

Sultan Qaboos University Students' knowledge and attitudes regarding organic and genetically modified food products

By

Ahmed Al-Rabaani and Ali Al-Shuaili

Curriculum & Instruction, College of education, Sultan Qaboos University

Abstract

The aim of this study was to investigate the knowledge and attitudes of students of Sultan Qaboos University regarding organic and genetically modified food products. Data was collected using a questionnaire that was distributed to 460 randomly selected students from eight colleges of Sultan Qaboos University, with 233 male students and 227 females included in the study. The results showed that students had average knowledge about organic food products but poor knowledge about genetically modified food. They also held highly positive attitudes toward organic food products and negative attitudes toward genetically modified products. The results showed there was a distinction in the knowledge and attitudes of male and female students; while male students had a higher level of knowledge about both types of food, females had stronger attitudes, with more strongly positive attitudes towards organic food products and more strongly negative attitudes towards genetically modified food products. The study also showed that students' knowledge and attitudes differed according to the college to which they belonged.

Keywords: Knowledge, Attitudes, Organic and Modified Food Products, Oman

1. Introduction:

One of the main global world issues we are facing today is the shortage of food production; as a result, millions of people around the world are suffering from hunger. Many people see biotechnology as a solution to this problem. For example, Mohapatra *et al.* (2010) state that biotechnology in general, and genetic engineering in particular, are poised to become one of the most important scientific revolutions of the twenty-first century. They assert that the sequencing of genomes will become commonplace and that the implications of this science and its resultant technologies will dramatically alter the way we fight diseases, grow crops and feed our population. One of the most important developments in recent molecular biotechnology is technical food production (Pardo *et al.*, 2002). This usually involves the transfer of genes from one plant to another in order to produce a better quality plant which can more easily be grown in bulk.

The application of this technology has increased rapidly throughout the world. In 2002, only four countries produced GM food products, while by 2005, farmers in 17 countries were planting genetically modified crops (Gaskell, 2006). The area in which GM crops were grown also increased from 1.7 million hectares in 1996 to 170 million in 2012. The number of farmers increased similarly, from approximately 8.25 million in 2005 to 17.3 million in 2012, with 90% of these farmers in developing countries (ISAAA,2013).

However, the increasingly widespread use of GM food has become controversial due to concerns about its effect on health, as well as philosophical and environmental concerns. This contrasts with people's attitudes to organic foods, which are generally seen as better quality, healthier and tastier (Hartman Group, 2006). In 2013, the World Health Organization (2013) announced that the transfer of the antibiotic-resistant genes inserted into GM food could be transferred to human cells. This announcement added to already negative attitudes resulting from environmental concerns about the possibility of contamination of the crop, as well as of land and water, by pesticides and chemicals (Fromartz, 2006). Social, ethical, philosophical and religious concerns have also added to the controversy. In some developing countries, biotechnology is criticized on the grounds that man is trying to play God; critics

argue that its use in modifying plants and animals takes it into the realm of God and goes against the laws of nature (Hallman et al., 2001).

While people and the media are generally positive towards organic food, there has been heated and critical debate in the media about genetically modified food. This debate has spread into social science, the humanities, politics and public opinion (Stewart & McLean, 2005). Mass media has played a particularly important role in fostering people's knowledge about and attitudes towards genetically modified food (Laros & Steenkamp, 2004). However, for writers like Slovic & Peters, the media has overdramatized and overestimated the health and environmental concerns, making people worry excessively about genetic technology (Slovic & Peters, 2000). The negative attitude of much of the media to GM food has created negative attitudes in the public, and made it difficult for those who support GM food to convince the public to trust their information (Frewer, et al., 2003 ;Albert & Labov, 2003).

The role of educational institutions, especially universities, plays an important part in enhancing people's knowledge about both organic and genetic food products, and shaping their attitudes towards these two different but related developments. There are a number of ways that both knowledge and attitudes of university students can be developed: through their science coursework, through laboratory work, through projects, and through the beliefs of their professors and instructors (Wingenbach et al,2003). Students, who often seem to be more open-minded and rational than the general population, may well have the ability to understand other cultures and ideas and to approach them with less prejudice (Rowley & Hutrado, 2002). Such an academic environment could have an interestingly positive effect on students' knowledge about and attitudes towards GM products, as indicated in studies by (Lewis & Leach, 2006; Prokop et al, 2007).

A number of studies have already examined the effect of both media and educational institutions on the two types of food. The majority of them showed highly positive attitudes towards organic food products (Bredahl, 2001; Frewer et al, 1995; Campbell et al, 2000; Gamble & Gunson, 2002; Honkanen & Verplanken, 2004; Szczurowska, 2005; Banati & Szabo, 2006), attitudes reflected in people's actual behavior, with the demand for the organic food increasing greatly around the world. For example, it has doubled over a few years both in the USA and Austria (Market Research, 2006).

The results of studies concerning levels of knowledge about both organic and GM foods have been mixed. Some have showed that students have adequate knowledge about organic and genetically modified products (Natasa et al,2003; Cavanagh et al, 2005; Al-Jebreen, 2010; Buah,2011)), while others showed that students' knowledge was limited (Patron, 2005; Huang et al, 2006; Turkmen & Darin, 2007; Mohapatra,2010; Ayaz et al.2011).

The current study looks at students in the Sultanate of Oman, one of the fastest developing countries in the Middle East. The chief motivation for the study was the shortage of studies about this topic in this region, and the researchers' thus aimed to investigate the situation of the Omanis and compare it with the situation in other countries. The study is particularly pertinent given that Oman depends heavily on food imports from a wide variety of countries; as some of the food might well be organic or genetically modified, it is important to know whether consumers are aware of the implications of these two rather diverse issues when they purchase their food.

This study concentrates only on Sultan Qaboos University students, and aims mainly to examine the effect of their university courses in developing their knowledge about and attitudes towards both organic and genetically modified food products. The selection of this population was based on the literature which assumes that university students are more highly educated than the general population and have more opportunities to learn about organic and GM food from a variety of sources: their coursework and laboratory work, the opinions of their professors and instructors, and their study of issues related to biotechnology (Wingenbach et al,2003; Fink & Kim,2003).

Purpose of the study:

The aims of the study were to:

- Examine the knowledge and attitudes of Sultan Qaboos University students' regarding organic and genetically modified food products.
- Measure the effect of Sultan Qaboos University courses and academic environment in developing students' knowledge about and attitudes toward organic and genetically modified products.

Research Questions

- What is the level of knowledge of students of the Sultan Qaboos University concerning organic and genetically modified food products?
- Is the knowledge of students of Sultan Qaboos University concerning organic and genetically modified products affected by their gender and the college to which they belong?
- What are the attitudes of the students of Sultan Qaboos University toward organic and genetically modified food products?
- Are the attitudes of students of Sultan Qaboos University toward organic and genetically modified food products affected by their gender and the college to which they belong??

2. Methodology

Sample:

Data was gathered from 460 students in eight colleges. Students were selected randomly from computer labs, coffee lounges, and student associations in each college, as the table shows.

Table 1: Study Sample

College	N	%
Art	64	13.9
Science	72	15.7
Education	135	29.3
Commercial	40	8.7
Medicine	32	7.0
Agriculture	36	7.8
Engineering	46	10.0
Law	35	7.6
Total	460	100.0

Instrument:

The data was gathered through a questionnaire developed based on literature. It included 41 items divided into seven domains or areas. Two measured the students' knowledge about organic and genetically modified food products, while the other five measured attitudes towards the process of genetic modification, the buying of genetically modified products, the buying of organic products, the production of organic materials, and awareness about organic and genetically modified products. The validity was checked through a jury panel while internal consistency reliability was calculated by piloting the questionnaire with 30 students and using Cronbach's alpha coefficient, which was found to be (85.7).

3. Descriptive Results:

What is the level of knowledge of students at Sultan Qaboos University concerning organic and genetically modified food products?

Tables 2 and 3 show the means and standard deviation values of the responses given by the participants concerning their knowledge about organic and genetically modified food products.

Table (2): Students' knowledge about organic food products

Domains	N	Mean	STD
Organic Food Products	460	2.87	.878
Genetically Modified Food Products	460	2.40	.739

Description of means: very low (1-1.49), low (1.5-2.49), average (2.5-3.49), high (3.5-4.49), very high (4.5-5)

The results revealed that student had an average level of knowledge about organic food products, but a very low level of knowledge about genetically modified food.

Is the knowledge of students of Sultan Qaboos University concerning organic and genetically modified products affected (a) by their gender and (b) by their college?

Tables 4 and 5 indicate the mean and standard deviation values, independent samples t-test analysis of variance of the responses given by the participants concerning their knowledge about organic and genetically food products with respect to their gender and the college to which they belong.

Table 4 means, STD and t-test for the gender

Domains	Gender	N	Mean	t. value	Sig
Genetically Modified Products	Male	233	2.56	4.668	.000*
	Female	227	2.2	4.663	
Organic Products	Male	233	3.02	3.720	.000*
	Female	227	2.72	3.718	

*: p<0.05

The results of the t-test showed that gender created little difference in knowledge about organic food, but significant differences concerning knowledge about genetically modified food. Both male and female students had an average level of knowledge about organic food products, but males showed an average level of knowledge about genetically modified products whereas that of females was very low.

Table 5 Results of ANOVA test for the academic faculty

		Sum of Squares	df	Mean Square	F	Sig.
Genetically Modified Products	Between Groups	19.787	7	2.827	5.524	.000*
	Within Groups	231.275	452	.512		
	Total	251.062	459			
Organic Products	Between Groups	3.364	7	.481	.619	.741
	Within Groups	351.103	452	.777		
	Total	354.467	459			

*: p<0.05

The college to which students belonged had no effect on their knowledge about organic food products, but created statistically significant differences in their knowledge about genetically modified food products. Scheffé's test was employed to obtain the post hoc values, with results revealing that Medicine, Agriculture and Science students had a higher level of knowledge about genetically modified food products than students in other colleges (Economics, Engineering, Arts, Education and Law).

What are the attitudes of the students of Sultan Qaboos University toward organic and genetically modified food products?

Table 6 shows students' attitudes toward organic and genetically modified food products, through the mean and standard deviation values of the responses given.

Table 6 means and STD of students' attitudes.

Domains:	M	STD
The process of genetic modification	3.34	.667
Buying genetically modified products	3.66	.765
Buying organic products	4.09	.805
Production of organic food	4.01	1.07
Raising awareness of organic products and genetically modified food	4.37	1.02

The results show that students had a generally negative and skeptical attitude towards the process of genetic modification. There was strong support for passing strict laws to prevent genetic manipulation; students also rejected the transforming of genes in plants and animals, and showed little trust in the information put out by companies producing GM food. They strongly rejected the idea of buying genetically modified products, and stressed that the companies producing these products should clearly label them as GM. Their responses also showed a lack of trust in the information about GM produced by scientists and companies. As a result, they do not want to buy GM food because of its health risks, and strongly advise that GM food products should not be given to children.

In contrast, they hold very positive attitudes toward producing organic food product because of its quality, and health benefits. They hold highly positive attitudes toward buying it and support the expansion of organic food cultivation, limitation of fertilizer use, and limiting of genetically modified seeds. They also strongly support the fostering of community, students' and farmers' awareness about organic and genetically modified food products.

Are the attitudes of students of Sultan Qaboos University toward organic and genetically modified products affected by their gender and academic college?

Tables 7 and 8 indicate the mean and standard deviation values, independent samples t-test analysis of variance of the responses given by the participants concerning their attitudes toward organic and genetically modified food products with respect to their gender and the college they belong to.

Table 7 means, STD and t-test for the gender

Domains	sex	N	Mean	T-value	Sig
The process of genetic modification	Male	233	3.24	.52	.954
	Female	227	3.24	.46	
Buying genetically modified products	Male	233	3.59	.88	.031*
	Female	227	3.74	.60	
Buying organic products	Male	233	3.44	.55	.001*
	Female	227	3.60	.51	
Production of organic materials	Male	233	3.86	1.36	.003*
	Female	227	4.16	.68	
Raising awareness of organic products and genetically modified	Male	233	4.07	1.07	.000*
	Female	227	4.69	.86	
Total	Male	233	3.64	.56	.000*
	Female	227	3.88	.42	

*: p<0.05

The results showed that female students had more strongly negative attitudes than males in four areas, namely: buying genetically modified products, buying organic products, the production of organic materials, and the need to raise awareness about organic and genetically modified products. However, there was no difference in the attitudes to the process of genetic modification, as both male and female

students hold negative attitudes towards it, and also believe that government should be strict about this process.

Table 8 Results of ANOVA test for the academic colleges

Domains		Sum of Squares	df	Mean Square	F	Sig.
The process of genetic modification	Between Groups	2.015	7	.288	1.169	.319
	Within Groups	111.264	452	.246		
	Total	113.279	459			
Buying genetically modified products	Between Groups	13.223	7	1.889	3.337	.002*
	Within Groups	255.862	452	.566		
	Total	269.085	459			
Buying organic products	Between Groups	7.617	7	1.088	3.853	.000*
	Within Groups	127.644	452	.282		
	Total	135.262	459			
Production of organic materials	Between Groups	27.614	7	3.945	3.530	.001*
	Within Groups	505.113	452	1.118		
	Total	532.728	459			
Raising awareness of organic products and genetically modified	Between Groups	26.958	7	3.851	3.839	.000*
	Within Groups	453.433	452	1.003		
	Total	480.391	459			
Total	Between Groups	9.319	7	1.331	5.380	.000*
	Within Groups	111.856	452	.247		
	Total	121.175	459			

*: $p < 0.05$

Examination of the results according to the colleges students belonged to shows clear variables, with statistical differences in their attitudes in all areas, except in their attitudes toward the process of genetic modification. Scheffe's test was used to determine the source of difference. It revealed that students from law, commerce and engineering had the most negative attitudes towards buying genetically modified products. Law and engineering students had the most positive attitudes in two areas, towards buying organic food products and towards organic food production. Science, law and commerce students had more positive attitudes than students in other colleges about the need to develop people's awareness about both organic and genetically modified food products.

4. Discussion:

The results of the study indicated that, in general, Sultan Qaboos University students had a moderate level of knowledge about organic food products, but a poor knowledge level about genetically modified food products. This could be because the university does not offer any special courses about organic and genetically modified food products, and even elective university courses do not cover the topic. Sultan Qaboos University should therefore think about offering at least an elective course to introduce the topic and ensure that students know enough about it. The findings of this study are similar to results of previous studies from other countries, which showed poor knowledge about genetically modified food products in urban China, Turkey and Saudi Arabia (Huang et al., 2006; Banati & Zaabo, 2006; Al-Jebreen, 2010).

It was also found that students' gender affected their level of knowledge about genetically modified products, with male students knowing more than female students. The results of this study differ from the findings of Turkmen & Darin (2007), who investigated students in Turkey. The Omani result could be due to the fact that most students in the colleges of agriculture, engineering and science are male, so

might have had a greater chance to learn about organic and genetically modified food products in their courses. This interpretation ties in with the results of the second question, which showed that Medicine, Agriculture and Science students knew more about genetically modified food products than students in other colleges. According to Wingenbach et al (2003), science students generally have more opportunity than others to gain information about organic and genetic food products through their science coursework, laboratory studies, and the beliefs of their professors and instructors.

The findings about students' attitudes show that they have similar attitudes to students in other countries (Bredahl, 2001; Frewer et al., 1995; Campbell et al., 2000; Gamble & Gunson, 2002; Honkanen & Verplanken, 2004). All these studies found that students had negative attitudes toward genetically modified products but highly positive attitudes toward organic food products. The results of this study could be attributed to common sense and the belief that organic food products are healthy and friendly to the environment (Hartman Group, 2006; Gotschi, 2010). They could also be due to the effect of culture, religious beliefs and environmental attitudes, all of which are powerful in our conservative society and are opposed to the idea of genetic engineering of any kind.

It was also found that gender had a definite effect on students' attitudes. As in studies in other countries, female students had more highly positive attitudes than males (Cutcliffe, 2000; Moerbeek and Casimir, 2005; Wilson & Wood, 2004). It was also found that students' attitudes were affected by the college they belonged to, but it was perhaps surprising that students who studied courses related to food, such as agriculture, science and medicine, had more negative attitudes toward modified food products than students of law and engineering.

Overall, then, the study can conclude that students at Sultan Qaboos University in Oman are similar to other students worldwide in their knowledge about organic and GM food, and in their attitudes to them. Like other students, they lack understanding of GM food (Hallman et al. 2004; Falk et al 2002; Wingenbach et al, 2003; Hallman & Hebden 2005), but have positive attitudes toward organic food and negative attitudes towards genetically modified food products (Finke & Kim 2003; Wingenbach et al, 2003).

However, it can be argued that university students are more highly educated than the public at large, and have greater awareness than most people about the use of biotechnology in agriculture (Finke & Kim 2003); they also have a greater chance to develop their knowledge and attitudes through courses, laboratory work and exposure to the opinions of professors (Wingenbach et al, 2003). In spite of this, their knowledge about both organic and GM foods is relatively low, a fact that can arguably be explained by two factors. First, university students tend to focus far more on their specialist areas of study than on topics like this. A second reason might be that students are not offered courses, activities, projects or involvement in community service work related to organic and genetically modified food products.

5. Conclusions and recommendations:

As the production of food, especially organic and genetically modified, is an important area of general knowledge in contemporary society, it is strongly recommended that Sultan Qaboos University should seriously consider the need to develop students' knowledge about both organic and genetically modified food products and the process of biotechnology. The university also needs to assess the effectiveness of any of its courses that do deal with organic and genetically modified food, to see whether students are gaining adequate knowledge about these two food types, and are developing valid attitudes towards them.

The researcher also suggests that it would be useful to conduct further studies about the reasons behind the low knowledge level of Sultan Qaboos University students about these topics, and to evaluate those courses which do deal with them. A further study examining the knowledge of the general Omani public about organic and genetically modified food products would also be useful.

Acknowledgements:

We thank all students who responded to our study questionnaire, as well as all those who helped us to distribute and collect the questionnaire in the different colleges.

References:

- Alberts, B. M. and Labov, J. B. (2003) The future of biotechnology depends on quality science education. *Electronic Journal of Biotechnology*, at <http://www.ejbiotechnology.info/content/vol6/issue3/editorial.html> (accessed April, 2013).
- Al-Jebreen, D.(2010) Perceptions and attitudes of Riyadh University students towards products derived from genetically modified crops in Saudi Arabia, *Pakistan Journal of Biological Science*, 13(1), 28 – 33.
- Ayaz, A., Bilici, S., Uyar, M., Ay, B., Borekci, S & Kok, E. (2011). Consumer acceptance, knowledge and attitudes towards organic and genetically modified foods: a cross-sectional study among Turkish university students. *Journal of Society for development in new net environment in B&H*, 5(5), 1014-1021
- Banati, D; & Szbo, J. (2006) Knowledge and acceptance of genetically modified foodstuffs in Hungary, *Acta Biologica Szegediensis*, 5, 115- 119.
- Bredahl L. 2001. Determinants of consumer attitudes and purchase intentions with regard to genetically modified foods - results of a cross-national survey. *Journal of Consumer Policy*, 24, 2361.
- Buah, J. (2011). Public Perception of Genetically Modified Food in Ghana, *American Journal of Food Technology*, 6(7), 541-554
- Campbell H, Fitzgerald R, Saunders C and Sivak L. (2000) *Strategic issues for GMOs in primary production: Key economic drivers and emerging issues*. Centre for the Study of Agriculture, Food and Environment, University of Otago, Dunedin, NewZealand.
- Cavanagh, H., Hood, J., Wilkinson, J. (2005). Riverina high school students“ views of biotechnology, *Electronic Journal of Biotechnology*, 8(2), 121-127.
- Chrioph, B.; Bruhn, M & Roosen, O(2008). Knowledge, attitudes towards and acceptability of genetic modification in Germany. *Appetite*, July. 51(1), 58-68.
- Cutcliffe, S.H. (2000) *Ideas, Machines, and Values: an Introduction to Science, Technology, and Society Studies*. Rowman & Littlefield, Lanham,MD.
- Darcin, E., & Turkkmen, L. (2007) A comparative study of Turkish elementary and science education major students' knowledge levels at the popular biotechnological issues, *International Journal of Environmental & Science Education*, 2(4), 125-131.
- Finke, M. & Kim, H. (2003). Attitudes about genetically modified foods among Korean and American college students. *Agbioforum*, 6(4), 1-7.
- Finke, M.S., and Huston, S.J. (2003). The brighter side of financial risk: Financial risk tolerance and wealth. , 24(3), 233-256.
- Frewer L J, Howard C and Shepherd R. (1995). Genetic engineering and food: what determines consumer acceptance? *British Food Journal*, 97, 31-36.
- Fromartz, S. (2006). *Organic, Inc.: Natural foods and how they grew*. New York: Harcourt Trade Publishers
- Gamble J and Gunson A. (2002) *The New Zealand Public's Attitudes Regarding Genetically Modified Food*. Hort Research, Mt Albert, New Zealand.

- Gaskell, G., Centre for the study of Bioscience BBaSB.(2006). *Europeans and Biotechnology in 2005: Patterns and Trends*. Eurobarometer 64.3.
- Gotschi, E. (2010) The role of knowledge, social norms, and attitudes toward organic products and shopping behavior: survey result from high school student in Vienna, *The Journal of Environmental Education*, 41(2), 88- 100
- Hallman, W; Adelaja, B; Schilling, B and Lang, J. (2001). *Consumer Beliefs, Attitudes and Preferences Regarding Agricultural Bio-technology*, Food Industry Centre, Food Policy Institute, University of Minnesota, New Brienswick, New Jersey
- Hartman Group (2006). *Organic2006: Consumer attitudes & behavior – five years later & into the future*. Retrieved on October 1, 2006 from <http://www.hartman-group.com/products/studyOrganic2006.html>
- Honkanen P, Verplanken B. (2004). Understanding attitudes towards genetically modified food: the role of values and attitude strength. *Journal of Consumer Policy* 27, 401–420.
- Huang, J; Qiu, H; Bai, J; & Pray, C. (2006) Awareness acceptance of and willingness to buy genetically modified foods in Urban China, *Appetite*, (46), 144- 151.
- ISAAA (International Service for the Acquisition of Agri-Biotechnology Applications).(2013). *Global Status of Commercialized Biotech*. <http://www.isaaa.org/resources/publications/briefs/44/executivesummary/> (July 27, 2013).
- Laros F and Steenkamp J-B E M. 2004. Importance of fear in the case of genetically modified food. *Psychology and Marketing*, (21), 889-908.
- Lewis, J., & Leach, J. (2006). Discussion of socio-scientific issues: The role of science knowledge. *International Journal of Science Education*, 28(11), 1267-1287.
- MarketResearch.com (2006). Organic on the menu: Healthy eating trends in Message and Messenger on Consumer Perceptions of Labels and Products, *Food Policy*, (32),49-66.
- MarketResearch.com (2006). Organic on the menu: Healthy eating trends in Moerbeek, H. & Casimir, G. (2005) Gender differences in consumers' acceptance of genetically modified foods. *International Journal of Consumer Studies*, 29, 308–318.
- Mohapatra, A., Priyadarshin, D & Biswas, A. (2010). Genetically Modified Food: Knowledge and Attitude of Teachers and Students, *Journal of Science Education and Technology*, 19, 489-497
- Natasa, R; Vesna, B and Sanda, R. (2003). Attitudes of the Croatian population toward genetically modified food, *British Food Journal*, 105,(3), 148-161
- Oguz, O. (2009) Attitudes of consumers toward the effects of genetically modified organisms (GMOs): The example of Turkey *Journal of Food, Agriculture & Environment*, 7 (3&4), 1 5 9 - 1 6 5.
- Pardo, R., Midden, C., & Miller, J. D. (2002). Attitudes toward biotechnology in the european union. *Journal of Biotechnology*, 98 (1), 9-24.
- Patron, D.(2005) A survey of genetically modified food consumed, health implications and recommendations for public health food safety in Trinidad, *Journal of Food Safety*, 7, 4 – 14.
- Patron, D.(2005) A survey of genetically modified food consumed, health implications and recommendations for public health food safety in Trinidad, *Journal of Food Safety*, (7) 4 – 14.
- Peters, E & Slovic, P (2000), 'The springs of action: Affective and analytical information processing in choice', *Personality and Social Psychology Bulletin*, 26, 1465-1475
- Prokop P, Lešková A, Kubiátko M, Diran C (2007). Slovakian students' knowledge of and attitudes toward biotechnology. *Int. J. Sci. Educ.* 29(7), 895-907.

- Rowley, L.L. and Hurtado, S. (2002). *The non-monetary benefits of an undergraduate education*. University of Michigan. Center for the Study of Higher and Postsecondary Education.
- Stewart,P& Mclen,W.(2005). Public opinion toward the first, second, and third generations of plant biotechnology. *In Vitro Cellular and Developmental Biology-Plant*, 41 (6), 718-724.
- Szczurowska, T. (2005) Poles on biotechnology and genetic engineering. TNS OBOP, Plant Breeding and Acclimatization Institute, Radzikow. <http://www.ihor.edu.pl>
- Türkmen L, Darcin ES (2007). A Comparative Study of Turkish Elementary and Science Education Major Students' Knowledge Levels at the Popular Biotechnological Issues. *Int. J. Environ. Sci. Educ.* 2(4), 125-131.
- WHO (World Health Organization). (2013). *Antimicrobial Resistance*. Fact sheet No. 194. Available: <http://www.who.int/mediacentre/factsheets/fs194/en/index.html> [accessed 22 July 2013].
- Wilson, G. & Wood, K. (2004) The influence of children on parental purchases during supermarket shopping. *International Journal of Consumer Studies*, 28, 329–336
- Wingenbach, G., Rutherford, T&Dunsford, D. (2003). Agricultural communications students' awareness and perceptions of biotechnology issues. *Journal of Agricultural Education*, 44(4),80-93.