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College Students' Cognition of Genetically Modified Foods

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Abstract In order to have knowledge about the college students' awareness and acceptance of genetically modified foods and their attitudes toward the identification of genetically modified foods and the government's regulation, we conduct a questionnaire survey of 150 college students' cognition of genetically modified foods in North College Town of Zhengzhou City. The results show that the college students have a certain understanding of genetically modified foods, but the cognition level is low; electronic media has become the main channel for the current college students to know the information about genetically modified foods; for security reasons, the majority of college students are wary of genetically modified foods, and pay more attention to whether there is genetically modified component in the foods labeling; college students generally believe that the government should strengthen the supervision of genetically modified foods, and make the GM labeling system strict, to protect consumers' right to know and choice.

Key words College students, Genetically modified foods, Cognition, Questionnaire survey

1 Introduction

Genetically modified foods (GM foods, or biotech foods) are foods produced from genetically modified organisms (GMOs), specifically, genetically modified crops. GMOs have had specific changes introduced into their DNA by genetic engineering techniques^[1]. These techniques are much more precise than mutagenesis (mutation breeding) where an organism is exposed to radiation or chemicals to create a non-specific but stable change. Other techniques by which humans modify food organisms include selective breeding and somaclonal variation. Commercial sale of genetically modified foods began in 1994, when Calgene first marketed its Flavr Savr delayed ripening tomato. Typically, genetically modified foods are transgenic plant products: soybean, corn, canola, and cotton seed oil. These may have been engineered for faster growth, resistance to pathogens, production of extra nutrients, or any other beneficial purpose. GM livestock have also been experimentally developed, although as of July 2010 none are currently on the market. There is broad scientific consensus that food on the market derived from GM crops poses no greater risk to human health than conventional food. However, critics have objected to genetically modified foods on several grounds, including safety issues, ecological concerns, and economic concerns raised by the fact GM plants (and potentially animals) that are food sources are subject to intellectual property law. The "Big Butterfly" incident in America in 1998 sparked wide discussion on the safety of genetically modified foods. Subsequently, some incidents, such as "GM Maize Contamination" in Mexico in 2001, "GM Super Weeds" in Canada in 2002 and "GM Maize" in Monsanto in 2005, have set off another round of controversy on GM crops (foods).

In November 2009, the Ministry of Agriculture issued the se-

curity certificate for two kinds of genetically modified rice varieties and one kind of genetically modified maize variety, which triggered controversy on genetically modified staple foods nationwide. The incidents "Xianyu 335" in 2010 and "Golden Rice" in 2012 have once again set off the great debate on whether genetically modified foods (crops) bring health risks to people and how to strengthen the management of genetically modified foods or crops. Whether genetically modified foods are safe, whether it should be commercialized, whether it is labeled, what policies do China take on genetically modified foods, and other issues, have become people's focus of attention along with the development of these events.

We take the special group of college students as the object of survey, to learn the college students' understanding and acceptance of genetically modified foods, as well as their cognition of labeling of genetically modified foods and the government's regulation. We research the college students' cognition and awareness of genetically modified foods and the related techniques in North College Town of Zhengzhou City, in order to provide useful information for the government to grasp consumers' cognition, take scientific and effective regulatory measures for genetically modified foods.

2 Design of questionnaire and selection of survey site

2.1 Design of questionnaire The questionnaire is mainly focused on the following aspects to carry out survey: the channels for college students to understand genetically modified foods and obtain information; requirements and attitude toward the identification of genetically modified foods; acceptability and consumption tendency of genetically modified foods; attitude towards the state regulation of genetically modified foods; awareness of security of genetically modified foods^[2-5].

There are 18 questions in the questionnaire, divided into seven groups.

(1) Q1 What do you think of DNA? Q2 Have you heard of

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genetically modified foods? Q3 Do you understand the meaning of genetically modified foods? These three questions reflect the college students' cognition of genetically modified foods.

(2) Q How do you know genetically modified foods? This question can reflect the channels for college students to obtain information.

(3) Q1 Have you ever eaten genetically modified foods? Q2 Have you purchased genetically modified foods? Q3 Do you prefer genetically modified foods or traditional foods when the prices are the same? Q4 What are the common genetically modified foods? These questions focus on surveying the college students' attitudes and acceptance towards genetically modified foods.

(4) Q1 Will you pay attention to whether there are genetically modified ingredients in the ingredients of commodities when you shop usually? Q2 Do you think the genetically modified foods should be labeled? These two questions can indicate the college students' understanding and attitudes on the identification of genetically modified foods in the Chinese market.

(5) Q1 Do you think genetically modified foods are safe? Q2 What are the major factors influencing your purchase of genetically modified foods? Q3 Do you think what is the total effect of genetically modified foods on social life? Q4 Do you think what impact the genetically modified foods will produce on the society? These questions aim to survey college students' awareness of safety and social influence of genetically modified foods.

(6) Q1 Do you think the domestic regulation of genetically modified foods is effective? Q2 What measures do you think the government should take to regulate genetically modified foods? These questions are to explain college students' awareness of the state regulation on genetically modified foods.

Table 1 College students' cognition of genetically modified foods

	Knowledge of DNA		Whether having ever heard of genetically modified foods		Understanding of genetically modified foods		
	Correct	Wrong	Yes	No	Know nothing	Know a little	Know a lot
The number of people selecting options	75	60	123	12	22	109	4
Percentage//%	55.56	44.44	91.11	8.89	16.30	80.74	2.96

3.2 The channels for college students to obtain information on genetically modified foods From the channels for college students to obtain information on genetically modified foods (Table 2), it is found that 45.93% of the people know the information through the Internet, television and other electronic media; 22.96% of the people know the information through newspapers and magazines; 20.74% of the people know the information through professional books; 10.37% of the people know the information through friends, family, and other ways.

This indicates that currently the electronic media has replaced traditional paper media to become the major way for the contemporary college students to obtain information and communicate. In recent years, people mainly carry out the discussion on the safety of GM technology and products through network, which

(7) Q1 Should the genetically modified foods be developed? Q2 Do you think genetically modified foods will eventually replace traditional foods? These two questions aim to understand college students' awareness of the development prospects of genetically modified foods.

2.2 Survey object and research method The survey object is the college student in the North College Town of Zhengzhou City, and the survey site is the campus of Zhengzhou Normal University and Zhongzhou University. A total of 150 questionnaires were distributed and 135 valid questionnaires were called back.

3 Results and analysis

3.1 College students' cognition of genetically modified foods

From college students' cognition of genetically modified foods (Table 1), college students are familiar with the term of genetically modified foods. 91.11% of consumers said they had heard of genetically modified foods, but 44.44% of the people did not know the science meaning of DNA, and only 55.56% of the people made it clear that DNA is the genetic material, indicating that most people have heard of genetically modified foods, but almost half of the people do not learn from the nature of genetically modified foods.

In terms of understanding of science meaning of genetically modified foods, about 80.74% of the people had a little understanding of genetically modified foods, 16.30% of people just heard of the term of genetically modified foods, but did not know about it, and only about 2.96% of people said they well knew genetically modified foods.

has also proved this point. In addition, due to rich university library resources, it provides the route and place for the students to obtain information through reading professional books, newspapers and magazines.

Table 2 The channels for college students to obtain information on genetically modified foods

	The channels for obtaining information			
	Internet and TV	Newspapers and magazines	Professional books	Others
The number of people selecting options	62	31	28	14
Percentage//%	45.93	22.96	20.74	10.37

3.3 College students’ acceptance and consumption propensity of genetically modified foods From the survey results on college students’ acceptability and consumption propensity of genetically modified foods (Table 3), we find that 20.7% of the people know that they have eaten genetically modified foods; 23.7% of the people think that they have not eaten genetically modified foods; 55.6% of the people do not know clearly about whether eating genetically modified foods; 15.56% of the people say that they once bought genetically modified foods, 22.2% of the people say that they have not bought genetically modified foods, and

Table 3 College students’ acceptability and propensity to consume

	Whether having eaten genetically modified foods			Whether having purchased genetically modified foods			Preferred products		
	Yes	No	Do not know	Yes	No	Do not know	Genetically modified foods	Traditional foods	Does not matter
The number of people selecting options	28	32	75	21	30	84	13	102	22
Percentage//%	20.7	23.7	55.6	15.6	22.2	62.2	9.6	75.6	16.3

3.4 College students’ understanding and attitudes on the identification of genetically modified products in the domestic market From the survey results on college students’ understanding and attitudes on the identification of genetically modified products in the domestic market (Table 4), 45.93% of the people will be very careful about whether the merchandise contains genetically modified ingredients when purchasing products, 35.56% of the people do not pay attention to this point, and 18.52% of the people say that whether there are genetically modified ingredients in the merchandise has little impact.

Table 4 College students’ cognition and attitudes on the identification of genetically modified products

	Whether paying attention to the genetically modified ingredients in the raw materials of commodity			Whether the genetically modified foods should be labeled		
	Very concerned about	Do not notice	Do not care about the impact	Yes	No	Does not matter
The number of people selecting options	62	48	25	120	5	10
PercentageB//%	45.93	35.56	18.52	88.89	3.70	7.41

3.5 College students’ awareness of safety of genetically modified foods From the survey results on college students’ awareness of safety of genetically modified foods (Table 5), only 6.67% of the people believe that genetically modified foods are safe; 55.56% of the people believe that genetically modified foods are harmful; 37.78% of the people say they do not know about whether the genetically modified foods are harmful. When considering whether to buy genetically modified foods, 62.96% of the people think that safety is an important factor influencing their selection of genetically modified foods; 16.30 % of the people select genetically modified foods, due to high nutritional value; 12.59% of the people believe that they will choose genetically modified foods, due to low price; 8.15% of the people choose genetically modified foods due to the taste.

In terms of the effects of genetically modified foods on socie-

62.2% of the people do not know whether they have bought genetically modified foods.

In terms of the propensity to consume, 75.6% of the people prefer traditional foods for security reasons; only 9.6% of the people believe that genetically modified foods are more nutritious than traditional foods; the remaining 16.3% of the people hold indifferent attitude toward the choice of genetically modified foods or traditional foods, and believe that whether it is genetically modified food does not make much difference.

In terms of whether the genetically modified foods should be labeled, 88.89% of the people believe that genetically modified foods should be labeled, so that consumers have the right to know and choose; 7.41% of the respondents hold indifferent attitude toward whether it is labeled; only 3.7% of the people believe that there is no need to be labeled.

The results show that in terms of the attitudes toward whether the genetically modified foods should be labeled on the market, the majority of college students think that consumers’ right to know and choose on genetically modified foods should be respected.

ty, 43.70% of the people think that advantages and disadvantages are evenly matched; 17.04% of the people think that advantages outweigh disadvantages; 12.59% of the people think that disadvantages outweigh advantages.

3.6 College students’ attitude towards the government’s regulation of genetically modified foods From the college students’ attitude towards the government’s regulation of genetically modified foods (Table 6), 54.07% of the people believe that government’s regulation lacks intensity; 12.6% of the people believe that government’s regulation is not very good; 33.33% of the people do not know about whether the government regulates genetically modified foods; almost no one believes that the current government’s regulation of genetically modified foods is very effective.

For the government’s regulation and monitoring of genetically

modified foods, no one thinks that genetically modified foods should be completely banned; 25.19% of the people think that the government should implement strict approval system, and strictly control the production and import of genetically modified foods; 61.48 % of the people require a special eye-catching sign on genetically modified foods, to protect the citizens' right to know, so that the public can choose on their own judgment;

Table 5 College students' awareness of safety of genetically modified foods

	Do you think genetically modified foods are safe?			Factors influencing the purchase of genetically modified foods				The total effects of genetically modified foods on social life			
	Safe	Unsafe	Unclear	Nutritional value	Price	Security	Taste	Advantages outweigh disadvantages	Disadvantages outweigh advantages	Advantages and disadvantages are evenly matched	Do not know
The number of people selecting options	9	75	51	22	17	85	11	23	17	59	36
Percentage//%	6.67	55.56	37.78	16.30	12.59	62.96	8.15	17.04	12.59	43.70	26.67

Table 6 College students' attitude towards the government's regulation of genetically modified foods

	The current government's regulation of genetically modified foods				How does the government regulate?			
	Very strong	Just so so	Lack of intensity	Do not know	Complete ban	Implement strict examination and approval system, strictly control the production and import of genetically modified foods	The public judge for themselves	Strengthen publicity, so that the public have an accurate understanding
The number of people selecting options	0	17	73	45	0	34	83	18
Percentage//%	0	12.60	54.07	33.33	0	25.19	61.48	13.33

3.7 Prospects for the development of genetically modified foods From the prospects for the development of genetically modified foods (Table 7), 45.93% of the people think that it is necessary to develop genetically modified foods; 25.18% of the people think that we should not develop genetically modified foods; 28.89% of the people hold indifferent attitudes.

As for whether the genetically modified foods will eventually

replace traditional foods, 48.15% of the people think that traditional foods and genetically modified foods will coexist; 38.52% of the people think that genetically modified foods will not replace traditional foods, and traditional foods still occupy the main location on the market; only 3.7% of the people believe that genetically modified foods will eventually replace the traditional foods.

Conspicuously, consumers want to know more about the knowledge of genetically modified, and have the right to know genetically modified products.

Table 7 College students' cognition of prospects for the development of genetically modified foods

	Should we develop genetically modified foods?			Will genetically modified foods eventually replace the traditional foods?			
	Yes	No	Does not matter	Yes	No	Coexist	Do not know
The number of people selecting options	62	34	39	5	52	65	13
Percentage//%	45.93	25.18	28.89	3.70	38.52	48.15	9.63

4 Conclusions

The survey results show that the college students in North College Town of Zhengzhou City universally have some knowledge about genetically modified foods, but the cognition level is low; electronic media has become the main channel for the current college students to know the information about genetically modified foods; for security reasons, the majority of college students are wary of genetically modified foods, and pay more attention to whether there is genetically modified component in the foods labeling; col-

lege students generally believe that the government should strengthen the supervision of genetically modified foods, make the GM labeling system strict to protect consumers' right to know and choice, and strengthen the publicity, so that consumers can have a more objective understanding of genetically modified foods.

5 Discussions

Since its inception, genetically modified foods have been aiming to pursue lowering foods costs, increasing nutrition and improving

quality, so genetically modified foods have greater competitive advantages than traditional foods, but they may cause potential risks and threats to human health and the environment, which is a problem that people have been concerned about.

In recent years, many scholars have carried out survey and research on consumers' awareness, attitudes, acceptance, and purchase intention for genetically modified foods^[6-16]. Yan Gongcui et al^[6] take the people of Shanghai as a sample to survey consumers' awareness, attitudes, acceptance, and purchase intention for genetically modified foods as well as the influencing factors, and find that consumers' awareness of genetically modified foods is still at low level. Hu Hao et al^[8] find that with the rising level of education of consumers, fewer and fewer consumers will choose genetically modified foods. Fan Liyan et al^[5] believe that the identification situation of genetically modified foods on the market is still rather chaotic. Wang Ruidong et al^[9] use the survey data on consumers' cognition of genetically modified foods in Wuhan City, and find that consumers' cognition of genetically modified foods is mainly affected by level of education. Chen Ying et al^[12] survey the consumers' cognition of genetically modified foods and willingness to purchase genetically modified foods in the Yanbian Area, and find that consumers' cognition level of genetically modified foods is not high in this area, and the willingness to purchase is also low. Ge Liqun et al find that consumers' willingness to purchase is affected by the individual characteristics, socio-economic factors, initial attitude and cognitive level^[13]. Chen Yinzhen et al survey 928 science and engineering graduates and the results show that the proportion of science and engineering graduates absolutely "supporting" or "against" genetically modified organisms is not high, and 65.2% of respondents hold the attitude of "cautious support"; on the one hand, it is necessary to strengthen carrying out scientific research on genetically modified organisms, and on the other hand, it is necessary to be concerned about the potential risks of genetically modified organisms^[16].

Based on this research and the above findings, we put forth the following recommendations:

The government departments should strengthen the knowledge publicity of networks and other new electronic media on genetically modified foods while continuing to use traditional media such as radio, television and newspapers for publicity, so that consumers have correct and objective understanding of genetically modified foods anytime, anywhere; in the future, it is necessary to focus on strengthening the improvement and promotion of labeling system of genetically modified foods, and fully embody the people-oriented principle to respect the consumer's right to know and consume, so that consumers can plainly consume; it is necessary to formulate relevant laws and regulations, increase supervision and testing of genetically modified foods, regulate the relevant enterprises' pro-

duction and sales of genetically modified foods; it is necessary to resolutely crack down on the manufacturers unauthorized or discretionally adding genetically modified ingredients to the food, to adequately protect consumers' food safety.

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