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**DEMAND FOR FOOD SAFETY ATTRIBUTES OF VEGETABLES IN THE
KLANG VALLEY, MALAYSIA**

By

KHALID JOYA

**Thesis Submitted to the School of Graduate Studies, Universiti Putra
Malaysia, in Fulfilment of the Requirements for the Degree of Master of
Science**

December 2020

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DEDICATION

My humble effort I dedicated to

My sweet and loving parents

Professor Mohammad Maqsoud Joya and Associate Professor Fawzia Rahmati

My siblings

Mrs. Khalida Joya and Mr. Bahram Joya for the overwhelming support and enormous sacrifices

My Dearest wife and children

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**DEMAND FOR FOOD SAFETY ATTRIBUTES OF VEGETABLES IN THE
KLANG VALLEY, MALAYSIA**

By

KHALID JOYA

December 2020

Chair : Nurul Nadia Ramli, PhD
Faculty : Agriculture

Due to the relation between food and health, food safety is receiving greater attention from consumers. Increasing in income and urbanization have changed the consumers' demand and preferences towards food safety attributes. Meanwhile in recent years, the vegetables' farmers in Malaysia has been reported of using excessive quantity of pesticides in order to increase the production. In 2015, some 300 batches of vegetables mostly leafy vegetables were stopped from being sold in Singapore after pesticide residues found on samples exceeded levels allowed by the authorities. Also, in 2017, vegetables from Cameron Highlands have been rejected from China due to the presence of excessive level of pesticides. In 2018 there was a recall of iceberg lettuce from Agri-Food and Veterinary Authority of Singapore (AVA) due to the excessive chemicals used. These incidences have created a concern to improve the safety of vegetables produce. Nowadays due to changing in life style as well as urbanization and increasing in incomes the consumers are more conscious about their health and they sharpen their attention to the safety attributes of food. Therefore, this study was conducted to determine the demand for food safety attributes of vegetables in Malaysia. Three types of vegetables such as leafy vegetables (Cabbage), root vegetables (Carrot), and fruit vegetables (Tomato) have been included in this study. Discrete choice experiment has been used to estimate the demand for food safety attributes of vegetables. A focus group discussion was done in order to determine the most relevant safety attributes before creating the choice sets. From the focus group discussion, it was found that appearance, production system, type of market, Malaysian Good Agricultural Practice (MyGAP) certification, and price were the most important safety attributes for vegetables. Proportionate sampling method was used to select the respondents in Klang Valley area. 505, 490 and 490 respondents have completed the survey for cabbage, carrot and tomato, respectively. Using the choice experiments, the respondents were asked about what type of vegetables

that they would buy among the orthogonally designed choice sets. The results showed that in terms of food safety attributes, Malaysian consumers prefer wholesome appearance rather than slightly damage, organic rather than conventional, sold at the supermarket rather than wet market and vegetables with MyGAP certification rather than not certified vegetables. In addition, results suggested that Malaysian consumers are willing to pay a premium for food safety attributes of vegetables. The findings also indicated that the willingness to pay varied according to income, education level and age. The higher willingness to pay for food safety attributes indicate that the consumers are paying more attention to the safer product. Therefore, policies on food safety should be pursued and supported by Malaysian government in order to enhance the safe food market, which it would be beneficial for all consumers. Since the consumers are willing to pay for safer attributes, if the industry and farmers can respond effectively to these changes it can be translated into business opportunities.



Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk Ijazah Sarjana Sains

**PERMINTAAN TERHADAP ATRIBUT KESELAMATAN MAKANAN BAGI
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Oleh

KHALID JOYA

Disember 2020

Pengerusi : Nurul Nadia Ramli, PhD
Fakulti : Pertanian

Disebabkan oleh hubungan makanan dan keselamatan yang berkait rapat, isu keselamatan makanan mendapat perhatian yang lebih daripada para pengguna. Peningkatan jumlah pendapatan dan proses urbanisasi telah menyebabkan perubahan dalam permintaan dan pemilihan pengguna terhadap aspek keselamatan makanan. Beberapa tahun lepas, sebahagian pekebun pekebun sayur di Malaysia telah dikesan menggunakan racun serangga yang berlebihan dalam penghasilan sayur mereka. Pada tahun 2015, sebanyak 300 kumpulan sayuran yang kebanyakannya sayuran berdaun yang di jual di Singapura telahpun diberhentikan penjualannya disebabkan oleh sampel racun seranggan yang digunakan untuk sayuran tersebut telah melebihi apa yang ditetapkan oleh pihak berkuasa. Pada tahun 2017 pula, sayuran daripada Cameron Highlands telah disekat daripada memasuki pasaran China juga disebabkan oleh penggunaan racun serangga yang berlebihan. Manakala dalam tahun 2018, Penguasa Makanan Pertanian dan Ternakan Singapura telah menghantar pulang stok salad yang juga disebabkan oleh penggunaan racun serangga yang berlebihan. Hal ini telah menyebabkan wujudnya keprihatian untuk menambah baik aspek keselamatan dalam penghasilan sayuran di Malaysia. Pada era ini, perubahan gaya hidup, proses urbanisasi yang berlaku dan peningkatan jumlah pendapatan telah meningkatkan kesedaran pengguna untuk memberi perhatian yang lebih terhadap aspek keselamatan makanan. Oleh itu, kajian ini dilaksanakan untuk mengkaji dan mengenalpasti permintaan terhadap atribut keselamatan makanan untuk sayur-sayuran di Malaysia. Terdapat tiga jenis sayuran yang terlibat iaitu seperti sayuran berdaun (kobis), akar (lobak), dan buah (tomato). Kaedah Eksperimen Pilihan Diskret telah digunakan untuk mengkaji tentang permintaan pengguna terhadap atribut keselamatan makanan dalam sayur-sayuran. Teknik Perbincangan Kumpulan Berfokus telah dijalankan untuk mengenalpasti atribut keselamatan makanan yang paling relevan sebelum merangka set pilihan di dalam kajian. Daripada teknik tersebut didapati

penampilan, sistem penghasilan, jenis pasaran, pensijilan MyGAP dan harga merupakan atribut paling penting untuk sayur-sayuran. Kaedah pensampelan mengikut nisbah telah digunakan untuk memilih responden di kawasan sekitar Lembah Klang. Sebanyak 505, 490 dan 490 orang responden telah melengkapkan soal selidik untuk sayur kobis, lobak dan tomato. Dengan menggunakan set pilihan yang disediakan, para responden ditanya mengenai ciri-ciri sayuran yang mereka akan beli daripada set pilihan yang dirangka. Keputusan didapati dari segi atribut keselamatan makanan, rakyat Malaysia lebih mementingkan penampilan yang sihat daripada penampilan yang separa rosak, yang organik daripada konvensional (bukan organik), yang dijual di pasar raya daripada yang dijual di pasar tani dan juga sayuran yang mempunyai sijil MyGAP daripada sayuran yang tidak mempunyai sijil MyGAP. Hasil kajian juga menunjukkan pengguna Malaysia mempunyai kesediaan untuk membayar harga yang lebih tinggi untuk sayuran yang mempunyai atribut keselamatan makanan. Hasil kajian juga menunjukkan kesediaan pengguna untuk membayar lebih terhadap atribut keselamatan makanan untuk sayur bergantung kepada jumlah pendapatan, tahap pendidikan dan umur. Semakin tinggi kesediaan untuk membayar atribut keselamatan, menunjukkan yang pengguna memberikan tumpuan kepada produk yang lebih selamat. Sehubungan itu, polisi-polisi keselamatan makanan perlu diteruskan dan mendapat sokongan yang berterusan daripada Kerajaan Malaysia agar usaha menambahbaik pasaran makanan yang selamat dapat dicapai, di mana ini akan memberi manfaat kepada seluruh pengguna di Malaysia. Secara keseluruhan, memandangkan hasil kajian menunjukkan kesediaan pengguna untuk membayar lebih terhadap atribut keselamatan makanan, adalah lebih baik sekiranya para petani dan industri dapat bertindakbalas secara efektif kepada perubahan dalam permintaan keselamatan makanan, dan akhirnya dapat menghasilkan satu peluang pemiagaan yang lebih baik.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of (Master of Science). The members of the Supervisory Committee were as follows:

Nurul Nadia Ramli, PhD

Senior Lecturer
Faculty of Agriculture
Universiti Putra Malaysia
(Chairman)

Mad Nasir Shamsudin, PhD

Professor Datuk
Faculty of Agriculture
Universiti Putra Malaysia
(Member)

Nitty Hirawaty Kamarulzaman, PhD

Associate Professor
Faculty of Agriculture
Universiti Putra Malaysia
(Member)

ZALILAH MOHD SHARIFF, PhD

Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date: 11 March 2021

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Name and Matric No.: Khalid Joya, GS53137

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Signature: _____
Name of Chairman
of Supervisory
Committee: Nurul Nadia Ramli

Signature: _____
Name of Member of
Supervisory
Committee: Mad Nasir Shamsudin

Signature: _____
Name of Member of
Supervisory
Committee: Nitty Hirawaty Kamarulzaman

TABLE OF CONTENTS

ABSTRACT	Page
ABSTRAK	i
ACKNOWLEDGEMENTS	iii
APPROVAL	v
DECLARATION	vi
LIST OF TABLES	viii
LIST OF FIGURES	xiii
LIST OF ABBREVIATIONS	xiv
	xv

CHAPTER

1	INTRODUCTION	1
1.1	Overview of Vegetable Industry in Malaysia	1
1.1.1	Production of Vegetables	1
1.1.2	Consumption of Vegetables	3
1.2	Changes in Consumption Pattern of Consumers	6
1.3	Changes in Consumer Preferences	9
1.4	Global Food Safety Challenges and Issues	10
1.5	Food Safety Issues and Challenges in Malaysia	13
1.6	Problem Statement	16
1.7	Research Questions	18
1.8	Objectives of The Study	18
1.9	Significance of Study	18
1.10	Organization of The Study	19
1.11	Summary of Chapter	19
2	LITERATURE REVIEW	20
2.1	Concept of Food Safety	20
2.2	Food Safety Attributes	21
2.2.1	Production Method	21
2.2.2	Certifications (GAPs and Traceability Labels)	22
2.2.3	Country of Origin	23
2.2.4	Health Related Attributes	23
2.3	Quality Attributes for Vegetables	24
2.3.1	Appearance	24
2.3.2	Freshness	25
2.3.3	Smell, Taste and Texture	25
2.4	Factors Affecting the Willingness to Pay for Food Safety Attributes	26
2.5	Techniques Used in Previous Studies	28
2.5.1	Contingent Valuation	28
2.5.2	Conjoint Analysis	29
2.5.3	Discrete Choice Experiment (DCE)	30
2.6	Summary of Chapter	32

3	METHODOLOGY	33
3.1	Conceptual Framework	33
3.2	Theoretical Framework	35
	3.2.1 Random Utility Theory	36
	3.2.2 Characteristics Theory of Value	37
3.3	Discrete Choice Experiment Techniques	38
	3.3.1 Development of Attributes and Attribute Levels	39
	3.3.2 Designing the Choice Sets	41
3.4	Pilot Test	42
3.5	Data Collection Procedure	43
	3.5.1 Study Area	44
	3.5.2 Sampling Technique	44
3.6	Estimation Method	46
	3.6.1 Conditional Logit	47
	3.6.2 Goodness of Fit	47
	3.6.3 Model Specification	49
	3.6.4 Willingness to Pay	50
3.7	Summary of Chapter	51
4	RESULTS AND DISCUSSION	52
4.1	Cabbage	52
	4.1.1 Descriptive Statistics	52
	4.1.2 Basic Model Results	54
	4.1.3 Willingness to Pay for Basic Model	55
	4.1.4 Interaction Model	57
	4.1.5 Willingness to Pay Based on Socio-Demographic Profiles	59
4.2	Carrot	60
	4.2.1 Descriptive Statistics	60
	4.2.2 Basic Model Results	61
	4.2.3 Willingness to Pay for Basic Model	63
	4.2.4 Interaction Model	64
	4.2.5 Willingness to Pay Based on Socio-Demographic Profiles	67
4.3	Tomato	68
	4.3.1 Descriptive Statistics	68
	4.3.2 Basic Model Results	70
	4.3.3 Willingness to Pay for Basic Model	71
	4.3.4 Interaction Model	72
	4.3.5 Willingness to Pay Based on Socio-Demographic Profiles	75
5	SUMMARY, CONCLUSION AND RECOMMENDATION FOR FUTURE RESEARCH	77
5.1	Summary	77
5.2	Policy Implication	78

5.3	Limitation of The Study	79
5.4	Suggestions for Future Research	79
5.5	Conclusion	79

REFERENCES	81
APPENDICES	103
BIODATA OF STUDENT	165
LIST OF PUBLICATIONS	166



LIST OF TABLES

Table		Page
1.1	Vegetable Production and Import, Malaysia, 2008-2018	3
3.1	Selected Attributes for Each Type of Vegetable	39
3.2	Population Estimates by Area in Klang Valley (in '000)	45
4.1	Socio Demographic Profile of Respondents for Cabbage	52
4.2	Estimation Results from Conditional Logit (CL)	54
4.3	Marginal Willingness to Pay for Food Safety Attributes of Cabbage	55
4.4	The Interaction Terms for Cabbage	57
4.5	Willingness to Pay Based on Socio-Demographic for Cabbage	59
4.6	Socio Demographic Profile of Respondents for Carrot	60
4.7	Estimation Results from Conditional Logit (CL)	62
4.8	Marginal Willingness to Pay for Food Safety Attributes of Carrot	63
4.9	The Interaction Terms for Carrot	65
4.10	Willingness to Pay Based on Socio-Demographic for Carrot	67
4.11	Socio Demographic Profile of Respondents for Tomato	68
4.12	Estimation Results from Conditional Logit (CL)	70
4.13	Marginal Willingness to Pay for Food Safety Attributes of Tomato	71
4.14	The Interaction Terms for Tomato	73
4.15	Willingness to Pay Based on Socio-Demographic for Tomato	75

LIST OF FIGURES

Figure		Page
1.1	Per Capita Vegetable Consumption, Malaysia, 1961-2017	4
1.2	Per Capita Consumption of Cabbage, Carrot and Tomato, Malaysia, 2010-2019	5
1.3	Per Capita Consumption of Different Commodities, Malaysia, 1961-2017	8
1.4	Food Poisoning Cases Occurring in Schools, Malaysia, 2010-2015	14
3.1	Conceptual Framework of The Study	33
3.2	Map of Klang Valley	43

LIST OF ABBREVIATIONS

ASEAN	Association of Southeast Asian Nations
AVA	Agri-Food and Veterinary Authority of Singapore
CA	Conjoint Analysis
CL	Conditional Logit
CM	Choice Modelling
CV	Contingent Valuation
DCE	Discrete Choice Experiment
DOSM	Department of Statistics of Malaysia
EEcoli	Enteropathogenic Escherichia Coli
FAMA	Federal Agricultural Marketing Authority
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross Domestic Products
IID	Independently and Identically Distributed
IPM	Integrated Pest Management
LMO	Living Modified Organism
MAFI	Ministry of Agriculture and Food Industries
MRL	Maximum Residue Limits
MRS	Marginal Rate of Substitution
MyGAP	Malaysian Good Agricultural Practice
NTS	Non-Typhoidal Salmonella
OLS	Ordinary Least Squares Regression
RUT	Random Utility Theory
WHO	World Health Organization
WTP	Willingness to Pay
ASEAN	Association of Southeast Asian Nations

CHAPTER 1

INTRODUCTION

This chapter describes the overview of the vegetable industry in Malaysia, changes in consumption patterns of consumers, changes in consumers preferences, global food safety issues, food safety issues in Malaysia, problem statement, research questions, objectives of the study, significance of the study, organization of the study and summary of the chapter.

1.1 Overview of Vegetable Industry in Malaysia

A freshly grown vegetable confers a substantial portion of Malaysian daily food intake. Vegetables are food crops that provide essential sources of minerals, vitamins, and fibres. Domestically, more than 50 types of tropical and temperate vegetables are consumed.

The vegetable industry is one of the crucial industries in Malaysia. It provides people with food, creates jobs for the rural population, and generates economic development revenue. Small-scale farmers usually carry out the vegetable industry in Malaysia. Mostly, farmers control their land or rented land from the government. The farm size typically varies between 1 and 1.5 hectares. Generally, the farm's small size is not sustainable, and the revenues from vegetable farming cannot support a better lifestyle. Consequently, many farmers do other jobs to increase their revenue (Halim and Rozhan, 2017).

In 2018, vegetables contributed 7.3% to Gross Domestic Products (GDP) of Malaysia's agricultural sector worth around RM 99.5 billion. 52% of the contribution comes from industrial crops such as oil palm, rubber, cocoa, and 48% from agricultural food crops, including fruit and vegetables (MAFI, 2018). In general, it is estimated that around 55,000 or 9.02% of the total farmers are actively involved in vegetable farming in 2018 (MAFI, 2018). The vegetable sector in Malaysia is best defined as small and fragmented. The main types of vegetables cultivated include spinach, cabbage, lady's finger, cucumber, long bean, chilli and tomatoes (MAFI, 2018).

1.1.1 Production of Vegetables

The increase in the consumption and production of vegetables has been no less than a recent phenomenon. Even though public attention has focused on the more noticeable growth of the areas of oil palm and cocoa, the unnoticed growth of vegetable cultivation has overtaken both regions in its growth rate as awareness level grips people and increases the consumption of "wholesome, safe, natural" food.

Tropical vegetables are grown throughout the year, for example, mustard green, ginger, chillies, okra, and eggplant. Temperate vegetables, namely capsicum, Chinese cabbage, cabbage, lettuce, celery, and sweet pea, are produced in the cooler highlands. However, with the recent introduction of heat-tolerant temperature vegetables, notably cabbage, cauliflower, and capsicum, cultivation of these vegetables has expanded considerably into the peat regions of Johore.

Traditionally, vegetable farmers cultivate a range of vegetables in rotation with other crops. Vegetables are also grown as cash crops between young rubber or oil palm. There is no single system of production, but different degrees of cropping system is practised. The cropping intensity is closely related to water availability (in rainfed rice areas), soil type, climate, infrastructure, and marketing consideration. In the rainfed rice areas, vegetables are planted during the offseason when water availability is insufficient for the rice crop. Usually, the fields are cultivated are ridged immediately after the rice harvest. Organic and inorganic fertilizers are used to establish vegetable crops.

Depending on the type of vegetables, two or more crops can be grown before the primary rice season. In Tanjong Minyak, Malacca, heavy application of fertilizers and continuous cultivation have improved the paddy soil to such an extent that subsequent paddy crops can be planted without fertilizer. Vegetable farming is inherently labour intensive. Limited mechanical power is employed in these farms. Water pumps may be available to pump water for irrigation. Hand operated knap-sack sprayers are used for crop protection measures. Other farm operations such as cultivation, planting, weeding, and harvesting are usually performed by family labour or hired hand.

On the contrary, the operations are well structured on larger farms in the main centres of vegetable production. Tractors and rototillers are employed for cultivation and ridging. Larger capacity water pumps are common. The more advanced farms may use power sprayers for crop protection practices. Other operations, like planting, weeding and harvesting are generally performed using contract labour (Tee, 1997).

By the intensity of crop rotation, the production is expected to improve from 1.8 million tonnes in 2010 to 2.5 million tonnes in 2020, according to a study by Halim and Rozhan (2017). The output of vegetables is anticipated to increase by 9.8% a year, from 0.7 million tonnes to 2.9 million tonnes. Production is projected to increase proportionally with increased productivity and expansion of new areas for cabbage, mustard, cucumber, spinach, eggplant, beans, and okra.

Based on the data obtained from the Ministry of Agriculture and Food Industries of Malaysia, the production of vegetables has fluctuated between 491,125 tonnes in 2008 to 997,745 tons in 2018. The highest rate of production was 1,425,846 tonnes in 2014. The data from MAFI shows that vegetable production

increased by 51% from 2008 to 2018. As presented in Table 1.1, Malaysia imported vegetables worth approximately US\$6885361.926 in 2017, an increase of about 5.5% from 2016. If we look carefully, we can see that after 2008, imports of vegetable increased every year, and a significant amount of money has been allocated to the imports of vegetables.

Table 1.1 : Vegetable Production and Import, Malaysia, 2008-2018

Item	Years					
	2008	2010	2012	2014	2016	2018
Average yield (Tonne/Ha)	16.2	17.1	18.8	21.2	19.9	18.1
Production (Tonne)	491,125	872,000	946,539	1,452,846	1,195,647	997,745
Production value (RM '000)	2,162,564.	3,158,624.13	3,180,767.28	3,881,484.17	2,927,588.7	2,407,554
Import Value (US\$ '000)	5,267,840.7	6,167,409.14	7,845,311.77	6,718,190.49	6,525,879.3	6,885,361.

Sources: MAFI (2018); WITS (2018)

1.1.2 Consumption of Vegetables

Nowadays, a global epidemic is changing the pattern of food consumption in tandem with economic growth. Economists generally explain that when an economy develops from a low level, there is an initial rise in conventional staple foods. It becomes much more evident in further development that there is a diversification in food consumption. This is a glimpse of the narrative that typical emerging economies are encountering and, therefore, Malaysia. Diversification is growing, as Malaysians demand more non-traditional staples, such as wheat, meat, fruit and vegetables, as well as higher value, processed and higher proteins. The impact of income growth, primarily due to economic development, is visible as a dominant force. Among the influences, there is a growing pool of middle-class consumers. The middle-class consumers are empowered by stronger purchasing power, which is dedicated to the rising demand for food. This demographic community often tends to shift food intake from conventional staples to higher-value foods (Mad Nasir et al., 2010).

Besides, people are nowadays concerned about food safety because of the changing lifestyle and the increase in income. This new awareness is due to lifestyle changes associated with more disposable income and development in urban areas. Better-off consumers are moving to a greater interest in food selection for characteristics such as freshness, quality, safety, and convenience beyond meeting basic dietary needs (Abdul Hadi, 2009).

Vegetables are important health supports because they are composed of critical nutrients such as vitamins, minerals, proteins, fibres and bio-functional elements and are low in fat, sodium and calories in comparison with many other foods (Slavin and Lloyd, 2012). Numerous studies have consistently associated the reduced risk of numerous cancers like cancer of the lung, oesophagus, mouth, stomach, colon and pancreas, as well as cardiovascular disease, diabetes, stroke, obesity, diverticulosis and cataract with high consumption of fruits and vegetables (Radnitz, Beezhold, and DiMatteo, 2015; Nurul Izzah et al., 2012). In a study by the World Health Organization (WHO), it has been recommended the consumption of a minimum of five servings or 400 grams of fruits and vegetables per day per individual, but not potatoes or other starchy tubing (Ziaei, Shahi, Dastgiri, Mohammadi, and Viitasara, 2019). This recommendation requires at least 3 daily portions of vegetables (240 g) with at least one serving of vegetables involving dark green and leafy or orange vegetable (nutrient-rich vegetable) (Striegel-Moore et al., 2006).

In recent decades, there has been a massive increase in vegetable consumption among Malaysian consumers. The consumption of vegetables in the 1970s to 1980s was about 18 to 28 kg per capita per year, respectively. In the 1990s, the demand for vegetables remained the same as the earlier amount, approximately 25 kg per capita per year. However, the increase in consumption of vegetables can be seen starting from 2001 until 2017. It should be noted that the per capita consumption of vegetables had increased from 16 kg in 1961 to 62 kg in 2017. Vegetable consumption in Malaysia is illustrated in Figure 1.1. This increase in vegetable consumption is due to the changes in lifestyles among the Malaysian consumers coupled with the growing consciousness in food intake, and they are consuming healthier and more nutritious foods such as fruits and vegetables.

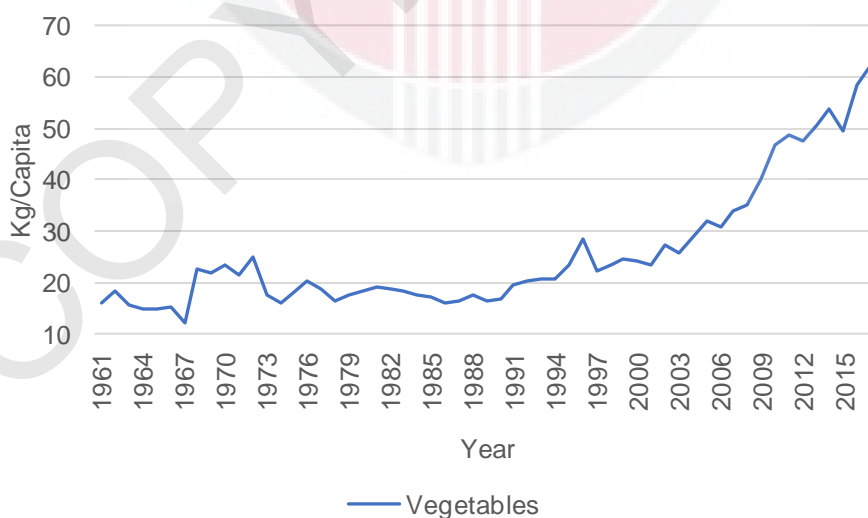


Figure 1.1 : Per Capita Vegetable Consumption, Malaysia, 1961-2017
(Source: FAO, 2020)

It is noteworthy that according to Agrofood statistics, vegetables can be categorized into three categories: leafy, fruit and root vegetables (MAFI, 2018). Therefore, this study aims to determine the consumer's demand for food safety attributes of vegetables in Malaysia. To achieve this purpose, three types of vegetables such as leafy vegetables (cabbage), root vegetables (carrot), and fruit vegetables (tomato) were included in this study. Each of the mentioned vegetables was selected based on its per capita consumption. The vegetable that has highest per capita consumption was selected based on each type of vegetable categories. The per capita consumption of these three vegetables has shown in Figure 1.2. Based on the Department of Statistics Malaysia (DOSM) data and the Food and Agriculture Organization of the United Nations (FAO), the per capita consumption of cabbage has been increased from 3.6 kg/capita/year in 2010 to 6.1 kg/capita/year in 2019. The data shows that among other leafy vegetables, cabbage has the highest per capita consumption in Malaysia. The data also shows that carrot's per capita consumption fluctuated between 1.3 kg/capita/year in 2010 to 3.1 kg/capita/year in 2019. As shown in Figure 1.2, the increment in consumption of carrot has occurred after 2013. The data indicated that carrot has the highest per capita consumption among root vegetables. Lastly, the per capita consumption of tomato has shown in Figure 1.2 and based on the data, the per capita consumption of tomato has increased from 2.9 kg/capita/year in 2010 to nearly 4.2 kg/capita/year in 2019 with an increase of 144%. This indicated that based on per capita consumption, tomato could represent the fruit vegetables in this study.

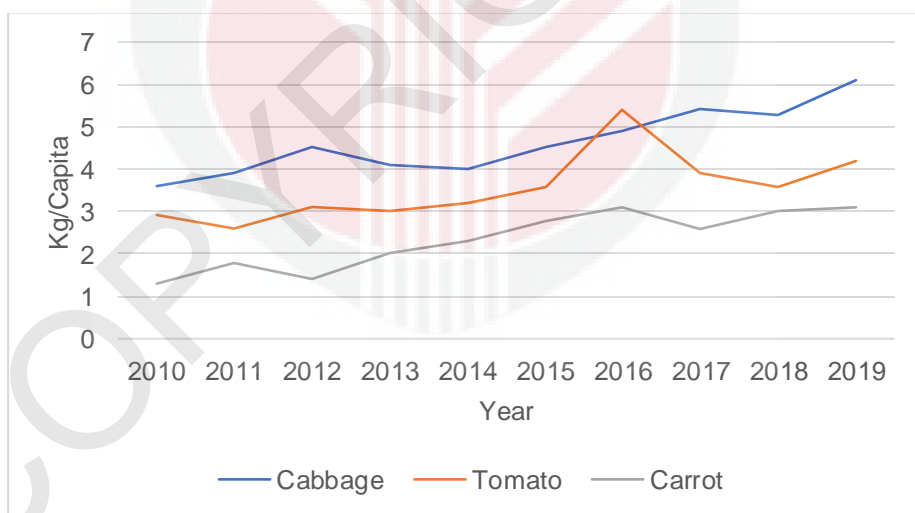


Figure 1.2 : Per Capita Consumption of Cabbage, Carrot and Tomato, Malaysia, 2010-2019 (Sources: FAO, 2020; DOSM, 2020).

It should be mentioned that global food security is a serious challenge to humankind, and it has emerged more seriously since the food price volatility in 2007–2008. Food security is rising to the centre of global discourse and has

become an issue of public concern (Bala, Alias, Arshad, Noh, & Abdul Hadi, 2014).

Food security is a social sustainability indicator and the most commonly used indicators in the assessment of food security conditions are food production, food self-sufficiency level, income, total expenditure, food expenditure, the share of expenditure of food, calorie consumption and nutritional status, etc. (Riely, Mock, Cogill, Bailey, & Kenefick, 1999).

Regarding the self-sufficiency ratio for Malaysia, the report from DOSM highlights that in 2019 by and large, Malaysia is self-sufficient in responding to domestic consumers' demand for many necessary food items. Out of 33 most commonly consumed agricultural products especially vegetables (i.e., brinjal, cucumber, cabbage, spinach and eggs), half of these food products have a self-sufficiency ratio of more than 100% with tomato (131.2%), cucumber (110%), brinjal (119%), spinach (112.6%), eggs (113.6%), long beans (107%), lady's finger (104.4%), pineapple (105.2%), cuttlefish (109.2%), banana (103%) and shrimp (102.9%) (DOSM, 2020).

1.2 Changes in Consumption Pattern of Consumers

The food sector has made an important contribution to Malaysia's economic growth and development. In the search for better economic and social opportunities, the past decade has seen rapid structural transformation and urbanisation. This has resulted in the increase of demand for food. The changes in Malaysian food consumption as a developing country classified into the following phases: an early increase in the consumption of traditional staple foods (such as rice); followed by an increase in the consumption of non-traditional staple foods (such as wheat and secondary products from conventional staple food); change in consumption habits together with the time and place of consumption; and finally, an increase in the consumption of greater variety and volume of food with higher vitamin and protein content (such as vegetables, fruits, milk, fish and meat) (Abdul Hadi, 2009). In Malaysia, demand for vegetables, fruits, wheat, eggs, and meat has generally increased, while the value of rice as a staple food has decreased gradually.

Based on the data obtained from FAO, per capita rice consumption consistently declined from 1961 – 2017, as presented in Figure 1.3. The consumption of rice was recorded at 181 kg per year capita in 1961. However, per capita consumption of rice had been fluctuating within the range of 180 to 187 kg/capita/year from the year 1961 to 1973. From 1965, the consumption of rice started to decline from 176 kg/capita/year in 1965 until it fell to 163.9 kg/capita/year in 1981 and 125 kg/capita/year in 1985. In 2001, the consumption of rice was recorded at 120 kg/capita/year, 121 kg/capita/year and 122 kg/capita/year in 2009 and 2013, respectively. In 2017, the consumption of rice fell drastically to 112 kg/capita/year. The decline in demand for rice may be

related to the substitution of the rice by wheat as the main staple food. This decline in rice consumption is because of the diversification in consumers' food consumptions (Abdul Hadi, 2009).

Generally, vegetables and fruits are referred to as healthy food among commodity groups. In the case of healthy food, there has been a dramatic increase over the past decade in the consumption of vegetables. Per capita consumption of vegetables had increased from 16 kg in 1961 to 62 kg in 2017. In the 1990s, the demand for vegetables remained the same as the earlier amount, which is approximately 25 kg/capita/year. However, the increase in consumption of vegetables can be seen clearly starting from 2005 until 2017. For instance, the per capita consumption of vegetables was about 32 kg in 2005 and it has increased to 62.5 kg in 2017. This change shows an upward trend. Figure 1.3 indicates the consumption of vegetables in Malaysia.

The role of meat (such as red meat, pork, and poultry meat) in supplying protein to Malaysians has increased in importance. The consumption of red meat (beef, mutton, and others) has seen a rapid increase over the 50 past years. The meat consumption pattern in Malaysia is shown in Figure 1.3. Per capita consumption of meat rose from 14.24 kg to 67 kg between 1961 and 2017. The most drastic change occurred in per capita consumption of poultry meat, which recorded a 47.33 kg increase in 2017 from 3.5 kg in 1961. In 1961, the red meat consumption was recorded at around 14.24 kg/capita/year and continued to increase progressively over the next ten years, which recorded an approximately 20 kg/capita/year. From 1980 to 2017, the consumption of red meat increased by 150%. The demand for pork increased by 140% from 1961 until 1995 before it slightly declined from 1997 to 7.4 kg in 2017 due to various disease, production problems and price rise.

In terms of eggs consumption, which offers the cheapest value for a protein source, the demand had also constantly increased from 1961 until 2017 as shown in Figure 1.3. The Malaysian consumption of eggs in 1960s at two to five kilograms per capita per year. For the next twenty years, the consumption of eggs was doubled. However, per capita consumption of eggs fluctuated within the range of 13 to 21 kg/capita/year from 1993 to 2017.

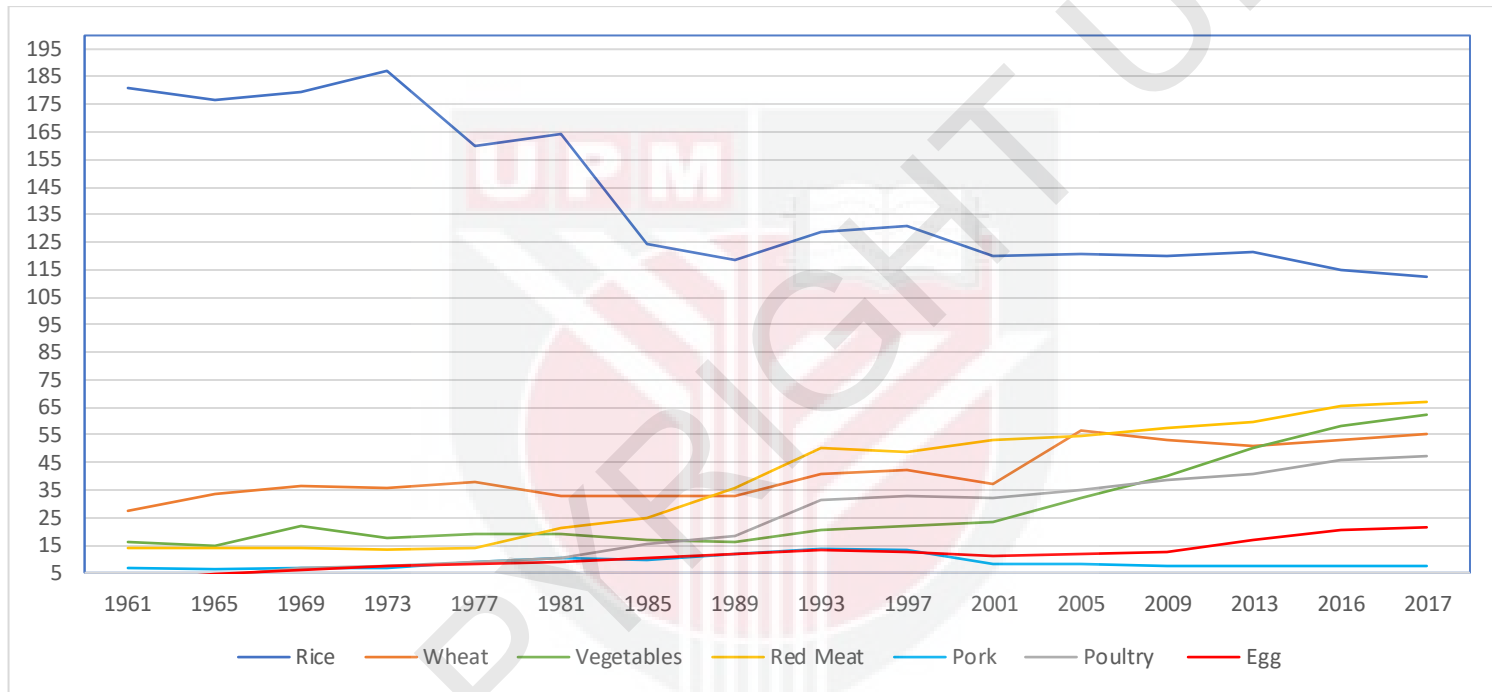


Figure 1.3 : Per Capita Consumption of Different Commodities, Malaysia, 1961-2017 (Source: FAO, 2020)

Having pointed out the patterns of changes in food consumption in Malaysia, several concerns need to be discussed. In the history of developed economics, such changes in the food consumption patterns are attributed mainly as a result of the changes in consumers' lifestyles and increases in incomes (Abdul Hadi, Selamat, Shamsudin, and Radam, 2010).

Generally, the increase in per capita income empowers consumers to have more food choices. Essentially, people at the lower income levels must fulfil their physiological need for food. As the income rises, consumers earn a level higher in the climb of the pyramid. The more affluent the consumers, the greater desire they will have for healthy and safe food and the greater attention they will pay to quality (Henson et al., 2006).

However, in addition to consumers' income, it should be acknowledged that, due to the urbanization, improvements in education, changes in consumer preferences and habits such as taking food away from home and eating in restaurants are also evolving. Because of that, consumers nowadays are more concerned regarding the safety of their foods hence, they increase their demand for safer foods.

Food safety is critical for operators in the food industry, as consumers are persistently looking for safe, high-quality, and wholesome food items. More details and enhanced awareness on pesticides, insecticides, fungicides and herbicides that are used in food processing are gained by the consumers (Teng, Rezai, Mohamed, and Shamsudin, 2011). They are becoming more concerned about the health and safety aspects of food products (Shaw, 2004). Malaysian consumers are also influenced by food safety concerns and the green concept. The Malaysians are now looking for wholesome, safe, tasty, and healthy foods in order to lead a healthier lifestyle. As a matter of fact, many Malaysian consumers are becoming more conscious of food safety, especially during the purchase of food products (Radam et al., 2007).

1.3 Changes in Consumer Preferences

Consumer preference is described as residential consumers' subjective preferences, determined by their satisfaction with definite products after they have purchased them. Sometimes, this satisfaction is related to as a utility. It is possible to assess consumer value by how consumer utility compares between different products. Consumer preferences can be determined by their satisfaction with a single item, compared to the opportunity cost of that item, and if you buy one item, you lose the opportunity to purchase a competing item (McCluskey, 2015).

Changing consumer tastes and preferences in line with food safety concerns and rising income have changed the food industry in recent years. Consumers are

not only looking for healthier and more affordable alternatives, but they also demand the convenience that impressive distribution networks provide. Such shifting demands put pressure on the industry to adjust to an ever-changing consumer, which is pushing the food industry to find funding to fuel industry innovation. Consumers today evaluate and search for items in a very different way than consumers did 20, 10, or even five years ago. More focus is placed on safer, fresher food at an affordable price (McCluskey, 2015).

In addition, people are presently growing concerned about food safety because of the changing in lifestyle as well as due to the increase in income. Studies by Abdul Hadi (2009), Röhr, Lüddecke, Drusch, Müller, and Alvensleben (2005), and Roitner-Schobesberger, Darnhofer, Somsook, and Vogl (2008) showed that food safety was a significant attribute to be considered regarding food choice.

Furthermore, due to the plethora of scientifically proven and recorded health benefits derived from consuming fresh products, fresh fruits and vegetables are perceived by consumers as balanced and nutritious foods. Nonetheless, the consumption of fresh fruits, vegetables, and unpasteurized juices has been intensively associated with the incidence of foodborne outbreaks around the world (Tunung et al., 2010).

Malaysia imports vegetables such as potatoes, garlic, turnips, carrots, onions, broccoli, dried chillies, ginger, and cauliflowers from China due to climate differences, a lack of appropriate land and inadequate skills. Food quality and food safety are emerging as critical issues in Malaysia as a consequence of the high dependence on food imports. In terms of the quality and safety of the food they intend to buy and consume, consumers are becoming more demanding (Chamhuri and Batt, 2015).

1.4 Global Food Safety Challenges and Issues

Minamata disease (methylmercury poisoning) is notoriously famous, initially discovered in Kumamoto Prefecture, Japan, around Minamata Bay in 1956. In 1965, in Niigata Prefecture, Japan, a second epidemic occurred. Cerebellar ataxia, sensory dysfunction, narrowing of the visual field, and hearing and speech disturbances were signs of this disease. In fishes and shellfish, the discharged methyl mercury accumulated and caused consumption poisoning (Komyo, Tokunaga, Nagashima, and Tadao, 2002).

Regarding food safety issues, Okafo, Umoh, and Galadima (2003) reported the presence of *Escherichia coli*, *Vibrio* spp., and *Salmonella* spp. in vegetables harvested from soils irrigated with contaminated streams in Nigeria. Little et al., (2007), conducted a study on the prevalence of pathogens in vegetables, in which they discovered *Listeria monocytogenes* in ready-to-eat mixed salads in the U.K. *V.parahaemolyticus* has also been documented in many other studies

on other forms of foodborne pathogens in vegetables and is recognised as a widespread foodborne pathogen in Asia. The two recent major outbreaks in the United Kingdom have been reported in a study by Meldrum et al., (2009), that depict the serious health issues that may result from the consumption of contaminated salads.

Food safety concerns continue to exist in the 21st century. Due to the speed and range of product distribution, local incidents may transform into international disasters. Serious foodborne disease outbreaks have occurred on every continent. In China alone, 300,000 infants and young children were affected by infant formula contaminated with melamine in 2008, 51,900 were hospitalised, and 6 of them died. In addition to kidney damage, potential risks such as tumorigenesis or growth retardation have been highlighted (El-Nezami et al., 2013).

In 2011, an outbreak of Enteropathogenic Escherichia coli (EHE coli) in Germany was connected with infected fenugreek sprouts in eight countries in European Union and North America, resulting in 53 deaths. The outbreak of E. coli in 2011 in Germany resulted in losses to farmers and factories of US\$ 1.3 billion and emergency assistance payments of US\$ 236 million to 22 European union member states (Yeni, Yavaş, Alpas, and Soyer, 2016).

While hundreds of thousands die every year because they consume unsafe food, several millions become sick as well (Fung, Wang, and Menon, 2018). Safe food enhances the health of individuals and the community. In the areas where food safety is practised and improved, it obviously seems that safe food enhances economic development. The availability of safe food relies on both fair law enforcement and sound science. With technological advances, new legislation must be implemented to ensure the continued provision of food items that are safe and good for people's health and well-being (Fung et al., 2018).

The challenges and tragedies in food safety include biological, chemical, incidents associated to the environment and personal hygiene. Historically, there have been well reported cases of food products contaminated with industrial contaminants. Incidents occurred in the United States, Iraq, Japan, and other nations where hundreds and thousands of individuals have fallen sick or died (Fung et al., 2018).

To sustain health and increase good health, access to adequate quantities of healthy and nutritious food is essential. More than 200 diseases, ranging from diarrhoea to cancer, are caused by contaminated food containing dangerous bacteria, viruses, parasites, or chemical substances. An estimated 600 million people (nearly 1 in 10 people worldwide) fall ill after consuming contaminated food, and 420,000 die each year, resulting in the loss of 33 million years of healthy life (WHO, 2019).

Mostly, all around the world children are more susceptible to foodborne illness, with 125000 deaths (40%) reported every year. Also, diarrheal diseases are the most common diseases arising from consuming contaminated food, causing 550 million people to succumb to the ill and 230,000 deaths every year. Unfortunately, by straining health care systems and harming national economies, tourism and commerce, foodborne diseases impede socioeconomic growth (WHO, 2019).

In human nutrition and wellbeing, vegetables and fruits have significant roles, in particular as sources of vitamin C, thiamine, niacin, pyridoxine, folic acid, minerals, and dietary fibre. In addition, several different organisations, such as the WHO and FAO, suggest increased intake of fruit and vegetables to help minimise the risk of cancer and cardiovascular diseases (Oliveira et al., 2015). The demand for fresh vegetables and fruits products has therefore risen frequently around the world in recent decade. Through rises in fresh products consumption, issues of food safety are definitely will become a major concern for individuals.

In the United States the number of food-borne incidents per year has steadily declined since 1998, according to the Food-borne Outbreak Online Database. However, number of product-associated incidents remain high , fluctuating from 23 cases to 60 cases per year in 2004 up to 2012, with no consistent pattern over this period of time (Callejón et al., 2015). The Norovirus has been identified as the predominant source of outbreaks associated with products (59% and primarily associated with vegetables), go along by Salmonella (18%), which has been determined as the foremost pathogen in outbreaks that have been occurred among different states and was in charge for most outbreaks associated with sprouts.

The number of incidents correlated with fresh products ranged from 10 to 42 in 2004 up to 2012 per year for the European Union, with unidentifiable trend developing. Nevertheless, significant increases were reported in 2006 (29 incidences), 2009 (34 incidences), and 2010 (44 incidences) (Callejón et al., 2015). The share of produce-associated outbreaks increased from 4.4% in 2009 to 10% in 2010 (Uyttendaele et al., 2014).

In 2011, an epidemic of a new pathogen, Shiga-toxin-producing *Escherichia coli*, which resulted the large number of cases of hemolytic-uremic syndrome related with a single outbreak, was investigated by German health authorities. There were 4075 incidence and 50 deaths in sixteen countries in the final case count (European Centre for Disease Prevention and Control, 2011).

The number of recorded foodborne incidence throughout 1975–1995 diverse meaningfully from year to year with respect to Canada (Hu, Chen, Wang, and Chen, 2017). Approximately, 4% of foodborne outbreaks in Australia between 2001-2005 accounted for fresh produce (Kirk, Fullerton, and Gregory, 2008).

Furthermore, chemical contaminants in vegetables and fruits have been the most significant health danger in China. In 2006, there were up to 326 cases in China, with a total of 2974 people poisoned, of food poisons caused by excessive pesticide residues, according to figures from the Ministry of Health, and 66 people died as a result. The corresponding statistics showed 160 food poisoning cases in 2014, A maximum number of of 5657 individuals were poisoned and nearly 110 people died (Hu et al., 2017).

1.5 Food Safety Issues and Challenges in Malaysia

Generally, meat, dairy products, eggs and vegetables are frequent sources of foodborne outbreaks, while *Salmonella typhi*, *Staphylococcus aureus*, *Escherichia coli* and *Clostridium perfringens* are the prevalent agents of foodborne outbreaks (Pires, Vieira, Perez, Wong, and Hald, 2012). The types, severity and impacts of foodborne diseases that occur are geographically influenced by different parts of the world and different kinds of human races. Children under five years of age and people in low-income countries are the most vulnerable groups affected by foodborne illnesses. Pregnant mothers, the elderly and the immuno-compromised are other groups that can be easily affected (Salleh, Lani, Abdullah, Chilek, and Hassan, 2017).

Malaysia is one of the countries with high incidences of foodborne disease owing to the conducive environment that encourages bacterial growth (Soon, Singh, & Baines, 2011). There were 60 episodes of food poisoning in Malaysia out of 2325 confirmed cases, with 47 of the episodes of food poisoning involving schools and institutions under the Ministry of Education. The incidence of food poisoning in schools rose from 30 cases in 2015 to 45 cases in 2016 (MoH, 2016). The kitchens and canteens of schools were involved in most of the incidents. Contaminated raw materials, temperature abuse during manufacturing, cross-contamination during handling, as well as, food prepared too early before serving (more than four hours of serving time), transportation, storage, and sales were the key factors leading to food poisoning. The incidence of food poisoning in Malaysia rose dramatically from 2005 to 2013, with some cases of mortality also involved (Salleh et al., 2017).

There were 220 food poisoning cases in schools throughout 2011, involving a total of 8,010 students in Malaysia. There were three episodes of food poisoning with 97 cases reported in One Malaysia Milk Program, followed by three cases each in Selangor, Perak, Kedah, Penang, Johor, Melaka, Terengganu and Kelantan, and only one case in Perlis. According to Tan, Bakar, Abdul Karim, Lee, and Mahyudin (2013), the majority of food poisoning cases in Malaysia occur in primary and secondary schools, with 53.4%, 62.7% and 67% reported in 2005, 2006 and 2007, respectively. The most recent incidence involved 50% of the food poisoning cases occurred in schools.

It is undeniable that food poisoning cases hit the highest level, based on Figure 1.4. Most cases of food poisoning were from young people, and since 2010, the data continues to indicate a progressive increment. Figure 1.4 depicts the cases of food poisoning that occurred in schools from 2012 to 2015, with an average of 8000 cases being the highest in 2015 (Fuentes, 2015). The outbreaks initially occurred in a sluggishly manner, before abruptly rising to an alarming level. In 2016, Perak confirmed that 887 of the 1263 victims were students. In August 2016, 45 cases were reported (Asrin and Ismail, 2016) and the number increased dramatically in October 2016 to 1015 cases (New et al., 2017). Also, in Kedah and Terengganu recorded a series of food poisoning episodes from school, however, the number of incidences was not as high as Perak which had 39 cases (New et al., 2017).

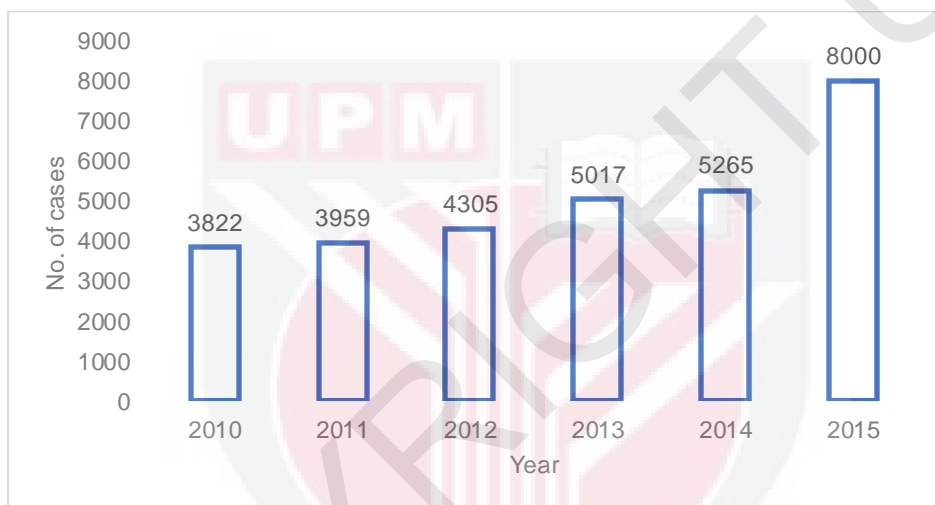


Figure 1.4 : Food poisoning cases occurring in schools, Malaysia, 2010-2015 (Source: New et al., 2017)

In 2011, cholera was reported to cause an outbreak in Limbang, Sarawak with about 111 cases resulting in high incidence rate in the state. The source of contamination was suspected of originating from infected food and water as traces of *Vibrio cholerae* were found on the sampled chopping board as the causative agent (Veno, 2011).

Typhoid cases were recently reported in Malaysia in 2015, which increased the incidence rate significantly compared to previous years. This form of typhoid is caused by *S. enterica* serovar Typhi and *S. Paratyphi* A. There were three states involved, namely Kuala Lumpur, Selangor, and Kelantan. In a study by New et al., (2017), it was confirmed that Kelantan had the highest number of cases as of October 2015, with 151 cases of typhoid. There was a total of 55 cases in both Kuala Lumpur and Selangor.

Non-typhoidal Salmonella (NTS), on the other hand, is Malaysia's most feared foodborne pathogen as it has caused many outbreaks and deaths during its epidemiology. Three people died, and 65 others were warded in hospital in 2013 after ingestion of food contaminated with Salmonella; four lives were claimed and more than 150 boarding school students suffered foodborne illness after consumption of Ayam Masak Merah (Chicken in Spicy Tomato Sauce) meal in Kedah in 2014, the chicken was confirmed to be infected with Salmonella; 106 patients of foodborne illness and a 5-year-old boy died from bacteremia in Dataran Syah Bandar, Terengganu in 2014; and 43 students suffered from foodborne illness after consuming Salmonella contaminated food in Tapah, Ipoh in 2016. Aside from that, *E. coli* also made the headlines once in 2012 whereby 20 athletes were sickened due to unsafe food at Teluk Keke, Terengganu (Latip, Balkis, Mohd, and Anwa, 2015).

Regarding the food safety issues in vegetables, it is mentionable that in Malaysia, some types of vegetables are consumed raw in the common dish Ulam. The vegetables can be procured either from fresh markets or supermarkets. A range of food types are typically sold in fresh markets in Malaysia, such as seafood, poultry, meat, fresh vegetables, and ready-to-eat food. Incidentally, supermarkets or hypermarkets generally serve food under conditions that appear more hygienic food products than those in fresh markets. Thus, the number of campylobacters in raw vegetables from supermarkets are less than the fresh markets (Chai et al., 2007).

Malaysia is a predominantly agricultural region where the use of pesticides is relatively common. Poisoning cases related to pesticides have not been well reported. According to a range of selected studies, however, such accidents do occur. A study found that poisoning had occurred in the Cameron Highlands in 14.5% of the 4,531 farmers growing vegetables, flowers, and fruits. Hospital admissions showed accidental pesticide poisoning at 32.1% and suicide cases at 67.9% (Kamaruzaman et al., 2020).

Consumers generally demand better quality vegetables in Malaysia these days. For them, quality vegetables mean healthy, succulent, and fresh-looking vegetables with no noticeable rashes or holes due to disease or pests. Farmers have to tackle pest and disease issues by all means in order to meet this demand. It has been found that the use of agrochemicals, including pesticides, is an immediate and cheaper way to grow unblemished vegetables and improve the productivity of the farm. Unfortunately, this practice has created multiple issues associated with pesticide abuse, such as accidental human contamination, destruction of the balance of the natural ecosystem, and chemical residues that are harmful to environmental health. Currently, the main issue is the ongoing occurrence of excessive pesticide residue in vegetables due to rampant pesticide abuse. When the vegetable export sector was officially affected, the problem became more evident. Between 1993 and 1996, a total of fifteen types of Sabah vegetables were officially banned from export to Brunei and Sarawak due to excessive pesticides found in the produce. A report from Sarawak confirmed that 5 vegetable types from Sabah contain excessive

residues of pesticides at a rate of 31-75% of the samples. Only when the vegetable tagging scheme was agreed upon it and enforced was the ban officially lifted (Jipani, Abd. Rahman, Jaimi, and Phua, 2001).

Despite the presence of the law and implementation body entrusted to ensure that Malaysians get safe and wholesome food, it has been rarely heard that Malaysian local produce, particularly vegetables and fruits, being recalled. In 2018, iceberg lettuce was recalled by the Singaporean authorities after high levels of pesticide were detected in the vegetable imported from a Malaysian farm (MoH, 2018). Also, in 2017, fruits and vegetables from Cameron Highlands have been rejected by China due to the presence of living modified organism (MoH, 2017).

In 2015, after pesticide residues detected in samples exceeded the levels permitted by the authorities, some 300 batches of vegetables, mainly leafy greens and fruits, were prohibited from being sold in Singapore. Nearly, 3% to 5% of Malaysian vegetables and fruits are said to have exceeded the pesticide limits set by the Singaporean authorities (MoH, 2015).

It should be noted that there are different standards and regulation for food safety in different countries. Due to that, the vegetables sold in Malaysia are permissible despite being banned by other importing countries. The levels used for food safety inspections is also known as Maximum Residue Limits (MRLs). For instance, in Malaysia the Codex MRL and MRL established by the Association of Southeast Asian Nations (ASEAN) is acceptable, but in Singapore, they have their own standards and only the Codex MRL is acceptable not the MRL established by ASEAN (Malaysian Food Regulations, 1985; Food Regulation, 2015).

1.6 Problem Statement

Nowadays, consumers pay more attention to food safety due to changing lifestyle as well as the rising income. This new awareness is related to dietary changes associated with more knowledge about food safety and urban growth.

The food consumption patterns in Malaysia have significantly changed over the decades. These changes in food consumption patterns have also changed the marketing method. The old-style marketing, which was perceived to be a production-oriented market in which farmers and processors had considerable influence in the past, now appears to be entirely irrelevant. The market has been transformed into a 'consumer-oriented market' in which affluent consumers have much more power to demand, especially in terms of the quality, health and safety of their food consumption.

Food safety is garnering greater attention from the consumers due to its connection between food and health. Rising income and urbanization have changed the consumers' demand and preferences towards food safety attributes. Unfortunately, there have been growing reports in recent years on the excessive use of pesticides.

Malaysian consumers are generally looking for higher quality vegetables in the present era. For them, quality vegetables mean good, succulent, and fresh-looking vegetables with no visible sores or holes caused by diseases or pests. Farmers have to fight diseases and pests issues by all means in order to meet these needs. It has also been found that the use of agrochemicals, including pesticides, is an instant and easier way to grow unscarred vegetables and increase the productivity of the farm. Sadly, this activity has made numerous problems associated with pesticide misuse, like accidental human poisoning, disruption of the balance of the natural ecosystem, and chemical residues that are harmful to public health. Currently, the main issue is the persistent incidence of excessive pesticide residue in vegetables because of excessive pesticide use.

When the vegetable export sector was officially affected, the problem became more obvious. Despite the presence of the law and enforcement body entrusted with ensuring safe and nutritious food for Malaysians, it has often been heard that Malaysian fresh produce is recalled. As it happens, several recalls of Malaysian foods have been registered in foreign countries for instance, iceberg lettuce was recalled by the AVA in 2018 after high levels of pesticide were found in vegetables imported from a Malaysian farm. As well as, China rejected fruits and vegetables from Cameron Highlands in 2017 due to the high levels of pesticide residues and living modified organic organism (LMO). Moreover, in 2015, some 300 batches of vegetables, mostly leafy greens and fruits, were prevented from being sold in Singapore after pesticide residues discovered on samples exceeded the levels permitted by the authorities. Three to five percent of Malaysian vegetables and fruits are said to have exceeded the pesticide limits set by the Singaporean authorities.

Preferences and demands for food products might no longer be food in their raw forms. The affluent consumers now demand new food products, more nutritious foods, better quality, more convenience, healthier food, new delivery systems, and safer foods at reasonable prices. Furthermore, the growing concern for health and food safety issues influences consumer's choices more strongly than past.

It should be noted that consumers' food choice involves many factors, including health claims, food related expectations and attitudes, ethical concerns, and price. Also, knowledge about food choice motivations which would-be possible to effect consumers' consumption decisions is crucial when designing food and health policies, as well as marketing strategies. Awareness regarding consumers' food choices would have implications for the agri-food industry's

organisational structure and for the economic well-being of farmers, food processors, distributors and other food production and marketing stakeholders.

Despite the changes in the consumers' preferences, the adjustment from the supply side has been slow. In order to increase marketability, the attributes need to be fulfilled to satisfy consumers' preferences and demands. Considering the issues above together with the changing lifestyle of the consumers towards healthy lifestyle, it is imperative to improve the food safety in Malaysia.

1.7 Research Questions

The research questions for this study are as follow:

- I. Is there a demand for food safety attributes of vegetables?
- II. Which safety attributes are preferred by consumers?
- III. How much consumers will pay for food safety attributes?
- IV. Which factors will affect the demand for food safety attributes?

1.8 Objectives of the Study

The general objective of this study is to determine the demand for food safety attributes of vegetables.

The specific objectives are:

- a) To determine consumer preferences towards the food safety attributes of vegetables
- b) To estimate the willingness to pay for food safety attributes of vegetables
- c) To identify factors affecting the demand for food safety attributes vegetables

1.9 Significance of Study

This study can contribute to the development of agricultural and food marketing in Malaysia, particularly to avoid a mismatch between supply and demand side, to determine marketing methods and targeting potential customers, and also to improve the marketability of vegetables.

The significance of the study will be beneficial to the following groups, the farmers and marketers; knowing and understanding the need of consumers towards safe vegetables can boost the profit of the producers (farmers) and

marketers. The study will aid the vegetable farmers to know which kind of vegetables are demanded in relation with the production system and will help them to correct their wrong practices in farming and handling vegetables as well as enable them to strive to do the right one to guarantee health safety.

For the marketers, this study will help them in the formulation of effective marketing strategies regarding vegetables. They will be capable of creating a competitive advantage in this particular marketplace with this information. For the researchers and academicians this study can be a platform to many other studies in the same area, especially those that are focusing on the individuals' demand for food safety attributes of vegetables. The policymakers; understanding the current situation on the Malaysian consumers' preferences towards food safety in general, and vegetables safety in particular, will aid the policymakers to create or revise certain food policies and regulations in order to provide better protection for consumers in case of any misconduct by producers. This study will be able to offer them some interesting consumer perspective.

1.10 Organization of The Study

The study was organized as follows: Chapter 1 explained the introduction, overview of the vegetable industry in Malaysia, changes in consumption pattern of consumers, changes in consumer preferences, global food safety challenges and issues, food safety issues and challenges in Malaysia, problem statement, research questions, objectives, and significance of the study; Chapter 2 presented a review of the literature relevant to the research problem. Chapter 3 described the theoretical framework, methodology, and sampling procedure. Results of the study were discussed in Chapter 4. Finally, in Chapter 5, conclusions were drawn based on the findings of the study, and recommendations in terms of required strategies and action plans were discussed.

1.11 Summary of Chapter

Changes in food safety demand and consumption patterns are influenced by the rising incomes, changing lifestyles, increasing awareness of food safety and urbanisation in Malaysia, where consumers have more power to choose in terms of their food intake and purchase. This study aims to measure the demand of Malaysian consumers for food safety characteristics of vegetables and to measure how much consumers are willing to pay for their demanded attributes, motivated by a "consumer-oriented market" to satisfy consumer demand and preferences.

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