An Exploratory Study on the Influence of Message Sidedness in Changing Consumer Attitude, Risk Perception and Purchase Intention for Genetically-modified Floral Crops[1]

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Abstract

Due to the arguments regarding the potential risks for food safety and bio-ecology, it is not uncommon to see consumers boycotting genetically-modified (GM) crops. Communicating efficiently with consumers in regard to GM crops has thus become critical to the development of GM technology in agriculture. This study intends to investigate the differences in consumer attitudes, risk perception and buying intention toward GM floral crops within different socio-economic groups, as well as to investigate the influence of message sidedness on changes in consumer attitudes, risk perceptions and buying intention for GM floral crops. Questionnaires were used as the instrument of data collection. There were a total of five different types of questionnaires designed to communicate with consumer participants about GM technology using messages based on different kinds of sidedness. A total of 1,098 valid questionnaires were obtained from a consumer survey that took place at a holiday flower market. The study's results indicate that gender and age had a significant effect on consumer attitudes and buying intention toward GM floral crops. Male consumers had a more positive attitude and a higher degree of intention to purchase GM flowers than female consumers; the elderly consumers also exhibited a more positive attitude and stronger intention to purchase GM flowers compared to consumers in other age groups. Compared with the controlled treatment, the two-sidedness message strategy that involved providing a negative message regarding GM technology first and then providing a positive message about GM technology revealed a better effect in terms of changing the consumers' risk perception and intention to purchase GM flowers.

Keywords: genetically modified organism (GMO), flowers, consumer behavior

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Introduction

There are several potential risks referred to by the general public regarding the use of genetically modified (GM) technology in agricultural production. Most of the possible side effects concerned with the development of GM crops focus on the issues of food safety and bio-ecology, such as human health, biodiversity, and environmental risk. These unresolved concerns even cause consumers to boycott purchases of GM crops. Consequently, issues to do with communicating with consumers have become critical for the market efficiency of GM crops.

Previous research shows that consumer acceptance of GM crops is influenced by several factors, such as nationality, socio-economic characteristics, and consumer value generated by GM technology, etc. For example, Kimenju and Groote (2008) examined the consumer's willingness to pay for GM food in Nairobi, Kenya. Their results indicate that participants were generally appreciative of GM technology, and 68% of the participants were willing to buy GM maize meal at the same price as their favorite brand. More than half of the respondents disagreed with the general statement that GM threatens the environment. Meanwhile, several factors influenced consumers' acceptance of GM food. These included the following: 1) Perceptions of health risks, as well as ethical and equality concerns, had a negative influence on the likelihood of purchasing GM maize meal, whereas trust in government to ensure food quality had a positive influence on WTP. 2) Consumers, at least those with some secondary school education and those in high-income categories, were more likely to purchase GM maize meal at the same price. Saba et al. (2000) studied consumers' perceived risk, benefit perceptions and attitudes toward GM food in Italy. There were several findings in their study: 1) More people had unfavorable attitudes towards the application of GM techniques to food production. 2) More people perceived the application of GM technology to food production as having low benefits and high risk, and high potential uncertainty regarding potential consequences. 3) The results of the regression analysis indicated that the perception of benefits (beta=0.41) outweighed the perception of risk (beta= -0.30) in terms of the impact on general attitudes towards the applications of genetic engineering to food production, whereas the perception of uncertainty (beta= -0.08) contributed marginally to the prediction of attitudes. 4) General attitudes appeared to be an important determinant of the expectation of consuming food produced using genetic engineering. Chen (2008) studied the antecedents related to the extent of the adoption of and the intention to purchase GM food in Taiwan. His findings indicated that the attitude toward GM food products links the attitude model with the behavioral intention model, namely, the consumer's perceived benefits from GM foods influence their attitude toward GM food, and the consumers' attitude toward technology/nature, food neophobia, alienation from the marketplace, and perceived knowledge all serve as antecedents of perceived benefits from GM foods. However, the consumers' perceived risk of GM food did not significantly affect their attitude toward GM foods.

When consumers face the choice associated with uncertainty or perceived risk, a feeling of anxiety is aroused. To reduce such anxiety, consumers tend to develop a risk-reducing strategy. Information seeking is one of the common strategies for reducing anxiety (Locander and Hermann, 1979). Since information search is a general strategy for consumers to overcome the possible risks associated with their purchase decision, how to design a persuasive message to communicate well with consumers is an important concern of marketing managers. Message sidedness is also one of the key factors influencing the persuasiveness of commercial information, and this is proved in many previous studies. For example, Chebat et al. (1998) studied the compensatory effects of the cognitive characteristics of the source, the message, and the receiver in response to an attitude change and found that two-sided messages were more persuasive with fewer arguments (when the number of positive arguments was lower), while one-sided messages were more persuasive when there were more arguments. Obviously the number of arguments influenced the effects of the message sidedness with regard to attitude change. Karp (1971) reviewed previous studies and concluded that there were several advantages of the two-sided message approach. As more consumers become more highly educated, the two-sided message approach becomes important for consumer communication in the market. The two-sided message has been validated as being more persuasive than a one-sided approach when dealing with sophisticated, well-educated individuals. Earl and Pride (1980) conducted a lab experiment to test the advertisement structure (comparative advertisements vs. non-comparative advertisements), message sidedness, performance test results as well as the interactions among these variables in relation to the informativeness of print advertisements. The study results indicated that message sidedness alone did not increase the consumers' perception toward the informativeness of the advertisement, and neither did it increase their awareness of the product features. However, the interaction between message sidedness and the advertisement structure significantly influenced the consumers' awareness to the product features. Two-sided comparative advertisements improved the advertising efficiency by increasing the consumers' awareness of the product features.

As regards the consumers' acceptance in terms of applying GM technology to agricultural production, issues related to GM food crops are much more the focus of research than those related to GM ornamental crops. In spite of this, there have been many GM techniques developed for the production of ornamental crops, such as changing the flowers' color, fragrance or morphology, or else increasing the disease resistance and vase lives of floral crops. Although these techniques are still an expensive molecular breeding

tool, there are several reasons why these techniques tend to have the potential to be highly valuable for the floral industry, such as the high market demand for product novelty, replacing toxic chemicals used in the post harvest treatment, and more efficiency compared with traditional breeding tools, etc. (Tanaka et al., 2005). Even though GM flowers are not grown for food, there are still some potential environmental risks associated with them. However, ornamental crops have been ignored from the mainstream of the study of consumer issues in GM agriculture. This study seeks to address this deficiency. This study aims to 1) investigate the differences in consumer attitudes, risk perception and buying intention toward GM floral crops within different socio-economic groups, and 2) to investigate the influence of message sidedness in terms of changing consumer attitudes, risk perceptions and buying intention for GM floral crops.

Methodology

Questionnaire design

Self-administered questionnaires were used as the instrument of data collection, and experimental design was used to present the message in different sidedness frames. Items in the first and third sections of the questionnaire were used to record the consumers' attitudes, risk perceptions and intention to purchase GM flowers before and after they received any treated message. The consumers' attitudes, risk perceptions and purchase intention for GM flowers were all measured with multiple items using a 7-point Likert scale.

The second section of the questionnaire was about the treated message designed with different sidedness frames regarding the pros and cons of the application of GM technology to flower production. Treatment I was in a single-sided frame which described the possible side effects of GM technology: "Some people consider modification technology to be harmful to human health, it damages the balance of environmental ecology, and conflicts with the ethics of life." Treatment II was also in a single-sided frame that described the positive side of GM technology: "Modification technology can change the bio-characteristics of flowers, like extending the longevity of flowers, to create a unique color and pleasant fragrance of flowers." Treatment III involved a two-sided frame that carried both the positive and negative sides of the message regarding GM technology so that the negative message was provided before the positive message: "Some people consider modification technology to be harmful to human health, it damages the balance of environmental ecology, and conflicts with the ethics of life; but modification technology can change the bio-characteristics of flowers, such as extending the longevity of flowers, and creating the unique colors and pleasant fragrance of flowers". Treatment IV was also in a two-sided frame where the positive message was provided before the negative message, i.e., "Modification technology can change the bio-characteristics of flowers, like extending the longevity of flowers, and creating the unique colors and pleasant fragrance of flowers; however, some people consider modification technology to be harmful to human health, damaging the balance of environmental ecology, and conflicting with the ethics of life". For the comparison of the effect of each experimental treatment, the control treatment was also applied in that it did not carry any message regarding GM technology.

According to the experimental design, there were a total of five different sets of questionnaires. Each set or edition was treated with a message that had a different message sidedness strategy regarding the application of GM technology to flower production. All editions of the questionnaires had the same items except that they carried messages for different sidedness strategies. Edition A carried the message of treatment I; edition B carried the message of treatment II; and edition C carried the message of treatment III. Edition D carried the message of treatment IV. Edition F was the control group that did not carry any message regarding the application of GM technology to flower production.

Before the survey, there was a pre-test for the wording of questionnaire design. A total of 123 students participated in the pre-test. The purpose of the pre-test was to ensure the validity of the questionnaire as well as the appropriateness of its wording. The results of the pre-test indicated that the wording of the questionnaire items was sufficiently comprehensive for the participants and the internal consistency for the multiple items for each variable measured using Cronbach's α ranged from 0.747 to 0.972. It was these results that proved the validity of the questionnaire.

Sampling

The consumer survey took place at the Taipei Holiday Flower Market, in order to reach the consumers who were also the flower buyers. The time period for the survey was the weekends of Nov., 2008. Questionnaires were distributed to the participants systematically, with questionnaires A, B, C, D and F being distributed to participants in order. This ensured that the participants have an equal opportunity to receive the questionnaires A, or B, or C, or D. Most of the participants spent about 10-15 minutes to complete the questionnaire. After removing the incomplete questionnaires, 1,098 questionnaires were valid for statistical analysis. The data were analyzed using the independent samples *t*-test, analysis of variance (ANOVA) tests, and Duncan's *post hoc* analysis when deemed necessary.

Results

Profile of the sample

A total of 1098 valid questionnaires were collected from the survey. As for the sample as a whole, 40.3% of the participants were male and 58.2% were female, whereas 1.5% of the participants did not provide their gender information. The age distribution was as follows: 8.1% were 18-24 years old; 13.8%, 25-34 years old; 19.5%, 35-44 years old; 30.4%, 45-54 years old; 18.7%, 55-64 years old; and 9.5%, over 65 years old.

The distribution of the participants' occupations was as follows: 31.6%, commercial business and service industry; 18.8%, housekeeping; 12.2%, civil service, military service and education; 6.9%, agriculture, forestry, fishing and animal husbandry workers; 5.9%, manufacturing; 6.4%, students; 18.8%, housekeeping; 8.8%, retirement, and 7.9% had other occupations. A total of 1.5% of the participants did not indicate their occupation.

The distribution of educational levels was: 6.3%, elementary school; 9.2%, junior-high school; 28.0%, senior-high or vocational school; 47.3%, college or university undergraduate; 8.3%, graduate school; 0.9%, did not provide their educational level.

About 22.0% of the participants reported that they had a family monthly income of less than New Taiwanese dollars (NT$) 30,000; 31.3% had an income between NT$30,001 and NT$50,000; 26.3% between NT$50,001 and NT$80,000; 6.1% between NT$80,001 and NT$100,000; 7.1% between NT$100,001 and NT$150,000; 2.5% between NT$150,001 and NT$300,000; and 1.8% reported that they had a monthly income of over NT$300,000. About 2.9% of the participants did not provide their income information.

The differences in terms of consumer attitudes, risk perception and purchase intention for GM flowers among the consumer groups with different socio-economic characteristics

Gender effect on consumer attitudes, risk perception and purchase intention for GM flowers

The statistical results of the *t*-tests indicated that consumer attitudes and the purchase intention toward GM flowers were significant differently in relation to gender, as shown in Table 1. The mean of the consumers' attitudes toward GM flowers for male participants was 4.81, and 4.61 for female participants, based on a 7-point Likert scale. Even though the participants did not evaluate the GM flowers with a very positive attitude, generally speaking, male participants had a more positive attitude toward GM flowers compared with the female participants (*P* =0.004). A similar phenomenon was found to occur regarding the participants' intention to purchase GM flowers, namely, that male participants also exhibited a significantly higher purchase intention toward GM flowers (group mean= 4.87) compared to the female participants (group mean= 4.68) (*P* = 0.009), even though the purchase intention was not high. However, the difference in gender did not have a significant effect on the consumer's risk perception toward GM flowers (*P* =0.089). As regards the participants' perception of the risk, or any possible impact on the environment, or on the social ethics caused by the development of GM flowers, there was no significant difference in terms of the overall risk perception for the GM flowers between the male and female participants (*P*= 0.089). The group mean of the overall risk perception for male participants was 3.30, while it was 3.43 for female participants, respectively. The group means suggested that the participants' overall risk perception in regard to the development of GM flowers tended to be mild, and not dramatic.

Table 1. *t*-test for the effect of gender on consumer attitudes, risk perception and purchase intention toward GM flowers

	Attitudes					Risk perception					Purchase intention				
	Mean[Z]	S.D.	Mean Diff.	*t*	*P*	Mean[Z]	S.D	Mean Diff.	*t*	*P*	Mean[Z]	S.D	Mean Diff.	*t*	*P*
Male (n=443)	4.81	1.05	0.20	2.87	0.004*	3.30	1.31	-0.14	-1.07	0.089	4.87	1.11	0.19	2.62	0.009*
Female (n=639)	4.61	1.08				3.43	1.07				4.68	1.18			

[Z] Measured using a 7-point Likert scale
* Significant at α= 0.05

Age differences and consumer attitudes, risk perception and purchase intention for GM flowers

The statistical results of the Analysis of Variance (ANOVA) indicated that the consumer's attitude and purchase intention toward GM flowers significantly differed with the consumer's age, but the consumer's

overall risk perception for GM flowers did not differ with age, as indicated in Table 2. Duncan's *post hoc* analysis was used to analyze the differences in the consumer's attitude and purchase intention among the different age groups. As a result, the consumer's attitude toward GM flowers exhibited a "U"-curved relationship against the variable of age, as presented in Table 3. Among the age groups, participants that were 18-24 years old or over 55 years old had the most positive attitudes and highest purchase intention toward GM flowers. They revealed a more positive attitude and a higher purchase intention than those who were 25-54 years old. However, there was no significant difference in terms of the risk perception toward GM flowers among the different age groups (P = 0.0593), for which the group means ranged from 3.15 to 3.44. The magnitudes of these group means implied that the participants' risk perception for GM flowers was not high.

Table 2. ANOVA for the effect of age on the consumers' attitudes, risk perceptions and purchase intention for GM flowers

ANOVA	Sum of Squares	df	Mean Square	F	*P*
Attitude	14.08	5	2.81	2.467	0.031*
Risk perception	6.14	5	1.23	0.741	0.593
Purchase intention	20.73	5	4.15	3.164	0.008*

* Significant at α= 0.05

Table 3. Duncan's *post hoc* analysis for the comparison of consumers' attitude, risk perceptions and purchase intention among different age groups [z]

Age range	Sample size	Attitude	Risk perception	Purchase intention
18-24	89	4.87[b]	3.44[a]	4.85[abc]
25-34	152	4.55[a]	3.38[a]	4.60[a]
35-44	214	4.72[ab]	3.38[a]	4.70[ab]
45-54	334	4.60[a]	3.43[a]	4.68[ab]
55-64	205	4.80[ab]	3.35[a]	4.95[bc]
65 or over	104	4.89[b]	3.15[a]	5.01[c]

[z] Group means with the same letter are not significantly different at α=0.05

Effects of different occupations on consumer attitudes, risk perception and purchase intention for GM flowers

The statistical results of ANOVA revealed no significant differences for consumer attitudes, risk perceptions and purchase intention toward GM flowers in terms of consumers' occupational differences (P = 0.296, 0.066 and 0.536, respectively), as presented in Table 4. Group means for participants' attitudes toward GM flowers ranged from 4.47 to 4.89. The attitudes tended to be positive, but not at a high intensity. Similarly, group means of risk perception toward GM flowers ranged from 3.02 to 4.42, and were not at a high level either. Regarding the intention to purchase GM flowers, group means ranged from 4.61 to 5.01, which tended to be positive but not high in intensity.

Table 4. ANOVA for the effect of occupation on consumer attitudes, risk perceptions and purchase intention for GM flowers					
ANOVA	Sum of Squares	df	Mean Square	F	*P*
Attitude	9.69	7	1.38	1.21	0.296
Risk perception	21.84	7	3.12	1.90	0.066
Purchase intention	7.99	7	1.14	0.86	0.536

Effects of differences in education on consumer attitudes, risk perceptions and purchase intention for GM flowers

The statistical results of the ANOVA showed that consumer attitudes, risk perceptions and purchase intention toward GM flowers did not differ significantly among the consumer groups who had different education levels (*P* = 0.872, 0.091 and 0.685, respectively), as presented in Table 5. Group means for consumer attitudes toward GM flowers ranged from 4.59 to 4.72 among the participants who had different education levels. The attitudes tended to be positive, but not high in intensity. Group means for participants' risk perception toward GM flowers ranged from 3.32 to 3.70. Obviously, different education groups had risk perceptions toward GM flowers that were under the neutral level, i.e., they did not think GM flowers were very risky. Regarding the intention to purchase GM flowers, group means ranged from 4.71 to 4.88, which implied that GM flowers were acceptable for various education groups. However, the purchase intention was not of a very high intensity.

Table 5. ANOVA for the effect of education on consumer attitudes, risk perceptions and purchase intention for GM flowers					
ANOVA	Sum of Squares	df	Mean Square	F	*P*
Attitude	1.43	4	0.36	0.31	0.872
Risk perception	13.24	4	3.31	2.01	0.091
Purchase intention	3.02	4	0.75	0.57	0.685

Effect of differences in income on consumer attitudes, risk perceptions and purchase intention toward GM flowers

The statistical analysis of ANOVA indicated that consumer attitudes, risk perception and purchase intention toward GM flowers did not differ significantly with the differences in family income (*P* = 0.859, 0.122 and 0.877, respectively), as indicated in Table 6. Group means for the different income groups regarding the attitude toward GM flowers ranged from 4.50 to 4.83, at a mild positive level. Group means for the risk perception ranged from 2.97 to 3.99, showing that the participants of the various income groups had low risk perception toward GM flowers. As regards the purchase intention for GM flowers, the group means ranged from 4.56 to 4.88. Participants within every income group had a positive purchase intention, even though the intensity was not high.

Table 6. ANOVA for the effect of income on consumer attitudes, risk perceptions and purchase intention for GM flowers					
ANOVA	Sum of Squares	df	Mean Square	F	*P*
Attitude	2.99	6	0.50	0.43	0.859
Risk perception	16.70	6	2.79	1.68	0.122
Purchase intention	3.21	6	0.54	0.40	0.877

The findings from this section show that consumers in Taiwan have low risk perception toward GM flowers. However, this does not mean that consumers tend to support the development of GM flowers, since the strength of their attitude and purchase intention toward GM flowers was not intensively positive. Their behavior on the whole could be described as: “not totally agree, but not totally disagree either.” Such a phenomenon is explainable based on the findings of previous research that the consumer purchase intention for GM products tends to be case-dependent. If consumers can perceive the specific benefits associated with GM products, they will be willing to buy GM products. For example, when Frewer et al. (1994) investigated the consumer purchase behavior for GM food in England, they gathered 60 consumers in England, who had an average age of 40, for their investigation of consumer attitudes toward GM food. In their study, they labeled the same products with different package information, namely “GM/ food benefit”, “non-GM/food benefit”, “GM only” and “non-GM only.” The study results revealed that consumers tended to purchase products for which the characteristics and food benefits were clearly identified. Whether the products were GM or non-GM did not affect the consumers’ purchasing choice. Cases from Taiwan and England seem to indicate that the consumer’s purchasing decision to buy or not to buy GM products is able to be driven by the benefits associated with GM technology. This might be the reason why in this study consumers behave in a “not totally agree, but not totally disagree, either” mode regarding the consumption of GM flowers, because their behavior toward GM flowers depends on what concrete benefits the GM flowers offer. In other words, it is very likely that concrete consumer benefits from GM flowers will influence the consumers’ acceptance to GM flowers.

When examining the effect of consumers’ socio-economic characteristics with regard to their attitude, risk perceptions and purchase intention toward GM flowers, it was found that only gender and age had a significant effect on the consumers’ attitude and purchase intention toward GM flowers, whereas the consumers’ risk perceptions toward GM flowers were not affected by any socio-economic factors. Regarding the effect of gender and age on the consumers’ attitudes and intention to purchase GM flowers, male consumers had a more positive attitude and higher purchase intention toward GM flowers; participants that were older also had a more positive attitude and higher purchase intention toward GM flowers. Such findings are consistent with the study results of some other scholars. For example, when Mucci et al. (2004) studied consumer perceptions and purchase intentions for GM food in Argentina, they found that GM food was more acceptable for male consumers than for the females. Christoph et al. (2008) examined consumer attitudinal clusters based on the acceptability of genetic modification (GM) in Germany and found that GM supporters tended to be older (about 54.15 years old on average) than those who were indifferent or opposed to them (about 48 years old in average), and supporters were more often male than female. By contrast, the GM opponent group contained more women and also contained more households with children under 12 years old, compared to the cluster that comprised GM supporters.

Besley and Shanahan (2005) investigated consumer support for biotechnology, and they found that those who were older, males or had received a higher level of education were more supportive of the development of biotechnology. Lee et al. (2005) also obtained a similar finding in nanotechnology technology, namely, consumers with a higher education level revealed a higher acceptance level for nanotechnology technology. These related studies gave rise to a similar conclusion that the consumers’ education level significantly affects their acceptance of high technology. However, this study did not find any significant effect of the education level on consumers’ attitudes, risk perceptions and purchase intention toward GM flowers. However, flowers are products with low involvement, and are different from the products of nanotechnology or biotechnology with high involvement. This might be the reason why this study obtains different findings regarding the effect of the consumers’ education level on their attitudes, risk perceptions and intention to purchase GM flowers.

The effect of message sidedness on consumer attitudes, risk perceptions and purchase intention toward GM flowers

In Experimental treatment I, the message was presented in a single-sided negative format whereby the participants were only given a message regarding the risks of GM technology. After participants had finished the pre-test regarding their attitudes, risk perceptions and purchase intention toward GM flowers, they were presented with the single-sided negative message of GM flowers. After the message was read, they were asked to describe their attitudes, risk perceptions and intention to purchase GM flowers again in the following section of the questionnaire. The study's results showed that the message so presented caused a -0.02 unit change in the attitude toward GM flowers, and a -0.01 unit change in the purchase intention. However, almost no change occurred in terms of the risk perception. The statistical analysis based on the independent *t*-test indicated that the change caused by this message treatment was not significantly different from the change in the controlled groups, which did not receive any message regarding GM flowers. In other words, the analysis of the independent *t*-test indicated that there was no significant difference between the Experimental treatment I and the control group (attitude, $P = 0.837$; risk perception, $P = 0.273$; purchase intention, $P = 0.327$), as shown in Table 7.

Table 7. Analysis of *t*-test for the comparison of Experimental treatment I vs. the control group for the effects on consumer attitudes, risk perceptions and intention to purchase GM flowers [y]

Experimental treatment	Attitude					Risk perception					Purchase intention				
	Mean[z]	Std.D	Mean Diff.	*t*	*P*	Mean[z]	Std.D	Mean Diff.	*t*	*P*	Mean[z]	Std.D	Mean Diff.	*t*	*P*
Treatment I (n=232)	-0.02	0.69	0.01	0.21	0.837	0.00	0.87	0.08	1.10	0.273	-0.01	0.74	0.06	0.98	0.327
Control group (n=218)	-0.03	0.73				-0.08	0.64				-0.07	0.55			

[y] Experimental treatment I had a negative single-sided message in that the possible risk caused by the development of GM technology was included

In Experimental treatment II, the message was treated in a single-sided positive format in that the participants were only given a positive message regarding the benefits from GM flowers. This message was given after the pretest had been taken regarding the participants' attitudes, risk perceptions and purchase intention toward GM flowers. After the participants had read through the message, they were asked to present their attitudes, risk perceptions and purchase intention for GM flowers again. The study results showed that the message treatment caused a 0.03 unit change in the participants' attitude and a -0.08 unit change in the participants' risk perception regarding GM flowers, but did not seem to cause any change in the participants' purchase intention. It appears the single-sided message treatment enhances the consumers' attitudes and reduces their risk perceptions toward GM flowers. However, the statistical analysis of the independent *t*-test showed that the change caused by the single-sided positive message was not significantly different from the change for the control group (attitude, $P = 0.464$; risk perception, $P = 0.955$; purchase intention, $P = 0.259$), as presented in Table 8.

Table 8. Analysis of *t*-test for the comparison of Experimental treatment II vs. the control group for the effects on consumer attitudes, risk perceptions and the purchase intention for GM flowers [y]

	Attitude					Risk perception					Purchase intention				
	Mean[z]	Std.D	Mean Diff.	*t*	*P*	Mean[z]	Std.D	Mean Diff.	*t*	*P*	Mean[z]	Std.D	Mean Diff.	*t*	*P*
Treatment II (n=216)	0.03	0.87	0.06	0.73	0.464	-0.08	0.72	0.00	0.06	0.955	0.00	0.62	0.07	1.13	0.259
Control group (n=218)	-0.03	0.73				-0.08	0.64				-0.07	0.55			

[y] Treatment II had the positive single-sided message whereby a positive message regarding the product benefits produced by GM technology for floral crops was provided

In Experimental treatment III, the message was presented in a two-sided format where the participants were given the negative message regarding the GM technology first and then the positive message regarding the GM technology. After the pre-test regarding the participants' attitudes, risk perceptions and purchase intention toward GM flowers, participants read through the two-sided message and then again answered questions regarding their attitude, risk perception and purchase intention toward GM flowers in the next section of the questionnaire. The study results showed that the treated message caused a 0.03 unit change in the participants' attitudes, a 0.09 unit change in the participants' risk perceptions and a 0.08 unit change in their purchase intention toward GM flowers. The statistical results of the independent *t*-test indicated that the change caused by the treated message in terms of the participants' risk perceptions and purchase intention was significantly different from that of the control group (risk perception, $P = 0.038$; purchase intention, $P = 0.012$), but not significantly different regarding the change in the participants' attitudes toward GM flowers (attitude, $P = 0.400$). Obviously, the two-sided message of "giving a negative message regarding GM technology first followed by a positive message regarding the GM technology" significantly increased the consumers' risk perceptions and intention to purchase GM flowers. The statistical results are presented in Table 9 below:

Table 9. Analysis of *t*-test for the comparison of Experimental treatment III vs. control group for the effects on consumer attitudes, risk perceptions and the purchase intention for GM flowers [y]

	Attitude					Risk perception					Purchase intention				
	Mean[Z]	Std.D	Mean Diff.	*t*	*P*	Mean[Z]	Std.D	Mean Diff.	*t*	*P*	Mean[Z]	Std.D	Mean Diff.	*t*	*P*
Treatment III (n=220)	0.03	0.77	0.06	0.84	0.400	0.09	0.98	0.17	2.08	0.035*	0.08	0.66	0.15	2.52	0.012*
Control group (n=218)	-0.03	0.73				-0.08	0.64				-0.07	0.55			

[y] Experimental treatment III had a two-sided message strategy whereby the negative side of the message was provided first, and then followed with the positive side of the message regarding GM technology
[Z] * Significant at α= 0.05

In Experimental treatment IV, the message was also treated in a two-sidedness format, but the participants were given a positive message regarding GM technology first, and then a negative message about GM technology later. Participants were tested with regard to their attitude, risk perception and purchase intention toward GM flowers first, after which they read through the treated message and re-answered the questions regarding their attitude, risk perception and intention to purchase the GM flowers again. The study results showed that the treated message caused a 0.05 unit change in the participants' attitudes toward GM flowers, a -0.06 unit change in risk perception, and a 0.02 unit change in purchase intention. The statistical analysis based on an independent *t*-test indicated that there was no significant difference between the changes in experimental treatment and the control group (attitude, $P = 0.294$; risk perception, $P = 0.742$; and purchase intention, $P = 0.150$), as presented in Table 10.

Table 10. Analysis of *t*-tests for the comparison of Experimental treatment IV vs. the control group for the effects on the consumers' attitudes, risk perception and purchase intention with regard to GM flowers [y]

	Attitude					Risk perception					Purchase intention				
	Mean[Z]	Std.D	Mean Diff.	*t*	*P*	Mean[Z]	Std.D	Mean Diff.	*t*	*P*	Mean[Z]	Std.D	Mean Diff.	*t*	*P*
Treatment IV (n=212)	0.05	0.81	0.08	1.10	0.294	-0.06	0.81	0.02	0.33	0.742	0.02	0.67	0.09	1.44	0.150
Control group (n=218)	-0.03	0.73				-0.08	0.64				-0.07	0.55			

[y] Experimental treatment IV involved a two-sided message strategy whereby a positive message was provided first, and then followed by a negative message regarding GM technology

These results have shown that, compared to the control group (i.e., the group for which no GM message was provided), Experimental treatment III (i.e., received a negative message regarding GM technology first,

and then a positive message about GM technology) had significant effects on consumer risk perceptions and purchase intention toward GM flowers. That is to say, this treatment not only increased the consumer's risk perception, but also enhanced the consumer's purchase intention toward GM flowers. The findings of an earlier study indicate that two-sidedness message has a better ability to persuade when there are fewer arguments regarding the positive side of the message (Chebat *et al.*, 1988), or when the consumers are socially sophisticated or have higher educational levels (Karp, 1971). Basically, the sample used in this study is a highly-educated group of which 55.6% of the participants are at least college educated (according to population census data, 51.49% of the population in Taipei are at least college or university educated). Therefore, we are likely to see in this study that a two-sidedness message strategy is more clearly revealed in terms of changing the consumer's risk perception and purchase intention with regard to GM flowers. Karp (1971) suggested that the two-sided message had a better effect on persuasion than the single-sided message because the single-sided measure usually leads the consumers to adopt a positive attitude. For instance, when the consumers receive any negative point of view, they become frustrated. By contrast, the two-sided message reveals both the positive side and the negative side of the message at the same time, but finally leads consumers to a positive point. Because consumers have already received the negative points from the two-sided message, once they receive the negative side of the message again, they will not be frustrated too much, and will finally tend to remain on the positive side.

Although the two-sided message strategy regarding the giving of a negative message about GM technology first and then the positive message about GM technology later increases the consumer's risk perception, it also enhances the consumer intention to purchase GM flowers. It is not confusing at all. Locander and Hermann (1979) suggested that there was no opposing relationship between risk perception and purchase intention. When consumers were more confident regarding the status of their purchase alternatives, they were more likely to decide to buy even though they faced a risk in terms of their purchase decision. Obviously, when consumers are confident about their ability to judge among various types of purchases, they tend to take risks and decide to buy. Flowers are not used for food, and so for consumers the possible risks associated with GM flowers do not have as great an impact as those for GM foods. This may make consumers more confident regarding the possible risks resulting from purchasing GM flowers. So, even though the two-sided message strategy increases the participants' risk perception with regard to GM flowers, it is still able to enhance the participants' intention to purchase GM flowers. Wee *et al.* (1995) also found that in terms of word-of-mouth communications, the two-sided message was more effective than the single-sided message in impacting the consumers' behavioral intention. Chebat and Picard (1988) also pointed out that, even though the two-sided message could strengthen consumers' recognition, it could not influence the consumers' affective preference. The consumer's attitude was one of the consumer's emotional factors, and could have been the reason why the two-sided message changed the participants' risk perception and intention to purchase GM flowers, but had no effect on the consumer's attitude toward GM flowers.

Conclusion

The study's results have shown that consumer attitudes and purchase intention toward GM flowers are significantly influenced by the consumers' age and gender. Males or elderly consumers reveal a more positive attitude together with a higher purchase intention toward GM flowers. However, the consumer's risk perception in relation to GM flowers does not vary with the consumer's socio-economic characteristics. As for communication, a two-sided message consisting of "giving a negative message, followed by a positive message" has the best communication function in that it increases the consumer's intention to purchase GM flowers. It is very likely to be due to the two-sided message strategy enhancing the consumer's confidence in his or her ability to control the possible risk arising from the GM flowers.

The study's results imply that the consumers' risk perception and purchase intention in relation to GM flowers can be changed with an appropriate message strategy. Women provide the main consumption power in the floral market; however, their attitude and purchase intention toward GM flowers are significantly lower than those for men. This implies that commercial communications regarding the promotion of GM flowers should be targeted at female consumers by means of a two-sided message strategy. It is recommended that future research focus on the selection of a message strategy for female consumers with a view to increasing sales in the floral market.

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