Beef safety certification: A contingent valuation study of Malay consumers

(Pensijilan keselamatan daging lembu: Kajian penilaian kontigen pengguna Melayu)

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Abstract

The objective of this study was to determine the Malay consumers' willingness-to-pay (WTP) for food safety with reference to beef consumption. A total of 243 respondents were interviewed for this purpose. The Contingent Valuation Method (CVM) was used to determine the consumers' WTP for the consumption of safer beef. A logit and probit model was used to estimate the premium that consumers are willing to pay for beef. The results indicated the important factors that influenced as well as determined the amount of premium a consumer was willing to pay for beef were household incomes and price levels. Based on this study, it was found that the demand and consumption of beef was still high despite the food contamination incidents in the country recently. However, many Malay consumers were becoming more vigilant when buying beef due to concern on health and diet. This trend will certainly have effects on the present market for beef. Hence, to ensure a better development of the beef market, there is a need to develop proper standards, policies and campaign programmes for meat safety, and to step up the efforts of research and development (R&D) to improve the production technologies and food safety systems for beef.

Introduction

The local beef industry has been growing at a snail's pace since the periods of 1961–1965 to 1991–1995, even though there had been efforts made by the government to improve the development of the local beef industry through various programmes in Malaysia Plans. The local beef industry is less developed as compared to poultry and swine industries which have grown progressively over the last two decades, and it is unable to compete for the available resources and funds. The rapid development in the industrial and manufacturing sectors, and the available cheaper source of beef supply, further slow down the growth of the beef industry. This is exacerbated by the hesitancy of the private sector to invest in the beef production even though the government promotes the industry.

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The general low performance of the local beef production industry has resulted to a dependency on imported beef in order to meet the market's demand.

The demand for beef comes from consumers and food manufacturing industries. The consumers' demand for beef is influenced by factors such as income, population, price, and price of its substitutes or complements and seasonal. Income has been an important factor in determining the demand for local beef, since the price of beef is higher compared to other meats in the market, such as chicken. It is postulated that the higher the income, the higher the demand for beef will be. Population size also determines the volume of beef demanded. The price of beef and its substitutes also affect the quantity of beef demanded and they are inversely related.

In addition, the consumption pattern for beef is significantly influenced by consumers' tastes and preferences, substitutability of beef for other meat types, ethnic group, price relationships, and consumers' responsiveness towards price change. Consumers are increasingly demanding food products possessing specific attributes related to production and/or processing (Streeter et al. 1991).

There has been a substantial increase of consumers switching to food with low calories, low fats and salt content but high in vitamins, minerals and fibres. Since consumers are becoming more health conscious, attributes such as quality, appearance, freshness, convenience and health enhancement are increasingly important. Thus, concerns about safe foods among Malaysian consumers are progressively essential. There seem to be daily complaints on the safety of beef constituent. For example, Consumer Reports found that the beef appeared red even if it was spoiled or had bacterial counts that were close to indicating spoilage.

The Malaysian consumers today, particularly the urban dwellers, demand safe and high quality food at a reasonable price.

The food safety concerns among them arise from better education as well as effective information and communication technology received. Despite technology advancement in food production and distribution, there are still food related illnesses which occurred intermittently. Food poisoning cases are still being recorded in hospitals and clinics. Furthermore, statistics on food risks need to be immediately addressed. Public awareness towards food safety must also be increased further especially among rural people.

At present, the Malaysian consumers consist of three major ethnic groups. The Malays, the largest ethnic group account for 51% of the total population. This is followed by the Chinese with 23% and the Indians with 7%. The balance constitutes other races in Malaysia. Being the largest in number but mostly having rural background, it is imperative to determine the Malays' awareness and willingness to pay for safer foods. Another important attribute of the Malays is that they are generally Muslims. Thus another significant product attribute that they would consider for consumption is whether the food was 'Halal'. Halal means that all products must be prepared, or in the case of livestock, must be slaughtered, according to the Islamic rules.

Hence, with the increasing food risks, consumers need to be vigilant while choosing food products for consumption. They should be equipped with relevant and sufficient knowledge of the presence of hazards in meat. The objectives of this study were to provide some insights on Malaysian Malay consumers concerns towards foods; and to estimate their willingness to pay (WTP) for food safety. Beef was used in this study to determine the consumers' WTP. Knowing and understanding the needs of consumers for beef safety can boost profits for both producers and marketers hence, facilitate the growth of the industry. The results of this study will help the industry's players in formulating effective marketing strategies for beef. This knowledge would

also assist them to build a competitive advantage in the market place.

Literature review

Consumer demand is the consumers deriving utility or satisfaction from the characteristics that goods possess, rather than the goods themselves (Rosen 1974). It is also related to the buyer's decision making process, which are attempts to address what people want (Engel et al. 1978). According to Christensen and Manser (1974), meat demand studies have focused on the flexible demand system and the impacts of demographic variables. Although many of these studies mentioned product quality characteristics to provide useful insights in explaining meat consumption behaviours, none incorporated meat quality into the demand analysis.

Haines et al. (1996) and Putnam and Allshouse (1999) have devoted substantial time to identify the effects of safety, nutrition, taste and price on food consumption and marketing, and to examine the relationships between consumer characteristics and food consumption. The literature has included the following findings: (i) over the last two decades, changes in population composition, lifestyles, incomes and attitudes on food safety, health and nutrition have significantly shaped consumer concerns in meat consumption; (ii) the health hazards have become a major concern for consumers because of increasing worries about pesticide residuals, chemical additives, antibiotics and hormones in foods; (iii) the major nutritional concerns have shifted from the deficiencies of diseases-related nutrients to the linkages between diet and chronic diseases resulting from over-consumption of saturated fat, cholesterol and sodium; (iv) consumers have been 'drifting' away from red meat to poultry and seafood in an effort to lower the amount of fat and cholesterol in their diet.

According to Bruhn et al. (1991), 77% of consumers surveyed at a California supermarket had food safety concerns, and over half of them indicated they had changed their buying practices as a result. Increased reading of labels, nutrition-related changes, purchasing organic products, and avoiding products were among the changes cited by consumers. Meanwhile, Unnevehr and Bard (1993) stated that, the problem of the beef market is systemic. The traditional beef marketing system fails to transfer information about what is considered to be the best product to the producer. They say*: Consumers clearly value reductions in the external fat on almost all beef table cuts and reductions in seam fat for chunk and round cuts*. However, improvements in quality require transmission of price signals from the retail level to feeders. These signals have not been apparent and pricing institutions have been slow to adjust, even though the grading system, for carcass yield provides an appropriate measure of quality.

Doyle (2000) emphasizes that biological hazards can be prevented or reduced at any point in the food chain from the farm to the table. In contrast, drug residue avoidance is primarily the responsibility of the beef producers. Specific preventive practices by producers, such as avoiding the use of specific drugs, accurately recording the use of drugs, following appropriate drug-withdrawal times, and limiting or controlling the route of drug delivery, are the primary means for eliminating the drug residue hazard.

Miller and Unnevehr (2001) find that avoiding or reducing risks have costs implications for producers, processors and consumers. For consumers, avoiding biological risk requires time and care in preparation, as well as potentially reduces product quality because of cooking requirements. Thus, to avoid such costs, consumers may choose to purchase products that will either directly or indirectly decrease their biological risk or decrease the time necessary for preparing safe foods. Furthermore, some consumers have higher risk of food borne illness, such as

young children, the elderly and immuno-compromised individuals.

In terms of consumer preferences, there are numerous studies which examined consumers' preferences and WTP for mandatory and voluntary labelling programmes associated with credence attributes related to preferences for traceability assurances and origin of beef. They include Loureiro and McCluskey (2000); Alfnes and Rickertsen (2003); Loureiro and Umberger (2003); Umberger et al. (2003); Alfnes (2004); Enneking (2004); and Dickinson and Bailey (2005).

Hayes et al. (1995) and Buzby et al. (1995), however, addressed consumers' WTP for food products with safety features or benefits. For example, in an experimental auction, Hayes et al. (1995) found that the average undergraduate Iowa State University students would pay approximately USD0.70 per meal for safer food (i.e. food screened for pathogenic bacteria).

In addition, Caswell (1991) claims that if consumers are willing to pay more for enhanced beef safety, then the beef industry will have incentives to adopt practices to improve safety and to market safer products. Food safety perceptions and their impact on consumption patterns represent a relatively new area of research, particularly for microbial hazards in meats, poultry and fish. Such research frequently relies on no market valuation methods.

The tendency for WTP consumers to value food products units safety features or benefits is also echoed by a research done by Hayes et al. (1995) in which they used experimental auctions to elicit the value of reduced microbial pathogen risk in a meat sandwich. They concluded that subjects were willing to pay more (between USD0.42 and USD0.82) per meal to reduce the normal risk of microbial pathogens down to a 1-in-1,000,000 risk. Their overall results suggest that an average subject would pay about USD0.70 per meal for safer beef.

Recently, there is a growing interest in the use of contingent valuation (CV)

to value improvements in the food safety, particularly in the United States. A number of studies estimate consumer WTP for food perceived to be safer, although not relating this to a specific reduction in risk. These CV studies are generally based on a simple expected utility model, which assumes a 'defenceless' consumer facing a given risk, which is associated with a clearly defined outcome. Nonetheless, models have been developed which take account of situations where risks are continuous rather than discrete, where there is ambiguity over the exact level of risk (Van Ravenswaay and Wohl 1995) and where consumers take averting actions to reduce the risks they face (Eom 1993).

Hammit et al. (1993) estimated the WTP for reductions in health risk associated with consuming pesticides residues on vegetables using the CV technique with in-person interviews. The CV technique has been used to measure non-market goods including air quality, water quality, recreation, hazardous waste sites and health risks. The CV approach has also been used in studies of food borne illness (Lin and Milon 1995). Eom (1993) also developed a contingent discrete-choice model integrating consumers' risk perceptions with their stated purchase behaviours for assessing a consumer's premium for a safer food.

As a conclusion, from the literature reviewed, it is apparent that CV technique has been widely used to estimate the economic values for all kinds of products. The approach has great flexibility, allowing valuation of a wider variety of non-market goods and services compared to any other non-market valuation techniques. The CV technique is also a potentially valuable supplement to other pre-test-market methods. The CV approach involves in directly asking people in a survey, on their level of WTP for certain products. Based on all these reasons, it is only appropriate to apply the CV technique in this study.

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Methodology and data

There is a large body of literature assessing consumer WTP for food safety and environmentally friendly production practices. Although there are several economic tools to value non-market goods, such as hedonic pricing and the travel cost method, the application of Contingent Valuation Method (CVM) has been largely limited to public-good commodities which are not traded in the market. CVM is generally considered by many researchers as the most appropriate choice for measuring food safety because it is a flexible tool which can be tailored to analyse specific food safety policies (Buzby et al. 1995).

In this study, CVM was used to analyse the data and the WTP was measured empirically by using this method. The basic model of the research is the Van Ravenswaay and Hoehn (1991) approach, an extension of Lancaster's attribute model (Lancaster 1971). The identified specification model for this study is as follows:

$$WTP = f(P, Y) \qquad (1)$$

where,

WTP = willingness to pay
P = price (RM)
Y = income (RM)

Subsequently, the logistic regression technique was used to estimate the WTP (Hanemann 1984). Using this approach, the probability of saying "YES" to bids at different levels of the independent variable are estimated as:

$$P = (1 - e^{-x})^{-1} \qquad (2)$$

where,

x = estimated regression logit regression equation
P = probability of accepting the price

Mean of WTP is estimated as the area under this probability function. This area shows the proportion of the population who would consume the goods at each level, and their associated utility. The area under the curve is estimated by integration techniques and can be expressed as:

$$E(WTP) = \int_{L}^{U} (1 + e^{a + bPRICE})^{-1} \ dPRICE \qquad (3)$$

where,

$(1 + e^{a + bPRICE})^{-1}$, are the probability of saying "YES"
U and L = upper and lower limits of integration respectively

Estimating mean WTP within this framework relies on making some assumptions about the upper and lower limits of the integral, i.e. knowing the price amounts at which the probability of saying "NO" is zero and the probability of saying "YES" is one. By applying this to the price behaviour, and assuming that individuals will not pay if they receive a disutility from it, negative WTP can then be ruled out and zero can be used as the lower limit. Bishop and Heberlein (1979) and Sellar et al. (1986) used the upper range for the integration of their price amounts as the upper limit for the integration. Hanemann (1984) argued that such an approach makes certain assumptions about the probability distribution for the unknown WTP in the sample. He argued that the upper limit should be infinity and that using the highest offered amount may be a poor approximation of the mean utility estimate when integrating between zero and infinity. In this study, zero was chosen as the lower limit of the integral and the maximum value as the upper limit. Confidence interval of WTP was also calculated using the variance-covariance matrix and a technique adopted for dichotomous CVM by Park et al. (1991).

The data were gathered by personal interview using structured questionnaires. Prior to survey interview, a questionnaire pre-testing was done to determine the appropriateness of data to be collected and the completeness of information to be gathered. The exploration and determination

of the premium price ranges that a consumer is willing to pay for safer beef was undertaken in the pre-testing as well. The samples were randomly selected individuals in selected major towns in Peninsular Malaysia. The Malays were chosen in this study due to their rural background, comprising middle income group, besides being the biggest number of the population. A total of 243 respondents were interviewed. The respondents were asked to complete a questionnaire regarding their WTP with respect to food safety based on the CVM format and their socio-economic profiles. They were asked the following question and were required to respond by either "YES" or "NO":

The process of beef production is a usual scenario to us. However, a lot of us do not know about the danger of physical, chemical and biological contaminations/ hazards that may occur in the production cycle, as what had happened in the mid-90s and also recently, in which imported beef and our local beef had been infected with Mad Cow disease and Food-Mouth disease. There are also researches that indicate certain contaminations can cause serious health hazards. Thus, we have to be more concern about our health by consuming beef that have been certified safe even if it means we have to pay more due to the high cost of inspection, implementation and maintenance of food safety systems. If the price of meat that is ensured of their safety, is __x____per cent higher than the market price, are you willing to purchase it?

where x ranged from 10% to 30% and representing a 'reasonable' additional amount of price to buy meat.

The willingness to pay is represented by the dichotomous variable of WTP, with values of 1 for those willing to pay the additional amount and 0 is otherwise. An OLS regression of the above relationship with WTP as the dummy variable is beseted by several problems namely: (1) non-normality of the error term, (2) heteroscedasticity, and (3) the possibility of the estimated probabilities lying outside the 0–1 boundary (Gujarati 1988). Since the dummy WTP is actually a proxy of the actual propensity or ability of willingness to pay, the probit and logit models guarantee that the estimated probabilities lie in the 0–1 range and that there are nonlinearly related to the explanatory variables. The difference between these two approaches is mainly in the distribution of the regression error terms. The logit approach assumes that the cumulative distribution of the error term is logistic while probit assumes that it is normal.

Results and discussion
Socio-economic profile of respondents
The compositions of respondents from rural and urban areas were 41.9% and 58.0% respectively (*Table 1*). More than half of the respondents (66.3%) were female. This is consistent with the study done by Rosen (1974), when couples were being interviewed, normally the wife or female partner would answer the questions. Therefore, they are at a better position to answer such questionnaire.

The majority of the respondents (82.7%) interviewed was below the age of 40 years. In terms of marital status, 49.4% of the respondents were single. It is important to categorize the respondents' marital status because of its influence on their purchasing attitude with regards to frequency of purchasing. These results were in accordance with the Malaysian situation where the majority population was Malay, while the Malaysian age range was between 20 and 40 years, and singles were more than married ones. In terms of household size, the majority has 2–4 members in the family. The household size usually influences consumers' attitude in making purchasing decisions as the number of members in the household affects the consumers' real disposable incomes.

The majority of respondents (56.8%) had gone through college or university

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Table 1. Socio-economic profiles of respondents (n = 243)

Characteristics	Percentage
Residential area	
Rural	58.02
Urban	41.98
Gender	
Male	33.74
Female	66.26
Age	
<20	29.63
20–30	27.16
31–40	25.93
41–50	15.64
>50	1.65
Marital status	
Single	49.38
Married	50.62
Household size	
Staying alone	0.41
2–4	39.92
5–6	31.28
>6	28.40
Family members above age 12	
1	2.06
2–4	61.32
5–6	16.87
>6	19.75
Education level	
Primary school	1.23
Secondary school	41.98
College/University	56.79
Occupation	
Public sector	44.44
Private sector	7.41
Self-employed	7.41
Housewife	0.82
Others	39.92
Monthly household income	
<RM1,000	18.93
RM1,000–RM2,000	18.52
RM2,001–RM3,000	13.99
RM3,001–RM4,000	19.75
RM4,001–RM5,000	9.05
>RM5,000	19.75

education. Secondary education forms 41.9% of respondents while only 1.23% received primary education. In terms of respondents' occupation, 44.4% worked in the public sector and only 7.4% in the private sector. Another 7.4% were self-employed, 0.8% were housewives, and 39.9% were categorized as others e.g. unemployed such as not working.

Occupation is an important aspect of demography factors because it usually reveals the consumers' social class and level of purchasing power which can influence the pattern of purchasing behaviour towards beef. Occupation and income are inter-related. Consumers who earned a higher income were believed to have different pattern of purchasing behaviour as compared to those with lower income. As shown in *Table 1*, 48.6% of the respondents' income were above RM3,000 per month.

Awareness analysis
The consumers' awareness towards beef is presented in *Table 2*. It shows that 90.5% of respondents have heard or read about illness caused by food. In terms of sources of beef contamination, 51.9% of respondents were aware of illness caused by meat due to physical, 79.8% aware due to chemical and 74.5% aware due to biological contaminations. Newspaper was the key source of food safety information as indicated by 92% of the respondents. Television, magazines and internet were other important sources of information as indicated by 72.5, 56.5 and 44.2% of the respondents respectively. This indicates that, in general, a very high percentage of respondents were aware of food safety or beef safety. However, from the interview it was noticed that many of them did not really understand the underlying definition or food safety related terms used by the authorities.

The survey also revealed that 79.4% (193) of respondents had experienced illness caused by foods such as white meats, red meats, seafood, vegetables, fruits, dairy products, salad dressing and others. Types

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Table 2. Consumers' awareness towards beef

Statements	Number	Percentage	Statements	Number	Percentage
1. Heard/read of illness caused by food?			7. Foods that made you sick:		
Yes	220	90.53	White meats	15	15.63
No	23	9.47	Red meats	40	41.67
			Seafood	56	58.33
2. Aware of following risk?			Vegetables	6	6.25
Physical	126	51.85	Fruits	8	8.33
Chemical	194	79.84	Dairy products	33	34.38
Biological	181	74.49	Salad dressing	12	12.5
			Others	23	23.96
3. Heard/read illness caused by beef?					
Yes	138	56.79	8. Type of illness experienced:		
No	105	43.21	Diarrhoea	78	81.25
			Vomit	46	47.92
4. The illness caused by:			Stomach cramp	16	16.67
Physical	47	34.06	Dizziness	39	40.63
Chemical	83	60.14	Headache	45	46.88
Biological	106	76.81	Gassy	68	70.83
5. Where was the information from?			9. Get illness caused by food from:		
Newspapers	127	92.03	Home-cooked	32	33.33
Magazines	78	56.52	Restaurant	45	46.88
Radio	69	50	Food stall	62	64.58
Television	100	72.46	Fast food	31	32.29
Friends and acquaintance	56	40.58	Festival/Celebrations	33	34.38
Doctor	36	26.09	10. Experienced illness caused by beef?		
Someone in your household	26	18.84	Yes	41	42.71
			No	55	57.29
Internet	61	44.2			
Others	8	5.8	11. Beef was prepared from:		
			Fresh	25	60.98
6. Experienced illness caused by food?			Processed	29	70.73
Yes	96	39.51	Canned	7	17.07
No	147	60.49			
			12. Get the illness caused by beef from:		
			Home-cooked	11	26.83
			Restaurant	16	39.02
			Food stall	24	58.54
			Fast food	14	34.15
			Festival/Celebrations	24	58.54

of illnesses due to contaminated foods that consumers experienced were diarrhoea (81.3%), nausea (47.9%), stomach cramp (16.7%), dizziness (40.6%), headache (46.88%) and also gassy stomach (70.8%). These figures indicate that some of the respondents might get more than one illness.

Meanwhile, 42.7% of respondents have experienced illnesses involving beef consumption. All of them had previously consumed beef that was either prepared fresh (cooked), processed meat (burger, nugget, frozen, vacuum-packed) and canned beef. The respondents also revealed that they had the illnesses from home-cooked meal (26.8%), restaurants (39.0%), food stalls (58.5%), fast foods (34.2%) and foods served/sold during festivals/celebrations (58.5%). High incidents of food illness which come from food stalls and festivals indicated poor handling, poor raw materials used and unhygienic utensils as well as surrounding environment.

Table 3. Important factors in consumer's perception towards beef

Factor	Percentage					Mean	Rank
	Very Important	Important	Neutral	Unimportant	Very unimportant		
Healthiness	67.5	18.9	12.3	0.8	0.4	1.48	1
Freshness	61.7	26.3	10.3	0.4	1.2	1.53	2
Source (local or imported)	56.8	26.3	14.8	1.2	0.8	1.63	3
Nutrient content	49.8	29.6	18.9	1.2	0.4	1.73	4
Texture/Tenderness	44.9	32.1	21.0	1.6	0.4	1.81	5
Taste	36.6	44.4	17.7	0.8	0.4	1.84	6
Availability	41.6	33.7	23.0	0.8	0.8	1.86	7
Colours	34.2	39.5	23.5	2.5	0.4	1.95	8
Packaging	35.8	32.9	24.7	5.3	1.2	2.03	9
Price	21.4	39.9	30.9	7.0	0.8	2.26	10

Perception and attitude analysis

Consumers' perceptions and attitudes can influence their decision making process and buying behaviour. Perceptions represent the formation of an individual state of mental awareness that is affected by internal and external environmental stimuli such as economic, social and cultural influences. On the other hand, attitudes are noted as an internal response, which is partially affective in nature and considered to be continuing evaluations of objects, issues, or persons.

In the questionnaire, respondents were asked to determine their main factors in perceiving beef. They were also asked to give each factor with an indication of 1 for very important to 5 for very unimportant. The factors were then ranked in the order of importance based on the means and standard deviation of the scores given. The lower the means, the more important is the factor.

The most important factor considered by the respondents was the healthiness of beef, followed by freshness and source of beef (*Table 3*). Nutrient content, texture, taste, availability and colour were also considered as factors that influence consumers' perceptions towards beef sold in market. However, the table also shows that packaging and price were not very important based on the consumers' perception and attitude when buying beef. This is consistent with most Malaysian consumers who prefer to look at the beef while purchasing it.

Furthermore, they also perceive that beef as 'fresh' when it is cut to the amount wanted at the purchasing point.

Willingness to pay (WTP) analysis

Table 4 shows the summary of respondents' WTP for certified safer beef for each increment price level. From the table, slightly more than 50% of the respondents were willing to pay up to 10% price increase. Beyond 10% price increase led to a reduction in the number of respondents who were willing to pay for safer beef. The result is parallel to the perception that the price of beef is already considered as expensive.

An initial estimation of the model using all the socio-economics characteristics as independent variables revealed that all variables were insignificant except for income and price. The maximum likelihood estimates of the specification for logit and probit models are estimated using Shazam, version 7.0 and the means of WTP are calculated using MATEMATICA, version 2.2 (Sherlock 1993).

The value of adjusted McFadden's psudo R^2 is 0.0398 and 0.0396 for logit and probit models respectively (*Table 5*). The percentage of right prediction is 63.00 and 62.96 for logit and probit models respectively. The price and income in both models are significant at 1% level. It was seen that the logit model performed marginally well than the probit model in

Table 4. Summary of consumers willingness to pay (WTP) for certified safer beef

Price increment (%)	Yes		No		Total	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
5	26	57.78	19	42.22	45	18.52
10	22	52.38	20	47.62	42	17.28
15	17	40.48	25	59.52	42	17.28
20	12	30.00	28	70.00	40	16.46
25	12	32.43	25	67.57	37	15.23
30	13	35.14	24	64.86	37	15.23
	102	41.98	141	58.02	243	100.00

Table 5. Coefficient estimate using logit and probit model

	Logit model		Probit model	
	Coeff.	t-ratio	Coeff.	t-ratio
ONE	–0.00593	–0.0167	–0.00506	–0.0231
PRICE	–0.24365	–2.7557*	–0.14988	–2.7784*
INCOME	0.00012	2.1248**	0.00007	2.1384**
Log likelihoof function	–158.7189	–158.7484		
McFadden R^2	0.0398	0.0396		
Percentage of right prediction	63.00	62.96		

*Significant at 1% level; **Significant at 5% level

Table 6. Mean premium WTP using logit and probit model

	Lower limit 95% confident interval	Mean	Upper limit 95% confident interval
Logit model	1.92	2.37	2.88
Probit model	2.19	2.49	2.81

terms of McFadden R^2 and percentage of right prediction. Hence, the mean WTP obtained from the logit model would be a slightly more reliable measure.

Based on the results of the estimation, equivalent premium WTP measures were calculated using logit and probit models at income level (*Table 6*). Assuming the current price of beef is RM18.00/kg, the calculated mean premium WTP ranged from RM1.92 to RM2.88 for the logit model, and for the probit model ranged from RM2.19 to RM2.81 based on 95% confidence interval. It was seen that the logit model performed slightly well than the probit model, in terms of McFadden R^2 and percentage of right prediction. Therefore, the mean WTP value of RM2.37 would be taken as the conservative WTP measure. Hence, the mean premium willingness to pay for safe beef is RM20.37/kg.

The results demonstrated differences between the logit and probit models in terms of summary statistics. This is in accordance with a previous study by Bowker and Stoll (1988), which reported that neither models dominated the other empirically in the binary dependent variable case.

Summary and conclusion
Public concern towards food safety has increased in recent years. Recent food scares have aroused consumers of food safety risk especially but exclusively in beef products. Consumers' concerns have focused on risks associated with physical, chemical

and biological contaminations. Much of the debate about food safety has been at a scientific level, which has not been easy to be interpreted by the general public. The uncertainty surrounding food safety has served to heighten consumers' concerns. This study was to investigate and explore on how important it is to the Malaysian consumers that beef should be free from any contaminants and hence, to find out how much they are willing to pay for safer beef products.

From the observation of consumers' perceptions and attitudes, it can be concluded that consumers who have positive perceptions and attitudes towards beef safety would continue to consume beef with less fear. In general, consumers perceived that beef would be safer to consume if it is free from food borne risks and other types of food adulterations. In other words, typically they trust the beef supply chain that distributes safe beef. Healthiness, freshness, and source of beef are found as important factors that influence the consumers purchasing decision.

This study used CVM to estimate consumers' decision on whether to pay a premium and how much more to pay for meat that is guaranteed safe for consumption. The results showed that price levels and household incomes were the most significant factors that influenced and determined the total premium price that an individual was willing to pay for beef. In addition, the result from the WTP analysis indicated that the consumers were willing to pay an extra 13% for safer beef. Hence, extra costs incurred for producing safer beef should be shared by producers and consumers so that fair price received by producers and reasonable price paid by consumers are established.

Food safety extensions to food producers, processors, retailer, distributors, and food handlers should be provided regularly as to equip them with enough knowledge on the right rules and regulations on how to produce safer meats. Consumer movements too should play their cards in developing and inculcating higher food safety awareness and right attitudes among consumers. On the other hand, research should be intensified to generate more cost effective production technologies and food safety systems, in order to produce good quality meat at an affordable price.

The findings in this study should be useful in helping the government and industrial players in the supply chain of meat products, particularly beef in assessing the market potential for beef by formulating alternative policies and marketing strategies for the beef and meat industry. It is expected that the provision and demand for safer food will become important food policy issues in most Asian countries as they are experiencing rapid economic growth with steady increases in the standard of living.

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Abstrak

Kajian ini bertujuan menilai kesanggupan pengguna Melayu membayar harga premium bagi daging lembu yang dijamin selamat. Seramai 243 responden telah ditemu bual bagi tujuan ini. Kaedah Penilaian Kontinjen (Contingent Valuation Method) telah digunakan untuk mengenal pasti kesanggupan pengguna membayar harga premium bagi daging lembu yang selamat dimakan. Model logit dan probit telah digunakan untuk menganggar harga premium yang sanggup dibayar oleh pengguna untuk mendapatkan daging tersebut. Hasil kajian menunjukkan faktor penting yang mempengaruhi dan menentukan harga premium yang sanggup dibayar oleh pengguna ialah pendapatan isi rumah dan harga. Kajian ini menunjukkan permintaan dan penggunaan daging lembu masih tinggi walaupun berlaku insiden pencemaran makanan baru-baru ini. Walau bagaimanapun, banyak pengguna Melayu semakin berhati-hati apabila membeli daging lembu kerana prihatin terhadap kesihatan dan pemakanan. Trend ini sudah pasti memberi kesan kepada pasaran daging masa kini. Oleh yang demikian, bagi memastikan pasaran daging yang lebih baik, piawaian yang sesuai, dasar dan program serta kempen berkaitan dengan keselamatan daging perlu dibangunkan. Dalam masa yang sama, usaha penyelidikan dan pembangunan perlu ditingkatkan untuk menambah baik teknologi pengeluaran dan sistem keselamatan makanan bagi daging lembu.