

## Muslim consumers' perception and purchase intention toward GM food

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### Abstract

The attention on genetically modified (GM) food industry is increasing due to the flourishing of biotechnology. However, there are some debates on the associated benefits and risks of employing modification technology in food industry. This study strives to examine the causes that determine consumers' benefit and risk perceptions on GM foods. Besides, the influence of perceived benefit and risk of GM food on consumers' attitude is investigated. The empirical results of this study showed that GM food knowledge, and GM food characteristics have been acting as important predictors of both benefits and risks perceptions. Further, it is also found that perceived benefits showed significant positive influence on attitude, and attitude affects purchase intention towards GM food. Research implications to policy makers, scientists, and market practitioners are covered, in which suggestions and recommendations are provided to these parties. Lastly, research implications and recommendations to future research are discussed.

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### Introduction

The application of genetic modification technology in the food production has started since the early nineties. The acceptance of GM products is still a sensitive issue in many countries (Bredahl *et al.*, 1998; Frewer *et al.*, 2003; Rodríguez-Entrena *et al.*, 2013; Amin *et al.*, 2014). However, without knowing there are already many GM food products in our supermarkets or groceries store shelves. These GM foods are perceived as value added food products (Frewer *et al.*, 2003). Most of the GM food products are claimed to be enriched with vitamins, fibers, minerals; low in cholesterol and fats; and sometimes can prevent certain diseases (Food Safety and Quality Division, 2013).

GM food is a result of scientific endeavor, which involved premeditated tempering of the genetic material of plants (Laux *et al.*, 2010). It is a new technology that causes the challenge between society and individuals in evaluating this genetic engineering technique. Such technology can produce a set of potential benefits and risks. The perceived benefits of employing modification technology particularly in food content includes low cost of production, less usage of pesticides and herbicides, increasing farming productivity, reduction of its market price, and enhancements of food attributes (Klerck and Sweeney, 2007; Qaim and Kouser, 2013). On the other hand, there are some perceived risks from

consumer perception, such as allergic responses, durable health and environmental effects, cultural and moral subjects, religion, and possible creation of new virus and toxins (Ho *et al.*, 2006).

The GM food products have been introduced into the market to cater this new trend of consumers. However, technological modification food productions can elicit a negative reaction from the consumers, especially the lack of good communication on risk assessment efforts and cost/benefit evaluations (Bredahl, 2001; Frewer *et al.*, 2003; Kim, 2012). Agricultural biotechnology has been much publicly debated in many countries compared to many other GM products (Juma, 1999). Previous researches that investigated consumer attitudes toward GM products (especially foods) found that major consumer concerns are related to issues of health, labeling, ecology, and ethics (Hellier *et al.*, 2012; Kim, 2012). Those studies also indicated that consumer concerns are link to demographic variables and socio-economic status, such as age, income, household size, employment, religious belief, education and knowledge of biotechnology. In Asia, the results of consumer surveys that have been conducted in China, Indonesia, and the Philippines indicate that most Asian consumers have positive attitude toward GM foods (Asian Food Information Center, 2002, 2003). Research findings revealed that there are estimated two thirds of consumers not only

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accept GM foods but also believed that they would individually benefit from consuming GM foods.

In Malaysia, the National Fatwa Committee and the Islamic Affairs Department (JAKIM) declared that “the transgenic genetically modified organisms (GMOs) are “halal” (permissible) if the transgenes were derived from “halal” sources (Fatwa Committee National Council of Islamic Religious Affairs Malaysia, 1999). This means that genes obtained from the halal sources such as plant species to create GM foods are acceptable by shariah law and food produced in such manner therefore should be accepted in Islam. Although according to Malaysian Islamic scholars, further discussion is required in producing GM animals or animal byproducts including transferring the genes from plants to animals and vice-versa.

#### *GM Food Characteristics on Knowledge, Perception, and Attitude*

Genetic modification within food production is performed to improve product characteristics and its functional attributes. GM food is deemed as the production of scientists by incorporating the gene of plants or animals into food production. Despite the high awareness on the presence of GM foods, consumers are not really aware of the impacts of GM transformation on the final products (Arvanitoyannis and Krystallis, 2005). Also, they are not able to differentiate the particular attributes of GM foods with accord to their reference criteria for conventional foods (Rodríguez-Entrena *et al.*, 2013). Furthermore, consumers with different levels of knowledge on GM food were found to have different perception when forming the concept of the potential benefits and risks or in their purchase intentions towards GM food (Rodríguez-Entrena *et al.*, 2013). This generally shows that consumers are not fully familiar with the characteristics of GM products and this appears to influence their level of knowledge on GM technology, which subsequently affects their perception and attitude.

Product characteristics may be informative for consumers since it can influence attitude towards that product. Consumers can choose whether to buy, or not to buy, or to consume such product depending on the attributes of the product itself (Mohapatra *et al.*, 2010). In relation to the GM food, Fortin and Renton (2003) found that genetic modification had negative influence on consumer attitudes. For instance, if the label content of the food product indicating the presence of genetically modified ingredients, it would increase hazard perception, and decrease purchase intentions in relative to a non-label food

(Hellier *et al.*, 2012). However, denoting the positive attributes of GM food can reduce consumers’ negative reactions on such food (Teisl *et al.*, 2008). Thus, it is important to examine the relationship between GM food characteristics and attitudes toward GM food, especially in this case of GM food, which is a new product introduced in the consumer marketplace.

Furthermore, a poor understanding about GM food characteristics create confusion for certain people when they tend to see more disadvantages instead of advantages on genetically engineered foodstuffs (Mohapatra *et al.*, 2010). Consumer beliefs about GM foods are constructed between the conflicts of safety and benefit in their consumption; however the perception of benefits itself is still not enough to offset the perception of low safety (Fortin and Renton, 2003; Arvanitoyannis and Krystallis, 2005). Consumers would only accept the use of biotechnology in food production when they truly understand the context and purpose of its use (Hossain *et al.*, 2003). Based on this discussion, this study postulate that acquired understanding about characteristics of GM product could lead consumers to see the greater benefits of GM product. Therefore, the following hypotheses are proposed:

H1: When consumers are more familiar with GM food characteristics, they will have more correct knowledge of genetic modification in food production.

H2: When consumers are more familiar with GM food characteristics, they will have more positive attitude towards genetic modification in food production.

H3: When consumers are more familiar with GM food characteristics, they will perceive more benefits of genetic modification in food production.

#### *GM Food Knowledge on Perceived Benefits and Risks*

Knowledge about GM in general and GM food in particular contributed their role in shaping consumers’ risk and benefit perception, and in the end influence their attitudes towards GM food. This is especially when they lost confidence in the production chain from lack of knowledge about the new technology, and the effect of these foods can have on health (Frewer *et al.*, 1995; Grunert *et al.*, 2001). Consumer knowledge in GM food can alter their perception. To date, consumers’ knowledge and awareness on GM food is still rather limited (Hu and Chen, 2005) and they tend to perceive products derived from biotechnology as high risk. Further,

consumer acceptance on GM food is related to their product knowledge (Baker and Burnham, 2001; Bredahl, 2001; Gaskell *et al.*, 2006; Canavari and Nayga Jr, 2009).

However, consumers' knowledge level does not necessary often lead to more positive attitudes due to two associated reasons. First, as the level increases, consumers show higher level of concern on food quality, production process and effects on the environment, resulting in more skeptical attitudes toward GM technology (Zhang *et al.*, 2010). Second, increasing knowledge by the availability of more information is more likely to trigger existing attitudes of the consumers, rather than to change these attitudes (Fazio, 1990; Frewer, 2000). In other words, earlier negative attitudes towards GM food will get worse rather than mitigated by the supply of information (Grunert *et al.*, 2000). According to empirical research data from European Commission (Gaskell *et al.*, 2006), the public will continue being skeptic on these new products unless they see benefits of consuming such food.

This research is in accordance with prior studies, making contribution to the body of knowledge regarding factors that explain perceived risks and benefits as well as attitude towards GM foods in Malaysia context. The research by Amin *et al.* (2006) studied the attitude of Malaysian consumers toward GM soybeans in the market. Besides, Chen and Li's (2007) study on consumers' attitude concerning GM food revealed that GM food knowledge has negatively impact on perceived benefits. Both perceived risks and benefits arising from genetic modification in food production are very much influenced by knowledge level on GM food production (Bredahl, 2001). Therefore, the following hypotheses are proposed:

H4: When consumers have more correct knowledge about gene technology in GM foods, then they will perceive more benefits of applying genetic modification in food production.

H5: When consumers have more correct knowledge about gene technology in GM foods, then they will perceive fewer risks of applying genetic modification in food production.

#### *Perceived benefits and perceived risks on attitude towards GM food*

Consumer's attitude is their tendency to evaluate a particular entity with favor or disfavor to a certain extent (Eagly and Chaiken, 1993). A specific attitude can be utilize to explain a situation in which some individuals tend to support some social policies or ideologies; while others against them. In general, an

attitude towards the use of gene technology is found to be influenced by both perceived risks and perceived benefits of genetic modification technology in food production (Siegrist, 2000; Nganje *et al.*, 2009; Kim, 2012). Kim (2012) found that consumers' belief and attitudes in regards to the risks and benefits of GM foods are related to consumers' choice behavior of GM foods. Moreover, Traill *et al.* (2006) and Yee *et al.* (2008) pointed out that perceived benefits are more vital than perceived risk in influencing individuals' willingness to consume. However, McCarthy *et al.* (2002) rehearsed that perceived risks played a more important role than perceived benefits. Besides, Gaskell *et al.* (2006), McCarthy *et al.* (2002), and Moon and Balasubramanian (2004) stressed that consumers will only accept the new food when more tangible benefits are provided for them. Therefore, the following hypotheses are proposed.

H6: When consumers perceive more benefits of applying genetic modification in food production, then they will have a more positive attitude toward GM foods.

H7: When consumers perceive more risks of applying genetic modification in food production, then they will have a less positive attitude toward GM foods.

#### *Attitude towards GM food and purchase intention of GM food*

Attitude and behavioral intention had been largely discussed in marketing literature. Theory of Reasoned Action suggests that a person's attitude predict their intention to perform the behavior (Ajzen and Fishbein, 1980). If a person has a positive belief towards an object, they will have more favorable attitude towards the object (Fishbein and Ajzen, 1975). That is, consumer with favorable attitude towards GM food would be more intend to buy GM food.

Spence and Townsend (2006) found that attitude towards GM food was strongly influenced by behavioral intention to try GM food. Similarly, Bukenya and Wright (2007) documented that attitude toward GM technology and its use in food production was a significant determinant of consumers' decisions and willingness to buy GM food. Also, Rodríguez-Entrena *et al.* (2013) found that the more positive attitude towards GM food, the greater the intentions to purchase GM food. Therefore, the following hypothesis is formulated as below:

H8: When consumers have a positive attitude toward GM foods, then they will have greater

intention to purchase GM food.

The following section covers discussion on research methodology, and followed by data analysis and discussion.

## Materials and Methods

### Data analysis

The objective of this study is to investigate the causes of perceived risk and benefit for GM food. Besides, the influence of both perceived risk and benefit on attitude toward GM food is examined, and the effect of attitude on purchased intention is also tested. In achieving the research objectives, a model of factors influencing consumer perceived risk and benefit of GM food is proposed using Partial least Square (PLS) together.

### Respondent Profile

This study successfully yields a total of 151 respondents. Data in the Table 1 shows that all of the respondents are Malay and professed Islam as their religion. Majority of them were females (65.6%), age between 31-40 years old (35.1%), are married (78.8%) and have three to four children (31.8%). Most of the respondents hold a bachelor's degree (57.7%) and earned annual income between RM36,000 to RM45,000 (28.5%).

## Results

### Measurement Model

The measurement model is evaluated by looking at individual item reliability, internal consistency or construct reliability, average variance extracted analysis, and discriminant validity. Table 2 provides the reliability of each construct in the measurement model. According to Hair *et al.* (2010), CR value of 0.7 or higher indicates good internal consistency. As shown in the table, all CR values of each construct in the measurement model are higher than 0.7, indicating that the construct validities in the model are good.

Indicator reliability of the measurement model is measured by examining its items loadings. A measurement model is said to have satisfactory indicator reliability when each item's loading is at least 0.7, significant at least the level of 0.05. Based on the analysis, all items in the model displayed loadings exceeding 0.696, ranging from a lower bound of 0.696 to an upper bound of 0.959. All items are significant at the 0.01 level and all items used in this study have shown satisfactory indicator reliability.

### Discriminant Validity

Next, Table 3 shows the AVE scores that located along the diagonal of each matrix. These are assessed by using the Fornell and Larcker's (1981) criterion, which is the square root values of AVE for each construct is higher than the correlation values between the respective constructs. Therefore, discriminant validity is attained in this study.

### Path coefficients and hypotheses testing

A major importance in PLS analysis is the variance explained, in addition to displaying the significance of all path estimates. More precisely, the predictive power of the structural model is assessed by  $R^2$  values of the endogenous constructs. Figure 1 shows the estimated standardized path coefficients of the six constructs in this study. The standardized path coefficients ranged from -0.008 to 0.764. Thus, apart from hypothesis 7, all the hypotheses as stated earlier were supported, as presented in Table 4.

## Discussion

From the statistical findings, it shows that GM food characteristics have a significant influence on knowledge, attitude towards GM food and perceived benefits. Consumers who are well-informed about the characteristics of GM food would have correct knowledge about genetic modification in food production. Thus, it would positively influence attitude towards GM food, and intention to buy as they perceive more associated benefits of GM food. This suggests that GM food characteristics serve as foundation in developing consumers' knowledge, perception, and attitude.

The study has presented findings on the causes that determine consumers' benefit and risk perceptions on GM food. Characteristics of GM food were found to positively influence the perceived benefits. As the customers become more familiar with the GM food characteristics, they tend to perceive more benefits of having genetic modification in food production. This is consistent with a previous finding by Hossain *et al.* (2003). Upon evaluating the food attributes, Muslim consumers in Malaysia find that GM food is beneficial to them, other people in general and also the environment. It is beneficial to them because the perceived benefits of eating genetically modified food are good flavor, taste and aroma. As for others, it might be that their family members enjoy the health benefits of GM food. Besides family members, the others might include the farmers and growers involved in GM food production. It is said that



Table 1. Respondents' profile

	<b>Frequencies</b>	<b>%</b>
<b>Gender</b>		
Male	52	34.4
Female	99	65.6
Total	151	100.0
<b>Age</b>		
21-30	46	30.5
31-40	53	35.1
41-50	42	27.8
51-60	10	6.6
Total	151	100.0
<b>Marital Status</b>		
Single	29	19.2
Married	119	78.8
Divorced	3	2.0
Total	151	100.0
<b>Number of children</b>		
None	46	30.5
1-2	38	25.2
3-4	48	31.8
5-6	18	11.9
7-8	1	0.7
Total	151	100.0
<b>Qualification</b>		
SPM	11	7.3
STPM/Diploma/Matrices	43	28.5
Degrees	86	57.0
Masters	10	6.6
PhD	1	0.7
Total	151	100.0
<b>Annual Income</b>		
Below RM25,000	39	25.8
RM26,000 - RM35,000	42	27.8
RM36,000 - RM45,000	43	28.5
RM46,000 - RM55,000	21	13.9
RM56,000- RM65,000	6	4.0
Total	151	100.0
<b>Ethnic</b>		
Malay	151	100
Total	151	100
<b>Religion</b>		
Muslim	151	100
Total	151	100

Malaysian consumers are health conscious because of their awareness about health and the level of their education as it is indicated that the consumers are university educated in this study. Such production methods may help farmers to save production cost while ensuring availability and high yield of crops despite adverse factors such as bad weather and insect infestation. Thus, in the light of these benefits, the customers' familiarity with characteristics of GM food influences the perceived benefits of genetically modified technology in food production.

Knowledge was also found to have a positive but weak relationship compared to GM food characteristics. This study found that consumers who have more correct knowledge about GM foods would be more aware on the perceived benefits of using genetic modification in food production. This finding is in line with existing studies by Baker and Burnham (2001), Canavari and Nayga Jr (2009) and

Gaskell *et al.* (2006) where consumers' acceptance of GM food is attributed by their product knowledge. It was found that knowledge influences perceived benefits. But it is possible that consumers who possess less knowledge about GM technology in food leads Muslim consumers to be less skeptical and critical towards GM food. Instead, they enjoy more on the advantages of GM food. Consumers may not be knowledgeable enough on the genetically modification process yet be able to enjoy the benefits of GM products. The relationship is weaker than GM food characteristics could possibly suggest that they are more interested with benefits rather than pursuing correct knowledge. The GM food characteristics such as economically advantageous promote useful and practical consumption to the consumers' daily lives. Thus, the correct knowledge has less effect than GM food characteristic on perceived benefits.

As knowledge was found to influence perceived

Table 2. Measurement model

	Scale type	Items	Loading	AVE	CR
Knowledge	Reflective	B10	0.696	0.603	0.819
		B11	0.770		
		B16	0.856		
Perceived Benefit	Reflective	D24	0.937	0.909	0.967
		D25	0.959		
		D26	0.964		
Attitude towards GM food	Reflective	F30	0.946	0.856	0.947
		F31	0.941		
		F32	0.888		
GM Food Characteristics	Reflective	I49	0.807	0.747	0.921
		I51	0.842		
		I56	0.917		
		I57	0.888		
Perceived of risk	Reflective	L27	0.849	0.797	0.922
		L28	0.943		
		L29	0.885		
Purchase Intention of GM food	Reflective	O83	0.887	0.772	0.931
		O84	0.883		
		O85	0.883		
		O86	0.862		

benefits, GM food characteristics also have but weak influence on knowledge. Consumers who are well-informed about the characteristics of GM food would have a correct knowledge about genetic modification in food production. But as the positive relationship is weak, it indicates that consumers learning the characteristics of GM food are not enough to gain correct knowledge on GM food. Familiarizing themselves with GM food characteristics is only the beginning to obtain correct knowledge about gene technology. There might be complex processes involved in GM food production that are hard to grasp. GM food is a wide scientific field that consumers being lay people could not fully understand the technology, unless they are the scientist themselves.

Knowledge on GM food was reported to have a positive but weak influence on perceived risks compared to its relationship with perceived benefits. Consumers who are informed with correct knowledge, have reduced perception of risk on such food and clears their doubts and confusion about the risks of eating such food. Similar findings are present in past researches by Rodríguez-Entrena *et al.* (2013), where different level of knowledge can be shaped by different perception on potential risk towards GM food. However, consumers might have very low level of knowledge on gene technology, similar to relationship between knowledge and perceived benefits. As scientific literature continues to debate on the health and safety concerns in food, consumers' little information on the health and safety or awareness of GM food could decrease very much on consumers' risk assessment. This point is far more serious and may lead them to unknowingly accept

and be open towards GM food. Second explanation to such relationship is that Muslim consumers think that GM food is not dangerous to eat as long it is according to the fatwa, which stated that consumption of GM food that has gene of halal origin. But beside the fatwa, GM food is debated with much heat in the secular literature in terms of its safety, dangers, impacts on health, morality and so on. For instance, it is questionable that DNA recombinant phase (GM initial process to create new food) is ever hygienic as risk of contamination might occur during the process (Consumers' Association of Penang, 1999), which might not be halal toyyiban because contamination is not hygienic. Because there is no clear religious implications on Muslims to consume the food, even though there is much scientific, healthy and secular ethics debating on the subject, this explain their level of knowledge makes less risk being perceived on GM food.

Apart from causes of perceived benefits and risks, the study has also highlighted the effect of both on consumer attitude towards GM food. Perceived benefits were reported to have positive and strongest relationship with attitude towards GM food. In short, as consumer perceive more benefits of applying genetic modification in food, they will have a more positive attitude toward GM food. This is consistent with previous literature (Siegrist, 2000; Nganje *et al.*, 2009; Kim, 2012) where it has been that found consumers attitude is determined by perceived benefits. They perceived that impact of genetic modification will be very beneficial to their lives, causing their openness and positive acceptance. After knowing the benefits

Table 3. Discriminant validity

	AVE	Attitude towards GM food	GM Food Characteristics	Knowledge	Perceived of Benefit	Perceived of risk	Purchase Intention of GM food
Attitude towards GM food	0.857	0.926					
GM Food Characteristics	0.747	0.736	0.864				
Knowledge	0.603	0.402	0.218	0.776			
Perceived of Benefit	0.910	0.770	0.601	0.375	0.954		
Perceived of risk	0.798	-0.045	-0.202	0.406	0.093	0.893	
Purchase Intention of GM food	0.772	0.764	0.667	0.273	0.612	-0.331	0.879

consumers might gain for themselves and other people like his/her family, growers, farmers, society and the environment, they like the idea of the gene technology in food production. Also, their perceived benefits about produce from GM food characteristics may reflect them as materialistic consumers, thus this also explains their positive attitude on GM food. With their materialist aims, the benefits of consuming GM food are useful and advantageous to their daily lives.

Nonetheless, the result obtained on perceived risks shows insignificant relationship. In short, consumer perception of risk on GM food does not apply in their attitude. This result differed from previous research findings by McCarthy *et al.* (2002), who found perceived risks played more critical role than perceived benefits. Unlike research by Wilson *et al.* (2004) where there are some concerns on the topic with regard to associated risks, consumer will frequently seek for more information on the topic to get balanced information and polarized views. Since genetic engineering is relatively a new technology which present potentially unforeseen risks, consumers might have view this technology as risky process which cause them to have fear, uncertainty and doubt (Kim, 2012). Yet, this result can be justified on the basis that they have the correct knowledge on GM food, lowering risk perception on GM food which in turn quells their fears and anxiety. Their acquainted understanding of GM food with the right knowledge causes them to perceive less risk and does not contribute to attitude toward GM food. It can also be explained that it is the perceived benefits that offset the perceive risks. Finding shows that perceived benefits has strong influence on attitude toward GM food. Perceived benefits are so strong among consumers to the point that they will forego the risk that may have in GM food. According to previous researches by Traill *et al.* (2006) and Yee *et al.* (2008), both authors have found perceived benefits as more important than perceived risk in determining

willingness to consume, suggesting that perceived benefits is greater than risks in determine the attitude toward GM food. Also, it may be due to consumers' high assurance on the food that is monitored by government bodies. The food sold nationwide is tested by the guardian of food safety, Ministry of Health via Food Safety and Quality Division (FSQD) (Arshard, 2011). This is a body ensure that food sold in Malaysia is safe and ensuring consumers are not cheated, in line with Food Act 1983, which gives the consumer peace of mind to consume GM food.

GM food characteristics were found to positively influence on attitude towards GM food. The more acquainted the consumers are with features of GM food, the more positive their attitude toward the GM technology in food production. This is consistent with finding by Teisl *et al.* (2008), which indicate that positive characteristics of GM food could decrease consumers' negative reaction on that very food. Consumers use information about GM food characteristics to guide their purchase of GM food. The item measurement in the study pertaining to GM food characteristics are worded positively, such as 'economically advantageous', 'better taste' and 'health properties'. To the consumers, such attributes are good, respectable, quality and beneficial and not detrimental to their welfare or interests. It is this attributes that consumer perception could not agree more that such food are good because of the quality characteristics.

In addition, the result of analysis also proved attitude to be a good predictor of purchase intention, in which it is found that attitude significant positively affect purchase intention. In other words, positive attitude towards GM food leads to greater purchase intention; whilst, the purchase intention is low when attitude is negative. Their attitude is a reflection of the perceived benefits that consumers might get if they consume the food and also their perceived value on GM food characteristics such as economically

advantageous and health properties. This suggests that the more favorable their attitude is toward GM food, the more likely the consumer has the intention to buy GM food.

### *Implications*

This study sheds new lights to market practitioners in the GM food industry, particularly on the influences of GM food characteristics, and knowledge on perceived benefit and risks, attitude and purchase intention towards GM food. Consumers who are not familiar with GM food characteristics would be more cautious in their attitude towards GM food and intention to buy such food. This study suggests that consumer's attitude towards GM food and their purchase intention on GM food in Malaysia can be improved if consumers have adequate knowledge that could shape their risks and benefits perception. One of the fastest ways to improve the consumers' state of knowledge is advertising GM food through visual media, such as video sharing site like YouTube and the ever traditional television. The advertisements, design as infomercial format, should debunk any misconceptions on GM food that public may have and enlighten on the truth and the advantages of GM food have on mankind. It is recommended that the education and knowledge on GM food is backed by reputable scientific journals so to raise consumer trust on the knowledge and lead them to accept and buy more of GM food. This suggestion to use YouTube is important because it can have wider reach to public and may be cheaper than advertising in television. It is especially useful since the majority of respondents is young and is highly likely to use video sharing sites like YouTube.

While delivering the marketing messages to the public, the associated benefits of GM foods should be more emphasized so that the consumers' attention will have very less focus on the associated risk of GM food. This is because perceived risk possessed a significant role in affecting consumers' attitude in an unfavorable way. As a remedy, this study suggests that a continuous communication may be essential to educate consumers and to lessen the negative attitudes on their intention to buy GM food. Furthermore, local authorities such as government agencies, institutions and scientists should take actions in spreading the positive information related to GM technology and GM foodstuffs to the public.

The empirical evidence also shows that consumers are willing to tolerate with the GM technology as long as they could see the associated benefits are larger than the associated risks perception. For marketers who are interested in entering the Malaysia market,

it is suggested that they should put more focus on the benefits and risks perception of GM food to induce consumers' trust and beliefs as a strategy to capture the local market. When marketing GM food to the consumers, it is important that product communication emphasize its cheapness in price, its special taste and aroma, vitamins and other nutrients, its production that contains sustainable effort due to less usage of herbicide and pesticide and the social support on farmers and growers. By displaying all advantages and compared against the normal or conventional food, the consumers could see the benefits better that affect them positively and spur them to purchase GM food products.

### **Conclusions**

This study aims to examine the causes of Muslim Malaysians' perception of benefit and risk on GM food, as well as to investigate the effect of both benefits and risks perceptions on their attitude. The empirical evidences have proven that GM food knowledge and GM food characteristics have been important agents that affect Malaysians' perceptions on the benefits and risks of GM food. Further, it is also found that perceived risk has been a crucial factor that affects consumers' attitude towards GM foods. Suggestions have been provided to policy makers, scientists, and market practitioners in boosting this GM food industry. Those suggestions are given from different perspectives such as education, creating awareness, and marketing messages. However, this study is also limited in some senses. First, this study focused on consumers' perception and attitude. Perception and attitude might not sufficient to explain and lend support to consumers' actual purchase decision. Therefore, future researchers are encouraged to examine the influence of consumer's attitude on actual decision. This can provide a more comprehensive picture on consumer behavior in GM food industry. Second, this research only focused in the Malaysian context. Future researchers are encouraged to replicate this study in other countries, as well as make comparative study. Also, they are encouraged to investigate consumers' attitude with regards to their socio-demographic and psychographic profile, as well as profiled GM food users. Hence, policy makers and marketing practitioners can get more clue in designing and implementing policy and marketing strategy that can promote GM food product a more productive and efficient way.



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