MODEL OF MUSLIM CONSUMERS' WILLINGNESS TO PURCHASE GENETICALLY MODIFIED FOODS (GM FOODS)

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Abstract

The study examined the relationship of three predictors which are attitude towards GM Foods, involvement of modern biotechnology and religious commitment with willingness to purchase GM Foods. Drawing from the literature on willingness to purchase GM Foods, hypotheses are constructed on does dimensions of attitudes towards GM Foods involvement of modern biotechnology and dimensions of religious commitment are associated with willingness to purchase GM Foods. Survey data from 419 Muslim consumers' in Malaysia is used to empirically examined the relationship hierarchical multiple regression. The results suggest that support of GM Foods positively associated with willingness to purchase GM Foods. Meanwhile, criticism of GM Foods negatively associated with willingness to purchase GM Foods. These findings showed that when both opposite dimensions of attitude towards GM Foods significantly supported, therefore, the willingness to purchase GM Foods is ambivalent since Muslim consumers did not tolerate GM Foods risks despite having a positive support on GM Foods benefits. Hence, the risks of GM Foods need to be addressed and explained to Muslim consumers through appropriate communication mediums to ensure GM Foods is able to penetrate Muslim consumer market.

Keywords: GM Foods, Muslim Consumer, Willingness to Purchase, Involvement of Modern Biotechnology, Religious Commitment.

INTRODUCTION

Muslim consumers nowadays are not only facing global Halal certification but also need to address the challenge of new food production technology, especially genetic engineering technology (Fischer, 2015). Genetic engineering technology, also referred to as modern biotechnology, is an innovation that allows the DNA genes of an organism to be manipulated or artificially modified (World Health Organization, 2013). The manipulation or modification of this DNA gene produces genetically modified organisms (GMOs) which will then be used in the production of GM Foods such as transgenic plants and genetically modified animals (Secretariat of the Convention Biological Diversity, 2000).

Modification of DNA genes through genetic engineering technique will give certain added value to GM Foods innovation such as food nutrient enhancement (Magnusson & Koivisto-Hursti, 2002) and increased on productivity through the extension of food life (Azadi & Ho, 2010). In addition, genetic engineering technology also allows GM Foods to offer ergonomic benefits such as

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agricultural land savings (Carter, 2007), reducing the use of pesticides (Chen, 2008) and improved endurance against climate change (Knight, 2009).

The benefits offered by genetic engineering technology have stimulated a positive development of the GM Foods market approximately worth USD 160 billion in 2011 and this amount is expected to increase year by year (James, 2012). The positive growth of the GM Foods market is also driven by the positive acceptance factor of more than 18 million farmers in 28 countries where about 11 GM crops have been commercialized in 2015 (James, 2015). Farmers' support and acceptance of the GM Foods innovation is not only influenced by ergonomic factors but also influenced by the potential of GM Foods as an alternative to solve starvation problems and the depletion of global food supply(D'Souza & Quazi, 2005).

The ergonomic benefits and potential solutions to global food supply problems also affect the Islamic countries to involve in the commercialization of GM Foods such as Pakistan, Burkina Faso, Iran and Egypt (Azie, 2011). Even though the participation of Islamic countries in commercialization is still at a minimum level, most Islamic countries are indirectly involved in importing GM Foods products either as raw materials or processed foods. For example, Malaysia imports 3 million tons of maize and 1.2 million tons of soybean meal products in which major exporters of these products are comprised of major producers of transgenic crops such as Brazil and Argentina (Wahab, 2013).

Despite the positive development of the GM Foods market, GM Foods is labeled as the most controversial modern biotechnology innovation (Rodríguez-entrena & Salazar-ordóñez, 2013) compare to other innovations such as medical biotechnology (GM Medicine) (Ishiyama et al., 2012; Siipi & Launis, 2009). The GM Foods controversy is due to concerns about uncertainty of GM Foods risk on human health and safety (Carpenter et al., 2002; Christoph, Bruhn, & Roosen, 2008; Kaplan, 2004). In addition, negative impact on environment (Azadi & Ho, 2010) and animal manipulation as experimental materials (Boecker, Hartl, & Nocella, 2008; Schuppli & Weary, 2010) are also raised as issues and concerns of stakeholders especially for GM Foods.

The controversies trigger debates among stakeholders about GM Foods acceptance till resulting on division of two groups of supporters and opponents of GM Foods commercialization (Knight, 2009). The Eurobarometer report recorded that European consumers are skeptical and rejects the commercialization of GM Foods (Gaskell et al., 2000, 2006, 2010) compared to consumers in the United States who are positive and willing to accept GM Foods commercialization (Hallman, Hebden, Aquino, Cuite, & Lang, 2003). The embodiment of these two group of stakeholders has encouraged the previous researchers to identify the components that influence GM's attitude formation and acceptance among consumers. However, the synthesis of the literature suggests that the attitude and GM Foods acceptance is complex and inconclusive.

Complexity in understanding the attitude and acceptance of GM Foods was recorded in the study of Ishiyama et al. (2012) where Japanese consumers are positive about GM Foods R&D activities but skeptical about the commercialization of GM Foods. Some researchers found that GM Foods' attitude and acceptance could be classified into three groups, namely supporter, opponents and indifferent (Christoph et al., 2008; Kikulwe, Wesseler, & Falck-zepeda, 2011; Latifah, Hasrizul, Nik Marzuki, Zinatul, & Nurina, 2011). Inconsistent findings indicate that there is a potential study avenue available for exploration.

This study aims to extend the understanding of the attitude and acceptance of GM Foods through the integration of the attitude model and the Elaboration Likelihood Model (ELM) in a framework of study. The scope of the study also focuses on Muslim consumers considering the gap

of previous studies which tend to examine the attitudes and acceptance of GM Foods among consumers in developed countries where the majority of its consumers are non-Muslims such as the European Union (Bredahl, 2001; Gaskell et al., 2010), Germany (Christoph et al., 2008), Taiwan (Chen, 2008), Mediterranean (Costa-Font & Gil, 2009), and Japan (Ishiyama et al., 2012). The style of food selecting and consuming of Muslim consumer influenced by Halal and Haram guidelines. However, compliance level towards Halal and Haram guidelines might differ between Muslim consumers (Alserhan, 2011; Soesilowati, 2010) and religious commitment suggested as a factor which differentiate Muslim consumptions pattern (Thambiah, Hishamuddin, Elsadig, & Khin, 2013) including food selection (Norkhazzaina, Maisarah, Latifah, Rasidah, & Normalisa, 2016). Thus previous findings is inaccurate to be referred to in understanding the attitudes and acceptance of Muslim consumers toward GM food.

LITERATURE REVIEW

The study of attitude and acceptance of GM Foods is mostly incline to use cognitive social theory as the principal theory in developing a model of attitude toward GM Foods. The model Bredahl (2001) recorded as the earliest model uses attitude theory as the principal and through that model, Chen (2008) integrates the Expectancy Value Model (Fishbein, 1963) and theoretical behavioral theory (Theory of Planned Behavior) in a single model.

The synthesis of literature shows the attitude towards GM Food is a major and consistent component in explaining the willingness to purchase GM Foods (Bredahl, 2001; Chen, 2008; Costa-Font & Gil, 2009; Latifah, Hasrizul, et al., 2011; Prati, Pietrantoni, & Zani, 2012; Rodríguez-entrena & Salazar-ordóñez, 2013; Saher, Lindeman, & Koivisto-Hursti, 2006) compared to subjective norms and perceived behavioral control. Socio-psychological factors have also been identified by previous researchers through the test of attitude theory as the principal theory for instance are the perceived benefits and perceived risks of GM Foods (Chen, 2008; Prati et al., 2012; Rodríguez-entrena & Salazar-ordóñez, 2013), institutional trust (Ishiyama et al., 2012; Prati et al., 2012), science literacy (Ceccoli & Hixon, 2011), knowledge (Teisl, Fein, & Levy, 2009) and social values (Latifah, Hasrizul, et al., 2011).

However, the existing GM Foods attitude and willingness to purchase modeling models have not been able to explain the differences in attitude patterns towards GM Foods where demographic factors are usually referred to detailing the differences in consumer behavior patterns towards GM Foods. Condit (2010) criticized the existing GM Foods purchasing attitude and willingness to purchase model. Condit (2010) study states that the lack of integration between attitude theory and the other social cognition theory causes the process of formation of attitudes towards GM Foods cannot be detailed whereas attitude is a process involving cognitive interaction, belief system and social environment. The integration of the attitude and theoretical cognition social theory within a framework will allow the process of formation of attitudes to be described in more detail (Fabrigar, MacDonald, & Wegener, 2005).

Therefore, this study presents model of Muslim consumers' willingness to purchase GM Foods consumers that integrates the theory of attitude and Elaboration Likelihood Model in the framework contained in Figure 1. Petty & Cacioppo (1981) expressing involvement or relevance to a subject or object influencing the consideration and judgment of an individual. Consumer engagement was found to be significant in influencing consumer behavior between shopping destinations (Swinyard, 1993), response to rebates(Hunt, Keaveney, & Lee, 1995), online purchase

intentions (Park, Lee, & Han, 2007) and quality perception toward food products (Espejel, Fandos, Flavián, & Flavia, 2009). In the context of the GM Foods acceptance, the components of modern biotechnology engagement are presented as variables based on past studies which find that the willingness to purchase GM Foods is influenced by the level of knowledge of modern biotechnology (Chen & Li, 2007) where the involvement of modern biotechnology is a component that affects consumer's knowledge (Latifah, Jamil, et al., 2011)

Previous studies also tend to measure attitudes toward GM Foods as a single component or uni-dimensional (Bredahl, 2001; Chen, 2008; Costa-Font & Gil, 2009; Prati et al., 2012; Rodríguez-entrena & Salazar-ordóñez, 2013). Nevertheless, the studies show that attitudes toward GM Foods are complex to understand and often make inconsistent findings between the types of innovations GM Foods (Magnusson & Koivisto-Hursti, 2002) and market segments (Bredahl, 2001; Costa-Font & Gil, 2009). The positive attitude of Japanese consumers to GM Foods R&D but being opposed to the commercialization of GM Foods (Ishiyama et al., 2012) also requires further understanding.

Krosnick, Judd, & Wittenbrink (2005) define attitude as latent or latent assessment of an object. The definition is consistent with some contemporary studies that understand attitudes as latent and internal states that affect assessments and judgments towards subject, object or situation (Albarracín, Johnson, Zanna, & Kumkale, 2005; Eagly & Chaiken, 2005; Fazio & Olson, 2003). Based on the findings of the previous study and the definition of contemporary studies on the concept of attitude, then this study presents attitude variables toward GM Foods as a multi-dimensional component. Five dimensions of attitude toward GM Foods, i) support for GM Foods, ii) criticism of GM Foods, iii) institutional beliefs, iv) attitude towards development and v) innovation skepticism adapted from (Christoph et al., 2008).

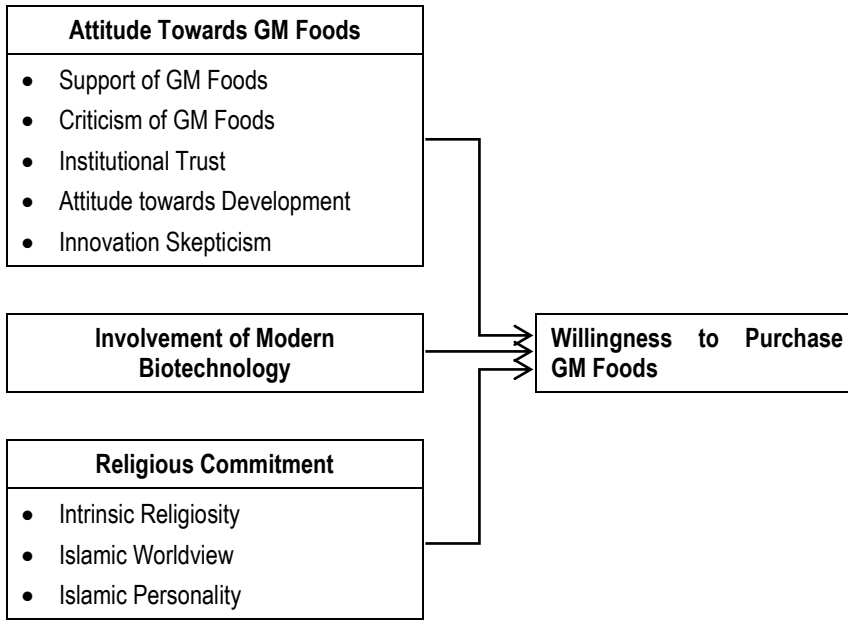

Figure 1: Model of Muslim Consumers' Willingness To Purchase GM Foods

RESEARCH METHODOLOGY

Sample of Study

A purposive sampling technique has been used in selecting the sample of the study. Sample selection through purposive sampling technique is to ensure that the research sample has a degree of literacy and access to information related to science and technology. Literacy and access to information related to science and technology are very important sampling criteria as the subjects (i.e. GM Foods) are still new among consumers in Islamic countries (Azie, 2011). Meanwhile, the Global Agriculture Information Network report (Ghani & Rittgers, 2015) also noted that the level of consumer awareness in Malaysia towards modern biotechnology including GM Foods is still low. Therefore, Muslim consumers with post-secondary education qualification are set as the main criteria for the selection of sample studies.

Instrument of Study

This study has adapted existing instruments to measure the study variables. A total of 21 items have been adapted from Christoph et al. (2008) to measure five (5) dimensions of attitude towards of GM Foods which as mentioned before. The 5-point likert measurement scale has been used which is at the feedback range 1 = strongly disagree to 5 = strongly agree. Christoph et al. (2008) instrumentation was adapted by this study as the definition of attitude variables towards GM Foods was operated as multi-dimensional variables while most of the previous instruments measured the attitude towards GM Foods with uni-dimensional approaches such as Bredahl (2001), Prati et al. (2012) and Rodríguez-entrena & Salazar-ordóñez (2013). Instruments developed by Gaskell et al. (2010) was adapted to measure the variables of modern biotechnology involving five items with a 5-point likert measurement scale (1 = never involved to 5 = always involved). Meanwhile, religious commitment was measured by three dimensions which the measurement adapted from two sources namely, Intrinsic Religiosity (8 items) by Abou-Youssef, Kortam, Abou-Aish, & El-Bassiouny, (2011) and instrumentation developed by Krauss et al. (2006) for remaining dimensions which were Islamic worldview (14 items) and Islamic Personality (21 items). The willingness to purchase GM Foods were measured by 3 items adapted from (Costa-Font & Gil, 2009).

FINDINGS AND DISCUSSIONS

SPSS software was used to analyze the data obtained from 465 collected questionnaires, after 46 sets of questionnaires were rejected following certain issues which were missing data (19), straight lining response (5) and outliers (22). Descriptive analysis shows that 212 respondents are male Muslim consumers and the rest are female Muslim consumers excluding 8 respondents who do not provide feedback on gender information. Muslim consumers ages 18 to 27 are the majority of survey respondents (55.1%) and age ranges over 58 years represent only 0.9% of total respondents. The first degree is an education qualification owned by 36.1% respondents followed by post-secondary, diploma and post-graduate minimum qualifications of 32.9%, 13.5% and 13.2% respectively. Descriptive analysis also showed that 45.8% of respondents received science education compared to 35.9% received social sciences education and remaining numbers of respondents consisted of vocational educated Muslim consumers (6.0%) and other education (12.3%) such as mixed education stream.

Pearson correlation analysis as shown in Table 1 shows that all predictor variables have a significant relationship with willingness to purchase GM Foods except innovative skepticism (p=0.351), intrinsic religiosity (p=0.277) and Islamic worldview (p=0.405).The insignificant relationship between innovation skepticism and willingness to purchase GM Foods was also recorded in the study (Christoph et al., 2008). However, further research needs to be carried out because possibly the factor such as measuring GM Foods in general without specifying a particular type of product causes the tendency of Muslim consumers to consider innovation skepticism cannot be observed significantly. This possibility is expressed based on supplementary research on Christoph et al. (2008) findings indicating that when GM Foods innovation type is more specific, the relationship of innovation skepticism relates significantly to the positive direction with willingness to purchase GM Rice.

Table 1 also showed that two dimensions of religious commitment are not significantly related to the willingness to purchase GM Foods. The findings consistent with Moschis and Fon (2011) which religiosity is not significantly related to the measurement of consumer behavior (i.e. brand preference and store preference). These findings might explained by Donoghue (2000) which consumers tend to protect their personal belief (i.e. intrinsic religiosity) from third parties due to personal ego and the tendency lead to the study inability in measuring relationship with the consumer behavior variable such as willingness to purchase GM Foods. Mokhlis (2009) also mentioned that specific measurement towards religious practice (i.e. Islamic worldview) might offense respondents' feeling and the situation might cause the insignificant findings as explained by Hirschman (1983) which religious commitment is a taboo subject even though the variable is meaningful to explain consumer behavior and consumption.

The relationship between institutional trust and willingness to purchase GM Foods found to be significant in positive direction is consistent with the findings of Ishiyama et al. (2012). Siegrist (2000) also summarizes the same findings in which consumer acceptance of new technologies such as genetic engineering and nanotechnology technologies is influenced by consumer trust in related institutions. Meanwhile, some past findings showed significant correlation to the negative direction of criticisms of GM Foods and the acceptance of GM Foods such as Bredahl (2001), Christoph et al. (2008)and Rodríguez-entrena & Salazar-ordóñez (2013). The involvement of modern biotechnology found to be positively associated with the willingness to purchase GM Foods at r = 0.123, p = 0.000 is consistent with the study Salman Yousaf & Muhammad Shaukat Malik (2013) where the wiling to purchase of Muslim consumers is influenced by the involvement of a product purchased.

Table 1:
Relationship of Dimensions of Attitude towards GM Foods, Involvement of Modern Biotechnology and Dimensions of Religious Commitment with Willingness to Purchase GM Foods

Variables	**Willingness to Purchase GM Foods**	
	r	**p**
Support of GM Foods	0.478**	0.000
Criticism of GM Foods	-0.201**	0.000
Institutional Trust	0.278**	0.000

Attitude to Development	0.232**	0.000
Innovation Scepticism	-0.018	0.351
Involvement of Modern Biotechnology	0.123**	0.000
Intrinsic Religiosity	0.028	0.277
Islamic Worldview	0.011	0.405
Islamic Personality	0.90*	0.026

** significant level at p<0.01, * significant level at p<0.05

In order to figure out the best set of predictors of willingness to purchase GM Foods among Muslim consumers, a hierarchical multiple regression analysis was performed in Table 2. The stepwise method has been used to determined significance variance for each predictor to the willingness to purchase GM Foods. Indicators of willingness to purchase GM Foods were interpreted by using model 3 in Table 2. The F statistics (26.34) for the overall goodness of fit of model 3 is very high and the corresponding p-value is highly significant (p=0.0001). As depicted in model 3, only two predictors were significantly explained adjusted variance of willingness to purchase GM Foods (24.7%). These findings consistent with the previous studies where perceived benefits and perceived risks of GM Foods were the best predictors of willingness to purchase GM Foods (Bredahl, 2001; Chen, 2008; Chen & Li, 2007; Costa-Font & Gil, 2009; Latifah, Jamil, et al., 2011; Prati et al., 2012; Rodríguez-entrena & Salazar-ordóñez, 2013). Furthermore, the stepwise method extends understanding on criticism towards GM Foods (i.e. perceived risks of GM Foods). The variance of constant variable increases from 0.154 to 0.168 when involvement of modern biotechnology was included as depicted in model 2. These findings explained, consumers involvement or knowledge might influence risk assessment towards GM Foods and significantly reduce willingness to purchase GM Foods.

Table 2:
Summary of hierarchical multiple regression for Willingness to Purchase GM Foods

		Coefficients [a]				
		Unstandardized Coefficients		Standardized Coefficients		
		β	Std.error	Beta	t	Sig.
1	(Constant)	1.787	0.303		5.901	0.000
	Support GM Foods	0.469	0.058	0.387	8.124	0.000
	Criticism GM Foods	-0.154	0.053	-0.123	-2.889	0.004
	Institutional Trust	0.102	0.059	0.084	1.743	0.082
	Attitude Development	0.094	0.057	0.077	1.659	0.098

2	(Constant)	1.744	0.303		5.754	0.000
	Support GM Foods	0.454	0.058	0.375	7.786	0.000
	Criticism GM Foods	-0.168	0.054	-0.134	-3.117	0.002
	Institutional Trust	0.095	0.059	0.078	1.621	0.106
	Attitude Development	0.102	0.057	0.084	1.804	0.072
	Involvement	0.061	0.035	0.072	1.755	0.080
3	(Constant)	1.672	0.389		4.296	0.000
	Support GM Foods	0.452	0.059	0.373	7.688	0.000
	Criticism GM Foods	-0.168	0.054	-0.134	-3.119	0.002
	Institutional Trust	0.095	0.059	0.078	1.616	0.107
	Attitude Development	0.103	0.057	0.084	1.805	0.072
	Involvement	0.060	0.035	0.071	1.704	0.089
	Islamic Personality	0.019	0.065	0.012	0.297	0.766

Model 3: $F=26.34$, $p<0.0001$, $R^2= 0.256$, $\triangle R^2= 0.247$

As a result, this study measures the acceptance of GM Food of Muslim consumers by integrating the theory of attitude and probability modeling in a framework of study. One of the key findings found in this study is to explain why attitude patterns and willingness to purchase GM Foods can be categorized at a cautious or ambivalent level (mean = 3.506) through multidimensional analysis of attitude to GM Foods. Multiple regression findings that show both dimensions, supporters of GM Foods and oppositions of GM Foods affect the willingness to purchase GM Foods of Muslim consumers. Based on these findings, the study details that willingness to purchase GM Foods is ambivalent as a result of cautious attitudes about the benefits and risks of GM Foods.

These findings provide meaningful input to policymakers and industry experts in organizing GM Foods commercialization strategy, particularly in Muslim consumer markets. This is because, Muslim consumers generally do not rule out GM Foods benefits like consumers in Europe but the risk of GM Foods is also considered in the purchasing process of GM Foods. As such, increased knowledge about the benefits of GM Foods may be able to alter the ambivalent tendency to behavior that supports GM Foods purchases of Muslim consumers. Further studies on the influence of modern biotechnology involvement on the willingness to purchase GM Foods of Muslim consumers need to be carried out where the science and knowledge literacy components are tested within the framework of the willingness to purchase GM Foods.

REFERENCES

Abou-Youssef, M., Kortam, W., Abou-Aish, E., & El-Bassiouny, N. (2011). Measuring Islamic-driven buyer behavioral implications: A proposed market-minded religiosity scale. *Journal of American Science*, *7*(8), 728–741.

Albarracín, D., Johnson, B. T., Zanna, M. P., & Kumkale, G. T. (2005). Attitudes: Introduction and scope. In D. Albarracín, B. T. Johnson, & M. P. Zanna (Eds.), *The Handbook of Attitudes* (pp. 3–19). New Jersey: Lawrence Erlbaum Associates.

Alserhan, B. A. (2011). *The principles of Islamic marketing*. Surrey, England: Gower Publishing.

Azadi, H., & Ho, P. (2010). Genetically modified and organic crops in developing countries: A review of options for food security. *Biotechnology Advances*, *28*(1), 160–168.

Azie, B. G. (2011). Global status of biotech crops: Islamic perspective and benefits to developing countries. *Journal of Biosafety*, *3*(3), 25–43.

Boecker, A., Hartl, J., & Nocella, G. (2008). How different are GM food accepters and rejecters really? A means-end chains application to yogurt in Germany. *Food Quality and Preference*, *19*(4), 383–394. Retrieved from http://linkinghub.elsevier.com/retrieve/pii/S0950329307001632

Bredahl, L. (2001). Determinants of consumer attitudes and purchase intentions with regard to genetically modified foods- results of a cross-national survey. *Journal of Consumer Policy*, *24*(1), 23–61.

Carpenter, J., Felsot, A., Goode, T., Hammig, M., Onstad, D., & Sankula, S. (2002). *Comparative Environmental Impacts of Biotechnology-derived and Traditional Soybean, Corn, and Cotton Crops*. Iowa: Council for Agricultural Science and Technology.

Carter, L. (2007). A case for a duty to feed the hungry : GM plants and the third world. *Sci Eng Ethics*, *13*, 69–82.

Ceccoli, S., & Hixon, W. (2011). Explaining attitudes toward genetically modified foods in the European Union. *International Political Science Review*, *33*(3), 301–319.

Chen, M.-F. (2008). An integrated research framework to understand consumer attitudes and purchase intentions toward genetically modified foods. *British Food Journal*, *110*(6), 559–579.

Chen, M.-F., & Li, H.-L. (2007). The consumer's attitude toward genetically modified foods in Taiwan. *Food Quality and Preference*, *18*, 662–674.

Christoph, I. B., Bruhn, M., & Roosen, J. (2008). Knowledge , attitudes towards and acceptability of genetic modification in Germany. *Appetite*, *51*, 58–68.

Condit, C. M. (2010). Public attitudes and beliefs about genetics. *Annual Review of Genomics Human Genetics*, *11*, 339–359.

Costa-Font, M., & Gil, J. M. (2009). Structural equation modelling of consumer acceptance of genetically modified (GM) food in the Mediterranean Europe : A cross country study. *Food Quality and Preference*, *20*, 399–409.

D'Souza, C., & Quazi, A. (2005). The dynamics of exploring future market potential of genetically modified foods. *Nutrition & Food Science*, *35*(2), 95–108.

Donoghue, S. (2000). Projective techniques in consumer research. *Journal of Family Ecology and Consumer Sciences*, *28*, 47–53.

Eagly, A. H., & Chaiken, S. (2005). Attitude research in the 21st century: The current state of knowledge. In D. Albarracín, B. T. Johnson, & M. P. Zanna (Eds.), *The Handbook of Attitudes* (pp. 743–764). New Jersey: Lawrence Erlbaum Associates.

Espejel, J., Fandos, C., Flavián, C., & Flavia, C. (2009). The influence of consumer involvement on quality signals perception: An empirical investigation in the food sector. *British Food Journal*, *111*(11), 1212–1236.

Fabrigar, L. R., MacDonald, T. K., & Wegener, D. T. (2005). The structure of attitudes. In D. Albarracin, B. T. Johnson, & M. P. Zanna (Eds.), *The Handbook pf Attitudes* (pp. 79–124). New

Jersey: Lawrence Erlbaum Associates.
Fazio, R. H., & Olson, M. A. (2003). Attitudes: Foundations, functions, and consequences. In M. A. Hogg & J. Cooper (Eds.), *The Sage handbook of social psychology*. Thousand Oaks, CA: Sage Publication.
Fischer, J. (2015). Manufacturing Halal in Malaysia. *Contemporary Islam*, *10*(1), 35–52.
Fishbein, M. (1963). An investigation of the relationships between beliefs about an object and the attitude toward that object. *Human Relations*, *16*, 233–240.
Gaskell, G., Allansdottir, A., Allum, N., Corchero, C., Fischler, C., Hampel, J., … Wagner, W. (2006). *Europeans and biotechnology in 2005: Patterns and trends*. London.
Gaskell, G., Allum, N., Bauer, M., Durant, J., Allansdottir, A., Bonfadelli, H., … Wagner, W. (2000). Biotechnology and the european public. *Nature Biotechnology*, *18*(September), 935–938.
Gaskell, G., Stares, S., Allansdottir, A., Allum, N., Castro, P., Esmer, Y., … Wagner, W. (2010). *Europeans and Biotechnology in 2010: Winds of change ?* Brussels.
Ghani, A. W., & Rittgers, C. . (2015). *Malaysia Agricultural Biotechnology Annual*. Washington DC.
Hallman, W. K., Hebden, W. C., Aquino, H. L., Cuite, C. L., & Lang, J. T. (2003). *Public perceptions of genetically modified foods: A national study of American knowledge and opinion*. New Jersey.
Hirschman, E. C. (1983). Religious affiliation and consumption process: An initial paradigm. *Journal of Research in Marketing*, *6*, 131–170.
Hunt, K. a., Keaveney, S. M., & Lee, M. (1995). Involvement, attributions, and consumer responses to rebates. *Journal of Business and Psychology*, *9*(3), 273–297.
Ishiyama, I., Tanzawa, T., Watanabe, M., Maeda, T., Muto, K., Nagai, A., & Yamagata, Z. (2012). Public attitudes to the promotion of genomic crop studies in Japan: Correlations between genomic literacy, trust, and favourable attitude. *Public Understanding of Science*, *21*(4), 495–512.
James, C. (2012). *2012 ISAAA report on global status of biotech/GM crops*.
James, C. (2015). *Biotech crops highlight 2015*.
Kaplan, D. M. (2004). What's wrong with genetically modified food? In A. Frederick (Ed.), *Ethical Issues of the 21st Century* (pp. 1–15). Charlottesville: Philosophy Documentation Centre Press.
Kikulwe, E. M., Wesseler, J., & Falck-zepeda, J. (2011). Attitudes, perceptions, and trust. Insight from a consumer survey regarding genetically modified banana in Uganda. *Appetite*, *57*, 401–413.
Knight, A. J. (2009). Perceptions, knowledge and ethical concerns with GM foods and the GM process. *Public Understanding of Science*, *18*, 177–188.
Krauss, S. E., Hamzah, A. H., Suandi, T., Noah, S. M., Juhari, R., Manap, J. H., … Mahmood, A. (2006). Exploring regional differences in religiosity among Muslim youth in Malaysia. *Review of Religious Research*, *47*(3), 238–253.
Krosnick, J. A., Judd, C. M., & Wittenbrink, B. (2005). The measurement of attitudes. In D. Albarracín, B. T. Johnson, & M. P. Zanna (Eds.), *The Handbook of Attitudes* (pp. 21–75). New Jersey: Lawrence Erlbaum Associates.
Latifah, A., Hasrizul, H., Nik Marzuki, S., Zinatul, A. Z., & Nurina, A. (2011). Public attitude towards modern biotechnology. *African Journal of Biotechnology*, *10*(58), 12409–12417.
Latifah, A., Jamil, A., Jamaluddin, M. J., Abd. Rahim, M. N., Mohamad, O., & Nor Muhammad, M. (2011). Factors influencing Malaysian public attitudes to agro-biotechnology. *Public Understanding of Science*, *20*(5), 674–689.

Magnusson, M. K., & Koivisto-Hursti, U.-K. (2002). Consumer attitudes towards genetically modified foods. *Appetite*, *39*, 9–24.

Mokhlis, S. (2009). Relevancy and measurement of religiosity in consumer behavior research. *International Business Research*, *2*(3), 75–84.

Moschis, G. P., & Fon, S. O. (2011). Religiosity and consumer behavior of older adults : A study of subcultural influences in Malaysia. *Journal of Consumer Behavior*, *10*, 8–17.

Norkhazzaina, S., Maisarah, A., Latifah, A., Rasidah, A., & Normalisa, M. I. (2016). Ketersediaan penerimaan makanan diubahsuai genetik (Genetically Modified Food- GM Food): Tinjauan dari perspektif pengguna Muslim. In *8th International Management and Accounting Conference* (pp. 691–700). Langkawi, Malaysia: Fakulti Ekonomi dan Pengurusan, Universiti Kebangsaan Malaysia.

Park, D. H., Lee, J., & Han, J. (2007). The effect of online consumer reviews on consumer purchasing intention: The moderating roles of involvement. *International Journal of Electronic Commerce*, *11*(4), 125–148.

Petty, R. E., & Cacioppo, J. T. (1981). *Attitude and persuasion: Classic and contemporary approaches*. Dubuque, IA: Willian C Brown.

Prati, G., Pietrantoni, L., & Zani, B. (2012). The prediction of intention to consume genetically modified food : Test of an integrated psychosocial model. *Food Quality and Preference*, *25*(2), 163–170.

Rodríguez-entrena, M., & Salazar-ordóñez, M. (2013). Influence of scientific-technical literacy on consumers' behavioural intentions regarding new food. *Appetite*, *60*, 193–202.

Saher, M., Lindeman, M., & Koivisto-Hursti, U.-K. (2006). Attitudes towards genetically modified and organic foods. *Appetite*, *46*, 324–331.

Salman Yousaf, & Muhammad Shaukat Malik. (2013). Evaluating the influences of religiosity and product involvement level on the consumers. *Journal of Islamic Marketing*, *4*(2).

Schuppli, C. A., & Weary, D. M. (2010). Attitudes towards the use of genetically modified animals in research. *Public Understanding of Science*, *19*(6), 686–697.

Secretariat of the Convention Biological Diversity. (2000). *Cartagena Protocol on Biosafety to the Convention on Biological Diversity*. Montreal, Canada.

Siegrist, M. (2000). The influence of trust and perceptions of risks and benefits on the acceptance of gene technology. *Risk Analysis*, *20*(2), 195–203.

Siipi, H., & Launis, V. (2009). Opposition and acceptance of GM-food and GM-medicine. *The Open Ethics Journal*, *3*, 97–103.

Soesilowati, E. S. (2010). Business opportunities for Halal products in the global market: Muslim consumer behavior and Halal food consumption. *Journal of Indonesian Social Sciences and Humanities*, *3*(2010), 151–160.

Swinyard, W. R. (1993). The effects of mood, involvement, and quality of store experience on shopping intentions. *Journal of Consumer Research*, *20*(September), 271–280.

Teisl, M. F., Fein, S. B., & Levy, A. S. (2009). Information effects on consumer attitudes toward three food technologies: Organic production, biotechnology, and irradiation. *Food Quality and Preference*, *20*, 586–596.

Thambiah, S., Hishamuddin, I., Elsadig, M. A., & Khin, A. A. (2013). Islamic retail banking adoption in Malaysia: The moderating effect of religion and region. *The International Journal of Applied Economics and Finance*, *7*(1), 37–48.

Wahab, A. G. (2013). *Malaysia agricultural biotechnology annual*. Washington DC.
World Health Organization. (2013). 20 questions on genetically modified (GM) foods. Retrieved from www.who.int