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Demand for Food Safety Attributes for Vegetables in Malaysia

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Abstract

In a developing economy like Malaysia with rising per capita income, there have been changes in the consumer demand for food attributes such as safety, freshness, appearance and texture. This study investigated the demand for food safety attributes for vegetables. The results suggested that food safety attributes were ranked the highest for leafy and root vegetables, and ranked second behind freshness for fruit vegetables. Consumers were also willing to pay premium prices for the safety attributes. The findings would have positive implications for the agrifood industry if it responds effectively to translate into business opportunities to these changes.

Keywords: food attributes; food safety; willingness to pay; vegetables

1. Introduction

As income increases for individuals in an economy, consumers sharpen their focus on food safety. This new awareness is related to dietary changes associated with more disposable income and urban growth. Better-off consumers move beyond meeting basic dietary needs to a keener interest in selecting food for attributes such as freshness, quality, healthfulness, and convenience. Studies by Baker (1999), Rhr *et al.* (2005), and Roitner-Schobesberger *et al.* (2008) indicated that food safety was an important attribute to be considered in terms of food choice. This shift in the consumption patterns would affect future food choices in the country, and the response of the agro-food system to such shifts is vital to ensure a sustainable growth of the agro-food industry in Malaysia. This study therefore attempts to identify the relative importance of food attributes by Malaysian consumers with particular interest on food safety. A case study was conducted on leafy, root, and fruit vegetables.

2. Methodology

This study employed the conjoint analysis method which has been applied in several studies to establish the relative importance of different attributes in the provision of a good and service (Van der Pol and Ryan, 1996; Jan *et al.*, 2006; Campbell *et al.*, 2004). Steps in using the conjoint analysis method are as follows:

2.1. Establishing the relevant attributes and their levels

A number of methods exist to identify the attributes of preference structure of consumer of food products. These include literature reviews, focus group discussions, and individual interviews. In this study, a focus group session was used to identify the appropriate attributes and their relevant levels. The advantages of a focus group research include an increased interaction between all participants and the researcher, visual aids and tangible products can be circulated, and areas of specific interest can be covered in greater depth. Thirty three adult respondents participated in the focus group session, which are in various age, gender, ethnic, and education level in order to reflect the actual Malaysian population. Initially, seven potential attributes (freshness, texture, appearance, packaging, safety, and price) were identified in the consumption of vegetables. From focus group discussions, five attributes were finally selected as the most important attributes for each leafy, root and fruit vegetables. Selected attributes for leafy vegetables were freshness, texture, appearance, safety, and price; and for both root and fruit vegetables are freshness, texture, packaging, safety, and price. The attribute levels that were also established from the focus session are presented in Table 1.

Table 1. Selected Attribute for each Vegetable Commodity

Attribute	Level
Leafy Vegetables	
1. Freshness	1. Not more than three days of harvesting 2. Not more than two days of harvesting 3. Not more than one day of harvesting
2. Texture	1. Medium Crisp 2. Crisp
3. Appearance	1. Slightly damage 2. Wholesome
4. Food Safety	1. Conventional 2. Controlled Environment 3. Organic
5. Price	1. 0% increase 2. 10% increase and 3. 20%increase from current price
Root Vegetables	
1. Freshness	1. Not more than three days of harvesting 2. Not more than two days of harvesting 3. Not more than one day of harvesting
2. Texture	1. Medium Crisp 2. Crisp
3. Packaging	1. Packed 2. Unpacked
4. Food Safety	1. Conventional 2. Controlled Environment 3. Organic
5. rice	1. 0% increase 2. 10% increase and 3. 20%increase from current price
Fruit Vegetables	
1. Freshness	1. Not more than three days of harvesting 2. Not more than two days of harvesting 3. Not more than one day of harvesting
2. Texture	1. Medium Crisp 2. Crisp
3. Packaging	1. Packed 2. Unpacked
4. Food Safety	1. Conventional 2. Controlled Environment 3. Organic
5. Price	1. 0% increase 2. 10% increase and 3. 20%increase from current price

2.2. Establishing preferences and estimating utilities

In the actual survey, 207 respondents from the capital cities of all the states in Malaysia were interviewed to rate the combinations of attributes in the range of one to ten (1 is the least preferred, and 10 is the most preferred). In terms of sampling, Hair *et al.* (1998) suggested that the traditional conjoint analysis method has no sample size requirements and could be utilized for single respondent; the larger sample size enhances the reliability of the results and allows the researcher to make some generalizations. To provide reliable estimates, Green and Srinavasan (1978) suggested a minimum sample of 100 respondents.

Based on rating score for each combination, the conjoint analysis procedure calculated the contribution of each vegetable attributes to the respondentûs preference. The contribution of the attribute level is termed as "part-worth utility". The part-worth was estimated using MLR (Multiple Linear Regression) analysis. MLR assumes independent product attributes. Conjoint also uses the utility ranges to compute importance scores for each attributes.

2.3. Estimating Willingness to Pay (WTP) for each attribute

With an understanding of the relative importance of attributes and the impact on specific levels, it was then possible to estimate the WTP for each attribute demanded. WTP is also known as consumer surplus, which gives an indication of the economic feasibility of changes in attributes. Consumer surplus is defined as the difference between the money values of the benefit derived from consuming the commodity (Hausman, 1993). WTP was calculated by using the formula stated as follows:

$$\mathbf{WTP = \beta_0 / -\beta_{price}}$$

Where β_0 = Coefficients value of attributes for each vegetables commodity

β_{price} = Coefficients value of price for each vegetables commodity

3. Results and Discussion

3.1. Utility and Relative Importance of Attributes for Leafy Vegetables

The results of this study indicated that food safety was the most preferred attribute for leafy vegetables, with 47.23% relative importance from out of 4 attributes calculated, as illustrated in Table 2. Freshness was ranked second, 36.74%, followed by texture (8.09%) and appearance (7.94%). These results were consistent with those of other studies, and suggested that food safety was an important attribute to be considered in terms of food choice (Baker, 1999; Rohr *et al.*, 2005; Roitner-Schobesberger *et al.*, 2008). The findings suggested that Malaysian consumers consider health and safety perspectives while consuming leafy vegetables. In the context of food safety, conventional leafy vegetables (involves the use of insecticides and pesticides in production) is not preferred since the utility value is negative (-0.9466). Meanwhile, the utility for organic and controlled environment are 0.5635 and 0.3831, respectively, which indicated that both are preferred by consumers. The findings also suggested that freshness was still an important attribute to be considered while purchasing leafy vegetables. Similar results were also found by Wandel and Bugge (1997), Babicz-Zielinska and Zagorska (1998), Babicz-Zielinska (1999) and Cardello and Schutz (2003), which suggested that freshness was an important aspect attribute in terms of consumer demand for attribute. In terms of freshness, the negative value for utility (-0.7364) explains that çnot more than three days of harvestingé is not preferred. The utility for "not more than one day of harvesting" at 0.4942 was larger than "not more than two days of harvesting" (0.2422). It indicated that consumers preferred leafy vegetables attributed with "not more than one day of harvest" compared to "not more than two days". Cardello and Schutz (2003) suggested that time since arrival of the product at the store or market is the most important variable contributing to ratings of freshness. The negative utility constituted by "not more than three days of harvesting" may explain the relatively good correlation between freshness and time since arrival of the product at the store or market. For the texture of leafy vegetables, the utility of crisp is was 0.1621. In contrast, the utility for slightly crisp is -0.1621. Such result suggests that people dislike the slightly crisp attribute. Another important finding is that slightly damaged leafy vegetables were not preferred by consumers as the utility is was -0.1592 compared to wholesome leafy vegetables (utility = 0.1592). Sun and Collins (2004) stated that appearance is very crucial in the visualization of the quality of food products. A possible explanation for this could be because consumers assume that the slightly damaged vegetables might not be good in quality.

3.2. Utility and Relative Importance of Attributes for Root Vegetables

As in leafy vegetables, food safety was the most

Table 2. Utility and Relative Importance of Attribute for Leafy Vegetables

Attributes	Level of Attributes	Utility	Relative Importance (%)
Freshness	Not more than 3 days of harvesting	-0.7364***	36.7407
	Not more than 2 days of harvesting	0.2422***	
	Not more than 1 day of harvesting	0.4942***	
Food Safety	Conventional	-0.9466***	47.2285
	Controlled Environment	0.3831***	
	Organic	0.5635***	
Texture	Slightly Crisp	-0.1621***	8.0890
	Crisp	0.1621***	
Appearance	Slightly Damage	-0.1592***	7.9418
	Wholesome	0.1592***	
Price	Actual Price	-	-

Std. error = 2.1618, F = 49.7208
Note: Significance levels are denoted by *** for 1%, ** for 5%, and * for 10%.

preferred attribute for root vegetables with 45.94% for the relative importance of attributes as shown in Table 3. Freshness is ranked second, 44.12%, followed by packaging (7.26%) and texture (2.69%). Consumers' interest of buying root vegetables that were sprayed with pesticides and insecticides is low as the utility value is -0.7093. In contrast, root vegetables produced in a controlled environment and organic method, which offers more safety in food consumption, were preferred by consumers as the utility for both levels were 0.2805 and 0.4287 respectively. A strong relationship between organic food and health has been reported in the literature (Hansen, 1995 and De Souza *et al.*, 2007), and this contributes to support of the idea that consuming organic food can provide better health to consumers. Regarding freshness, the results found in this study also basically support previous researches by Wandel and Bugge (1997), Babicz-Zielinska and Zagorska (1998), Babicz-Zielinska (1999) and Cardello and Schutz (2003), which suggested that freshness was also an important attribute. This study also found that generally "not more than three days of harvesting" was not preferred, since the utility value was negative (-0.6812). It can thus be said that consumers do not accept the "not more than three days of harvesting" root vegetables as fresh root vegetables. The higher utility for "not more than one day of harvesting" (0.4049) compared to "not more than two days of harvesting" (0.2762) therefore assist in our understanding of the role of level of freshness in terms of consumer demand. The better level of freshness helps to increase the consumers' interests to buy root vegetables. As expected, packed root vegetables were also preferred by consumers. Bower *et al.* (2003) mentioned that packaging plays an important role in purchase intention, acting as a means to attract attention and provide information, thus affecting consumer perception of product quality. The result of this study confirms that packaging is associated with attracting consumer attention to purchase product, since the utility for packed root vegetables is 0.1592. Unpacked root vegetables are found to be not preferred by consumers as the utility computed is -0.1592. For texture, the utility for crisp is 0.1621, while slightly crisp is -0.1621. Such result suggests that consumer dislike the slightly crisp attribute.

3.3. Utility and Relative Importance of Attributes for Fruit Vegetables

Unlike leafy and root vegetables, freshness was found to be the most important attribute demanded by consumers in terms of purchasing fruit vegetables, with 46.50% relative importance from out of four attributes calculated (Table 4). Food safety is ranked second, 36.78%, followed by packaging (8.59%) and texture (8.13%). The findings were consistent with a study conducted by Ragaert *et al.* (2004), which found that freshness is the most important factor both at purchase and at consumption of minimally processed vegetables and packaged fruits. Similar results were also found by Wandel and Bugge (1997), Babicz-Zielinska and Zagorska (1998), Babicz-Zielinska (1999) and Cardello and Schutz (2003). In terms of freshness, "not more than three days of harvesting" was not preferred, as it has negative utility value, -0.8735. The negative utility constituted by "not more than three days of harvesting" may explain the relatively good correlation between

Table 3. Utility and Relative Importance of Attribute for Root Vegetables

Attributes	Level of Attributes	Utility	Relative Importance (%)
Freshness	Not more than 3 days of harvesting	-0.6812***	44.1159
	Not more than 2 days of harvesting	0.2762***	
	Not more than 1 day of harvesting	0.4049***	
Food Safety	Conventional	-0.7093***	45.9378
	Controlled Environment	0.2805***	
	Organic	0.4287***	
Texture	Slightly Crisp	-0.0415***	2.6862
	Crisp	0.0415***	
Packaging	Unpacked	-0.1121***	7.2601
	Whole and Packed	0.1121***	
Price	Actual Price	-	-

Std. error = 2.0864, F = 49.2145
Note: Significance levels are denoted by *** for 1%, ** for 5%, and * for 10%.

freshness of fruit vegetables and time since arrival of the fruit vegetables at the store or market. The utility for "not more than one day of harvesting" (0.5355) was larger than "not more than two days of harvesting" (0.3380) indicate that consumers preferred fruit vegetables attributed with "not more than one day of harvesting" compared to "not more than two days of harvesting". It can be said that the better level of freshness helps to increase the consumer's interests to buy fruit vegetables. It is also shown that for food safety attributes, conventional fruit vegetables (involves the use of insecticides and pesticides in production) is not preferred, since the utility value is -0.6909. As expected, organically produced was the most preferred for level of food safety, as the utility is 0.4287. Apart from that, the utility value was 0.2622 for fruit vegetables produced in controlled environment, and this indicated that consumers preferred this attribute as well. In line with previous researches (Zakrys *et al.*, 2008; Bower *et al.*, 2003), packed fruit vegetables are found to be preferred by consumers as the utility is 0.1614. These findings enhance our understanding that consumers prefer packed fruit vegetables compared to unpacked fruit vegetables. For texture, the utility of crisp and slightly crisp fruit vegetables were 0.1528 and -0.1528, respectively. Such results suggested that consumers dislike the slightly crisp attribute in purchasing fruit vegetables.

Table 4. Utility and Relative Importance of Attribute for Fruit Vegetables

Attributes	Level of Attributes	Utility	Relative Importance (%)
Freshness	Not more than 3 days of harvesting	-0.8735***	46.4979
	Not more than 2 days of harvesting	0.3380***	
	Not more than 1 day of harvesting	0.5355***	
Food Safety	Conventional	-0.6909***	36.7787
	Controlled Environment	0.2622***	
	Organic	0.4287***	
Texture	Slightly Crisp	-0.1528***	8.1324
	Crisp	0.1528***	
Packaging	Unpacked	-0.1614***	8.5910
	Whole and Packed	0.1614***	
Price	Actual Price	-	-

Std. error = 1.9945, F = 44.9207
Note: Significance levels are denoted by *** for 1%, ** for 5%, and * for 10%.

Table 5. Willingness to Pay for Attributes of Leafy Vegetables

Attributes	Level of Attributes	WTP* (RM/kg)	Overall WTP* (RM/kg)
Freshness	Not more than 3 days of harvesting	8.27***	8.62***
	Not more than 2 days of harvesting	8.61***	
	Not more than 1 day of harvesting	8.96***	
Food Safety	Conventional	8.27***	8.71***
	Controlled Environment	8.81***	
	Organic	9.06***	
Texture	Slightly Crisp	8.27***	8.39***
	Crisp	8.50***	
Appearance	Slightly Damaged	8.27***	8.38***
	Wholesome	8.50***	

Std. error = 2.1618, F = 49.7208, 0 = 5.0946, Coefficients of price = -0.0778
Note: Significance levels are denoted by *** for 1%, ** for 5%, and * for 10%.
WTP* calculated based on the current average price of leafy vegetables at RM5.00/kg

3.4. Willingness to Pay for Attributes for Leafy Vegetables

Table 5 shows the WTP for each attribute and level of attributes for leafy vegetables. The WTP was calculated based on the current average price of leafy vegetables such as mustard, cabbage and spinach which was RM5.00 per kg. In terms of attributes, food safety conferred the highest WTP, which is RM8.71 per kg of leafy vegetables. Freshness was ranked second, RM8.62 per kg, and then followed by texture and appearance, which were RM8.39 per kg and RM8.38 per kg respectively. For level of attributes, the highest WTP was conferred by organic leafy vegetables, which was RM9.06 per kg. The WTP for controlled environment and conventional leafy vegetables were RM8.81 and RM8.27 per kg respectively. The analysis also discovered that the WTP for leafy vegetables which were "not more than one day of harvesting" was RM8.96 per kg. The WTP for leafy vegetables which were "not more than 2 days of harvesting" was RM8.61/kg, and RM8.27/kg for "not more than 3 days of harvesting". Concerning the texture of leafy vegetables, the WTP for both levels, crisp and slightly crisp were RM8.50/kg and RM8.27/kg. The same values constituted for the level of appearance of leafy vegetables, the WTP for both levels, wholesome and slightly damaged were RM8.50/kg and RM8.27/kg respectively.

3.5. Willingness to Pay for Attributes for Root Vegetables

As shown in Table 6, the WTP for both freshness and food safety of root vegetables attributes were the highest, which was RM9.81 per kg. The WTP was calculated based on the current average price of root vegetables such as carrot, white carrot, turnip and potatoes, which was RM5.00 per kg. Both WTP for texture and packaging were RM9.79 per kg. For the level of attributes, the highest WTP was obtained by organic and controlled environment root vegetables, which was RM9.84 per kg. The WTP for controlled conventional root vegetables was RM9.75 per kg. For the three level of freshness, the analysis revealed that the WTP for root vegetables which were "not more than one day of harvesting" was RM9.83 per kg. The WTP for root vegetables which were "not more than two days of harvesting" and "not more than three days of harvesting" were RM9.85/kg and RM9.75/kg respectively. The WTP for both levels of texture of root vegetables, crisp and slightly crisp were RM9.82/kg and RM9.75/kg respectively. From the calculation, the WTP for both level of packaging (whole and packed and unpacked) were found to be the same with crisp and slightly crisp, which were RM9.85/kg and RM 9.75/kg respectively.

3.6. Willingness to Pay for Attributes for Fruit Vegetables

The highest WTP was that of freshness and food safety attributes at RM9.01/kg compared with the current average price of fruit vegetables (chilli, tomato, brinjal and cucumber) at RM5.00/kg (Table 7). The WTP for packaging was ranked third, RM9.00/kg and texture was ranked fourth, with the WTP equal to RM8.99/kg. In the context of food safety, the WTP conferred by organic, controlled environment and conventional fruit vegetables were RM9.04/kg,

Table 6. Willingness to Pay for Attributes of Root Vegetables

Attributes	Level of Attributes	WTP* (RM/kg)	Overall WTP* (RM/kg)
Freshness	Not more than 3 days of harvesting	9.75***	9.81***
	Not more than 2 days of harvesting	9.85***	
	Not more than 1 day of harvesting	9.83***	
Food Safety	Conventional	9.75***	9.81***
	Controlled Environment	9.84***	
	Organic	9.84***	
Texture	Slightly Crisp	9.75***	9.79***
	Crisp	9.82***	
Packaging	Unpacked	9.75***	9.79***
	Whole and Packed	9.82***	

Std. error = 2.0864, F = 49.2145, $_0$ = 5.4105, Coefficients of Price = -0.0569
Note: Significance levels are denoted by *** for 1%, ** for 5%, and * for 10%.
WTP* calculated based on the current average price of root vegetables at RM5.00/kg

RM9.04/kg and RM8.97/kg respectively. For freshness, the highest WTP was for çnot more than two days of harvestingé, which was RM9.04/kg, followed by çnot more than one dayé and çnot more than three days of harvestingé, which were RM9.03/kg and RM8.97/kg respectively. As expected, the WTP for whole and packed was higher than unpacked fruit vegetables at RM9.03/kg and RM8.97/kg respectively. The calculated WTP for crisp texture of fruit vegetables was also higher than medium crisp of fruit vegetables, with the value of RM9.02/kg and RM8.97/kg respectively.

4. Conclusion

The Malaysian food supply chain is increasingly market-led, with the end consumer being one of the main drivers for change. Consumer spending on food is expected to grow faster than the quantities consumed as quality, primarily in terms of food safety, plays a major role in food selection in the years ahead. This shift in the demand for food attributes would actually provide a great business opportunity for the agrifood businesses if they can responds effectively to the changes. The changes in the food choices would also have implications for the organizational structure of the agri-food industry and for the economic well-being of farmers, food processors, retailers and other participants in the food production and marketing system.

Table 7. Willingness to Pay for Attributes of Fruit Vegetables

Attributes	Level of Attributes	WTP* (RM/kg)	Overall WTP* (RM/kg)
Freshness	Not more than 3 days of harvesting	8.97***	9.01***
	Not more than 2 days of harvesting	9.04***	
	Not more than 1 day of harvesting	9.03***	
Food Safety	Conventional	8.97***	9.01***
	Controlled Environment	9.04***	
	Organic	9.04***	
Texture	Slightly Crisp	8.97***	8.99***
	Crisp	9.02***	
Packaging	Unpacked	8.97***	9.00***
	Whole and Packed	9.03***	

Std. error = 1.9945, F = 44.9207, Coefficients of price = -0.0682
Note: Significance levels are denoted by *** for 1%, ** for 5%, and * for 10%.
WTP* calculated based on the current average price of fruit vegetables at RM5.00/kg

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