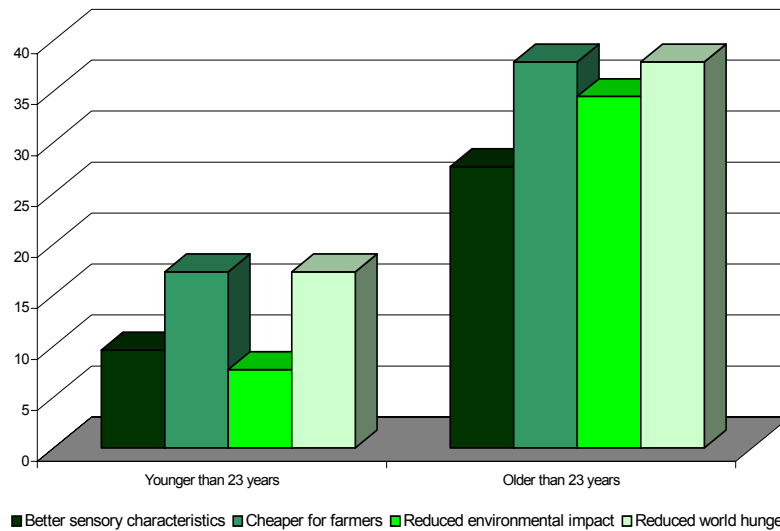
Taking in account only those respondents that the first day denied that GM foods have benefits, 75% of them changed their opinion the second day, while 25% remained constant. Almost the total of respondents who considered GMOs offered benefits to them stayed in the same position (95.6%). Main benefits pointed out by the respondents were a longer shelf life of GMOs products (40.7%), a higher nutrient content (27.2%), and a lower cost for the farmer as well as to reduced the world hunger (both 24.7%). The positive changes in benefits perceptions of GMOs after listening the conferences are shown in Table 2.

Table 2.- Benefit perception relation between the two days survey (taking into account all the respondents that considered GMOs would report them benefits).

			Day 2	
	P value	Day 1	Yes	No
More nutrients	p=0.000	Yes	40.38	1.92
		No	40.38	17.30
Better sensory characteristics	p=0.000	Yes	23.07	1.92
		No	42.3	32.69
Cheaper for farmers	p=1.000	Yes	21.15	17.30
		No	17.30	44.23
Reduced environmental impact	p=0.581	Yes	11.53	15.38
		No	9.61	63.46
Longer shelf life	p=0.020	Yes	59.61	3.84
		No	23.07	13.46
Cheaper for consumers	p=1.000	Yes	17.30	11.53
		No	13.46	57.69
Reduced world hunger	p=0.454	Yes	17.30	19.23
		No	11.53	51.92
Others	p=0.344	Yes	0	13.46
		No	5.76	80.76

As it is shown in figure 8, significant differences on the potential benefits considered by the two age groups of attendants, were found. University students were worried about how to reduce the environmental impact as well as to reduce world hunger.

Figure 8.- Potential benefits of GMO foods.



After receiving the information and considering the McNemar test, the increase on benefits perception was due to an increase on the issues: sensory characteristics, nutrients content and the possibility to extend the shelf life of GM fresh products.

Finally, the attendants were asked about their purchase intention. From their answers we can conclude that 77.4% would choose and buy GM food if they are properly labelled and they offer them advantages, with only a 10.4% of DK/DA.

Respondents were also asked to evaluate the educational activity performed. 58.3% of respondents considered to have learned quite enough, rising it to a 69% if we consider together the options “a lot” and “quite enough”. There were significant differences between the two age groups ($p < 0.05$), since 12.7% of students expressed to have learned a lot and 62% said to have learned quite enough. On the other hand, 5.6% of respondents older than 23 years said to have learned a lot and just the half of them said to have learned quite enough. Respondents younger than 23 years were the ones who ignored more about biotechnology and therefore the ones who have learned more about it (Table 3).

Table 3.- Evaluation of the educational activity performed.

How much have you heard or read about biotechnology?	Have you learned anything else after attending this symposium?			
	A lot	Quite enough	Something	Nothing
A lot (14.8%)	0	66.7	25	8.3
Quite enough (19.8%)	12.5	56.3	31.3	0
Something (60.5%)	14.3	61.2	22.4	2
Nothing (4.9%)	0	50	50	0

Considering the attendants previous knowledge on biotechnology, and their evolution, after attending the symposium, the chi-square tests ($p=0.002$) showed that 14.8% of those respondents that affirmed to know a lot of biotechnology, 66.7% recognized to have learned quite enough. Also, 9.8% of those that said to know quite enough, more than half (56.3%) increased their knowledge. In the case of the 60.5% who said to know something about biotechnology, 61.2% said to have learned enough, and finally the ones who said to know nothing about biotechnology (4.9%), 50% said to have learned quite enough and the other 50% opted for the option of something.

After listening to the speakers, two-thirds of the respondents (78.3%) confirmed they had the intention to participate again in public debates or conferences about biotechnology, with a zero percentage of abstention. In the same way, 85.2% said they would use part of their time to read articles and to see TV programs related to advantages and disadvantages of biotechnology. In this case the percentage of abstention was also very low, a 6.1%. The willingness to participate in public debates was higher in respondents older than 23 years.

Finally, most of the respondents (96.3%) expressed that it was not a lost of time to consult to the public about the GMOs, without significant differences among the two age groups.

- CONCLUSIONS

Although respondents considered to know what GM foods are, they would like to receive more information about them as they expressed their interest on GM foods, specifically those topics related to human health. We found a significant decrease on risk perception (10%) and an increase on benefits perception (26%) after listening the speakers. Most respondents would choose GM foods if they offer them advantages and are appropriately labelled as such.

Related to the evaluation of the activity performed, more than 50% of the attendants said they had learned quite enough during these days, in special those under 23 years. Most of them have the intention to participate again in public debates or conferences related to biotechnology and said they would use part of their time on reading articles and see TV programs.

With independence that trust in GM food has an important affective component, from the results of this case study, we can conclude that the information received has a significant effect on trust, and consumers' acceptance of GM food. Nevertheless due to the controversy on this issue between different authors we will investigate this behaviour more deeply in future studies.

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