Full Length Research Paper

Consumer preference for genetically modified (GM) food: The case of less saturated fat palm oil in Malaysia

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Identification of consumer preference for genetically modified (GM) food is a complex process, as the consumer's decision may differ based on information received. The aim of this study is to capture the determinants of consumer preference for GM palm oil that has less saturated fat using discriminant analysis and binary logistic regression. Data was collected via a face to face survey of 1017 respondents within the affluent Klang Valley area, near Kuala Lumpur. Results from both models indicate that consumer preference is mainly shaped by perception variables such as health effect, religious views and socio-demographic variables like younger age and middle level income. Besides, respondents who were more optimistic and knowledgeable of biotechnology also tend to favor GM palm oil. The study further found that most respondents (56%) were undecided or unwilling to purchase GM food. Overall, results imply the importance of credible and effective dissemination of consumer information by the relevant authorities in the country.

Key words: Genetically modified (GM) food demand in Malaysia, discriminant analysis, Binary Logit model, GM palm oil.

INTRODUCTION

Modern biotechnology has been regarded as the new techno-economic paradigm of the 21st century. The strength of biotechnology in Malaysia is in its agricultural sector. It has been envisaged as a potential means to ensure food security and to boost the country's agricultural economy. Palm oil is undoubtedly Malaysia's most important agricultural commodity. To date Malaysia is the second largest producer and largest exporter of palm oil in the world. Oil palm accounts for the country's largest share of agricultural land use at 4.3 million ha (55%) in 2008 (Department of Statistics Yearbook, 1985-2009) and employs some 570,000 workforce (World Growth Palm Oil Green Development Campaign, 2009). The major export markets (60%) are China, the EU,

Pakistan, United States and India. Apart from cooking oil, palm oil is mainly used as input in the manufacture of margarine, specialty fats and oleo-chemicals. The Malaysian Palm Oil Board (MPOB) is actively carrying out research to improve the quality of palm oil. Palm oil has saturated and unsaturated fatty acids in, approximately, equal amounts. The MPOB is trying to increase the oleic acid (unsaturated) content and reduce the palmitic acid (saturated) content through genetic engineering.

In the 1980s, the high saturated fats content of palm oil had been associated with health risk especially in the US market. This was attributed to the American Soybean Association which conducted a negative advertizing campaign against palm and coconut oil. A study in the early 1990s indicated that the negative attention on the health issue induced structural change in US domestic consumption of edible palm oil in the late 1980s (Jamal et al., 1993). The Malaysian National Biotechnology Policy was formulated in 2005 with the aim to improve the life

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quality of Malaysians by increasing national income and creating more job opportunities. While the first phase of the policy (2005 to 2010) has focused on capacity building, the second phase (2011 to 2015) will be directed towards industrial development and commercialization of biotechnological products and services (MABIC). Thus, it will be essential that policy-makers develop a domestic GM food market that is both economical and acceptable to consumers. Further, Malaysia, as the first Southeast Asian country to approve the importation of Roundup Ready soybeans in 1997 (Fuller, 2002), the policy direction of the country regarding GM food markets may influence similar decisions and approaches by other countries in the region.

Advancement in biotechnology and genetic engineering has been so rapid over the past ten years; however, a number of uncertainties make it the object of an intense and divisive debate worldwide. Sagar et al. (2000) argues that a major factor in the emergence of controversies surrounding biotechnology has been the neglect of the needs, interests and concerns of the primary stakeholders – the commoners or general public at large. Public perceptions, understanding, and acceptance of Genetically Modified Organisms (GMOs) can both promote and hamper commercial introduction and adoption of new technologies (Kamaldeen and Powell, 2000). The commercialization of GM food was greeted by resistance from Europeans, and the consumer acceptance of GM food varies among regions (Just et al., 2006; Kolodinsky, 2006; Kamaldeen and Powell, 2000; Latifah et al., 2010a). Past studies have shown that the determinants of consumer preference for GM food are rather peculiar, relative to ordinary food, as it is strongly influenced by non-economic factors. Michael and Heason (2003) studied the attitudes of American and Korean college students about GM foods and noted the majority of the respondents were concerned about the health risks from such food. Onyango et al. (2005), Onyango and Govindasamy (2005), EC (2008), Canavari et al. (2010), and Latifah et al. (2006, 2010b) generally observed that consumer preference is shaped by attitudinal attributes such as ethical considerations and religious acceptance, and to a lesser extent product properties such as quality and freshness. Font (2009) summarized the factors shaping consumer attitudes towards GM food, where perceived risk and benefits, individual values, and ability to filter information received were considered as three most important factors associated with GM food acceptance.

Hossain and Onyango (2004), and Noussair et al. (2004) pointed out that a mere public attitude research or opinion polls generally provide weak indication of consumers' actual behavior towards GM food. Most of the studies on consumer attitudes towards GM foods have used logistic regressions including multinomial Logit/Probit. The technique also has been widely applied to analyze consumer demand for most other goods and services (Ishak et al., 2008; Ramanathan and Muyldermans, 2010; Nishitani, 2010). To date, local studies on consumer preference or demand for GM food have been rather sketchy. Latifah et al. (2006, 2009) had used structural equation modeling to examine Malaysian consumer attitudes towards modern biotechnology and GM foods. This study employs discriminant analysis and logistic regression to identify the socio-economic and attitudinal characteristics that affect Malaysian consumer preference for GM foods, specifically for GM palm oil (modified to have less saturated fat).

METHODS

Discriminant function analysis

Discriminant function analysis (DA) is a technique similar to linear regression. For a two-group DA, its outcome is similar to that of an Ordinary Least Squares linear probability model. However, the DA is mainly preferred if the aim is to determine the characteristics of respondents in each category of the dependent variable. Consider the equation;

$$D = c + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_i X_i \qquad (1)$$

Where: D=discriminant score; β_i = coefficient for the ith discriminant variable; X_i = predictor or discriminant variable; C = Constant.

The coefficients β_i are estimated such that the groups would differ as much as possible on the values of the discriminant score. In this study, DA will be useful to identify on what variables are the respondents who favor GM palm oil different from those who are not supportive of GM palm oil.

The Logit model

Binary logistic regression is oftenly used to model the event probability for a categorical response variable with two outcomes. It predicts a categorical dependent variable using a set of predictor variables, comprising numeric and categorical scale variables. The probability for the ith case (P_i) would experience the event of interest (e.g. to be accepted or otherwise) is written:

$$P_i = \frac{e^{z_i}}{1 - e^{z_i}} = \frac{1}{1 + e^{-z_i}} \qquad (2)$$

Where: P_i=is the probability the ith case experiences the event of interest; e^{z_i}=is the value of the unobserved explanatory variable given the ith case; $Z_i = \ln [P_i/(1-P_i)] = \alpha + \beta_{i1}X_{i1} + \ldots + \beta_{in}X_{in} + \varepsilon_i$. Note $[P_i/(1-P_i)]$ is the ratio of the odds of $i = 1$ against $i = 0$.

The Logit model has a distinct advantage over other probability models, as it does not require strict assumptions, such as, multivariate normality and equal variance-covariance matrices across groups. Further, unlike in a linear probability model, P_i is

bounded between 0 to 1. Details of the Logit model can be seen in Kmenta (1986).

Data collection and instrument

Primary data collection via a survey was carried out in the Klang Valley (one of the most densely populated zones in central Peninsular Malaysia, which includes the capital, Kuala Lumpur, and surrounding areas). The area was chosen because it is the most affluent area in the country in terms of socio-economic and infrastructural development, and also, the diverse backgrounds closely represent the multi-racial and cultural status of Malaysia. The questionnaires were administered by trained graduate enumerators, face to face, to 1,017 randomly selected adult respondents, aged 18 years and above. Samples were stratified according to the population distribution of the major ethnic groups. The questionnaires were designed to measure a host of consumer attitude to modern biotechnology based on a Likert scale. The respondents were briefed on the basic knowledge and concepts of biotechnology before answering the questionnaires. Respondents were given a scenario where GM palm oil with less saturated fats were presumably available in the market and at a competitive price.

They were then asked if they would be willing to purchase the GM palm oil. Such an approach implies that respondents were asked to make the choice on the basis of pure preference alone as prices were not presumed to be different relative to ordinary palm oil. In this study, seven selected perception variables, thought to have relatively more influence on consumer demand for GM palm oil were used in the empirical analysis. They are; i) perceived negative health concern (NHCN), ii) perceived religious acceptance (RA), iii) perceived negative long term effects (NLTE), iv) interest in biotechnology issues (IBO), v) optimistic of biotechnology (OPTBO), vi) knowledge of biotechnology (KNWBO), and vii) self religiosity (SEREL). The last variable (SEREL) reflects the view of respondents on the importance of upholding religious values in his/her life.

Model specification

This study utilized a two-group discriminant analysis, in which the respondents were divided into two groups. The first comprised those who were willing to purchase the GM palm oil and the other who were not. Following Equation 1, the following DA specification was chosen to determine which variables were able to discriminate respondents who favored purchasing GM palm oil from those who were not:

$$D = \beta_0 + \beta_1 GENDER + \beta_2 AGE\ 18-30 + \beta_3 AGE\ 31-40 + \beta_4 AGE\ 41-50 +$$
$$\beta_5 INC\ 20 + \beta_6 INC\ 21-30 + \beta_7 INC\ 31-40 + \beta_8 INC\ 41-50 + \beta_9 INC\ 51-60 +$$
$$\beta_{10} INC\ 61-70 + \beta_{11} INC\ 71-80 + \beta_{12} EDU\_LOW + \beta_{13} EDU\_MID +$$
$$\beta_{14} NHCN\_HIGH + \beta_{15} NHCN\_LOW + \beta_{16} NLTE\_HIGH + \beta_{17} NLTE\_LOW +$$
$$\beta_{18} RA\_HIGH + \beta_{19} RA\_LOW + \beta_{20} IBO\_HIGH + \beta_{21} IBO\_LOW + \beta_{22} SEREL +$$
$$\beta_{23} OPTBO + \beta_{24} KNWBO$$

(3)

The dependent variable D is the discriminant score that takes a value of 1 for respondents who were willing to purchase the GM palm oil. For the binary Logit model, the following specification, based on Equation 2, was employed to examine which variables would contribute to the tendency of respondents to be willing to purchase GM palm oil with less saturated fat. Note that for comparison purpose, the same regressors were used as in the discriminant analysis:

$$ln\left[\frac{P_i}{1-P_i}\right] = \beta_0 + \beta_1 GENDER + \beta_2 AGE\ 18-30 + \beta_3 AGE\ 31-40 + \beta_4 AGE\ 41-50 +$$
$$\beta_5 INC\ 21-30 + \beta_6 INC\ 31-40 + \beta_7 INC\ 41-50 + \beta_8 INC\ 51-60 + \beta_9 INC\ 61-70 +$$
$$\beta_{10} INC\ 71-80 + \beta_{11} EDU\_LOW + \beta_{12} EDU\_MID + \beta_{13} NHCN\_HIGH +$$
$$\beta_{14} NHCN\_LOW + \beta_{15} NLTE\_HIGH + \beta_{16} NLTE\_LOW + \beta_{17} RA\_HIGH + \beta_{18} RA\_LOW +$$
$$\beta_{19} IBO\_HIGH + \beta_{20} IBO\_LOW + \beta_{21} SEREL + \beta_{22} OPTBO + \beta_{23} KNWBO$$

(4)

The description and summary of the explanatory variables for both DA and Logit model are shown in Table 2.

RESULTS AND DISCUSSION

Sample characteristics

From the total of 1,017 respondents, 463 were male and the rest were female. The average age was 33.4 years. The ethnic ratio was 60% Malay, 21% Chinese, 14% Indian, and 1.5% other ethnic groups. In terms of education, 3.8% of the respondents had lower secondary education, 21% upper secondary, 6% pre-university level, 13% had diplomas, 38% undergraduate degree, while another 13% had either a masters or PhD degrees. The average monthly income per household was about MYR3422 (1 USD=MYR3). According to the Household Study (2007) by the Economic Planning Unit (EPU), the average monthly household income for Malaysia was MYR3686. Table 1 summarizes the basic socio-demographic profile of the respondents.

Perception towards GM palm oil

Respondents were asked about their willingness to purchase GM palm oil with less saturated fats. Table 2 displays the distribution of responses based on a seven-point Likert scale. Findings in Table 1 show that consumer indecisiveness (neutral) constitutes the largest category of responses (25%). This partly reflects the difficulty on the part of consumers to make a definite choice based on preferences or pure utility alone. About 31% of the respondents were within the uninterested category (slightly uninterested - strongly uninterested), while 44% were at least 'slightly' willing to purchase. This indicates the majority of the respondents (56%) were rather reluctant to make a choice favoring GM palm oil. Table 3 depicts the frequency and mean for the selected perception variables that are thought to affect the preference of consumers for GM palm oil. On average, the respondents were slightly interested in biotechnology issues (IBO), with an average perception scale of 4.7. The respondents displayed somewhat a neutral attitude (mean 4.4) with respect to the negative health concern (NHCN). Respondents also perceived GM food as having moderate negative long-term effects (NTLE) with a mean scale of 4.6.

Interestingly, the mean score for religious acceptance (RA) was closer to neutral (4.4). This indicates very clearly the extent of uncertainty in terms of religious

Table 1. Profile of respondents (N=1017)

Variables	Description	Frequency	Mean
Age	Respondents' age	-	33.40
Gender	Male = 1,	463	1.54
	Female = 2	546	
Education level	1 = lower secondary school	39	
	2 = higher secondary school	212	
	3 = pre-university	61	
	4 = diploma	136	4.14
	5 = first degree	385	
	6 = second degree and PhD level	134	
	7 = other	30	
Income (MYR)	Monthly household income	-	3422
Ethnicity	Malay	609	59.90
	Chinese	215	21.10
	Indian	167	16.40
	Other	15	1.500

Table 2. Frequency of responses on willingness to purchase GM palm oil with less saturated fats

Likert scale	Frequency	Percent
1 = Strongly uninterested	105	10.5
2 = Uninterested	86	8.6
3 = Slightly uninterested	121	12.1
4 = Neutral	247	24.7
5 = Slightly interested	195	19.5
6 = Interested	155	15.5
7 = Strongly interested	92	9.1
Total	1001	100

stance on GM products. Knowledge on biotechnology (KNWBO) was also fairly low at 0.33. However, the respondents seemed to show a high level of optimism with biotechnology (OPTBO) products, with a mean score of 0.86. The respondents on average demonstrated strong association with faith (SEREL), given a mean score of 0.9. Overall analysis of attitude of respondents for GM products points towards the tendency of respondents to center around the middle value, that is, the neutral scale.

Determinants of consumer preference for GM palm oil

To identify empirically the determinants of consumer preference for GM palm oil, respondents' responses that ranged from strongly disagree to slightly disagree were recoded into dummy value 0, while responses from slightly agree to strongly agree were recoded into dummy value 1. The neutral choice of 4 in the Likert scale was excluded from the analysis as it has been clear that the respondents were incapable of making a clear decision to purchase or otherwise. The DA and Logit model, respectively, employed the discriminant function (Equation 3) and logistic specification as shown in Equation 4. Note that both approaches used the same set of regressors. Table 4 summarizes the regressors and their descriptions as well as the mean statistics for the selected variables.

The discriminant model

By excluding the neutral choice tendency of respondents

Table 3. Frequencies and mean of selected perception variables.

Perception variables	Description	Frequency	Mean
IBO	1 = Strongly uninterested	41	
	2 = Uninterested	63	
	3 = Slightly uninterested	120	
	4 = Neutral	231	4.646
	5 = Slightly interested	242	
	6 = Interested	167	
	7 = Strongly interested	149	
NHCN	1 = Very highly concerned	42	
	2 = Concerned	90	
	3 = Slightly concerned	152	
	4 = Neutral	272	4.396
	5 = Slightly unconcerned	177	
	6 = Unconcerned	153	
	7 = Strongly unconcerned	125	
NLTE	1 = Strongly disagree	34	
	2 = Disagree	63	
	3 = Slightly disagree	129	
	4 = Neutral	274	4.585
	5 = Slightly agree	205	
	6 = Agree	170	
	7 = Strongly agree	134	
RA	1 = Strongly disagree	69	
	2 = Disagree	51	
	3 = Slightly disagree	114	
	4 = Neutral	320	4.385
	5 = Slightly agree	182	
	6 = Agree	144	
	7 = Strongly agree	113	
OPTBO	1 = Optimistic of biotechnology	865	0.855
	0 = Not optimistic of biotechnology	147	
KNWBO	1 = High knowledge of biotechnology	283	0.326
	0 = Low knowledge of biotechnology	703	
SEREL	1 = Lowest 'self religiosity'	899	0.922
	0 = Highest 'self religiosity'	76	

more intuitive results can be obtained, but it came at a cost, where out of 737 valid respondents, only 558 respondents were utilized for the regression analysis. The substantial reduction of 179 respondents suggests that a substantial proportion of consumers in Malaysia are undecided about or unfamiliar with biotechnology products or issues related to it. The DA indicates AGE18-30, INC41-50, NHCN_LOW, NLTE_LOW, RA_HIGH, OPTBO, and KNWBO are associated with respondents who were willing to purchase GM palm oil. On the other hand, NHCN_HIGH, NLTE_HIGH, AGE41-50, and RA_LOW significantly characterized those who were unwilling to purchase GM palm oil. The cross-validated classification shows that overall, 74% of the respondents were correctly classified into their respective groups. Table 5 portrays the findings of discriminant analysis.

Overall results suggest that respondents who favored GM palm oil tend to be younger, medium income, and low perception of ill effects of health and long term effects from GM food. They also believed that GM palm oil is

Table 4. Description for the DA and Logit regression.

Dependent variable	Data type and description	N	Mean
D (Equation 3)	1 = Respondents willing to buy GM palm oil, 0 = others	558	0.600
Independent (predictor) variables	**Data Type and Description**	**N**	**Mean**
AGE18-30	Dummy, 1 = Age between 18-30, 0 = others	558	
AGE31-40	Dummy, 1 = Age between 31-40, 0 = others	558	
AGE41-50	Dummy, 1 = Age between 41-50, 0 = others	558	
GENDER	Dummy, 1 = Male, 2 = female	558	1.546
EDU_LOW	Dummy, 1 = Pre-university education level and below, 0 = others	558	
EDU_MID	Dummy, 1 = 1st degree education, 0 = others	558	
INC21-30	Dummy, 1 = Household income between RM 2001-3000, 0 = others	558	
INC31-40	Dummy, 1 = Household income between RM 3001-4000, 0 = others	558	
INC41-50	Dummy, 1 = Household income between RM4001-5000, 0 = others	558	
INC51-60	Dummy, 1 = Household income between RM5001-6000, 0 = others	558	
INC61-70	Dummy, 1 = Household income between RM6001-7000, 0 = others	558	
INC71-80	Dummy, 1 = Household income between RM7001-8000, 0 = others	558	
NHCN_HIGH	Dummy, 1 = Perceived high negative health concern, 0 = others	558	
NHCN_LOW	Dummy, 1 = Perceived low negative health concern, 0 = others	558	
NLTE_HIGH	Dummy, 1 = Perceived high long term negative effect, 0 = others	558	
NLTE_LOW	Dummy, 1 = Perceived low long term negative effect, 0 = others	558	
RA_HIGH	Dummy, 1 = High perceived religious acceptance, 0 = others	558	
RA_LOW	Dummy, 1 = Low perceived religious acceptance, 0 = others	558	
IBO_HIGH	Dummy, 1 = High interest in biotechnology issues, 0 = others	558	
IBO_LOW	Dummy, 1 = Low interest in biotechnology issues, 0 = others	558	
SEREL	Dummy, 1 = High association of religious faith in daily life, 0 = others	558	0.208
OPTBO	Dummy, 1 = High optimism toward biotechnology, 0 = others	558	0.930
KNWBO	Dummy, 1 = High knowledge of biotechnology, 0 = others	558	0.294

acceptable from the religious viewpoint as well as optimistic and knowledgeable about GM food products. The reverse of the above variables tend to characterize respondents who disfavored purchasing GM palm oil.

The Logit model

Results in Table 6 indicate that the log of the odd ratio for respondents to make a purchase of GM palm oil is moderately influenced by medium household income (MYR4000-5000), but strongly influenced by knowledge of biotechnology (KNWBO), and high religious acceptance (RA_High) attributes. On the other hand, the log of the odd ratio is negatively influenced by high negative health concerns (NHCN_HIGH) and low perception of religious acceptance (RA_LOW). The findings suggest very strongly the importance of consumer education and clear stance of faith/religion with respect to the acceptability of GM products. The Logit model has an overall predictability power of group membership of 76.3%, which is slightly higher than that of DA (74%). By comparing discriminant and Logit models, both suggest that variables, such as concerns on

negative health effects (NHCN), whether or not GM food is accepted by religious standing (RA), knowledge on biotechnology (KNWBO), and respondent with middle level income (INC41-50), are relatively strong and positive predictors of consumer preference for GM palm oil. The result is consistent with previous studies where food safety (NHCN) is the predominant consideration for consumers when buying GM or organic food (Lin et al., 2006; Govindasamy et al., 2010).

This study also shows that the level of religious acceptability (RA) of GM food could significantly influence consumer demand for GM palm oil. However, self religiosity (SEREL) seems to have no impact on consumer preference - this has been well consistent with the findings of Hossain and Onyango (2004) and Latifah et al. (2010b). The finding implies that, in a conservative country like Malaysia, faith is a very relevant factor in shaping consumer preference for GM food. The discriminant model suggests that younger respondents, (AGE18-30) are more favorable towards GM palm oil. This is somewhat consistent with the finding of the Logit model that middle level income rather than higher level income influences consumer preference for GM food. However, older respondents, (AGE41-50), are probably,

Table 5. Results of discriminant analysis.

Variables	Coefficient	Structure Matrix	Probability
Constant	0.041		
GENDER	-0.250	-0.078	0.218
AGE18-30	*0.290*	*0.106*	*0.094*
AGE31-40	0.178	0.002	0.975
AGE41-50	*-0.234*	*-0.131*	*0.039*
INC21-30	0.216	0.027	0.665
INC31-40	0.232	0.025	0.692
INC41-50	*0.538*	*0.129*	*0.042*
INC51-60	-0.301	-0.075	0.237
INC61-70	-0.018	0.000	0.997
INC71-80	-0.154	-0.049	0.438
EDU_LOW	0.090	-0.023	0.717
EDU_MID	-0.241	0.013	0.840
NHCN_HIGH	*-1.458*	*-0.747*	*0.000*
NHCN_LOW	*0.096*	*0.492*	*0.000*
NLTE_HIGH	*-0.010*	*-0.409*	*0.000*
NLTE_LOW	*0.073*	*0.540*	*0.000*
RA_HIGH	*0.590*	*0.540*	*0.000*
RA_LOW	*-0.887*	*-0.575*	*0.000*
IBO_HIGH	0.207	0.094	0.138
IBO_LOW	0.384	-0.022	0.727
SEREL	0.314	-0.023	0.715
OPTBO	*0.070*	*0.142*	*0.025*
KNWBO	*0.422*	*0.288*	*0.000*
Wilks' Lambda	0.691		
Predicted group membership	Not willing to buy	74.4	
	Willing to buy	73.4	
Cross-validated groups classification (N=558)	73.8		

more inclined to reject GM palm oil, showing that elderly respondents are more wary about GM food than younger respondents. Both models suggest that the tendency to buy GM palm oil decreases with age.

Furthermore, respondents who are more knowledgeable of biotechnology (KNWBO) also display positive tendencies to favor GM palm oil, suggesting the type and credibility of information regarding biotechnology is essential for consumer acceptance. Studies by McCluskey et al. (2006), Lin et al. (2000), and Hossain and Onyango (2004) also concur to this possibility. A substantial portion of respondents expressed neutral response to most of the perception questions. This phenomenon may indicate that a significant proportion of Malaysians are largely undecided or unfamiliar with issues regarding biotechnology. This is quite similar to the situation in the US during the early 2000s, whereby, American consumers withheld their judgment on agro-biotechnology (Moon and Balasubramanian, 2001).

Hence, to improve consumer preference for GM food, the producers and researcher community must possess definitive knowledge to assure the consumer that GM products are indeed safe to consume, and further the relevant GM food are not forbidden by religions.

Conclusion

GM food is an emerging agricultural practice worldwide, albeit shrouded with mystery, uncertainties and controversies. Nevertheless, it has the potential to minimize the impact of pesticide residues, lower food production cost, and may also promote health benefits. This paper makes a contribution to understanding consumer preference for GM palm oil with less saturated fat in Malaysia. Results from the model suggest that there is a tendency that the younger consumer, with moderate income (RM4001-5000), may favor GM food. However, a

Table 6. Results of Logit model.

Variables	Coefficient	Standard error	Probability
Constant	0.436	0.751	0.561
GENDER	-0.320	0.218	0.142
AGE18-30	0.445	0.402	0.268
AGE31-40	0.276	0.423	0.515
AGE41-50	-0.306	0.427	0.736
INC21-30	0.275	0.294	0.350
INC31-40	0.301	0.384	0.433
INC41-50	*0.696*	*0.403*	*0.084*
INC51-60	-0.429	0.562	0.446
INC61-70	-0.146	0.621	0.814
INC71-80	-0.275	0.686	0.708
EDU_LOW	0.105	0.325	0.745
EDU_MID	-0.362	0.334	0.278
NHCN_HIGH	*-1.602*	*0.299*	*0.000*
NHCN_LOW	0.219	0.362	0.546
NLTE_HIGH	-0.026	0.292	0.928
NLTE_LOW	0.145	0.378	0.701
RA_HIGH	*0.754*	*0.257*	*0.003*
RA_LOW	*-0.100*	*0.281*	*0.000*
IBO_HIGH	0.277	0.277	0.317
IBO_LOW	0.487	0.331	0.141
SEREL	0.365	0.295	0.216
OPTBO	0.100	0.315	0.751
KNWBO	*0.643*	*0.253*	*0.011*
Log-likelihood	558.241		
Cox & Snell R	0.292		
Predicted group membership	Not willing to buy	66.4%	
	Willing to buy	83.0%	
Percent correct predictions(N=558)		76.3%	

more decisive factor would be religious acceptability, and also the perceived negative health effect of GM food. In other words, perception and socio-demographic variables do have significant influence on consumer demand for GM food in Malaysia.

Since the majority of the respondents were at least undecided or unfamiliar with biotechnology issues, the relevant authorities, researcher community and mass media should take a stronger role in educating the public about biotechnology, so that the public will be able to make an informed decision. This will help policymakers identify appropriate policy scenarios for the development of biotechnology industry in Malaysia. The questionnaire in this study was essentially designed to capture and analyze public perception towards biotechnology in general. Related food prices and supply scenarios were simply presumed to be constant. Hence, further studies that focus on consumer demand, incorporating price, substitutability and supply scenarios and utilizing more rigorous econometric methods are warranted to more precisely identify the determinants of consumer preference and demand for GM food.

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