Effects of Information on Young Consumers’ Willingness to Pay for Genetically Modified Food: Experimental Auction Analysis

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This study examines the effects of information on consumers’ willingness to pay (WTP) for genetically modified food (GMF). We used Vickrey second price experimental auction method for elicitation of consumer WTP for GM potato chips and GM soya-chocolate bar. The sample used in this study was university students from Delhi, India. Four information formats (positive, negative, no information, and combined information about GM technology) were used for the examination. The results show that, when students received the combine information they were willing to pay around 17%–20% premium for GMF and when received the negative information they demanded around 22% discount for GMF. While the positive- and the no-information formats alone have no considerable effect on consumers’ WTP for GMF. Overall, our findings suggest that while doing marketing of GMF in India, the best strategy is to provide combined information about GM technology.

KEYWORDS genetically modified food, information effects, Vickrey auctions, willingness to pay

Recent advances in science and technology have delivered a number of sophisticated techniques in almost all fields to solve versatile problems of humankind. One of them is genetic modification (GM) technology. The fundamental reason for the application of this technology to the food sector is to make desirable changes in various food attributes such as an increase in
taste, flavor, yield, and nutritional value. It is a fact that in a market consumers are the final determinants of the success or failure of scientific inventions (Springer et al. 2002). Hence, an understanding of consumer attitude towards specific scientific inventions is very important for predicting the future of that invention. The widely accepted theory of formation of consumer attitudes is the Fishbein multi-attribute model (Fishbein 1963). This model proposes that consumer knowledge about a product and its various attributes defines consumer attitude towards the product. The findings suggest that consumers around the world have a low level of knowledge about GM technology and genetically modified food (GMF) (see Anand et al. 2007; Batrinou et al. 2005; Curtis, McCluskey, and Wåh 2004; Dannenberg, Scatasta, and Sturm 2008; Guivant 2006; Hallman et al. 2003; Moon and Balasubramanian 2001). In this uncertain environment, the information about GM technology or GMF that consumers receive from various sources is likely to have an influence on consumer attitude formation towards GMF, and eventually on willingness to pay (WTP) for GMF (see Anand et al. 2007; Colson and Huffman 2009; González, Johnson, and Qaim 2009). In today’s competitive market, it is rational that various firms and organization always disseminate biased information about GMF to promote their personal interest. Therefore, this study examines the effects of different information types/formats on consumer WTP for GMF. For the investigation, we conducted Vickery second price experimental auctions for student sample in India.

BACKGROUND

It is a fact that consumer perceptions of risks of any innovation are the one of the most important determinants of the future of innovation. German Sociologist Beck (1992) argues that today consumers perceive more food risks than the actual risks compared to earlier times, also in earlier times consumers use to trust more on experts, while this has been reduced over the time. Seippel (1996) criticize Beck that there is no change in consumers trust in experts in earlier times and today. Beck (1992) suggest that still experts play important role but the conflict between experts opinion is the main issue of consumers concern, which creates uncertainty in consumers mind. Consumers strong opposition to GMF can be explained by anthropological approach, as GMF is a modern cultural taboo and public will evaluate this innovation within traditional cultural outlines, irrespective of its benefits (Kwieciński 2009). Acceptance of GMF might increase in the future because of more benefits and political acceptance of GMF with cultural changes (Kwieciński 2009). There are few barriers for GMF to enter in the market and the most important is consumer acceptance (Rommens 2010). Phillips and Corkindale (2002) revived marketing literature and theory of marketing innovative products; they suggest that marketing of GMF should be proactive
as addition to the available products or replacement to the existing products in the market. Further, they found that GMF industry tried proactive marketing but the success was not effective, hence they suggest that marketing should be more focused and targeted. The main assumption behind the mostly accepted model of human behavior is that appropriate information builds pleasing attitude, which results in positive behavior towards the product (Phillips and Corkindale 2002). According to Beck (1992) consumers are likely to receive contrary information from experts about food risks and Phillips and Corkindale (2002) suggest that information plays significant role in the acceptance of GMF, hence we will revive literature about effects of information format on consumers’ WTP for GMF.

To our knowledge, Frewer and colleagues (1998) were the first to conduct a study about communication strategies for GMF in the UK. In this study, they found that providing information about the scientific inventions generates confidence in consumers and eventually the acceptance of technology. They give the reason that conveying information about GMF, as a totally risk-free food will likely be unacceptable to consumers because they are aware of past risk-free promoted products, which were truly not.

Scholderer and Frewer (2003) tested whether consumer attitude and product selection changed due to the type of information they received. They used four information formats (balanced information, product-specific information, conventional product advertising information, and no information as a baseline) and two food products in the experiment. The sample used in this study was from Denmark, Germany, Italy, and the UK. They found that all the information formats failed to alter consumers’ prior attitude. This may be because the information formats used in the experiments were expert’s views. Consumers may have received this information as not understandable or irrelevant and, therefore, these information types failed to alter the prior attitude of the consumer. Further, they also report that all the information formats influenced consumer selection of GMF negatively. They argue that this might be because consumers have prior strong negative attitudes, which override any information effects and become stronger. Therefore, the provision of additional information decreases the probability of selection of GMF.

Tegene and colleagues (2003), Huffman and colleagues (2006), and Rousu and colleagues (2007) analyzed the influence of different information types on consumer WTP for GM and non-GM labeled food products including vegetable oil, potatoes, and tortilla chips in the United States. They used six information formats about GMF (positive, negative, both positive and negative together, positive plus third party verifiable information, negative plus third party verifiable information, positive and negative plus third party verifiable information). They found that when consumers received positive information about GMF they bid higher for two out of three GM labeled foods than for non-GM labeled; with negative information, consumers purchased GM labeled foods at 34%–38% discount; with both
types of information (negative and positive together), consumers bid more for plane labeled foods. When consumers received negative and third party verifiable information, they purchased GMF at 17%-22% discount. When given positive information they bid higher for GM labeled foods than plane labeled. When given positive and third party verifiable information they bid less for GMF labeled than for plane labeled foods. When consumers received all types of information together, they bid more for two plane labeled foods than GMF. Finally, they suggest that the verifiable third party information has a strong influence on consumer’s WTP for GMF, which will help to increase consumer acceptance of GMF. The findings from this study report that the influence of information formats is inconsistent with the food products.

Lusk, House, and colleagues (2004) conducted a study in the United States, England, and France. Four types of product specific information (environmental benefit, health benefit, world benefit, and no information) was used. They found that all the information formats decreased consumers demand for a discount to buy GM cookies in the United States and England, while in France, when given the positive information, consumers demanded a higher discount to consume GM cookies. The reason behind the unexpected behavior of French consumers may be that they have a prior strongly negative attitude, which overrides the influence of the new information (Scholderer and Frewer 2003). Further, they also report that the magnitude of influence varies with the information type and across the locations. This suggests that the specific information format is unlikely to appeal to all consumers.

Li and colleagues (2004) analyzed the US consumer response to GM beef. They found that those consumers who received no information demanded 23% discount while those with the positive information were willing to pay 6% premium for GM beef. They argue that the reason behind the consumers demand for the discount may be their risk perception about GMF. They report that the positive and beneficial advertisements were likely to reduce consumer skepticism about GMF.

Martinez-Poveda and colleagues (2005, 2009) conducted a study regarding the consumer willingness to accept and risk perception of GMF in Spain. They found that very few consumers’ prior attitude changed by positive and negative information together in a negative direction, which suggests that consumers put more weight on negative information than positive information. The first reason may be that recently consumers have seen some food scandals. Hence, they are more cautious about novel foods like GMF. Another reason may be a lack of understanding about GMF.

Hu and colleagues (2006) analyzed consumer WTP for GM soya-oil in China. They used three information formats (positive, negative, and no information). They found that the positive information increases WTP but the influence was insignificant, and the negative information decreases WTP at a significantly high degree compared with the influence of the positive information. They explained this finding by using the “attribute theory” and
“prospect theory”. Li and colleagues (2002) conducted a study in China for the analysis of consumer WTP for GM rice and soybean oil. They found that most of the consumers have positive opinions about biotechnology, which eventually has a positive influence on consumer WTP for GMF. Further, they argue that consumer positive opinion towards biotechnology was due to positive media coverage about the use of GM technology in the agricultural sector.

Depositario and colleagues (2009a) conducted uniform-price auctions for golden rice in the Philippines. They used four information formats (positive, negative, both together, and no information). All the information used in the experiment was about golden rice. They found that consumers placed the highest bid for the positive information followed by the no information, the negative information and then the combined information. Moreover, they argue that the reason behind the lowest bid under combined information might be that consumers valued the negative information more than the positive information. They also report that the difference between the influence of the positive-information and the no-information formats was not high. Hence, they argue that positive information about GMF does not increase consumer WTP to a very high degree.

Concerning India, so far only one study is available by Anand and colleagues (2007). They analyzed the effects of four information formats (consumer-friendly, producer-friendly, negative information, and no information) on consumer WTP for chapatti (Indian bread) made from GM wheat. The information used in this study was product specific. For estimation of consumer WTP, they employed the double bounded contingent valuation method (CVM). They found that consumers with no information were willing to pay about 7% price premium, those with consumer-friendly information 23%, and 10% for the producer-friendly information; while for the negative information, consumers demanded a high discount of 139%. Anand and colleagues argue that with no information consumers were willing to pay a small premium because they have positive attitudes towards modern technology. While for the producer benefit information, consumer WTP was not much different from the no-information type. They explain that the influence of this information may have fallen under the no-information format, or that they do not value the public good attribute. For the consumer benefit information, they were willing to pay a considerable premium due to private benefits. For the negative information, consumers were not willing to buy at any price because consumers might be worried about the long-term health risks. Moreover, the comparison of influence between the positive personal and the negative information suggests that consumers value the negative information more than the positive information.

The overview of the available literature reports that most of the studies have employed experimental auctions and CVM to measure the
effects of information on consumer attitude. The information formats used were positive information (positive health, positive environment, producer-friendly, consumer-friendly), negative information (negative health and negative environment), and third-party verifiable information about GMF. Though there is a huge difference in the findings of past studies, there are some common findings. When consumers receive negative information, they demand a certain amount of discount to choose GMF. For positive information, consumers are willing to pay a premium. Health information has a greater influence than environmental. Overall, negative information has an influence with high magnitude as compared with all other information formats. In developing countries like India and China, consumers are willing to pay a premium when receiving no information or positive information, but for negative information consumers demand a very high discount to buy GMF (Anand et al. 2007; Hu et al. 2006; Li et al. 2002).

We extend Anand and colleagues (2007) study with the inclusion of the combined information format. Moreover, we can say that our study is an extension of the Anand and colleagues (2007) and Depositario and colleagues (2009a) research works. We use four different information formats: positive information, negative information, both positive and negative combined, and no information about GM technology and GMF. To our knowledge, this is the first study in India, of this kind. The food products chosen for the analysis are processed food products. The reasons behind the selection of these products are that these are popular among students and plenty of processed food products are available in India, which may contain GM ingredients. Recently, the government has proposed a mandatory labeling policy for all GMF products (Gruere and Rao 2007), but the implementation is not yet complete. Hence, it is hard to find any food product labeled as GMF. Currently, India imports many food products from the US including meat products, edible oils, grains, and pulses (USDA-FAS 2010). In the United States, GM crops are cultivated at a high level as compared to other nations (James 2009). Hence, we cannot deny the presence of GM ingredients in processed food products in the Indian market, which comes from the United States and GM crop growing nations. For confirmation of the availability of processed GMF products in the Indian market, which come from the United States, we visited around 10 supermarkets in different locations in Delhi. The imported products we spotted were Pringles potato chips, tortilla chips, soya-chocolate nutrient bars, biscuits (cakes), chocolates, fruit juice, soya milk, and plenty more.

So far, no study used four information formats (as discussed earlier), which consumers are likely to receive in general, while Depositario and colleagues (2009a) used these four information formats and they carried auction for only GMF products. While in our study, we use GM and non-GM types of food products for auctions, this helps to get precise value of WTP for GMF in comparison with non-GMF.
OBJECTIVES

The objectives of our study are: (1) to estimate consumer willingness to pay for two processed GMF products: potato chips and soya-chocolate bars; and (2) to analyze the effects of positive, negative, combined information, and no information about GM technology on consumers’ WTP for GMF products.

METHOD

Vickrey Second-Price Auction Mechanism

We have selected non-hypothetical valuation method: Vickrey second-price experimental auction for valuation of GMF products. The reasons behind the selection of Vickrey auction are that it is simple to understand for the consumers, is demand revealing and easy to implement (Alfnes 2007; Lusk 2003). However, Kagel (1995) and Harstad (2000) argue that this mechanism has problems such as overbidding and irrelevant bids reported by inexperienced participants, while past studies (Karni and Safra 1989; McAfee and McMillan 1987; Parkhurst, Shogren, and Dickenson 2004; Vickrey 1961) verified truthful WTP and incentive compatibility of this method. Lusk, Feldcamp, and Schroeder (2004) argue that estimations are higher in second price auctions than in other methods. To avoid this problem, we used innovative approach. We have valued both GMF and non-GMF alternatively. By doing this we expect that if Vickrey second price auction method report high WTP, it will report for both the food products (GM and non-GM). Hence, the difference in WTP between both the products will be truthful and not high as argued by Lusk, Feldcamp and colleagues (2004).

In the experiments, we use the endowment mechanism. We endow respondents with a certain amount for bidding during the auction experiment. For detail description of endowment procedure see Kahneman and colleagues (1990) and Lusk, Feldcamp, and colleagues (2004). Concerning GMF, to our knowledge only one study has used endowment mechanism with money for the valuation of GMF in the Philippine by Depositario and colleagues (2009a). To analyze the influence of information types we have to compare the means of the bids for GMF and non-GMF. We need to know whether these means are statistically different or not. We have two observations (bids for GMF and non-GMF) for the same sample and we are not sure whether the bids are normally distributed or not. Hence, we need to use a non-parametric test. Hence, we will employ the Wilcoxon signed-rank test (Wilcoxon 1945). From this, we will infer whether different information formats have a significant influence on consumer WTP for GMF.
Experimental Design and Data Collection

For the experimental auctions, we selected two food products: soya-chocolate bar (chocolate bar containing soya) and potato chips. We purchased these food products from the market then repacked them as GM and non-GM soya-chocolate bar and potato chips. We did this to avoid brand bias. The labels show only information about the GM nature of the food. Each package of soya-chocolate bar was 50 grams and a package of potato chips was 138 grams, which are the normal sizes of these kinds of products found in supermarkets. The research sample we used in this study was a student sample. Earlier, Lusk and colleagues (2001) and Depositario and colleagues (2009a) used a student sample for valuation of food products. Moreover, Depositario and colleagues (2009b) found that WTP for GMF is similar for both student and non-student sample. Hence, we used student sample in our study. Moreover, we will not generalize our results for overall population. In early 2009, we conducted student survey at the Jawaharlal Nehru University. Delhi, India. Our sample size was very small \((n = 64)\), which is common in experimental auctions (see Bernard, Zhang, and Gifford 2006; Depositario et al. 2009a, 2009b; Lusk et al. 2001; Lusk, House, et al. 2004; Rousu and colleagues 2004). We were unable to get the list of students from the university; hence, simple random sampling was not possible. Therefore, a convenience sampling method was used; we interviewed students at the university cafeteria, student hostels, and different institutes. Those who agreed to participate in the auctions were invited to the university cafeteria, where the final auctions were conducted. The participants were from different disciplines such as environmental science, physics, mathematics, chemistry, history, economics, literature, geography, and political science.

Figure 1 shows the experimental auction procedure, each experimental auction consisted of nine steps. At the beginning, all the participants filled out the first part of the questionnaire, which contained general questions about socio-demographic variables and GMF. The second part of the questionnaire contained questions about experimental auctions.

Before the beginning of the actual auctions, all the participants received a text to read, which contained only one type of information from the four types (positive, negative, combined, and no information). Figure 2 shows the employed four information formats. We answered all the questions raised by the respondents before and after the explanation of the Vickery second price auction mechanism. Before conducting the real experiments, we conducted a trial round for a Coca-Cola bottle. Then, all the participants received 150 INR (Indian Rupee) for bidding in the auction rounds (1 US$ = 45 INR). The condition put forward was that they had to spend the entire amount on bidding during 10 rounds of the auctions, if not they had to return the unspent money. They could use the whole amount in one round or distribute...
**Step 1**  
Respondent filled out general questionnaire

**Step 2**  
Explained Vickrey second price auction mechanism

**Step 3**  
A trial round of the auction was carried for a coca-cola bottle

**Step 4**  
All the participants received one type of information about GMF  
(Positive information, negative information, both information together and no information)

**Step 5**  
Every participant received 150 INR to bid for GM and non-GM potato chips

**Step 6**  
First round of the auction for GM potato chips was carried out, winner of the first round announced

**Step 7**  
Second round of the auction for non-GM potato chips carried, winner of the second round announced

**Step 8**  
10 rounds of auctions carried out as GM potato chips – non-GM potato chips - GM potato chips  
– non-GM potato chips and so on…. 

**Step 9**  
Winners of all the rounds got the products, unspent amount of money collected back

**Step 10**  
Again, every participant received 50 INR to bid for GM and non-GM soya-chocolate bar

**Step 11**  
Repetition of the procedure as from step 6 - 9 for GM and non-GM soya-chocolate bar

**FIGURE 1** Experimental procedure: Vickery second-price auctions.

It in different rounds. In the first round, we asked the respondents to bid for GM potato chips, and requested them to submit their bid in sealed form to the enumerator, without the knowledge of the other participants. The enumerator collected all the bids and arranged them in ascending order. The participant who bid the highest was the winner and paid the price equal to the second-highest bid. After the first round, only the winner of the first round had less money (150 INR minus the amount of second-highest bid), while all the others had 150 INR to bid on the remaining rounds. Then in the second round, we auctioned non-GM potato chips by using the same procedure as for the first round. After the second round, only two participants had less money to bid in next rounds: the winners of the first and second rounds. The third round of auction was for GM potato chips
Willingness to Pay for Genetically Modified Food

- **Positive information**
  - Genetically modified (GM) crops require a minimum amount of pesticides and herbicides
  - They are stress resistance and maturity time is reduced
  - GM foods are enriched in taste, quality and nutrient content
  - GM animals have improved productivity and feed efficiency i.e. increased production of eggs, milk and meat
  - GM crops are environmentally friendly and help conserve water, soil and energy
  - GM food can solve food security and malnutrition problems of the developing world by increasing yield and nutrient rich foods

- **Negative information**
  - Possible negative impacts such as allergen reaction and unknown health effects on human
  - Unintended transfer of gene through cross-pollination (on non-target species)
  - Unknown effects on flora, fauna and soil
  - Domination of world food production by a few companies which are key players in GM technology i.e. Monsanto, Syngenta
  - Increasing dependence of developing nations on developed nations
  - Tampering with nature by mixing genes among species
  - Violation of natural laws “against the nature”

- **Combine information**
  - Positive and negative information together

- **No information**
  - No information was given to the respondents

FIGURE 2 Information formats.

and so on. In the same manner, we conducted 10 rounds of the auctions, five for GM potato chips and five for non-GM potato chips. The auction series was as R1 (R = auction round) for GM potato chips – R2 for non-GM potato chips – R3 for GM potato chips – R4 for non-GM potato chips – R5 for GM potato chips – R6 for non-GM potato chips – R7 for GM potato chips – R8 for non-GM potato chips – R9 for GM potato chips – R 10 for non-GM potato chips. Then after the 10th round of auction, we collected the unspent money from all the participants. After the auctions of potato chips, we informed the participants that they had to take part in another auction for soya-chocolate bars. We gave 50 INR to all the participants to bid for GM and non-GM chocolate bars containing soya. We employed a similar auction procedure as used for the potato chips and conducted 10 rounds of auctions for soya-chocolate bars. At the end of the 10th round, we collected the unspent money from all the respondents. After both the experiments, the winners received their products and we informed them that the GM and non-GM products are similar, we just labeled them differently and we
purchased them from a city supermarket. The enumerator tasted both the food products in the presence of all the participants. Further, we informed all the participants that our purpose behind this was only research. At the end, we gave some amount of money to all the participants as a reward for their participation and the time they gave for the experiment. We employed similar procedure for other three information formats with different student groups. The numbers of students in each experiment were as 17 for no information, 18 for positive information, 12 for negative information, and 17 for combined information.

RESULTS AND DISCUSSION

Table 1 reports summary statistics of the sample used in the survey. The survey sample represents 51.56% male and 48.44% female. Since the research sample was university students the age of the participants was between 19 and 31, and the median age of the sample was 23 years. Around 69% of the respondents had a master degree, 9% had a Bachelors degree and 22% had a PhD degree. Concerning household annual income distribution, 8% of the respondents’ income was below 25,000 INR, 17% of respondents’ income was between 25,000 and 50,000 INR, 26% was between 50,000 and 100,000 INR, 22% was between 100,000 and 200,000 INR and 27% was 200,000 INR and above. Around half of the respondents had a positive attitude towards modern technology—they believed that modern technology

| TABLE 1 Socio-demographic Characteristics of the Participants in Auctions (N = 64) |
|-------------------------------------------------|---------------------------------|
| Variable                                        | Percentage of the sample        |
| Female (1 if respondent is female; 0 if male)   | 48.44                           |
| Age of the respondent (y) Median                | 23.00                           |
| Education                                       |                                 |
| 1. Bachelors degree                             | 09.38                           |
| 2. Masters degree                               | 68.75                           |
| 3. PhD degree                                   | 21.88                           |
| Household income level; Scale 1–5 (INR/annum)   |                                 |
| 1. Below 25 000                                 | 07.81                           |
| 2. 25,000–50,000                                | 17.19                           |
| 3. 50,000–100,000                               | 26.56                           |
| 4. 100,000–200,000                              | 21.88                           |
| 5. 200,000 and above Mean income 3.42 (SD 1.26) | 26.56                           |
| Mean income 3.42 (SD 1.26)                      |                                 |
| Attitude towards modern technology: Modern technology always makes human life convenient (1, yes; 0, otherwise) | 51.56                           |
| Consumer knowledge: Naturally grown food does not contain genes while genetically modified food contains genes (1, no; 0, otherwise) | 59.38                           |
always makes human life convenient. Though the respondents were university students, only around 60% of the respondents gave the correct answer for the question that naturally grown food does not contain genes while GMF contain genes. This finding reports a lack of knowledge about GM technology. This finding is consistent with past findings (Anand et al. 2007; Curtis et al. 2004; Guivant 2006) that consumers in developing countries have poor knowledge about GM technology and GMF.

First, we will discuss the findings for potato chips. So far, most of the studies have compared means of bids of consumer WTP (see Fox, Hayes, and Shogren 2002; Huffman et al. 2006; Knetesch, Tang, and Thaler 2001; Lusk, Feldcamp, et al. 2004; Shin et al. 1992; Shogren, Fox, et al. 1994; Shogren, Shin, et al. 1994) therefore we also computed means of the bids from all the rounds for four information formats. Table 2 presents the summary of the bids (mean, standard deviation, median, minimum, and maximum of the bids) from each auction round.

The comparisons between means of bids for GMF and non-GMF were also calculated. These comparisons were between closer rounds: as mean of the bids from R1 (GMF) with R2 (non-GMF), and R3 with R4, R5 with

| TABLE 2 | WTP for GM and Non-GM Potato Chips under Different Information Types (INR) |
|-------------------------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|----------------|----------------|----------------|
| Auction rounds                | R1    | R2    | R3    | R4    | R5    | R6    | R7    | R8    | R9    | R10   |
| Product                       | GM    | NGM   | GM    | NGM   | GM    | NGM   | GM    | NGM   | GM    | NGM   |
| Information type: No information | Mean  | 61.29 | 43.65 | 48.65 | 46.35 | 45.88 | 47.88 | 46.35 | 45.47 | 37.59 | 49.06 |
|                               | SD    | 45.13 | 26.7  | 31.4  | 32.52 | 28.19 | 26.27 | 20.85 | 21.5  | 23.31 | 34.61 |
|                               | Median| 60    | 45    | 50    | 40    | 57    | 50    | 50    | 42    | 38    | 45    |
|                               | Min   | 5     | 5     | 10    | 5     | 3     | 5     | 5     | 15    | 10    | 0     |
|                               | Max   | 150   | 90    | 110   | 120   | 103   | 80    | 80    | 85    | 90    | 130   |
| Information type: Positive information | Mean  | 56.22 | 48.33 | 56.83 | 46.78 | 55.94 | 49.39 | 40.67 | 44.72 | 42.56 | 61.06 |
|                               | SD    | 36.02 | 28.54 | 31.34 | 18.34 | 37.27 | 21.07 | 29.48 | 20.46 | 24.09 | 37.21 |
|                               | Median| 55    | 42.5  | 56    | 42.5  | 52    | 47.5  | 37.5  | 51    | 42.5  | 53.5  |
|                               | Min   | 1     | 10    | 1     | 20    | 1     | 1     | 10    | 1     | 1     | 10    |
|                               | Max   | 150   | 150   | 100   | 80    | 150   | 85    | 120   | 85    | 80    | 150   |
| Information type: Negative information | Mean  | 35.42 | 46.25 | 41.67 | 52.33 | 39.58 | 51.08 | 37.33 | 49.58 | 24.83 | 32.33 |
|                               | SD    | 30.03 | 24.13 | 23.34 | 20.51 | 23.59 | 19.78 | 18.46 | 25.09 | 17.77 | 20.84 |
|                               | Median| 30    | 42.5  | 37.5  | 50    | 37.5  | 55    | 37.5  | 55    | 20    | 22.5  |
|                               | Min   | 5     | 20    | 10    | 20    | 10    | 20    | 18    | 20    | 5     | 15    |
|                               | Max   | 120   | 95    | 100   | 80    | 95    | 80    | 75    | 90    | 70    | 80    |
| Information type: Combine information | Mean  | 57.97 | 38.24 | 45.59 | 40.59 | 38.29 | 28.94 | 32.88 | 30.35 | 31    | 32.24 |
|                               | SD    | 31.65 | 22.15 | 22.63 | 21.56 | 23.49 | 16.36 | 20.71 | 19.66 | 20.75 | 22.54 |
|                               | Median| 50    | 40    | 50    | 40    | 45    | 30    | 25    | 30    | 32    | 35    |
|                               | Min   | 12    | 6     | 8     | 3     | 2     | 5     | 1     | 0     | 0     | 0     |
|                               | Max   | 148   | 80    | 75    | 85    | 69    | 55    | 70    | 75    | 80    | 70    |
R6, R7 with R8, and R9 with R10, yielding five comparisons. Figure 3 shows the difference between the means of bids (mean of bids for GMF minus mean of bids for non-GMF), for the four information formats. This figure also presents, whether the difference was statistically significant or not. We found that when students received no information, they were willing to pay more for GMF only in the first comparison, while in the remaining comparisons the difference was not absolute. Moreover, in the third comparison, they demanded a very small discount. In the last comparison, they demanded discount because they have to spend the unspent amount in 10th round or need to give back and the last round was for non-GM potato chips. For the positive information, students were willing to pay a premium for GMF in the first three comparisons and in the fourth comparison, they demanded a discount, in the 5th comparison they demanded a discount. For the negative information in all comparisons, students were willing to pay a premium for non-GMF. For the combined information in all comparisons except last one, students were willing to pay a premium for GMF. These findings indicate that only the negative and the combined information formats have shown absolute and consistent difference between WTP for GMF and WTP for non-GMF. The negative information had a negative influence on WTP for GM potato chips. The positive information alone did not show an absolute positive influence while the influence of the positive information increased when it was provided with the negative information. Our findings are consistent with past findings that negative information passes risk to the consumers (Huffman
et al. 2006; Rousu et al. 2005; Rousu et al. 2007; Tegene et al. 2003), and consumers value combined information more because they perceives both pros and cons which convince them that nothing is risk free (Frewer et al. 1998). Our findings are inconsistent with the findings that under the combined information consumer value the negative information more than the positive information, therefore, consumers demand a discount for GM (Fox et al. 2002; Viscusi et al. 1987). We notice that the lowest WTP for GM potato chips was observed under the negative information and the highest was under the combined information, while the positive information showed an inconsistent trend over the comparisons. The test results (Wilcoxon signed rank sum test) show that under no information the differences were statistically insignificant. For the positive information, we observed significant difference only in the fourth comparison. For the negative information, we observed a significant difference under four comparisons and for combined information in the first two comparisons. Moreover, we also calculated what percentage price premium students were willing to pay for GM potato chips under different information formats. We calculated mean of WTP for GM and non-GM from five rounds for both the products. Then estimated what percentage of premium students were willing to pay for GM potato chips as compared with non-GM potato chips. We found that students were willing to pay 3.16%, 0.78%, and 20.76% price premium for GM potato chips under the no-information, positive-information, and combined-information formats, respectively, and they demanded 22.77% discount under negative information format.

Here, we will discuss the findings for soya-chocolate bar. Table 3 presents the summary of the bids (mean, median, minimum, and maximum bids) from all the auction rounds under four information formats. Figure 4 shows the difference between the means of bids for all information formats as discussed earlier for potato chips. The findings show a uniform trend for the negative information: the mean of the bids for GM are lower than non-GM soya-chocolate bar in all comparisons. For the other three information types, only one comparison under each information format showed that the mean of the bids for non-GM was higher than for the GM chocolate bar, while in the remaining comparisons the means of the bids for GM were higher than for the non-GM chocolate bar.

These findings are not much different from the findings we observed for potato chips. The results indicate that the lowest WTP for GM was under the negative information and the highest was under the combined information. The positive and no information showed an inconsistent trend and the WTP under these information types were lower than the combined information. Hence, we can say that for GM soya-chocolate bar the negative information had a negative influence on WTP and a positive influence was observed under the combined information. The test statistics show that under all comparisons for the no and positive information there is no significant
### TABLE 3 WTP for GM and Non-GM Soya-Chocolate Bar under Different Information Types (INR)

<table>
<thead>
<tr>
<th>Auction round</th>
<th>R1</th>
<th>R2</th>
<th>R3</th>
<th>R4</th>
<th>R5</th>
<th>R6</th>
<th>R7</th>
<th>R8</th>
<th>R9</th>
<th>R10</th>
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<tbody>
<tr>
<td>Product</td>
<td>GM</td>
<td>NGM</td>
<td>GM</td>
<td>NGM</td>
<td>GM</td>
<td>NGM</td>
<td>GM</td>
<td>NGM</td>
<td>GM</td>
<td>NGM</td>
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<tr>
<td>Information type: No information</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>21.35</td>
<td>18.18</td>
<td>19.94</td>
<td>18.47</td>
<td>20.06</td>
<td>19.76</td>
<td>19.18</td>
<td>17.12</td>
<td>15.18</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>11.61</td>
<td>10.25</td>
<td>8.36</td>
<td>9.55</td>
<td>6.86</td>
<td>9.02</td>
<td>10</td>
<td>7.39</td>
<td>5.35</td>
<td>7.54</td>
</tr>
<tr>
<td>Median</td>
<td>20</td>
<td>15</td>
<td>20</td>
<td>20</td>
<td>18</td>
<td>18</td>
<td>20</td>
<td>17</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Min</td>
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<td>5</td>
<td>6</td>
<td>7</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Max</td>
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<td>35</td>
<td>38</td>
<td>28</td>
<td>35</td>
<td>50</td>
<td>33</td>
<td>25</td>
<td>30</td>
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<tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>13.8</td>
<td>8.78</td>
<td>10.11</td>
<td>10.57</td>
<td>8.77</td>
<td>7.19</td>
<td>8.49</td>
<td>7.72</td>
<td>10.4</td>
<td>16.71</td>
</tr>
<tr>
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<td>20</td>
<td>17.5</td>
<td>20</td>
<td>15</td>
<td>17.5</td>
<td>15</td>
<td>15</td>
<td>12.5</td>
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<tr>
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<td>SD</td>
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<td>10</td>
<td>15</td>
<td>12.5</td>
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<td>15</td>
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<td>10</td>
<td>1</td>
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<td></td>
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</tr>
<tr>
<td>SD</td>
<td>12.27</td>
<td>7.53</td>
<td>9.13</td>
<td>9.56</td>
<td>7.74</td>
<td>6.29</td>
<td>8.2</td>
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</tr>
<tr>
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<td>11</td>
<td>20</td>
<td>17</td>
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<tr>
<td>Min</td>
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<td>2</td>
<td>5</td>
<td>8</td>
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<td>3</td>
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</tr>
</tbody>
</table>

difference between WTP for GM and non-GM chocolate bar. For the negative and combined information, we only found a significant difference for two comparisons. We also calculated what premium students were willing to pay for GM soya-chocolate bar under different information types as we calculated for GM potato chips. We found that students were willing to pay, 5.08%, 3.82%, and 17.46% price premium for the GM soya-chocolate bar under the no-information, positive-information, and combined-information formats, respectively, and demanded a 22.59% discount under the negative-information format. The overall findings for both the products are nearly similar.

## CONCLUSIONS

The application of GM technology for the food sector has set up a strong debate among stakeholders. So far, there is no consensus over the various issues of GMF, particularly regarding safety concerns. In this uncertain environment, it is hard for consumers to make their decisions about buying of
GMF and WTP for GMF. Consumers are likely to act towards GMF according to their knowledge level of GMF. The knowledge level of consumers around the world is insufficient, particularly in developing countries where the knowledge level is very poor (Anand et al. 2007; Curtis et al. 2004; Guivant 2006). Therefore, the type of information consumers perceive is likely to play a significant role in their response for various aspects of GMF such as WTP. In general, the possible information formats are no information, positive, negative, and combined information about GM technology and GMF. Hence, in this study we have analyzed how these information types influence students WTP for processed GMF products.

The results show that, for GM potato chips, we found the highest WTP under the combine information then the no information followed by the positive information and the lowest for the negative information. The findings about WTP for GM soya-chocolate bar showed that students were willing to pay the highest amount under the combine information, then the no information followed by the positive, and lowest under the negative information type. These finding are in accordance with the argument by Phillips and Corkindale (2002) that information plays vital role in the acceptance of GMF. Our findings suggest that negative information has a negative influence on WTP for GMF, positive information has no substantial positive influence as
compared with the no information format. Hence, we can say that when stu-
dents receive the positive information alone, WTP for GMF does not change
significantly and when they receive this information with negative informa-
tion, their WTP for GMF products increase considerably. Our results suggest
that while marketing of these products the best strategy is to provide com-
bined information about GM technology or GMF to the consumers because
the highest WTP was observed under combine information. These findings
suggest that marketers should go beyond the proactive marketing as sug-
gested by Phillips and Corkindale (2002), they should focus on balanced
information. Our study was limited in that the information provided was
not product specific and small student research sample. Hence, the find-
ings might be different for product specific information and representative
sample. Therefore, we recommend further research with product specific
information and consumer representative sample. Despite these limitations,
our findings are valuable.

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