

## Chinese Consumers' Attitude towards Genetically Modified Foods-Taking Genetically Modified Soybean Oil as an Example

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### Abstract

China is the largest importing country of Genetically Modified (GM) soybean produced in the USA. Oil made from the GM soybean is the main edible oil for Chinese consumers. Chinese traditional culture does not against the GM food, but since 2013, some celebrities has taken a public stand against GM food, and following these celebrities, Chinese consumers has showed diverse attitude toward GM food. This study investigated Chinese consumers' attitude toward edible oil made from GM soybean based on a survey conducted in Hangzhou China. The findings revealed that most Chinese consumers generally hold positive or neutral attitude toward GM soybean oil, and rarely have sufficient biological knowledge. Respondents' age and educational background do not correlate to their acceptance of GM soybean oil. Income level is the most important factor influencing Chinese consumers' acceptance. The growth of Chinese consumers' income and negative publicity from social media might cause Chinese consumers' attitude toward GM soybean oil more conservative in the future. The promotion of GM soybean oil in China will be more difficult and challengeable.

**Keywords:** Chinese consumer; Genetically modified foods; Soybean oil; GM

### Introduction

China is the largest importing country of Genetically Modified (GM) soybean produced in the USA. Import of GM soybean increased year by year. In 2013, nearly 60 million tons of GM soybean was imported into China, 40% of the amount was from the USA. Oil made from the GM soybean is the main edible oil for Chinese consumers. Chinese traditional culture does not against the GM food [1]. The belief of science and technology constituting a primary productive force made Chinese people willing to accept the most advanced achievements of science and technology, including GM food.

GM food has been introduced into China over 10 years. Public has showed no specific attitude towards the GM food, but since 2013, some celebrities has taken a public stand against GM food, they suggested GM soybean oil was tightly related to cancer and infertility, which triggered a new round of fierce debate. Following these celebrities, Chinese consumers' attitude towards GM food becomes more negative.

Previous findings from Europe, Japan and China showed various factors influence consumer attitudes towards GM soybean oil: age, educational background, income level, celebrities' attitude, media publicity, etc [2]. These factors can be classified into internal and external factors. In this study, not only the influence of internal factors including age, educational background, income level were examined, also celebrities' attitude, media publicity and characteristic of GM soybean oil that were regarded as external factors were employed to investigate the formulation of Chinese consumers' attitude toward edible oil made from GM soybean based on a survey conducted in Hangzhou China. The results of this study not only offer an insight of Chinese consumers' attitude towards GM food, also have practical implications to the administrators of both GM food consumption and production countries.

### Methods

#### The procedure of survey

An on-site survey was conducted on March 2014 for over three weeks at Hangzhou national new & hi-tech development zone,

Hangzhou China. The Chinese consumers were approached at the main entrances of five supermarkets located in different places of the area. Chinese consumers were invited to fill in the questionnaire about their awareness and acceptance of general GM food and different kinds of GM food in the type of Yes or No question. Moreover, their attitude towards GM soybean oil, the influence of media and characteristic of GM soybean oil on their attitude and their demographic information were recorded. The question about attitude towards GM soybean oil is a categorical choice including positive, negative and neutral. The question about influence of media on GM soybean oil is a single-choice question. The one about characteristic of GM soybean oil is a sorted listing question.

Ten pre-trained survey assistants from the Zhejiang Chinese Medical University explained the questions in the questionnaire for respondents and recorded the answers to minimize the number of uncompleted questionnaires, and insure respondents' understanding of questions and items. Finally, 285 valid questionnaires were collected.

#### Participants

The profile of respondents is displayed in Table 1. The respondents were almost equally grouped by gender. Most respondents were in their 25 to 40s or 41 to 60s. The groups of respondents with college diploma and bachelor degree constituted two largest percentages to the sample pool, and were largely greater than other groups. Over 50 % respondents had a natural science education background. Among the respondents willing to respond to the income question, most of them had an individual monthly income ranged from RMB 3000 to 5000.

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	Catalogue	Population	Percentage
Gender	Male	131	45.9
	Female	154	54.1
Age	18-24	42	14.7
	25-40	104	36.5
	41-60	115	40.4
	Above 60	24	8.4
Education level	Primary school or illiteracy	17	5.9
	High school	21	7.4
	College Diploma	92	32.4
	Bachelor degree	113	39.6
	Master degree or above	42	14.8
Monthly income	Below 3000 RMB	37	12.9
	3000-5000 RMB	161	56.5
	5000-10000 RMB	56	19.6
	Above 10000 RMB	31	11.0
Major of tertiary education	Humanities and Social Sciences	109	44.1
	Natural science	138	55.9
	Medicine and traditional Chinese medicine(List separately )	13	5.3
	Agriculture, food and biological engineering (List separately )	11	4.5

Table 1: Demographic characteristics of the respondents

### Data analysis

Three steps of data analysis were conducted to investigate Chinese consumers' attitude towards GM food. First, a simple description analysis was used to analyze Chinese consumers' awareness and acceptance of GM food. Second, a specific analysis of the relationship between internal factors (i.e. demographic factors) and consumers' attitude of GM soybean oil were conducted, using logistic regression. The formula of logistic regression would be:

$$Y = aX_1 + bX_2 + cX_3 + d$$

The explanation of variables in the logistic regression model can be found in the Table 2. Further, to investigate the different attitude of GM soybean oil across different groups of Chinese consumers, the T-test was used. In the third step, the simple description analysis was used to reveal the influences of media and characteristic of GM soybean oil on consumers' attitude [3-6].

### Results and Discussion

#### Chinese consumers' awareness of GM food

According to the result of survey, around 85.3% respondents heard of GM food, while in 2002, the amount was 28.6% according to the earliest study about consumers' awareness of GM food reported. As Table 3 indicated, the amount of Chinese consumers who have awareness of GM food increased significantly in the past 10 years.

On the other hand, the amount consumers who have conservative attitude towards GM food has decreased from 2002 to 2011, because the government-run media has promoted GM food in a positive way and the popularization of GM food did solve the predicament of grain shortage in China. Interestingly, according to the investigation of this study, the amount of consumers who are against to GM food is raising from 2011 afterward. Some scholars believed the increase of conservative was due to a debate of GM food at 2013 [7]. But the

phenomenon also could be the consequence of consumers' increase of income and emphasis of health.

The study also investigated consumers' awareness and acceptance of GM food. As Table 4 shown, among oil, fruit and vegetable, grain and cereal, and formula feed, oil is the most realized and accepted type of GM food. Actually, the consumption amount of GM oil is the largest one among kinds of GM food for Chinese market. According to CPPCC media session 2013, the amount of GM soybean import was 58.38 million ton and the GM soybean oil consisted 90% of total soybean oil sold in Chinese market [8].

Although a few respondents were aware of the GM formula feed, over 40% respondents indicated their acceptance of GM formula feed. They also mentioned that the most unacceptable GM food would be meat from GM animal rather than animal fed with GM feed, while the scientists from food science always concern that the risk of GM feed might accumulate in the bodies of GM feed-feeding-animal.

Although over half of respondents indicated their awareness of GM soybean oil, meanwhile over 80% respondents admitted that they did not have sufficient knowledge of the productive process of GM soybean oil, and whether the GM soybean oil containing exogenous gene. Over 60% respondents said that their judgments of the safety of GM soybean oil were not based on their understanding of GM soybean oil productive technique, but mostly influenced by celebrities' expressions and media reports.

#### The influences of internal factors on Chinese consumers' attitude of GM soybean oil

Since GM soybean oil is the largest consumed GM food in Chinese market, this study specifically investigated Chinese consumers' attitude of GM soybean oil, the influences of demographic characteristics on consumers' attitude of GM soybean oil. Using SPSS 18.0 to analyze the data collected from survey, the logistic regression revealed that income level has a significant influence on consumers' attitude, while age and education background are insignificant in terms of the influence on consumers' attitude (Table 5).

Further, T-test was used to investigate the different attitude of GM

Variable	Meaning	Value
X1	Age	Recorded as the reported ages of respondents
X2	Education background	Continuous variable from 1 to 5
X3	Income level	Continuous variable from 1 to 4
Y	Attitude	Positive attitude=1; Negative or neutral attitude=0

Table 2: The explanation of variables in the logistic regression model

	Before 2002	2002	2005	2008	2011	2014
Awareness of GM food	No related report	28.6%	35.1%	42.18%	75.4%	85.3%
Conservative to GM food	No related report	52.1%	69%	61.67%	26.2%	31.2%
Data resource		Ming, 2002 [3]	Wang, 2005 [4]	Wang, 2008 [5]	Wu, 2011 [6]	Current survey

Table 3: Changes of Chinese consumers' awareness of and conservative to GM food from 2002 to 2014

	Edible oil	Fruit and vegetable	Grain and cereal	Formula feed	Others
Awareness	50.9%	37.9%	27.0%	17.9%	19.6%
Acceptance	42.1%	33.0%	18.2%	41.1%	8.4%

Table 4: Awareness and acceptance of GM food

soybean oil across different groups of Chinese consumers. Generally, respondents have three different types of attitudes towards GM soybean oil, namely positive, neutral and negative. Respondents with different age and educational background do not show significant difference on their positive attitude of GM soybean oil, which contradict to the previous findings from Europe, Japan and China, while the income greatly influences respondents' attitude.

According to Table 5, age and education background did not influence respondents' positive attitude towards GM soybean oil significantly. But as shown on Figures 1 and 2, the amounts of consumers holding neutral attitude were quite different across groups of respondents with different age and education background. Since respondents with neutral attitude could be regarded as potential consumers who are willing to buy GM food [9], the size of GM soybean oil market is decided by the amount of consumers with positive and neutral attitude. The rates of respondents having negative attitude towards GM soybean oil are the highest in groups who were in their 25 to 40 and have bachelor or master degrees. In other words, respondents with higher educational level have more conservative attitude towards GM soybean oil.

Also this study investigated the influence of respondents' specialties on their attitude towards GM soybean oil. The respondents with college diploma, bachelor or master degree were classified into two groups based on their majors, namely natural science or social science. The supporting rate of each group is 20%. However, a further investigation showed that respondents with medical background have conservative attitude towards GM soybean oil. The acceptance of respondents with medical background was lower than 10%. At the same time, there was a better acceptance of GM soybean oil among the respondents who have food or agriculture engineering background.

Figure 3 indicated that income of the respondents was the most significant factor influencing the attitude towards GM soybean oil. Respondents having higher income have more negative attitude towards GM soybean oil and lower willingness to buy it. When have lower income, Chinese consumers have to choose GM soybean oil which is cheaper and the negative influence from celebrities and media publicity has not been so significant. With the growth of income, Chinese consumers worry more about GM security and have more choice of edible oil. Therefore, Chinese consumers' attitude toward GM soybean oil might become more conservative in the future. The promotion of GM soybean oil will be more difficult and challengeable.

### The influences of external factors on Chinese consumers' attitude of GM soybean oil

Table 6 demonstrated the influences of different media on respondents' attitude of GM soybean oil. Among five different types of media, most respondents (over 50%) admitted that their attitude of GM soybean oil was significantly influenced by traditional media, for example TV, newspaper, or broadcasts, and internet. More interesting, compared to a similar study conducted at 2009 [9], the influence of social media is increasing rapidly (equal to 26%), especially the social media manipulated by the celebrities. Compared to traditional media, social media is less scientific in terms of knowledge dissemination [10]. Since there were a significant portion of social media experts against GM foods [11], it can be a reason why Chinese consumers' attitude changed.

The respondents were required to check some important characteristic of GM soybean oil that cause respondents' acceptance or rejection of GM soybean oil. These characteristic were collected

from the texts of media publicity about GM food. Table 7 listed the most important five characteristic of GM soybean oil that influence respondents' acceptance or rejection of GM soybean oil.

Regarding the characteristic of GM soybean oil, the most important reason that consumers accept GM soybean oil is the price. The price of GM soybean oil is lower than GM-free soybean oil. Due to the lower price of GM soybean, they have been largely imported into China and made edible oil. Chinese edible oil market has been crowded with kinds of GM soybean oil. Consumers have little choice of different kinds of edible oil. On the other hand, the most important reason that consumers do not accept GM soybean oil is because of the concern of the food safety. Although the price of GM soybean oil is lower than GM-free oil, in these days, the growing income of Chinese consumers makes them pay more attention on their health. They are willing to pay more money to buy GM-free oil which is considered to be more health and safety. Especially, due to the debate of GM food in 2013, common consumers have more concerns about GM food.

### Conclusion

In the past decade, some research indicated that with the increasing

Variable	B	S.E.	Wals	Sig.	Exp(B)
X1	-0.013	0.014	0.863	0.353	0.987
X2	0.035	0.147	0.056	0.814	1.035
X3	-0.419	0.205	4.177	0.041	0.658
Constant	-0.086	0.767	0.012	0.911	0.918

Table 5: Results from logistic regression analysis

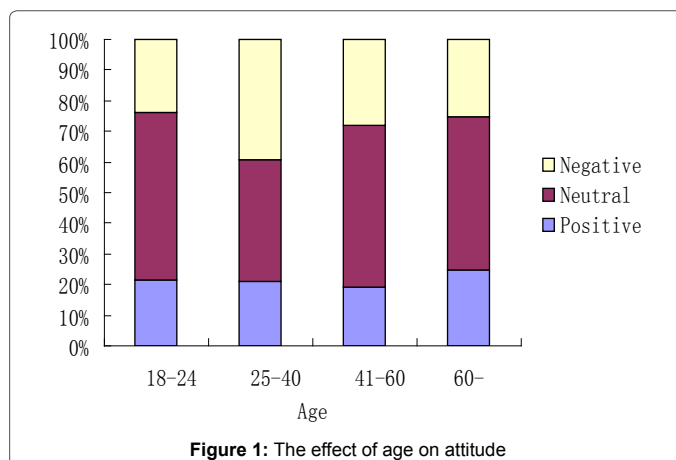


Figure 1: The effect of age on attitude

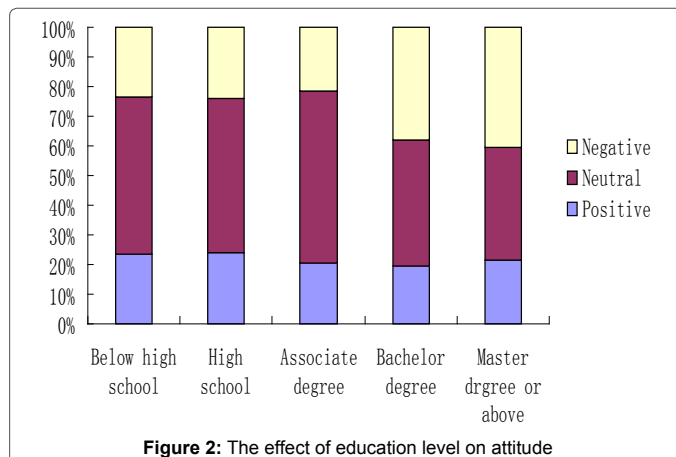


Figure 2: The effect of education level on attitude

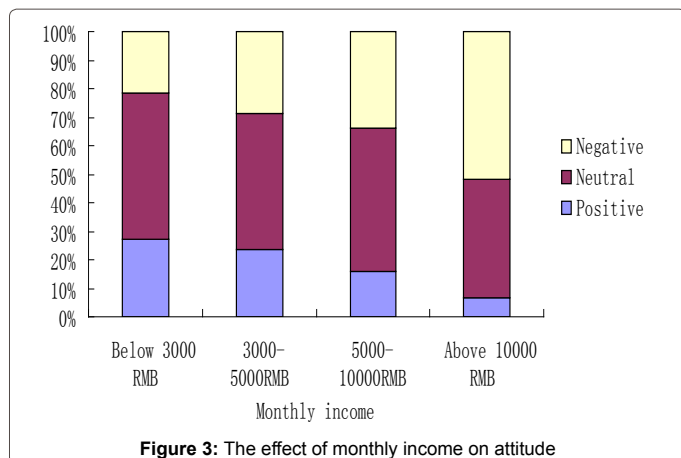


Figure 3: The effect of monthly income on attitude

	Tradition Media	Internet	Book	Social Media	Others
Percentage	35.4%	29.1%	5.3%	26.0%	4.2%

Table 6: The influence of media on consumers' attitude

Characteristics for acceptance of GM soybean oil	Characteristics for rejection of GM soybean oil
Low cost	Doubt about its safety
Have no choice	Worse taste or lower nutrition
Better taste or higher nutrition	Conservative attitude towards new food
Trust of its safety	Environmental protection consideration
Relatively low use of pesticide	Traditional cultural or religion factors

Table 7: The most important 5 characteristic for acceptance or rejection on GM soybean oil

popularity of GM food, Chinese consumers' acceptance of GM food has been increasing [12,13]. Young and/or well-educated consumers have higher willingness to consume GM food [14]. However, this study concluded that the permissive environment for GM food in today's China has changed.

Taking GM soybean oil which is the most acceptable GM food among Chinese consumers as an example, this study found that middle-young age consumers who are well educated have a more negative attitude towards GM soybean oil, although generally speaking, age and education level do not influence consumers' attitude. Consumers with specialties of food and agriculture engineering have significant different attitude from other consumers. This implies the influence of professional knowledge on consumers' attitude. Payment capacity is the key reason that consumers choose the GM soybean oil, therefore with the growing income of Chinese consumers, consumers having higher income would choose GM-free edible oil instead of GM soybean

oil. The wealthy consumers have more negative attitude towards GM soybean oil. From this point of view, the development of China's economy and growth of Chinese consumers' income might cause Chinese consumers' attitude toward GM soybean oil more conservative in the future. Also, the negative messages from social media increase consumers' negative attitude of GM food. In sum, in the future, the consumption of soybean oil will continually grow, while the promotion of GM soybean oil in China might be more difficult and challengeable.

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