Exploring Preferential Food Selection: A Cross-Cultural Study between Chinese and Malay Undergraduates in a Private University.

Adila Alias

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Abstract

Previous studies and cross-sectional surveys conducted in Malaysia have shown that the prevalence of obesity, diabetes and other non-communicable diseases (NCDs) are associated with poor diet practices. Overeating is contributing to the increasing prevalence of obesity and other NCDs among Malaysians. This study aims to investigate how environmental influences might impact food preferences between Malay and Chinese.

Past research shows that ethnicity is related to differences in food-related beliefs, preferences and overall eating behaviour. To investigate how environmental factors might influence food preferences, a series of experiments were conducted using psychological paradigms. First, food consumption patterns using a Food Frequency Questionnaire (Chapter 2) between the two groups were compared. It was found that Malay participants consumed more spicy and savoury foods, and larger portions of both artificially and naturally sweet foods, such as fruits. Overall findings of the FFQ showed that Malay participants consume a higher level of energy intake compared to the Chinese participants, which is reflective of existing literature in Malaysia. Additionally, Malay participants showed a preference for wheat-based foods other than rice- which is staple food in traditional Malay cuisine. In contrast, Chinese participants showed a higher preference for traditional Chinese cuisine for everyday meals such as noodles and porridge.

Preferential food selection was examined using a 2AFC method (Chapter 3). Malay participants selected spicy foods more than Chinese participants, and both groups made more preferential selections of savoury foods than they did for spicy foods. Malay participants made the most selections for sweet foods, whereas the Chinese participants chose savoury foods the most. Spicy foods were the least preferred among the Chinese participants, whereas the control food items (e.g. raw vegetables and fruits) were the least preferred among Malays.

To understand whether selections made on a 2AFC task are representations of actual preferences; a categorization and ratings task was given to assess participants' recognition of spicy, savoury, and sweet foods (Chapter 4). Results showed that Malay participants had significantly more errors in categorizing the savoury foods than Chinese participants, while the Chinese participants made significantly more errors in categorizing spicy foods than the Malay participants. Both groups attributed highest ratings of palatability to spicy foods, followed by sweet foods and rated control foods the lowest. The Chinese participants found

spicy foods to be higher in flavour compared to the other categories of food. It is proposed that although the Chinese participants might not consume spicy foods on a regular basis, they provided higher ratings of palatability.

The effects of semantic priming on categorising different categories of foods flavours between the groups was examined in Chapter 5. It was predicted that the presence of a prime (visual imagery) would interfere with participants' abilities in characterising target words effectively depending on what category the prime represented. Malay participants had higher errors than Chinese participants in processing target words from spicy, sweet, and control categories although this difference was not significant. Both groups had difficulties in characterising spicy and savoury target words when the prime presented were spicy and savoury food stimulus.

The final experiment explored the role memory and familiarization in food recognition abilities across the two groups. Certain types of dishes might be more "salient objects" for one group rather than the other and this could influence food preferences (Chapter 6). Results showed a higher average consumption quotient for spicy, savoury and sweet foods on the R-FFQ among the Malay participants. Malay participants were not more susceptible in discriminating repetitions of spicy and sweet food stimuli more than the savoury and control food stimuli. Although Malay participants exhibited the lowest *d'* scores in recognition for the spicy food items, scores were not significantly different from scores in recognizing the other food categories. Chinese participants showed the highest accuracy in recognition for control food items, and no relationship between familiarity and recognition of the savoury food items. We were unable to establish a connection between familiar foods and performance on the recognition task.

Cumulatively, the overall findings from this entire investigation raises questions about measures which can effectively measure food selection. For future studies, we hope to employ more indirect, discreet measures in assessing preferential food selection among Malaysians. Overall, the findings show that both groups show a slight predisposition towards flavour components present in their traditional cuisines, but more research needs to be carried out to understand this further.

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Glossary

Terms	Definition
Aqueous solution	Any solution in which the solvent is water.
Aras	A Malay word for level.
Bird’s nest soup	Edible bird's nests are bird nests created by edible-nest swiftlets, Indian swiftlets, and other swiftlet using solidified saliva, which are harvested for human consumption. They are particularly prized in Chinese culture due to their rarity, and supposedly high nutritional value and exquisite flavour.
BMI	Body mass index is a measure of one’s weight relative to their height. It is one key measure used to assess if someone is overweight or obese.
Bubur pulut hitam,	A thick, creamy, baked or boiled dessert that is cooked with black rice, coconut milk, and palm sugar.
Cili merah	A type of chili pepper mostly found in Asian cuisine i.e. C. frutescens.
Cili padi	A smaller, type of chili pepper most commonly found in South East Asia. i.e. capsicum annuum.
CS	Conditioned stimuli used in the study by Havermans and Jansen (2007).
CS-	Unsweetened CS i.e. no added dextrose to the fruit juice.
CS+	Conditioned stimuli which had approximately 20g of dextrose added to the CS- the juice.
fMRI	Functional magnetic imaging measures brain activity by detecting changes associated with blood flow.

Glutamate	Glutamate is a chemical that nerve cells use to send signals to other cells.
Halal	Foods which are permitted according to the Islamic teachings. Permitted foods include animals-with the exclusion of prohibited meats; which have been slaughtered according to Sha'riah compliance
Haram	Foods which are prohibited according to the Islamic teachings. Prohibited foods include pork, foods cooked with alcohol, alcohol, meat which was not slaughtered according to Sha'riah compliance.
Humoral Medical Theory	A former theory that explained physical and psychological health or illness in terms of the state of balance or imbalance of various bodily fluids. According to Greek physician Hippocrates (5th century BCE), health was a function of the proper balance of four humors: blood, black bile, yellow bile, and phlegm (the classical humors or cardinal humors).
Ikan bilis	The Malay word for anchovies. The anchovy is a small, common forage fish of the family Engraulidae.
Ikan kembung	Rastrelliger is a mackerel genus in the family Scombridae.
Ikan tenggiri	Scomberomorini or commonly known as the Spanish mackerel.
Kampung	A village is a clustered human settlement or community, larger than a hamlet but smaller than a town, with a population ranging from a few hundred to a few thousand. They are often located in rural areas.
Keropok lekor	Keropok lekor is a traditional Malay fish cracker originating from the state of Terengganu, Malaysia. It is made from fish and sago flour and seasoned with salt and sugar.
Kuih baulu	Kuih baulu is a sponge cake traditionally served as dessert or as a snack. It is favoured by the Chinese to celebrate the Lunar New Year and is also favoured by the Malays in Malaysia.

Kuih seri muka	Seri muka is a Malaysian steamed layer cake which consists of a glutinous rice layer steamed with coconut milk and a sweet pandan custard layer.
Laksa Johor	Laksa is a spicy noodle soup popular in the Peranakan cuisine. Variants of the laksa uses other types of noodles-in which case laksa Johor uses spaghetti.
Local kuih	Kuih are bite-sized snack or dessert foods originating from Malaysia. It is a broad term which may include items that would otherwise be considered cakes, cookies, dumplings, pudding, biscuits or pastries in English and are usually made from rice or glutinous rice.
Macronutrient	A type of food required in large amounts in the diet. Examples of macronutrients are fat, protein, and carbohydrate.
MANS	The Malaysian Adult Nutrition Survey is a cross-sectional, national nutrition survey that measures aspects related to eating behaviour. Examples include food security and daily nutrient intakes.
Micronutrient	Micronutrients are only needed in small amounts but play important roles in human development and well-being, including the regulation of metabolism, heartbeat, cellular pH, and bone density. Vitamins and minerals are the two types of micronutrients.
Milo	Milo is a chocolate and malt powder that is mixed with hot water and milk to produce a beverage popular mainly in Oceania, South America, South-eat Asia and certain parts of America.
MSG	Monosodium glutamate is the sodium salt of glutamic acid, one of the most abundant naturally occurring non-essential amino acids.
NCDs	Non-communicable diseases, also known as chronic diseases, cannot be transmitted from person to person. Examples of NCDs are hypertension, diabetes, and obesity.
NHMS	The National Health Morbidity Survey is a nation-wide survey aimed to collect information on health needs, health expenditures, and patterns of

	health problems, which would enable the Ministry of Health to assess and plan programs and allocate resources appropriately.
Novel foods	Novel foods are defined as types of foods that do not have a significant history of consumption or is produced by a method that has not previously been used for food.
Palatable	Palatable signifies an agreeable or pleasant stimulus, event, or idea.
Pengat pisang	Pengat is a sweet dish found in Indonesia, Malay and Nonya cuisine. Pengat pisang involves the use of pisang raja or pisang kapok for making pengat.
Rendang	Spicy meat dish that originated from Indonesia, among the Minangkabau people. It has been incorporated into Malaysian cuisine and is a traditional Malay dish that is easily found.
RNI	Recommended nutrient intake is the daily intake, which meets the nutrient requirements of almost all apparently healthy individuals in an age and sex-specific population group.
Rock sugar	A type of confection composed of relatively large sugar crystals.
RS	Restraint scale by Herman & Polivy (1980) is a questionnaire that contains items which assess weight fluctuation and subjective concern for dieting.
Sago	Sago is a starch extracted from the spongy centre, or pith, of various tropical palm stems, especially that of Mextroxylon sagu.
Salient	A term used to describe something that is most noticeable or important.
Satay	Satay is a dish of seasoned, skewered and grilled meat, served with a peanut sauce. It is a dish of Southeast Asia, particularly Indonesia, Malaysia, Singapore and Thailand.
Satiety	The quality or state of being fed or gratified to or beyond capacity

Schwartz value theory	A theory encompassing basic human values according to Schwartz (1996). Applications of this theory is used to understand the formation of how a culture within a population occurs as well as understanding differences across cultures.
STAI	The State-Trait Anxiety Inventory is a commonly used psychological inventory based on a 4-point Likert scale and consists of 40 questions on a self-report basis. The STAI enables us to quantify adult anxiety.
STS	Superior temporal sulcus is the sulcus separating the superior temporal gyrus from the middle temporal gyrus in the temporal lobe of the brain.
Tang yuan	Tang yuan is a Chinese dessert made from glutinous rice flour mixed with a small amount of water to form balls. These balls are either cooked and served in boiling water or sweet syrup, or deep fried.
Tastants	Tastants are taste-provoking chemical molecules that are dissolved in ingested liquids or saliva.
Tauhu	Tauhu or tofu/bean curd is a food prepared by coagulating soymilk and then pressing the resulting curds into soft, white blocks. Tauhu is a component in East Asian and Southeast Asian cuisines.
TCM	Traditional Chinese medicine represents a style of traditional medicine built on the foundation of more than 2.500 years of Chinese medical practice. The practise of TCM includes various forms or herbal medicine which utilises roots, herbs, seeds, fruits or plants which poses many benefits to the human body.
Tempe	Tempe is a traditional soy product originating from Indonesia. It is made by natural culturing and controlled fermentation processes that binds soybeans into a cake form. Tempe is the only major traditional soy food which did not originate from Greater Chinese cuisine.
TFEQ	The Three Factor Eating Questionnaire is a self-reported questionnaire that is often applied in food-intake behaviour related research. It was developed by Stunkard and Messick (1985).

Umami	Umami is a category of taste in food which corresponds to the flavour of glutamates, especially monosodium glutamate.
Vanillin	A fragrant compound which is the essential constituent of vanilla. Vanillin is synthetic and may be produced using petrochemicals and by-products from the paper industry.

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Overview

1.1. Overview

Malaysia has undergone phases of industrialisation and urbanisation, which have inevitably brought about changes in lifestyle of its inhabitants. Like many countries across the world that are experiencing globalisation, inhabitants' diet has changed which has led to health-related issues such as the rise in Non-communicable diseases (NCDs). According to recent statistics (Naing, 2016), Malaysia has had an increase in the prevalence of NCDs, for instance, a 43% increase in the rate of hypertension, an 88% increase in the prevalence of diabetes and a 250% increase in obesity from 1996 to 2006. In Malaysia, there has yet to be an explanation to why certain ethnic groups are more prevalent to certain NCDs than others. However, what we do know is the prevalence of NCDs is attributed to poor dietary practices. With the concept that the different ethnic groups in Malaysia have different dietary practices, we aim to establish whether this is a connection between dietary preferences in different ethnic groups. We hope to put forward the argument that ethnicity represents the underlying factor to which undergraduate students from two of the biggest ethnic groups within Malaysia (Malay and Chinese[1]), base their food choices on.

This thesis investigates the impact of environmental influences and psychological factors on food selection rather than biologically orientated signals, such as hunger. Environmental influence in this context refers to the ethnic identity of an individual. To see whether the influence of ethnicity is strong enough to influence perception and selection towards foods, six different tasks/techniques were employed. First, I investigated whether there are group differences in food consumption (Chapter 2). We employed the use of the FFQ to measure differences in diet between the groups.

To investigate general food preferences, a simple 2AFC was used (Chapter 3) as well as how easily certain dishes are recognised (Chapter 6) to see whether group differences emerged in recognition. The food items used across all five experiments were a combination of prepared dishes and processed snack foods. In Chapter 4, I investigated whether both groups categorized different food items in terms of whether they were savoury, spicy, or sweet, with fruit and vegetables used as a control condition. Participants were also required to rate on a scale how flavourful they found the food items to be. I also investigated the effects

[1] Malaysian Malay and Malaysian Chinese will be referred to as Malay and Chinese respectively from this point onwards.

of semantic priming to see whether the effect of priming can influence participant's ability in detecting and categorizing different foods (Chapter 5). By exploring the concept of semantic priming, we can assess whether repeated exposure of other foods impedes participant's ability to characterise foods known to them.

With differing ethnic identities as distinguishing factor; there should be a significant difference in the performance on all tasks between the groups. Based on the literature on the food consumption habits of Malaysians, we hypothesise that Malay participants will have a higher preference for sweet foods than Chinese participants. Chinese participants would prefer savoury or salty tasting foods more than Malay participants and will show the greatest disposition towards this category of food the most. The consumption pattern and preference for spicy tasting foods will also be explored without any prior conceptions of which ethnic group show a higher inclination for.

1.2. The Malaysian Diet

Culturally specific tastes of food are defined by its members' historical heritage, local experiences and by its local and global processes (Tan, 2001). Generally, both major ethnic groups (Malay, and Chinese) in Malaysia adopt the humoral medical theory when explaining why certain foods are eaten or avoided. Under the humoral medical theory, foods are classified as hot and cold (not temperature wise) which relate to the reputed effects the foods have on the well-being of the body (Manderson, 1981). In this study, we focus on eating behaviours of two of the biggest ethnic groups in Malaysia which are the Malays and Chinese.

The choice of food categories we used are the primary flavours of each ethnic groups' cuisine. We had the intention to include umami and sour tastes, as they are part of the five basic tastes, however, we had decided that umami and sour tastes are flavour components present to both the Malay and Chinese cuisine, so therefore we had grouped them to be under savoury tasting. This is also because, although participants may like sour foods, they would not be eating it on a regular basis compared to savoury tasting foods. Additionally, the quantity of sour and bitter foods would not be enough to balance out spicy and savoury tasting foods among Malaysians, therefore were not included as taste or food categories in this study. We concluded on investigating popular food choices and flavour categories among our Malaysian participants.

1.2.1. Basic Principles of the Malay Diet

Radzi et al. (2010) state firstly that the basic principles of food choice among the Malay group in Malaysia are few. Whether food is *halal* and *haram* (i.e., what is permissible in Islam and what is strictly prohibited in the religion) is the most prevalent factor. Malays in Malaysia are predominantly Muslim, who avoid foods which are prohibited in the religion of Islam, such as pork, or any food which has traces of alcohol, or has not been prepared according to Shariah compliance (Hanzaee & Ramezani, 2011).

Apart from religion being the most prominent factor, past research in Malaysia have shown that within the urban Malay community of Malaysia where fast food and other various types of cuisine are easily accessible, the other main motives for food choice are health and convenience (Asma, Nawalyah, Rokiah, & Mohd Nasir, 2010). Additionally, Malays believe the simple rule of 'eat when hungry' and to fast in order to fulfil one of the pillars in Islamic teachings (Radzi, Murad, & Bakar, 2010).

The ingredients used in Malay cuisine are dependent on the organisms readily available at the *kampong* site or Malay settlement areas. Historically, Malays were fishermen, so fish and seafood are popular protein choices along with frequent use of agricultural products, such as *ulam*. Malay cuisine is often spicy and flavourful and utilizes ingredients, such as lemon grass, pandan (screwpine) leaves, and kaffir lime leaves. Fresh herbs, such as daun kemangi (a type of basil), daun kesum (polygonum or laksa leaf), nutmeg, kunyit (turmeric), and bunga kantan (wild ginger buds), are also used. Also, rice is a staple food in Malay cooking, and it can be eaten for breakfast, lunch or dinner. There is also heavy usage of coconut milk in Malay cooking (Shazali, Salehuddin, Zahari, & Nor, 2013).

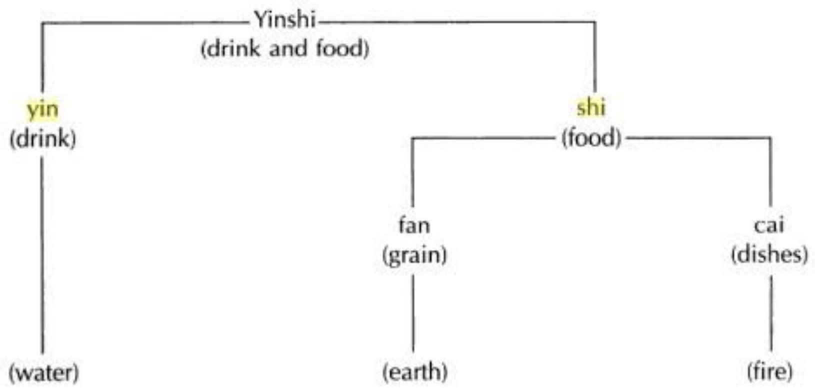
Studies show that Malay cuisine differs according to regional state which was influenced historically by neighbouring countries, such as Thailand and Indonesia (Hassan, 2014; Raji, Ab Karim, Ishak, & Arshad, 2017). As such, the traditional Malay cuisine found in states which are closer to the border of Thailand, such as Penang, Perlis and Kedah are spicier and sourer compared to the Malay cuisine found in Negeri Sembilan, which is a combination of spicy, sour and sweet due to Javanese influence (Ainuddin, 2012; Raji et al., 2017). Nevertheless, the general characteristics of Malay food remain the same across regional states.

Traditionally, Malay cuisine has a heavy usage of spice (Shazali, Nor, Salehuddin, & Zahari, 2013; Shazali, Salehuddin, Zahari, & Nor, 2015). The presence of *cili padi* and *cili* *merah* is ever omnipresent in traditional Malay cooking. The most obvious example of Malay cuisine is the infamous *nasi lemak* which by heritage consists of rice cooked in coconut milk, *sambal*, fried anchovies, slices of raw cucumber, roasted peanuts and a hard-boiled egg compactly wrapped in a banana leaf (Omar, Karim, Abu bakar, & Omar, 2015).

1.2.2. Chinese Diet

The principles of food choice among the Chinese in Malaysia are more extensive, with influences, such as *yinshi* (meaning food and drink) and *fan* (meaning grain), derived from the ancient Zhou period (Leppman, 2005). The diagram (Fig.1) below illustrates what a regular Chinese meal should encompass. As shown, under *shi* (food), it branches out into *fan* (grain) which literally refers to rice or *ts'ai* (dishes) which refers to any meat or vegetable that has been cooked. In Traditional Chinese Medicine (TCM), specific foods are depicted to serve unique functions to the human body, such as the prevention of diseases and the facilitation of rehabilitation in addition to maintaining and improving one's own health status (Weng & Chen, 1996). TCM nutrition classifies food as part of a diet, tonic, medicine, and as part of abstention (Weng & Chen, 1996).Therefore, unique foods used in TCM, such as ginger and ginseng, are combined with other foods for herbal medicines purposes and to produce medicinal properties in the overall dish consumed. For instance, in TCM, stewed duck egg with green tea has been linked to avoiding or decreasing blood sugar levels in diabetic patients (Weng & Chen, 1996). Suffice to say in TCM every component involved in the overall food preparation process from ingredient to method of cooking serves a unique function which is thought to improve the human physiology (Wang & Lu, 1992; Weng & Chen, 1996). The emphasis of functional foods and the medicinal properties associated to it are the fundamentals of TCM (Weng, 1990).

Figure 1: The structure of Chinese food and drink.



Stir-frying is a method of cooking preparation that is distinctively apparent in Chinese cuisine as compared to other ethnic cuisines (Thomas George, 2000). The basic "flavour principles" of Chinese cuisine are soy sauce, rice wine, and ginger mixture (Rozin, 1983). Furthermore, one of the approaches in understanding Chinese cuisine in Malaysia parallels that of the Indians in Malaysia whereby there both groups places emphasis on focus on the five elements (Chinese: wood, fire, earth, metal and water; Indians: space/ether, air, fire, water and earth) and their interactions with the internal organs in the body. This similarity is only present for the Buddhists and the Hindus amongst the Chinese and Indians in Malaysia.

In addition to the practice of TCM, Chinese may follow other restrictions in diet depending on their religious belief. Chinese practice various faiths which include Mahayana Buddhism, traditional Chinese religions such as Taoism, Christianity, and up until recently, Islam (Ma, 2005; Mohd Nor, 2016). In Mahayana Buddhism, the vegetarian diet is known as zhāicài (Moira, 2015), which is a diet that is believed to cultivate compassion for animals (Mohd Nor, 2016). Also, it is believed that non-vegetarian food is deemed as impure and poses a hinderance to the spiritual development on an individual (Tan, Chan, & Reidpath, 2014). It is therefore argued that Mahayana Buddhists, through spiritual teachings, increase their fruit and vegetable intakes and decrease their animal meat intake to the betterment of their spirituality.

1.2.3. The Malaysian Culture of Eating

Malaysia, like many other developing countries in the world, is constantly undergoing rapid changes attributed to both globalisation and urbanisation (Tee, 1999). Changes that follow these two occurrences include the incidence of an even more sedentary lifestyle and changes in food consumption patterns (Radam, Mansor, & Marikan, 2006). The trend among

Malaysians to consume FAFH is becoming more the norm (Aris, Zainuddin, Ahmad, & Kaur, 2014; Hasnan & Ahmad, 2014; Norimah et al., 2008) and is the more preferred option than FAH (Tan, 2010). The culture of having FAFH appeals to most Malaysians as it is more accessible and convenient (Lee & Tan, 2006; Osman et al., 2014; Tan, 2010). Other factors, such as affordability, accessibility, awareness (perception towards food) and socialisation, did not pose a significant influence on daily food selection (Osman et al., 2014) when it comes to choosing FAFH.

FAFH needs to be tasty to attract customers; therefore FAFH are high in caloric content, fat and sodium (Lee & Tan, 2006). In addition to Malaysians adopting the practice of having FAFH, literature reports that Chinese eat on average four meals per day (Radam et al., 2006), and Malays eat up to five meals a day, the fifth being afternoon tea (Zalilah et al., 2008). The calories from afternoon tea contributes to approximately 16.8% of total daily energy for the Malaysian adults who reported having this meal (Zalilah et al., 2008). The type of food eaten during afternoon tea ranges from traditional sweet and savoury cakes/local kuih, to sweet porridge and other spicy tasting snacks. Zalilah et al. (2008) reported that 54% of the population who participated consumed afternoon tea which is typically eaten between late afternoon and dinner.

According to the findings from the MANS 2014 (Zainuddin et al., 2016), 31.9% of respondents have developed a habit of consuming heavy meals after dinner (known as supper). A total of 34.2% of participants who reported to have a heavy supper stated their source of food for supper was home prepared, 31.3% attained supper from food stalls, and 27.5% of participants had their supper at restaurants. Having a heavy supper means that there is excessive energy intake which undoubtedly does not get burned out. This growing trend of hanging out late nights and having supper at 'around-the-clock' eateries has contributed to the rising rates in obesity among Malaysians (Sharkawi, Mohamed, & Rezai, 2014).

In addition to eating around the clock, Malaysians on average consume high amounts of calories through the types of food that they eat (Mirnalini et al., 2008; Sharkawi et al., 2014; Zalilah et al., 2008). The types of food Malaysians consume on a daily basis include rice as being a staple food typically eaten for lunch and dinner (Norimah et al., 2008). Rice is a food which is high in caloric content and is still the most commonly consumed food among Malaysians (Norimah et al., 2008). In addition, according to the MANS 2014, that Malaysians consumed a total of 1.79 (95% CI: 1.72-1.86) serving size of confectionary daily (Aris et al., 2014). Therefore, it is believed that Malaysians encompass all unhealthy eating behaviours, such as too many sweets, sodium, too much high calorie foods, and eating too often.

1.2.4. Food Composition

For this investigation, I compiled an overview of the types of foods Malaysians consume, which range from spicy, savoury and sweet categories. I provided a brief overview on the categories of food which will be used in this experiment and outlined the impact of Malaysians eating these foods.

The liking for spicy foods is common among Malaysians (Dorall, 2019; Foo, 2018, Weston, 2014). The spiciness or 'hotness' of a food is determined by the levels of capsaicin contained in the hot peppers used in the food's preparation (Huang, Mabury, & Sagebiel, 2000; Scoville, 1912). Capsaicin is an active, pungent ingredient in red peppers (Gonlachanvit, Mahayosnond, & Kullavanijaya, 2009; Huang et al., 2000). Levels of capsaicin have been associated to the occurrence of gastrointestinal upset (Nebel, Fornes, & Castell, 1976; Westerterp-Plantenga, Smeets, & Lejeune, 2005), health benefits, such as anti-tumour and anti-cancer properties (Murakami, Ali, Mat-Salleh, Koshimizu, & Ohigashi, 2000), and other therapeutic treatments especially in regard to the treatment of physical pain. There has been notable evidence stating that capsaicin hold numerous therapeutic properties especially in the relief of pain and discomfort such as nausea for patients who suffer from chronic illnesses (Caterina et al., 1997; Huang et al., 2000; Kumar, Singh, & Sharma, 2013).

This is due to the function of nociceptors which are a subgroup of sensory neurons that transmit sensory information regarding the body's tissue damage to various pain-processing centres which are located in the spinal cord and brain (Fields, 1987). As nociceptors are sensitive to capsaicin, the body's exposure to capsaicin causes an excitation of the nociceptors which are then followed by an initial registration of pain, leading to a release of inflammatory mediators (Szolcsanyi, 1993). Research (Caterina et al., 1997; Szallasi & Blumberg, 1996) has shown that prolonged exposure to capsaicin causes the nociceptor terminals to be less activated or become less sensitive to capsaicin. An implication of this occurrence is the treatment of NCDs, such as diabetic neuropathis, where capsaicin can be used as an analgesic for patients to cope with the physical pain (Campbell, Bevan, & Dray, 1993; Szallasi & Blumberg, 1996). The liking for spicy food among Malaysians has not been identified in literature as to date. But spicy food on its own needs to have another component of taste, otherwise it would just taste bland. While we are considering how

Malaysians like spicy foods, we should also be exploring the other components of taste, I will focus on sweet and savoury

The amount of salt needed in foods for it to be detectable varies across individuals and are based on personal preference thresholds. The preference for salt is innate, whereby its craving is dependent on a specific physiological need which is required to fulfil certain biological functions, including blood pressure maintenance, muscle contraction, and nerve conduction (Beauchamp, 1987). The preference for salt concentration is higher among children than adults, although cause of this phenomenon is unclear (Beauchamp & Cowart, 1990). Salt or sodium other than in its raw (granulated) form are also in sauces, such as ketchup, soy sauce, and oyster sauce, but they are also hidden in processed foods, such as sausages or fishcakes, for means of preservation, and added to snacks, such as potato chips to add extra flavour. Research has shown that a high enjoyment for salty foods is associated with a habitual preference for salty tasting foods (Harris & Booth, 1987; Shin, Lee, Ahn, & Lee, 2008).

High intakes of salt has been associated to an increased prevalence in hypertension and other NCDs (Lucas, Riddell, Liem, Whitelock, & Keast, 2011; Schechter, Horwitz, & Henkin, 1974). There is a direct relationship between high intakes of salt and salted food and a high prevalence of gastric cancer (Goh, Cheah, Md, Quek, & Parasakthi, 2007; Tsugane, Sasazuki, Kobayashi, & Sasaki, 2004). A study conducted in Malaysia showed that one of the risk factors of developing gastric cancer is being ethnically Chinese (Goh et al., 2007). Foods which are high in salt, such as salted fish and vegetables, are more commonly consumed by Chinese, than by Malays (Goh et al., 2007).

The inclination towards sweet tastes has been explained by our body’s innate function to relate foods high in sugar as energy dense (Appleton & Rogers, 2004; Ventura & Worobey, 2013). However, excessive sugar intake leads to detrimental effects, such as early onset of diabetes and a higher prevalence of obesity among normal populations (Khor, 2012; Letchuman et al., 2010). Malaysians consume high amounts of sugar on a daily basis (Institute for Public Health, 2014; Masood, Yusof, Hassan, & Jaafar, 2014; Norimah et al., 2008). According to the MANS 2014, biscuits, sugar and condensed milk are part of the top ten eaten foods on a daily basis among Malaysians (Hasnan & Ahmad, 2014). One serving of condensed milk, which is one teaspoon (20.7 ml), has approximately 71 kcal of energy. Condensed milk in Malaysia is usually added to both hot and cold beverages, such as coffee and milo, which is readily available at any *mamak* stall in Malaysia. In addition, top ten beverages consumed daily by Malaysian adults include malted drinks, such as milo and Horlicks, cordial syrup, tinned and box drinks- which are all high in sugar content (Hasnan & Ahmad, 2014).

Both Malay and Chinese Malaysians adopt forms of processed sugar as an ingredient in their savoury dishes. In traditional Malay cuisine, sugar is added to both sweet and savoury dishes for flavour. The usage of gula Melaka is very popular in Malay cuisine. It is added to many local kuihs, such as kuih baulu and kuih seri muka, and as a condiment for traditionally Malay desserts, such as sago with coconut milk, Bubur pulut hitam, or pengat pisang (Raji et al., 2017). As mentioned, Malays add sugar to traditional savoury dishes such as rendang and satay which have 3.14g and 1g of sugar on a generic scale (per serving). Given that food scientists are aware of high sugar intakes in Malay cuisine, the substitution of stevia for artificially processed sugar and natural sugars like gula Melaka are slowly being introduced and incorporated as a healthier alternative added to Malay desserts (Kamarulzaman, Jamal, Vijayan, & Ab. Jalil, 2014).

Traditional Chinese cuisine utilises processed sugar as a flavour enhancement to sweet meats, tang yuan (rice snack with various fillings) and seafood dishes (Li & Hsieh, 2004). Compared to the composition of Malay cuisine, Chinese cuisine has lower amounts of processed sugar added to their food (Mirnalini et al., 2008). The type of sugar used in traditional Chinese cuisine is rock sugar (Liu, Wang & Zhang, 2015; Weng & Chen, 1996), which although not a healthier alternative to normal sugar, is added scarcely into traditional Chinese desserts for flavour (Tan & Van, 1972). Bird's nest soup is an avid example of a Chinese dessert which utilises rock sugar to sweeten the otherwise tasteless soup (Ghazali et al., 2015). There is a commonly held belief among elderly Chinese that having fruits and vegetables aggravates rheumatism and other geriatric illnesses (Goh et al., 2007). This belief originates from the teachings of TCM (Wang & Lu, 1992) and is not practiced in Malay culture (Goh et al., 2007).

Although both groups would be inclined towards sweet tasting foods such as biscuits and local kuih, based on previous research, Malay participants should exhibit higher predispositions towards sweet tasting foods compared to Chinese. It is also hypothesised that Chinese participants' predisposition towards savoury or salty tasting foods would be higher than that of Malay participants. These predictions stem from the difference in the intake of macronutrients found by Mirnalini et. al (2008). Table 1 below illustrates the daily intake of carbohydrate, fat, protein, sodium and energy respective to the two ethnic groups (Mirnalini et. al 2008). From Table 1, it is evident that Malays consume more carbohydrate and has a higher energy intake daily in comparison to Chinese. In comparison, Chinese have a higher intake of fat, protein, and sodium daily in comparison to Malays (Mirnalini et al., 2008).

Table 1: Daily intake of carbohydrate, fat, protein, sodium and energy content for Malay and Chinese.

Daily Intake	Malay	Chinese
Carbohydrate (g)	242	209
Fat (g)	49	53
Protein (g)	59	62
Sodium (μg)	2507	2916
Energy (kcal)	1653	1567

The Ministry of Health and other concerning governing bodies have been monitoring the prevalence of NCDs and its rise since 1996. Unfortunately, little evaluation has been carried out in understanding the dynamics which contribute to this rise apart from experimental methods involving surveys and self-reported questionnaires. Additionally, the existing literature on the current health status in Malaysia has been conflicting. Recent data derived from the MANS 2014 shows Chinese consumed more sugar and have a higher energy intake compared to Malays (Zainuddin et al., 2016). Other implications, such as participants underreporting, have been raised as an explanation to the discrepancies in data between ethnicities. Mirnalini et al. (2008) found half the participants under-reported their total energy intake. Zainuddin et al. (2019) recently highlighted under-reporting of energy and nutrient intake as a common cause of bias in the MANS data collection and in nutritional studies. Results from Zainuddin et al. (2019) reported an increase of 8% from 2003 (53%) to 2014 (61%) of under-reporting, with age being a strong independent predictor of under-reporting.

Other forms of data collection, such as the finger-prick glucose test as a form of detecting diabetes (Institute for Public Health, 2015; Letchuman et al., 2010; Wan Nazaimoon et al., 2013) only addresses the issue of the irrefutable rise in NCDs. Given the rise in NCDs within Malaysia, there has never been a greater need for prioritising one's health and overhauling completely the diet of the average Malaysian (Letchuman et al., 2010; Tee, 1999; Zalilah et al., 2008). We can get a better understanding to what Malaysians eat by looking at primarily how they make their choices when selecting food.

1.3. Mechanisms that Influence Food Choice

We first need to identify factors which influence food choice for us to determine if the effect of ethnicity influences food selection. It is widely known that eating the right foods can help determine one's health status (Chao, Grilo, White, & Sinha, 2014; Shim, Oh, & Kim, 2014; Tee, 1999; Van den Akker, Stewart, Antoniou, Palmberg, & Jansen, 2014). Adequate amounts of protein, ample fruits and vegetables and moderate amounts of carbohydrates are the building blocks to a healthy diet. However, in practice, there are other variables which determine food choice apart from health considerations. Mela (2012) states that determinants of food choice include factors such as food availability, culture, sensory properties of a food, and learning. Furst, Connors, Sobal, Bisogni and Falk (2000) state that combinations, such as the environment, ritual and belief systems (both religious and secular), the dynamics of the community and family structure, human endeavour, mobility, economic and political systems, are integrated into a range of 'traditional' and accepted rules of cuisine and appropriateness. For instance, orthodox Buddhists abstain from eating animal meat including fish due to their high regard for animal life (Hinnells, 1997; Kwon & Tamang, 2015) and foods containing fermented soybeans and vegetables were highly consumed among Korean Buddhists with the belief that they pose many beneficial properties for the body (Kwon, Jang, Yang, & Chung, 2014; Park & Rhee, 2005). More information on variables which influence the acceptance and avoidance of food will be explained later.

By understanding culture and its strong historical antecedents, we can assess how an individual's diet in a specific society is moulded. Before expanding on the influence of cultural factors on food choice; a brief overview of other factors which affect food choice should be given. Research investigating food choice has so far adopted an empirical approach that lacks in ecological validity. Methods of investigating motives for food choice are conducted via mono-structured questionnaires and surveys and ignores the basis which creates the motives when selecting certain foods. This lack of insight into human behaviour cites major approaches such as the theory of reasoned action and planned behaviour which are based solely on the concept that all individuals undergo a rational and conscious decision-making process when selecting food. According to Mojet (2003), factors to consider when understanding the essentials in explaining food choice include intrinsic product characteristics, socio-cultural biases. We focused on how culture has been shown to influence factors which modulate food choice.

1.3.1. Cultural Differences in Food Studies

Previous literature looking at differences in food choices amongst ethnic groups shows a higher consumption of fruits and vegetables on a daily basis for Blacks and Hispanics as compared to whites (Devine, Wolfe, Frongillo, & Bisogni, 1999). Other studies looking at the differences in food preferences between ethnic groups have looked past daily consumed foods or what is deemed as contextually familiar to certain ethnic groups and focused more on the perception of the participants when consuming the foods.

Taste preferences for types of marinade used on chicken fillets was assessed in cross-cultural study between Malaysian and European assessors (Yusop, O' Sullivan, Kerry & Kerry, 2009). Yusop et al. (2009) showed that there was a greater preference for tandoori paste and tikka glaze among the Malaysian participants compared to the European participants who preferred different variants of tikka masala sauce. The marinades in the experiment were 13 different types of commercially available Indian-style marinades which differed in pH level, moisture, and fat content. Taste preferences for both groups were made for texture, aroma, colour, Tikka-masala flavour, herblike flavour, authenticity, juiciness and overall acceptability of the chicken fillets. The Malaysian participants gave a significantly lower score for hotness than the European participants emphasizing on the impact of culture and its influence on taste for spicy foods. It is to be noted that marinade L had the highest fat content which was detected in its taste and had appealed to the Malaysian participants more and that marinade I was rated to be most authentic in flavour by both groups. Results show that, although the Malaysian and European participants exhibited similar ratings towards their perception to all the marinades used in the study, ultimately their preferences for certain marinades were distinct indicating an underlying factor which causes this difference in overall taste preference (Yusop et al., 2009).

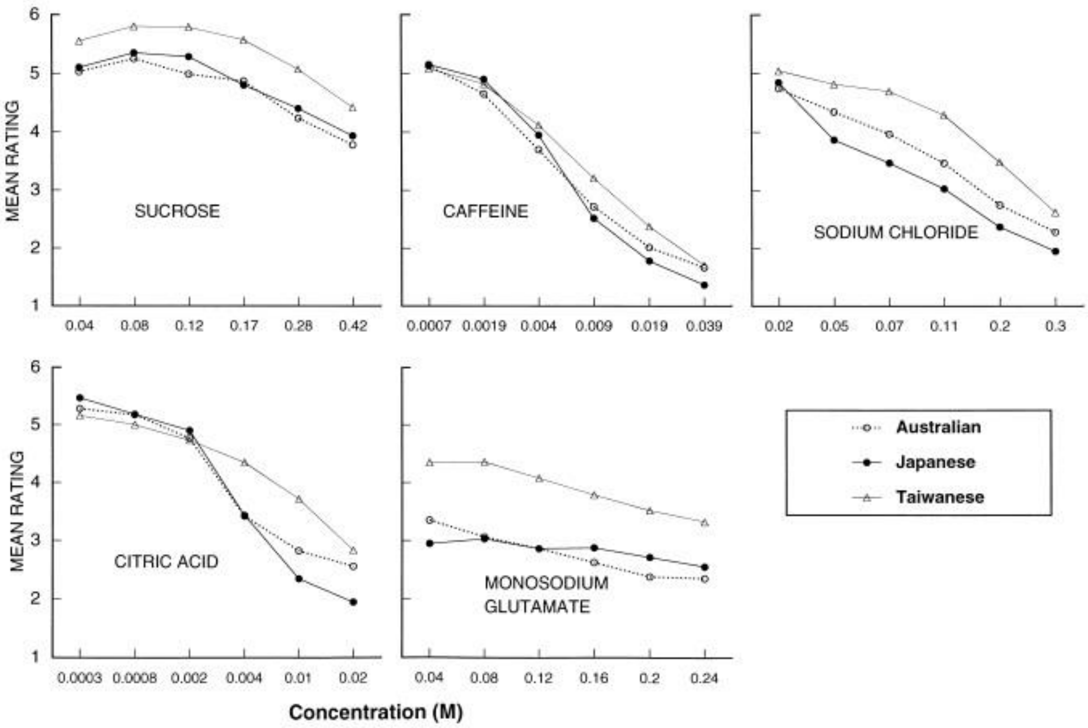
Stimuli, such as variants of sweet foods or artificially sweetened beverages, have been used extensively in food research when exploring detection thresholds and palate preference in cross-cultural studies. A study which investigated the effects of dietary habits and its influence on perception and liking of sweetness among Australian and Malaysian participants is another example to how ethnicity contributes in determining taste (Holt, Cobiac, Beaumont-Smith, Easton, & Best, 2000). In the study, all participants rated the intensity and their liking for different concentrations of sucrose solutions, orange juice, vanilla custard and shortbread biscuits. Results showed that there was a significant effect of ethnicity when measuring likeness for different variants of sucrose solutions with the Malaysian participants providing higher scores in likeness. The Australian participants showed a higher liking towards all mixtures of orange juice as compared to the Malaysian participants. However, both groups showed the same preference for orange juice having very low levels of sucrose concentrations (0 or 5% added sucrose). Both groups showed a great disinclination towards the vanilla custard with the lowest sucrose concentrations. Overall, there was not a significant difference in ethnicity for the overall liking of all types of custards used in the experiment between the groups. However, there was a significant interaction between ethnic group types and sucrose level. The Australian participants (42 females, 27 males) liked the 0 and 5% levels of sucrose in the vanilla custard samples more than the Malaysian participants (34 females, 29 males; 73% Malays). The mean overall liking for biscuits was significantly greater for the Australian participants when compared to the Malaysian participants for all four sucrose levels. Results also showed that body weight and the frequency of consumption of sweet foods and beverages between Malaysian and Australian participants did not differ significantly, indicating that total amount of sugar intake consumed on a daily basis does not affect preference or likeness towards sweet foods (Holt et al., 2000).

A recent study by Risso et al. (2017) have shown that there was a difference in food preference among the different ethnicities but all localised in a singular geographical location. A total of 183 participants, comprising of 111 Italians, 18 from the Maghreb region, 28 North Europeans and 26 Sri Lankans, completed a questionnaire whereby they were required to rate 12 common foods in terms of likeability (dislike, sort of, like extremely) and frequency (yearly, monthly, and weekly). There were seven bitter-tasting foods, three sweet-tasting foods and two umami-tasting foods. Results showed that there was a significantly higher preference for the bitter-tasting foods, which were broccoli, mustard and beer among the North Europeans. There were significantly lower consumption and liking scores among the Sri Lankan participants for one bitter-tasting food (liquorice) and one umami-tasting food (Parmesan cheese) compared to the other ethnic groups.

Taste assessment was also carried out amongst the sample using three taste qualities which were umami, sweet and bitter compounds. Results showed that Maghrebi and Sri Lankan participants showed a lower percentage of umami sensitives (6% and 8% respectively) when their results were compared to taste sensitives of the Italian (44%) and North European participants (64%). The Maghrebi (39%) and Sri Lankan participants (46%) were less sensitive towards MSG, as compared to the Italian (13%) and North European participants (7%). There were a higher percentage of non-likers among the North European participants (71%) for sucrose preference when compared to the Maghrebi (44%), Italian (36%) and the Sri Lankan participants (27%). Bitter taste perception varied across groups for the same substance tasted but not for salicin and PROP bitterness which did not very between the groups. By combining a mixture of biological and social aspects, Risso et. al (2017) were able to provide insight into what shapes an individual's food behaviour and their global and local preferences for the food choices that they make.

A review of cross-cultural studies compiled by Prescott (1998) showed differences in hedonic ratings across Taiwanese, Japanese and Australian participants for five concentrations of sucrose, caffeine, NaCl, citric acid and MSG tastants (Prescott, 1998). As illustrated in the compilation of graphs (Figure 2), Taiwanese participants gave high hedonic ratings for sucrose, sodium chloride and monosodium glutamate as compared to the Australian and Japanese participants.

Figure 2: Hedonic ratings for the 5 aqueous solutions (sucrose, caffeine, sodium chloride, citric acid, and MSG) for the Australian, Japanese, and Taiwanese participants.



The goal of the review by Prescott (1998) was to not only emphasize on differences in the preferences of the different tastants across various ethnic groups, but to also highlight the disparities in taste thresholds held by certain ethnic groups. For instance, Prescott (1998) highlights that the taste thresholds of umami and sour concentrations were theorized to be much higher among Japanese participants as compared to the Australian and Taiwanese participants. In related studies (Prescott, Young, O'Neill, Yau & Stevens, 2002; Prescott & Bell, 1995), it was shown that the sensory qualities of the different variants of taste varied between ethnicities. In a taste manipulation study by (Prescott et al., 1997), findings showed a dissimilarity between Australian and Japanese panels when assessing the *fruitiness* of an orange and grapefruit juices and the *creaminess* of ice cream. These disparities in how both taste respondents react to the various sensory qualities of the same food tasted poses the question to whether both cultures in any cross-cultural study exploring perception towards food and taste can primarily define the same sensory qualities on the equally.

Other socio-cultural factors which influence eating and drinking behaviour include the role of society itself and its institutions of socialisation. The fundamentals of appropriate norms and traditional values, belief systems and attitudes held by individuals which encompass a society plays a vital role in determining what is acceptable to consume and what should be avoided. Symbolic meanings, such as tributes offered in response to changing seasons or religion-associated sacrifices, are often expressed through the relationship between food and person or group (Ma, 2015). Therefore, to understand the consumption of food between cultures, it is important to study the culture itself and its norms and beliefs. For instance, Ma (2015) stated that in Chinese culture, foods that are specific to Chinese culture and cooking hold significant connotations, such as luck or the prospect of growing wealthy. For example, Chinese dates are a symbol that married couples can have children early and noodles meant health and longevity. Additionally, there is a greater emphasis to the symbolic significance of food consumed in response to religion or the relationship between man and God than its nutritional value. Devine, Sobal, Bisogni and Connors (1999) believed that individuals would break their traditionally consumed foods pattern when there is a change in health status such as the incidence of diabetes or other chronic illnesses.

Although there is evidence that Malays also adhere to the ‘hot’ and ‘cold’ ayurvedic properties foods can place on the human body (Omar et al., 2015), there is a more fundamental element which governs both purchasing intention of food products and food selection among Malays. In Malay culture, the degree of importance placed on foods being haram (prohibited) and halal (accepted) is greatly emphasized. The prohibition and acceptance of foods is stated clearly in the religion of Islam through the holy scripture of The Qur’an (Omar et al., 2015). Studies within Malaysia have shown that among Malays, the prohibition/acceptance of foods are the basic tenets and overriding factor compared to variables such as cost and taste (Asma et al., 2010; Omar et al., 2015). Foods which are prohibited in Islam include birds of prey (hawks, eagles, vultures, and falcons), pork or any by-product of pork, alcohol or alcohol added to foods, and any type of animal meat which has not been prepared according to Sharia law (Hamdan, Issa, Abu, & Jusoff, 2013). Additionally, Malays patronise restaurants and eateries which have halal accreditation (Hall, Ballantine, & Zannierah Syed Marzuki, 2012) – which limits the choice available compared to Chinese customers who do not consider halal accreditation as a principle in food selection.

Therefore, the basic principles of food choice between the two ethnic groups in Malaysia differ although the aspect of affordability and accessibility to both food products and eateries remain constant. As mentioned, all Malays should make food choices according to what is firstly considered as acceptable and reject or avoid foods which are prohibited in Islam. On the other hand, the concept of maintaining a harmonious element of the human body is not as highlighted in Malay culture as it is prominent in Chinese culture. As such, it is proposed that socio-cultural factors, which in this case is differences in religious beliefs is an important factor in understanding food choices between Chinese and Malays.

1.3.2 Psychological Factors Influences Selection

The concept incidental (non-intentional) and intentional learning has both been applied to understand food preference. Incidental learning is not limited to early childhood but continues to develop throughout the life (Møller, Mojet, & Köster, 2007; Møller, Wulff, & Köster, 2004). Furthermore, incidental learning does not deteriorate with age unlike intentional learning, which becomes less effective.

There have been conflicting reviews on what influences food choice. Mela (1999) adopted an approach which is both psychological and situational and states a set of rules that should be considered when investigating food preference. The global rules which are used to consider in understanding an individual's food choice and intake are if it is not available, it will not be eaten, and if it is available it is likely to be eaten. Furthermore, if there is no alternative, it will be eaten. However, the concept of availability has been shown in studies to only contribute minutely towards the decision-making process on deciding what one should eat. In fact, studies have shown that by limiting access towards particular foods actually increases the overall wanting and intake of the restricted food; which is to the detriment of its intended purpose-especially when the nature of the restricted foods are high in caloric content (Fisher & Birch, 1999).

Fisher and Birch (1999) investigated the effects of restricting access towards palatable foods and its influence on subsequent selection and intake among children aged 3-5 years old. In Experiment 1, participants were restricted from eating certain palatable food and food selection and consumption patterns were measured 3 weeks before and after the period of restriction. Access to the target food was restricted, whereas the control foods were easily accessible to the participants. In contrast, participants in Experiment 2 had access to both target and control foods. Both experiments were designed to measure the effects of restricting access to a food on the participant's subsequent behaviour which included selection and consumption of the palatable food. The first experiment measured the effects of restriction within and outside the restricted context. The second experiment localised on the effects caused within the restricted context. Fisher and Birch (1999) concluded from both experiments that, by restricting the access to palatable, energy-dense or high caloric foods, the selection and intake of such foods increases (Fisher & Birch, 1999). Additionally, repeated exposure to a specific taste has been stated to increase liking and overall acceptance of that taste (Birch, McPhee, Shoba, Pirok, & Steinberg, 1987).

Through intentional learning (i.e. forming positive associations in the past) increases the likelihood of that behaviour being repeated in the future. Because behaviour tends to be stable, past behaviour is a good predictor of future behaviour (Mela, 2001). Mela (1999) hypothesizes that if learning can take place, it probably will, if learning cannot take place, it will not. Context is as important as content, perceived quality and intake reflect matching of expectations. Additionally, Mela describes that through learning, individuals can enjoy certain foods and the prevalence of consuming that specific food is higher if not definite if the food consumed is closely paired to a positive outcome, such as satisfaction with satiety. Furthermore, it has been highlighted that through learning, individuals are able to exclude foods that they do not like through the development of aversions to specific sensory qualities of foods which occur when the food is strongly associated with negative outcomes, such as nausea or gastrointestinal upset (Pelchat, 2002; Pelchat & Rozin, 1982). These negative associations not only discourage the individual in selecting a specific type of food for consumption (to reach satiety), it is believed that the occurrence of the food in question to be consumed again in the future is unlikely (Mela, 2001; Mela, 2012).

In developmental studies, the positive effects of a child being exposed and becoming familiar with a wide variety of foods has been linked to an overall healthy diet (Cooke, 2007). Therefore, it is extremely beneficial in identifying which influence food preferences or avoidance to certain foods at an early age. Fundamentally, the mechanisms involved in increasing liking towards certain foods (especially towards bitter tasting compounds usually found in nutritional foods) among children needs examined in order to comprehend the underlying motives for food choice of adults. As eating and drinking are deemed as learned behaviours; specific preferences as well as neophobic attitudes towards certain foods are psychologically learned behaviours as well.

Concepts of learning in relation to food choice which adopts the Pavlovian conditioning approach includes flavour-nutrient (Yeomans, Leitch, Gould, & Mobini, 2008) and flavour-flavour (Stevenson, Prescott, & Boakes, 1995) learning. Flavour-nutrient conditioning refers to a pairing of a flavour to a positive consequence of nutrient ingestion leading to a liking of the initial flavour (Yeomans, 2012). Flavour-flavour learning, which is a conditioning procedure, creates a liking or disliking for a neutral flavour depending on whether the initially neutral flavour is paired with a preferred or an undesirable flavour respectively (Havermans & Jansen, 2007). Positive flavour-flavour learning allows the transformation at what was initially a neutral flavour into a preferred flavour which is especially beneficial in increasing an individuals' liking and acceptance of novel foods.

Havermans and Jansen (2007) investigated the efficacy of flavour-flavour conditioning on increasing children's liking and the acceptance towards certain types of vegetables. Children received six pairs of sweetened (CS+) and unsweetened (CS-) vegetable tastes during the conditioning trials. The same types of vegetables were used for both the CS+ and the CS-. CS+ was sweetened with approximately 20g of dextrose. Havermans and Jansen (2007) found that there was a significant increase in flavour preference for vegetable tastes which were paired with the added sweet taste of dextrose. These results not only suggests that through flavour-flavour conditioning a positive shift in preference for the taste of vegetables among children can be achieved, but also this shift can be achieved in a short amount of time (Havermans & Jansen, 2007).

Other concepts of learning in relation to food choice include imprinting (Haller, Rummel, Henneberg, Pollmer, & Koster, 1999), and imitation (Birch, 2016). The concept of imprinting in food psychology theorises that an onset of an early experience in relation to a specific food exerts a strong influence for future food choices and flavour preferences (Beauchamp & Mennella, 2011; Haller et al., 1999). In a taste detection study, detection of the presence of vanillin within ketchup showed that there was a preference for the mixture among the sample who admitted to have had vanillin in the first feeding experiences of their life as it was an extract used in baby formula (Haller et al., 1999). Participants tasted two forms of ketchup and had to indicate which of the two they liked better. Of the two portions of ketchup, one of them had 0.5g of vanillin per 1kg of ketchup added. Ketchup was chosen as the base tastants as it is not conventionally associated with the taste of vanillin. The results showed that 70.9% of participants who reported to have been breastfed after birth preferred the pure ketchup taste and only 29.1% preferred the mixture of ketchup and added vanillin. As compared to 33.3% participants who reported to be bottle-fed after birth preferred the pure ketchup taste and 66.7% preferred the mixture of ketchup and added vanillin. However, the addition of vanillin to ketchup is less common and therefore it should come to no surprise that only 37.6% of participants preferred the ketchup with added vanillin. The study by Haller et. al (1999) which highlighted a preference for the ketchup-vanillin mixture among participants who were bottle-fed with formula when compared with participants who were breastfed demonstrates the effectiveness of unintentional learning in taste preferences, even when the tastants involved are conventionally uncommon.

Research suggests that food choices made during early adolescent years persist throughout adulthood due to the impact of modelled behaviour. Imitation serves as the act in which adolescents select and consume foods when they see their modelled adult consuming the same foods (Birch, 2016). This concept of imitation considers novel foods as well as familiar foods. According to the theory, children are more likely to consume novel foods when they see their modelled adult consuming it. This conception inexplicably dismisses the notion of neophobia as well as ignores intrinsic factors in sensory properties, such as taste, texture and smell of the food. Conceptually, imitation cannot happen without the process of imprinting occurring first. This chain of events can be made due to the direct influence of imprinting. Modelling has shown to create a huge impact on the development of children (Birch & Fisher, 2000) and their eating behaviour. Consequently, it has been shown in studies that, when children view their parent’s behaviour, they imitate or adopt eating practices carried out their parents (Brown & Ogden, 2004; Dickens & Ogden, 2014; Palfreyman, Haycraft, & Meyer, 2014).

Palfreyman et al. (2014) explored the relationship between parental modelling of eating behaviours and its consequences on healthy and unhealthy snacking habits in both mothers and their children using the Parental Modelling of Eating Behaviours Scale (PARM) as well as a food frequency questionnaire (FFQ). Palfreyman et al. (2014) were able to highlight that the efficacy of mothers’ intentionally modelling healthy food intake is the same as their unintentionally modelling unhealthy food intake. Results showed that there was a positive relationship between behavioural consequences of maternal modelling and an increase in the intake of fruits and vegetables among their children. In contrast, unintentional modelling was negatively associated with higher levels of savoury snack intakes for both mothers and their children.

Therefore, by applying the concepts of learning and its determinants, we can propose that food preferences can be learnt-whether intentionally or unintentionally-through successful food pairings (or conditioning). Subsequently, by understanding that food preference is a product of learned behaviour, we can alter our eating behaviours by including more beneficial foods and exclude foods which are harmful to our body.

1.4. Thesis Aims

This investigation aims to bridge a connection between differences in food preference and the ethnic identity of the individual. As there are stages in deciding what foods to eat, for instance the identification of the food itself, we will measure how both groups identify and characterise different foods based on their visual recognition on what the food looks like to them.

Chapter Two: Cross Sectional Food Frequency Questionnaire: Investigating Ethnic Differences in Dietary Intake among Malaysian Undergraduates.

2.1. Introduction

Diet is usually defined in terms of its nutrient content. Other types of eating-related behaviours, such as typical food patterns, eating habits, and the use of specific foods or groups of foods, also constitute as diet (Johnson, 2002; Shim et al., 2014). In food related research, several methods are used for assessing dietary intake. Three of the most common are food frequency questionnaires (FFQ), food records (which are usually prolonged for a specified period of time), and twenty-four-hour diet recalls (Shim et al., 2014). An understanding of the common types of food consumed is essential in identifying the population's food choices. The method that will be adopted in this cross-sectional survey is the FFQ. Primarily, a FFQ is a checklist of foods and beverages combined with a frequency response section for participants to report how often each of the items were consumed over specified periods of time (Wrieden, Peace, Armstrong, & Barton, 2003). Semi-quantitative FFQs collect information on portion size as standardized portions according to the food items or as a choice of portion sizes by the participant. The development of a FFQ for a study needs to be constructed specifically for each target group and research purposes as research shows that diet is influenced by ethnicity, culture, individual preference, economic status and other social factors (Shim et al., 2014).

Benton (2002) and Christensen and Pettijohn (2001) suggests that 'highly' palatable foods are foods which are most commonly consumed. In which case, foods which are often high in sugar, and therefore high in carbohydrate and fat, such as chocolates, sweets, cakes or biscuits, provide a pleasurable experience, which, from a physiological perspective, is mediated through the release of endorphins (Benton, 2002). Some specific foods are consumed to alleviate negative moods within an individual. Rozin, Hammer, Oster, Horowitz and Marmora (1986) propose that the central feature within the development of food selection behaviour resides in the conditioning of learning what not to eat. Appleton and Rogers (2004) believe that there exist individual differences in food preference and that personal tastes are determined by learning. Individual characteristics in the selection of what types of food to eat is important explored as highlights the factors which influence food selection which are not based predominantly on individual's biological make-up (Rozin, 1990).

Other studies within the area of food selection focus on the rationale to why individuals reject certain foods. Mooney and Walbourn (2001) highlighted that health values poses as primary influences on food selection including factors, such as those relating to disease avoidance and feelings of wellbeing. Taste, convenience, concerns about specific ingredients, age and sex are other factors which determine what types of food will be selected (Rappaport, Peters, Downey, McCann &Huff-Corzine, 1993; Steptoe, Pollard & Wardle, 1995; Logue & Smith, 1986). Although the demographics for the study conducted by Mooney and Walbourn (2000) do not coincide with those in this study, these findings are a significant contribution to the construction of the FFQ when considering the rapid changes in diet. As such, it was depicted that, due to the rapid economic growth and urbanization of Malaysia since 1970s, food expenditure structure particularly in West Malaysia has diversified inclining towards Malaysians spending more money on western-type foods as compared to local Malaysian foods (Ishida, Law, & Aita, 2003).

Food consumption data assesses the adequacy or inadequacy of nutrient intake; which is extremely helpful when establishing policies and the Recommended Nutrient Intake (RNI) within a country (Hasnan & Ahmad, 2014; Pon et al., 2006). Food consumption data varies considerably from country to country and even within a country due to variation in socio-demographic information, such as socioeconomic status, culture, ethnicity (Teufel, 1997), religion and geographical area. For instance, historically, Malays were fishermen and farmers. Therefore, the usage of ingredients easily accessible to Malays were those available near the beach or coastal regions or through vegetation plots surrounding the kampung. As such, the usage of coconut milk and fish and seafood is prominent in Malay cuisine (Raji, Ab Karim, Ishak, & Arshad, 2017).

The greatest influential factor in the formation of diet is culture (Axelson, 1986; Prescott & Bell, 1995; Prescott, Young, O'Neill, Yau, & Stevens, 2002; Risso et al., 2017). There have been numerous studies conducted in Malaysia which have used the FFQ in its original form or variations of the FFQ according to the research topic (Loy, Marhazlina, Nor Azwany, & Hamid Jan, 2011; Norimah et al., 2008; Shahar et al., 2011). Studies which have used the FFQ as a method of measuring dietary nutrient intake were focused on Malaysian men diagnosed with prostate cancer (Shahar et al., 2011), women (Chee et al., 2002; Pon et al., 2006), pregnant women (Loy et al., 2011) different ethnicities (Holt et al., 2000) and the general population (the MANS Institute for Public Health, 2014; Mirnalini et al., 2008;

Norimah et al., 2008; Wan Abdul Manan et al., 2012). The FFQ used in this cross-sectional study was an adaptation from the FFQ used to measure the dietary nutrient intake among pregnant women (Loy et al., 2011).

The purpose of the study by Loy et al. (2011) was to produce a valid and reliable semi-quantitative FFQ among pregnant women. Although the true purpose of this FFQ is used for a specific target group, food consumption data produced by this cross-sectional study would be as equally valid. Results from the study by Loy et. al (2011) showed that the FFQ presented an acceptable reproducibility and was high in validity for categorising pregnant women according to dietary intake which prompted its utility in this investigation. The FFQ used in this cross-sectional study measures the dietary eating habits of the target group which comprised of Malay and Chinese young adults who were at the time of completing the FFQ who were residing in Malaysia. As we were not investigating nutrient intake specifically, we omitted certain foods i.e., types of vegetables eaten, and expanded on the list of snack foods which are popular among our sample.

Participants needed to be residing in Malaysia to ensure that they had a constant habitual intake of Malaysian foods. The frequency and portion size of the daily intake among the participants were recorded to be compared to the RNI among Malaysians. The FFQ was used to find out regular dietary intake for the two ethnic groups. Also, we can find out the most frequently eaten foods among the groups; for example, we can look at the number of macronutrients such as carbohydrate and protein consumed. Additionally, individual preferred tastes such as the regularity in the intake of savoury snacks, levels of spiciness (capsaicin spicy) preferred in certain food and sweet flavoured foods can also be identified. Furthermore, we will be able to explore the differences between the two ethnic groups in response to food intake (type) as well as motives for food choices.

2.2. Method

The FFQ is a cross-sectional survey comprising of 144 images of food. For each image there were two questions which required the respondent to provide specific information about the food that they eat. The information respondents were required to provide was firstly if they consumed a food/dish or they did not. Respondents were required to include the frequency of intake for the food that they consumed- whether it is on a daily, weekly, or monthly basis. The method of preparation for specific foods upon consumption needed to be stated for example if the dish was prepared by deep-frying, baking, boiling or steaming. The portion size for each dish or food needed to be stated according to the frequency of consumption for example, participants needed to state if they ate 2 plates of rice daily or had 3 servings of apples per month. According to the RNI for Malaysians, the minimum macro-nutrient intake of Malaysians need to equate to: 20-30% of energy derived from total fat, 55-70% of carbohydrates, and 10-15% reserved for protein intake (Mirnalini et al., 2008).

Questions pertaining any additional supplements or medication were also included. There was an inclusion of additional standardized questionnaires measuring the overall emotional state and the type of eater the participant is (see appendix B, section 1 for the full version of the questionnaire).

2.2.1. Construction of Survey

Previous research have used the Food Frequency Questionnaire to measure the nutrient and food intake among pregnant Malaysian women who were residing in Malaysia (Loy et al., 2011). Modification to the current survey was the addition of snack foods such as confectionary and savoury snacks intake which were not present in the original FFQ by Loy et. al (2011). Additionally, food items found in the section under Fruits and Vegetables was substantially reduced as we were not interested in measuring micronutrient intake such as vitamin C and iron. The FFQ used in the present study comprised of questions on the variety of foods which were readily available in the local Malaysian diet. The foods stated in the questionnaire were divided according to category.

2.2.1.1. Food Component of the FFQ

The total breakdown of the types of foods mentioned in the questionnaire is stated in Table 3 below. The categories of food A-M were stratified according to nutritional content. Each category of food included in the FFQ included only foods or variation of the foods mentioned in each category which are most commonly consumed and readily available in both Peninsular (West) and East Malaysia. Table 2 shows the total number of questions for each food category in the FFQ.

The nutritional profile of each food in categories A-M is illustrated in Table 3. Total nutritional composition of each food per category is included in Appendix A (Table 1-12). Nutritional information was obtained from an online food composition database from the Nutrition Society of Malaysia (Tee, 1997).

Table 2: The total number of questions for each food category in the FFQ.

Food Category	Total Number of Questions per Category
A. Grains	16
B. Meat and Meat Products	8
C. Fish and Seafood	13
D. Eggs	3
E. Pulses	5
F. Milk and Milk Products	6
G. Vegetables	19
H. Fruit and Juice	26
I. Confectioneries	23
J. Savoury Snacks	8
K. Bread Spread	8
L. Flavourings	8
M. Others	3

Table 3: The nutritional profile per food category in the FFQ.

Food Category	Nutritional Profile	Examples
A. Grains	Generally accepted whole grain foods and flours	Rice, roti canai, noodles, pasta, sago, pizza, oats, corn
B. Meat and Meat Products	Land-animal tissues, skeletal muscle or fat used as food. Includes both red-meat and white-meat (with the exclusion of pork)	Chicken meat, beef, burger patty, sausages, chicken ball, beef ball
C. Fish and Seafood	Tissues from water borne animals. Includes marine life from the sea and freshwater species	Mackerel, canned fish (sardines), shellfish, squid, prawn, crab, fishball, keropok lekor
D. Eggs	Consists of eggs which have albumen (egg white) and vitellus (egg yolk) only	Chicken egg, duck egg, salted duck egg, quail eggs

E. Legumes	Pulses or grain legumes which are members of the pea family	Tofu, baked beans, tempeh, groundnuts
F. Milk and Milk Products	Consists of animal milk and specific variations of animal-based milk	Powdered milk, condensed milk, cheese, curd
G. Vegetables	Various parts of plants that can be consumed by humans as food as part of a meal	Spinach, pumpkin, tomato
H. Fruit and Juice	The fleshy seed-associated structures of a plant that is sweet or sour, and edible in the raw state The liquid substance produced upon extraction from a fruit.	Apples, bananas, grapes Lemon juice, orange juice, pineapple juice
I. Confectioneries	Sweets or candy Includes both bakers' confections and sugar confections	Bakers' confections: cakes, chocolate croissant, doughnut Sugar confections: chocolates, lollipops, ice-cream
J. Savoury Snacks	Any dried processed foods with added salt or seasoning. Includes all types of nuts or wheat and rice floured based foods	Peanuts, potato chips, pretzels
K. Bread Spread	Spreads used to enhance the flavour of breads or any type of foods. Includes plant-derived, yeast and dairy-based spreads	Marmite, butter, cheese, jam
L. Flavourings	Solid or liquid substances used to impart taste to food	Chilli sauce, fish sauce, soy sauce
M. Grains	Generally accepted whole grain foods and flours	Rice, *roti canai*, noodles, pasta, sago, pizza, oats, corn

2.2.1.2. Food Component of the FFQ: Additional Questions

The questions stated under the 'Others' category was a set of queries asking participants about additional information pertaining to their diet. The questions that were asked required participants to elaborate on the types of foods eaten. The name of the dishes and portion size of food from the Malaysia's three main ethnic groups' cultural diets which are Malay food, Chinese food and Indian food[2] were asked. Additionally, there were two questions about the type of foods eaten when the participant is feeling emotionally happy or stressed.

The questionnaire consists of food choice, and questions on portion size and the frequency of times the food is eaten. Questions pertaining to the intake of any additional supplements or medication were also included (refer to appendix B, Section 1). Respondents were also asked if they ate foods from restaurants serving foods outside what they would normally eat and if so, respondents were required to state from which ethnic background those restaurants were based on. Respondents were also asked what dish they most preferred when patronizing at a Malay, Chinese or Indian restaurant.

2.2.1.3. Summary of Frequency Intake and Portion Size

The scale for the frequency intake and its equivalent scale for analysis are illustrated in Table 3. Scales used in the present FFQ were adapted from the original questionnaire (Loy et al., 2011). The scale for the portion size varies according to the food item; for instance, if the food item is measured by scoop (e.g. rice, pasta) '1' denotes one scoop of the item. An example of food items and the scale used is illustrated in Table 4. Table 5 illustrates the formation of each subscale that was used in in the tabulation of participants' responses in the FFQ for frequency intake of the foods. The method and range of measurement used to indicate portion size for each food is shown in Table 6.

Table 4: Scales illustrating respective indicators in the FFQ.

Indicator in FFQ	Scale in Analysis
Never	0
Once a day	1
2-5 times a day	3.5 ([2+3+4+5]/4)
Once a week	0.14 (1/7)

[2] Indian cuisine was not researched as in depth as the other traditional ethnic cuisines (Malay and Chinese) in Malaysia.

2-5 times a week	0.5 ([{2+3+4+5}/4] /7
Once a month	0.03 (1/30)

Table 5: The formation of value in each subscale for indicators in FFQ.

Indicator in FFQ	Scale in Analysis	Formation of the value in each subscale
Never	0	The value of 0.
Once a day	1	The value of 1.
2-5 times a day	3.5	The sum of the values in the set from values 2 to 5, divided by their count.
Once a week	0.14	The value of 1 divided by the count of days in a week.
2-5 times a week	0.5	The total value of the sum of the values in the set from values 2 to 5, divided by their count; divided by the count of days in a week.
Once a month	0.03	The value of 1 divided by the count of days in a month.

Table 6: Range of measurement for each method respective to food item in the FFQ.

Food Item	Method of measurement	Range of measurement
Rice	Scoop	0-10
Porridge	Cup	0-10
Sea fish	Piece	0-10
Prawn	Portion	0-10
Sweet potato soup	Bowl	0-10
Popcorn	Handful	0-10

Figures 3a-3d show some examples of the images used to illustrate portion sizes for individual food items. Figure 4 shows a sample question in the FFQ.

Figure 3a: One scoop of cooked rice

Figure 3b: One cup of cooked porridge.

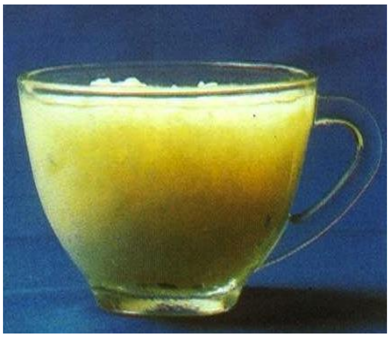


Figure 3c: One piece of fish.

Figure 3d: Three pieces of prawn. Size of prawn ranged from large, medium, to small.

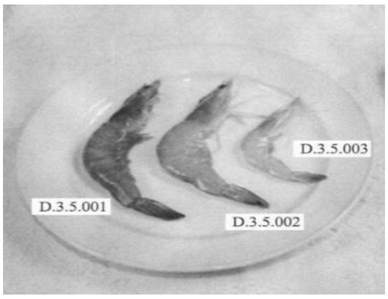
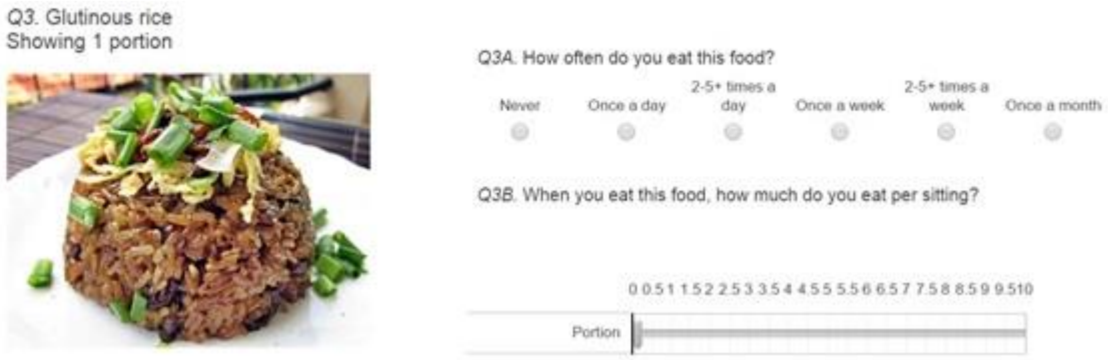


Figure 4: An example of a question in the FFQ where an image of a food item is presented (left) and the questions on participant's frequency intake and portion size for the food (right).



2.2.1.4. Additional Questionnaires: The State vs. Trait Anxiety Inventory (STAI) and The Three Factor Eating Questionnaire (TFEQ)

The STAI and TFEQ were used as control measures in this survey to ensure that we have a normal sample to base our findings on. State anxiety reflects the psychological and physiological transient reactions of an individual which are directly related to situations with an external stressor. In contrast, trait anxiety refers to a trait of personality, which describes individual differences that are related to a tendency to exhibit state anxiety (Leal, Goes, da Silva, & Teixeira-Silva, 2017). The STAI comprises of 40 questions. This 2-part questionnaire is divided into 2 sections whereby 20 items are for assessing trait anxiety and the following 20 items are for assessing state anxiety. All items were rated on a 4-point scale from “Almost Never” to “Almost Always”. Higher scores represent greater anxiety (Tilton, 2008).

To eliminate factors which could influence participant’s choice in food selection, it is important to investigate whether the individual is an emotional eater or a non-emotional eater, restrained eater or a non-restrained eater, and other classifications. Herman and Polivy (1975) state that if an individual is classified as a restrained eater, the individual will restrain themselves from selecting foods desired to lose weight or to prevent weight gain. By utilizing the Three-Factor Eating Questionnaire (TFEQ), we can distinguish restrained eater and non-restrained eaters among the participants. The TFEQ is a 51-item self-report questionnaire measuring food-related behaviour through three aspects: cognitive restraint of eating, disinhibition, and hunger (Anglé et al., 2009). The TFEQ has been used to successfully establish the eating patterns within a population in a study conducted by Lauzon et al. and Fleurbaix Laventie Ville Sante (FLVS) Study Group (2004).

The TFEQ measured 3 dimensions of human eating behaviour: cognitive restraint of eating (20 items), disinhibition (16 items), and hunger (15 items) (refer to Appendix B). The minimum score for factors I-II-III is 0-0-0, and the maximum possible score is 20-16-15. Part I includes items 1-36 which are rated either 1-True or 0-False. Part II includes items 37-51 and which rated on a 4-point scale except for item 50, which is rated on a 6-point scale.

2.2.2. Participants

A total of 320 responses were recorded for the survey (213 were excluded due to incomplete data set, n=107). All participants were studying at the University of Nottingham Malaysia. All participants were required to be residing in Malaysia and be within Malaysia whilst completing the questionnaire. The requirement for participants to be residing in Malaysia was included as the types of food in the questionnaire were characteristically found in Malaysia. All participants were Malaysian and were from one of the 2 main ethnic groups (Malay and Chinese). This study was approved by the UNMC Psychology Research Ethics Committee.

A total of 74 Chinese and 33 Malay participants completed the FFQ. Participants' age ranged from 18-27 years old (*M* = 19.85, *SD* = 1.84). Participants' age ranged from 18-27 years old (*M* = 19.82, *SD* = 1.84).

As mentioned, disordered eating behaviours and emotional stress were external factors which can manipulate food choice (Taboada et al., 2015; Tilton, 2008). The TFEQ and STAI scores were compared between groups to exclude possibilities of other biases towards foods in the FFQ. Participants did not differ in their scores on the TFEQ and showed no cognitive restraint of eating and hunger. Results showed no significant difference in State and Trait score between the two groups (State score as $t(106) = 0.90$, $p = .345$; Trait score as $t(99) = 0.09$, $p = .77$). Table 7 illustrates the means and standard deviations for the state and trait score for both groups separately.

Table 7: State and Trait scores for both groups.

Group	Chinese	Malay
State	*M* = 53.17, *SD* = 7.08	*M* = 52.09, *SD* = 7.33
Trait	*M* = 54.52, *SD* = 5.124	*M* = 52.52, *SD* = 5.52

2.2.3. Procedure

Informed consent was obtained from all participants before completing all the questionnaires via Qualtrics. The total time taken for participants to finish the entire FFQ plus the additional two questionnaires was approximately 90 minutes. Participants were encouraged to complete the questionnaire in one sitting. Participants received monetary compensation (RM5) in exchange for their participation in the experiment. Participants had the opportunity to clarify any questions before they begun the experiment. Participants were not informed of the nature of the experiment and were only debriefed after completing the questionnaire.

2.3. Results

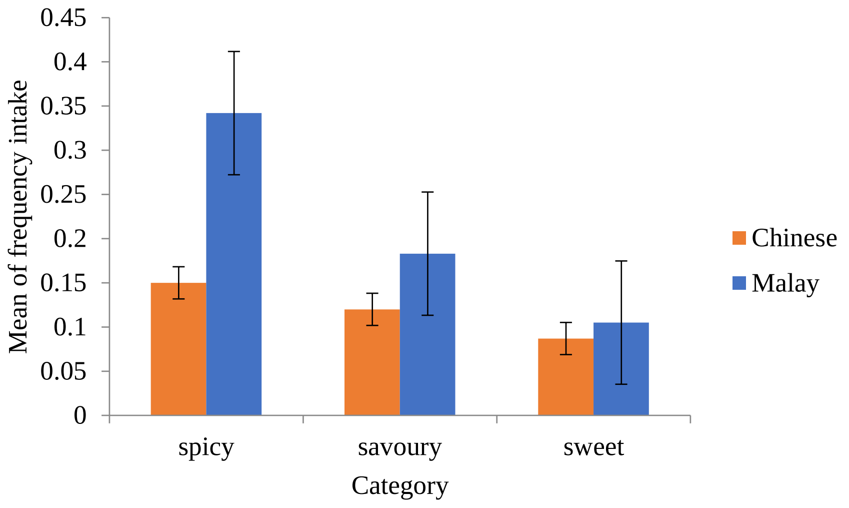
A Between Groups Analysis: Comparison in Frequency Intake

A 2 (ethnicity) x 3 (food category: spicy, savoury, and sweet) between subjects ANOVA[3] was calculated to measure differences in frequency intake. There was a main effect of ethnicity on the frequency intake of foods reported, $F(1, 105) = 13.56$, $p < .001$, $\eta_p^2 = 0.114$. Chinese participants reported a significantly lower mean for total frequency intake of foods. The assumption of sphericity was violated, as the group sizes were too different from each other, therefore corrections to the degrees of freedom were applied. A main effect for category type was observed, $F(1.17, 122.45) = 27.234$, $p < .001$, $\eta_p^2 = 0.206$. Pairwise comparisons (Bonferroni) showed significant differences between the spicy and sweet ($p < .001$), savoury and sweet ($p < .001$), and spicy and savoury ($p = .001$) categories. Both groups consumed spicy foods more frequently than sweet and savoury foods but consumed savoury foods more frequently than sweet foods.

There was an interaction between category type and ethnicity, $F(1.17, 122.45) = 8.94$, $p = .002$, $\eta_p^2 = 0.078$. Simple main effects analysis showed that there were significant differences in frequency intake between the groups for spicy ($p < .001$), savoury ($p = .001$), but not sweet foods ($p = .41$). Figure 5 shows the frequency intake for both groups across categories. The error bars illustrate the SE for each group. Malay participants (*M* = .34, *SD* = .44) consumed spicy foods more frequently than Chinese participants (*M* = .15, *SD* = .13). Malay participants (*M* = .18, *SD* = .13) also consumed savoury foods more frequently than Chinese (*M* = .12, *SD* = .07) in this study. Although Malay participants consumed sweet foods more frequently than Chinese participants, this difference in intake was not significant.

[3] All analyses in this thesis were carried out using an open-source statistical software program, JASP (Version 0.9.0.1.).

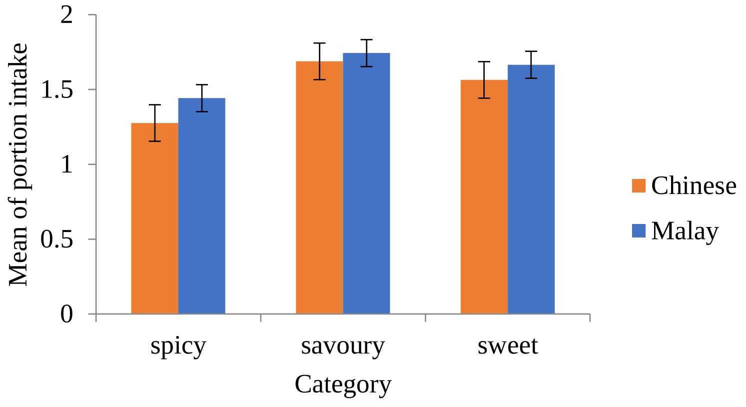
Figure 5: The mean of frequency intake of the three categories of food for both groups.



3.2.4.2. A Between Groups Analysis: Comparison in Portion Size

A 2 (group) x 3 (food category: spicy, savoury, and sweet) between-subjects ANOVA was calculated to measure differences in portion size. Results show that group type did not affect differences in portion sizes across categories, $F(1, 105) = .27$, $p = .603$. There was an effect for category type, $F(1.63, 170.66) = 19.60$, $p < .001$, $\eta_p^{2} =$ 0.157. Pairwise comparisons (Bonferroni) showed that portion intake differed significantly between spicy and savoury ($p < .001$), spicy and sweet ($p < .001$), and savoury and sweet ($p = .007$) categories. Both groups consumed significantly larger portion sizes of savoury foods compared to spicy foods. Sweet foods were consumed in larger portion sizes than the portion intake of spicy foods. Savoury foods were eaten in significantly smaller portion sizes compared to the intake of sweet foods by both groups. There was no interaction between category and group type for portion intake, $F(1.63, 170.66) = .345$, $p = .664$. Figure 6 shows the mean of portion intake of the three categories of food for both groups.

Figure 6: The mean of portion intake of the three categories of food for both groups.



3.2.4.3. Comparisons Across Categories

To understand the reported food consumption further, additional analysis was carried out according to food category. The mean frequency intake and portion size for each group was compared according to category type. Data was compiled according to the type of dish in each category.

3.2.4.3.1. Carbohydrates

Figures 7 and 8 show the mean between the two groups for frequency of food intake and the quantity of portion size reported by the participants who completed the FFQ. The error bars illustrate the SE for each group.

Figure 7: Illustrating the mean for the frequency of food intake reported by Chinese and Malay participants for all carbohydrates.

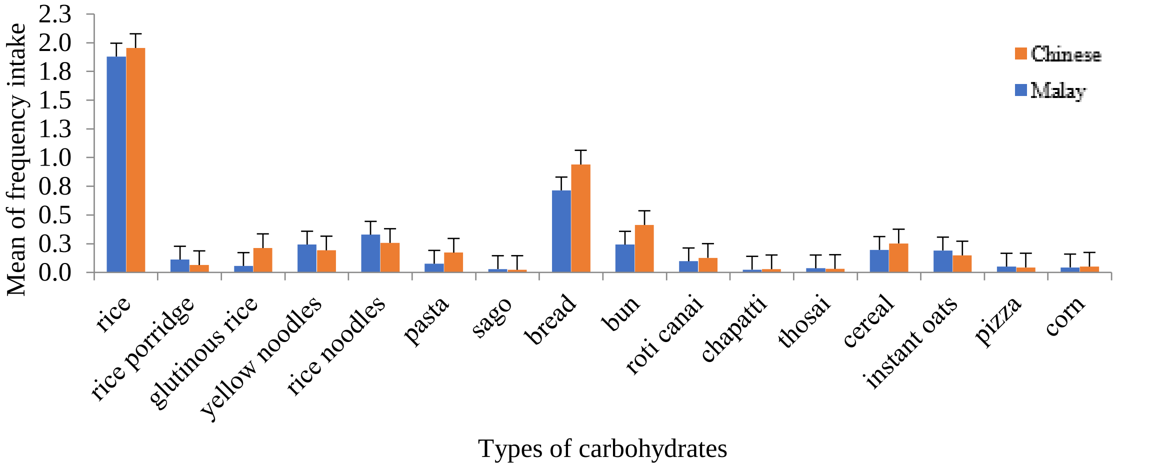
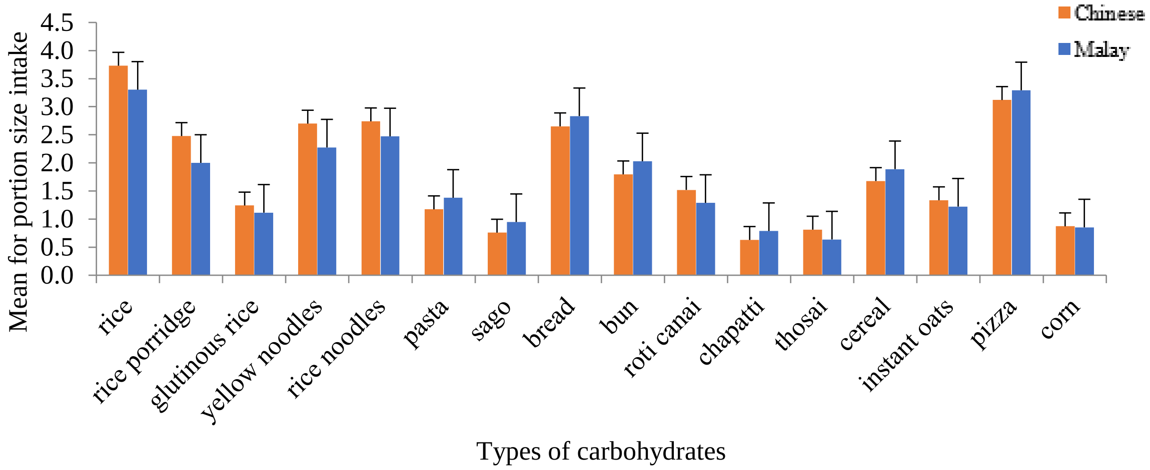


Figure 8: Illustrating the mean for the portion size of food intake reported by Chinese and Malays for all carbohydrates.



A one-way between-subjects ANOVA measuring group differences for carbohydrates show no significant difference in frequency intake ($F(1, 105) = 1.51$, $p = .22$), and portion size ($F(1, 105) = .26$, $p = .61$). Although the differences eating behaviour were not significant, Chinese participants ($M = 1.86$, $SD = .89$) consumed slightly larger portions of total carbohydrates compared to Malay participants ($M = 1.77$, $SD = .55$). In comparison, Malay participants ($M = .31$, $SD = .13$) consumed carbohydrates slightly more often compared to Chinese participants ($M = .27$, $SD = .15$).

One-way between-subjects ANOVAs were calculated for both groups for frequency of each of the food items under carbohydrates eaten as well as the portion size per time of consumption. Table 8 illustrates the findings for significant differences in individual carbohydrate dishes. Table 9 shows types of carbohydrate dishes which differed significantly between the two ethnic groups.

Table 8: Results from separate one-way between-subjects ANOVA for carbohydrate dishes.

Carbohydrate	Frequency	Portion Size
Glutinous Rice	$F(1, 105) = 4.15$, $p = .04$*	$F(1, 103) = .46$, $p = .5$
Pasta/Spaghetti	$F(1, 105) = 11.41$, $p = .001$*	$F(1, 105) = 1.66$, $p = .2$

Table 9: Carbohydrate dishes which differed significantly between the two ethnic groups.

Food item	Chinese	Malay
Glutinous Rice	($M = .06$, $SD = .14$)	($M = .21$, $SD = .63$)
Pasta/Spaghetti	($M = .08$, $SD = .1$)	($M = .17$, $SD = .2$)

3.2.4.3.2. Protein

A one-way between subjects ANOVA measuring group differences for protein intake showed a significant difference in frequency intake ($F(1, 105) = 7.39$, $p = .008$, $\eta_p^2 = 0.066$), where Malays ($M = .21$, $SD = .15$) reported a higher average of frequency than the Chinese participants ($M = .15$, $SD = .09$). There were no significant differences in the average portion size ($F(1, 105) = .05$, $p = .82$), and in the overall average consumption ($F(1, 105) = 2.87$, $p = .09$), of protein between the groups. Although the differences in eating behaviour were not significant, Malay participants ($M = 1.77$, $SD = .58$) consumed slightly larger portions of protein compared to Chinese participants ($M = 1.75$, $SD = .75$). In addition, Malay participants ($M = .39$, $SD = .34$) had a slightly higher average consumption of protein compared to Chinese participants ($M = .28$, $SD = .28$).

One-way between-subjects ANOVAs were calculated for both groups for frequency of each of the food items under carbohydrates eaten as well as the portion size per time of consumption. Table 10 illustrates the findings for significant differences between the groups for the individual carbohydrate dishes. Table 11 shows types of protein dishes which differed significantly between the two ethnic groups.

Table 10: Results from separate one-way between-subjects ANOVA for protein dishes.

Protein	Frequency	Portion Size
Chicken	$F(1, 105) = 5.74$, $p = 0.02$*	$F(1, 105) = 2.51$, $p = .17$
Beef	$F(1, 105) = 6.83$, $p = 0.01$*	$F(1, 81) = .01$, $p = .91$
Mutton	$F(1, 105) = 5.84$, $p = .02$*	$F(1, 69) = 1.46$, $p = .23$
Burger patty	$F(1, 105) = 5.22$, $p = .02$*	$F(1, 93) = 1.36$, $p = .25$
Sausages	$F(1, 105) = 9.89$, $p = .002$*	$F(1, 95) = .51$, $p = .48$
Nuggets	$F(1, 105) = 4.43$, $p = .04$*	$F(1, 83) = 1.62$, $p = .21$
Duck	$F(1, 105) = 15.11$, $p < .001$*	$F(1, 53) = 13.43$, $p < .001$*
Sea fish	$F(1, 105) = 4.11$, $p = .05$*	$F(1, 88) = .05$, $p = .83$
Anchovies	$F(1, 105) = 6.24$, $p = .01$*	$F(1, 94) = 2.75$, $p = .1$
Shellfish	$F(1, 105) = 4.42$, $p = .04$*	$F(1, 57) = .32$, $p = .58$
Fresh squid	$F(1, 105) = 9.09$, $p = .003$*	$F(1, 79) = 1.961e-4$, $p = .99$
Fish cracker	$F(1, 105) = 9.7$, $p = .002$*	$F(1, 77) = 6.1$, $p = .02$*
Dried bean curd	$F(1, 105) = 2.84$, $p = .1$	$F(1, 81) = 4.23$, $p = .04$*

Table 11: Protein dishes which differed significantly between the two ethnic groups.

Food item	Chinese	Malay
Chicken	($M = .42$, $SD = .43$)	($M = .72$, $SD = .81$)
Beef	($M = .09$, $SD = .15$)	($M = .29$, $SD = .61$)
Mutton	($M = .02$, $SD = .04$)	($M = .06$, $SD = .12$)
Burger patty	($M = .06$, $SD = .08$)	($M = .01$, $SD = .12$)
Sausages	($M = .11$, $SD = .16$)	($M = .22$, $SD = .22$)

Nuggets	(*M* = .22, *SD* = .61)	(*M* = .07, *SD* = .13)
Duck	Freq. (*M* = .02, *SD* = .03)	(*M* = .002, *SD* = .01)
	Portion (*M* = 2.87, *SD* = 1.85)	(*M* = .64, *SD* = 1.08)
Sea fish	(*M* = .15, *SD* = .21)	(*M* = .31, *SD* = .62)
Anchovies	(*M* = .18, *SD* = .19)	(*M* = .47, *SD* = .99)
Shellfish	(*M* = .03, *SD* = .06)	(*M* = .07, *SD* = .14)
Fresh Squid	(*M* = .04, *SD* = .07)	(*M* = .1, *SD* = .14)
Fish cracker	(*M* = .03, *SD* = .07)	(*M* = .1, *SD* = .17)
	(*M* = 3.78, *SD* = 3.55)	(*M* = 5.76, *SD* = 3.28)
Dried bean curd	(*M* = 1.71, *SD* = 1.19)	(*M* = 1.16, *SD* = .87)
Tempe	(*M* = .02, *SD* = .06)	(*M* = .06, *SD* = .12)

3.2.4.3.2. Fruits and Vegetables

The food items in this section consists of all fruits, fruit juice and vegetables in the FFQ. A one-way between-subjects ANOVA measuring the group differences for fruits and vegetables intakes was carried out. There was no significant group difference in the average consumption ($F(1, 105) = 4.964$, $p = .98$), frequency intake ($F(1, 105) = .018$, $p = .89$) and portion size ($F(1, 105) = .917$, $p = .34$) between the groups for vegetable intake. To view the analysis of group differences in fruit intake, please refer to section 3.2.4.3.5.2. (Naturally Sweet Items). Table 12-13 illustrates the average consumption quotient, frequency intakes and portion sizes of both groups for the intake of vegetables and fruits, respectively.

Table 12: Average consumption quotient, frequency intake and portion size of both groups for the intake of vegetables reported on the FFQ.

Group	Average		
	Frequency Intake	Portion Size	Consumption Quotient
Chinese	(*M* = .05, *SD* = .23)	(*M* = 1.82, *SD* = 1.03)	(*M* = .27, *SD* = .52)

Malay	(*M* = .06, *SD* = .24)	(*M* = 1.64, *SD* = .7)	(*M* = .27, *SD* = .53)

Table 13: Average consumption quotient, frequency intake and portion size of both groups for the intake of fruits reported on the FFQ.

Group	Average Frequency Intake	Portion Size	Consumption Quotient
Chinese	(*M* = .08, *SD* = .08)	(*M* = 1.86, *SD* = 1.06)	(*M* = .17, *SD* = .24)
Malay	(*M* = .08, *SD* = .06)	(*M* = 1.97, *SD* = .83)	(*M* = .14, *SD* = .14)

According to the Malaysian RNI for fruits and vegetables, the average Malaysian adult should be consuming 3 servings of vegetables and 2 servings of fruits per day. Based on the findings, both groups did not meet their RNI for fruit and vegetable intake.

3.2.4.3.3. Spicy Food Items

The food items in this section consist of pepper/capsicum, sambal belacan, and chilli sauce. A one-way between-subjects ANOVA measuring the group differences for intake of the mentioned spicy items. Results show that there was a significant difference in frequency intake between the groups, $F(1, 105) = 11.61$, $p < .001$, $\eta p2 = 0.100$. Malay participants (*M* = .34, *SD* = .44) consumed the spicy items more frequently than Chinese participants (*M* = .15, *SD* = .13). Although Malay participants (*M* = 1.44, *SD* = .86) consumed larger portions of the spicy items than Chinese participants (*M* = 1.28, *SD* = 1.19), this difference was not significant, $F(1, 105) = .53$, $p = .47$. Figures 9 and 10 show the frequency intake and portion size in each group for the individual spicy food items.

Figure 9: Illustrating the mean for the portion of food intake reported by Chinese and Malay participants for all spicy items.

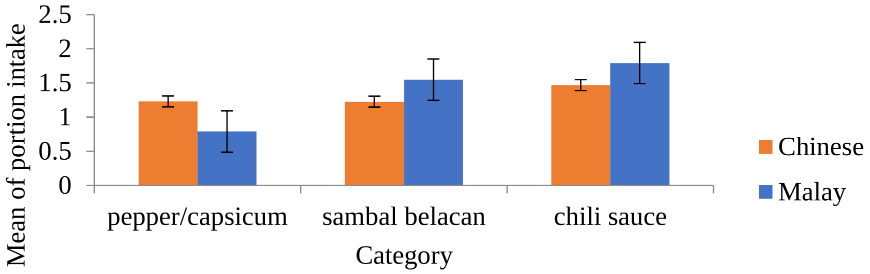
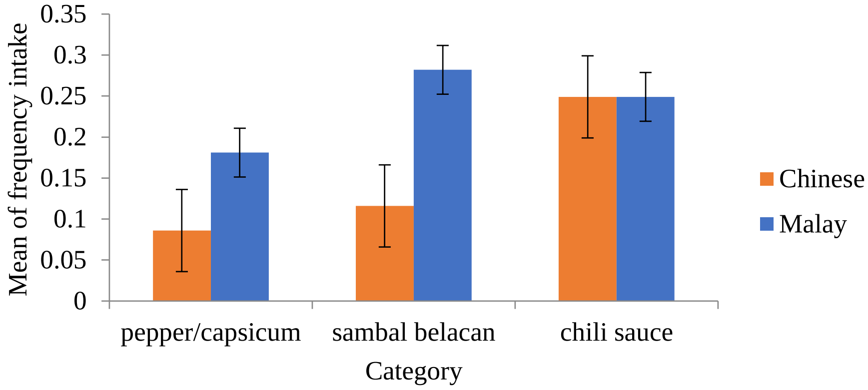


Figure 10: Illustrating the mean for the frequency of food intake reported by Chinese and Malay participants for all spicy items.



3.2.4.3.4. Savoury Food Items

The food items in this section are savoury snacks, condiments (sauces) such as cincalok, and soy sauce. The food items in this section also consist of foods which are eaten with rice which is a staple food among Malaysians (Norimah et al., 2008). This is because a staple meal of rice is eaten with variants of protein such as chicken, egg, or beef (Aris et al., 2014; Institute for Public Health, 2014), also, all forms of protein have sodium. For a full list of items included in this section, please refer to appendices (Appendix A, Table 13).

A one-way between-subjects ANOVA measuring the group differences for intake of the savoury items. Results show that there was a significant difference in the mean frequency intake of savoury items between the groups, $F(1, 105) = 11.27$, $p = .001$, $\eta_p^{2} =$ 0.097. Malay participants ($M = .18$, $SD = .13$) had a higher mean frequency intake of savoury items compared to Chinese participants ($M = .12$, $SD = .07$). There were no significant differences between the groups for mean portion size of savoury items, but Malay participants ($M = 1.74$, *SD* = .53) were reported to have a slightly higher mean of portion intake than Chinese participants (*M* = 1.69, *SD* = .82), $F(1, 105) = .128$, $p = .722$.

3.2.4.3.5. Sweet Food Items

Food items in this category have been divided into two sections which are artificially sweetened and naturally sweet items. The food items in the artificially sweetened section comprise of foods which have been processed, or have had artificial sweeteners added such as brownies, condensed milk, and jam. For a full list of items included in each of the two sections, please refer to appendix A (Table 4-5). The food items in the naturally sweet items comprises of foods which are naturally sweet such as fruits.

3.2.4.3.5.1. Artificially Sweetened Foods

A one-way between-subjects ANOVA measuring the group differences for intake of artificially sweetened foods. Results show that there was no effect of group type for frequency intake, $F(1, 105) = 0.683$, $p = .410$. Malay participants (*M* = .13, *SD* = .09) consumed artificially sweetened foods more frequently than Chinese participants (*M* = .1, *SD* = .06). There was no significant difference between the groups for portion size, $F(1, 105) = .45$, $p = .5$; but Malay participants (*M* = 1.36, *SD* = .5) reported slightly higher average portions of artificially sweetened foods than Chinese participants (*M* = 1.26, *SD* = .73).

3.2.4.3.5.2. Naturally Sweet Items

A one-way between-subjects ANOVA measuring the group differences for intake of naturally sweet items show no significant difference in frequency intake ($F(1, 105) = .002$, $p = .97$), and portion size ($F(1, 105) = .28$, $p = .6$). Although the difference was not significant, Malay participants (*M* = 1.97, *SD* = .83) consumed slightly larger portions on average compared to Chinese participants (*M* = 1.86, *SD* = 1.06). Both Chinese (*M* = .08, *SD* = .08) and Malay (*M* = .08, *SD* = .06) participants consumed fruits similarly often.

3.2.4.4. Reported Foods Excluded from FFQ

Foods that participants eat which were not included in the FFQ included both beverages and variants of the foods already stated in the FFQ. A total of 28 participants (19 Chinese, 9 Malays) reported having had foods which were not included in the FFQ. There was one participant who did not specify the foods which were not included in the FFQ. The table below (Table 14) shows the breakdown of foods from both groups who reported having items which were not included in the FFQ.

It should be noted that participants had also recorded food items which were already included in the FFQ such as rice and biscuits. The number of counts per food items consumed by the participants does not correspond with the total number of participants having reported to have eaten that food item for all items. This is because there were some participants who had reported more than one food item in this section.

Table 14: Foods Reported as Not Included in the FFQ.

Food Items	Specified Foods
1. Condiments	Mayonnaise (n=2), wasabi (n=1)
2. Protein	Pork (n=5), salmon (n=1), seafood tofu (n=1), bacon (n=2)
3. Carbohydrates	Wholemeal bread (n=1), wheat bran (n=1), bread with raisins (n=1), bread (not stated) (n=2), vermicelli (n=1), egg noodles (n=3), yellow noodles (n=1), pasta (n=1), rice (n=1), muesli (n=1), biscuits (n=1)
4. Variants - sandwich	Chicken (n=1), ham (n=1)
5. Beverages	Coffee (n=1), Milo (n=1), tea (n=1), soya bean (n=2), green tea (n=1), lemon tea (n=1), chocolate drink (n=1)
6. Fruits	Passion fruit (n=1), dried prunes (n=1), raisins (n=1)
7. Pulses	Dahl (n=1), lentils (n=1)
8. Dairy	Cheese (n=1)
9. Vegetables	Cucumber (n=1), tomato (n=1), lettuce (n=1), seaweed (n=1)

3.2.4.5. Foods Eaten According to Mood (Stressed/Happy)

Participants responses which did not specify foods eaten were excluded from the analysis. Table 15 illustrates scores given to each response given. Participants mostly reported chocolate, ice-cream, and other confectionaries as foods eaten when they were feeling stressed or happy.

Table 15: Scores according to food category.

Score	Food Category	Participants Responses
0	None	No responses given
1	Any	‘anything’
2	Spicy	Assam laksa, ramen
3	Savoury	Burger, pizza
4	Sweet	Chocolate, cakes, cookies
5	Control Foods	Fruit
6	Spicy and Sweet	Combination of spicy and sweet foods
7	Savoury and Sweet	Combination of savoury and sweet foods
8	Spicy and Savoury	Combination of spicy and savoury foods
9	Sweet and Control Foods	Combination of sweet and control foods

Malay participants preferred eating sweet foods (55.6%) the most when stressed, followed by a combination of savoury and sweet foods (27.8%). Chinese participants also preferred eating sweet foods (45%) the most when feeling stressed. Table 16 illustrates the percentage of responses given when participants feel stressed. Both the groups made the most preferences for sweet foods when feeling happy (Malays: 36.1%, Chinese: 41.3%). Table 17 shows the percentage of responses given by participants on foods eaten when they feel happy. A summary of participants' food choices when feeling stressed and happy is included in Appendix A (Table 14-15).

Table 16: Percentage responses of foods eaten when participants feel stressed.

Group	Category	Frequency	Percent
Malay	None	2	5.6
	Any	3	8.3
	Spicy	0	0.0
	Savoury	1	2.8
	Sweet	20	55.6
	Control Foods	0	0.0
	Spicy and Sweet	10	27.8
	Savoury and Sweet	0	0.0
Chinese	None	16	20.0
	Any	7	8.8
	Spicy	1	1.3
	Savoury	10	12.5
	Sweet	36	45.0
	Control Foods	1	1.3
	Spicy and Sweet	8	10.0
	Savoury and Sweet	1	1.3

Table 17: Percentage responses of foods eaten when participants feel happy.

Group	Category	Frequency	Percent
Malay	None	3	8.3
	Any	7	19.4
	Spicy	0	0.0
	Savoury	9	25.0
	Sweet	13	36.1
	Control Foods	0	0.0
	Spicy and Sweet	0	0.0
	Savoury and Sweet	4	11.1
Chinese	None	10	12.5
	Any	19	23.8
	Spicy	1	1.3
	Savoury	11	13.8
	Sweet	33	41.3
	Control Foods	2	2.5
	Spicy and Sweet	1	1.3
	Savoury and Sweet	3	3.8

2.4. Discussion

Results show that Malay participants have a higher intake of spicy tasting foods for both frequency and portion size compared to Chinese participants. The three foods (pepper/capsicum, sambal belacan, and chilli sauce) are ingredients that are most commonly found in Malaysian cooking. However, it poses many questions concerning the flavour components in each food for both participants. For instance, pepper/capsicum; which in its natural form gives food its ‘spicy’ flavour because of its levels of capsaicin; is only consumed in little quantities by Malay participants. If there really is a disposition for spicy foods among Malays, this inclination should have been reflected for capsicums. It suggests that for the Malay participants, although there is a general inclination towards spicy foods, the food being eaten needs to have other taste properties apart from spiciness. Basis for this is that the taste component of sambal belacan is more inherently salty/savoury and that chilli sauce is sweet in addition to both condiments being frequently added to foods which are spicy tasting in flavour. It is proposed that among the Malay participants, there is a wider taste palette in their preferential selection of foods-especially spicy tasting foods, compared to Chinese participants.

Additionally, Malay participants also had higher intakes for savoury tasting items compared to Chinese participants for both frequency and portion size, although this difference was not significant for portion size. The results showing this was surprising, as it was predicted that there would be a greater consumption intake of savoury tasting foods among Chinese participants in comparison to Malay participants Although we excluded pork as a protein in the FFQ, only few Chinese participants reported eating it under the section of excluded foods in the FFQ. Therefore, the exclusion of pork as a potential source of sodium would not have affected the findings as only five Chinese participants have reported to consume pork on a regular basis.

Furthermore, these findings show that overall, the Malay participants have a higher total energy intake on average compared to Chinese participants. When further analysis was carried out, results showed that rice as the staple food among Malaysians, was consumed in higher amounts by Chinese participants. However, there is a wider variety of the type of carbohydrates among Malay participants in comparison to Chinese participants- suggesting that although rice is still being consumed as the staple food among the Malay participants, foods like pizza and bread are also consumed in large amounts by this group. In this, the FFQ tells us that there is a wider selection in the selection of foods among the Malay participants compared to the Chinese participants when it comes to carbohydrate intake. It suggests that the Malay participants prefer wheat-based products which are out of the traditional Malay cuisine compared to the Chinese participants who still pose a greater preference towards noodles which is still a traditional food in Chinese cooking. The findings are in support with existing literature of the rise in intake of wheat-based foods like bread and pasta among Malays (Mirnalini et al., 2008; Zalilah et al., 2008). It poses the question to whether the Malay participants seem less ‘traditional’ in their selection of foods and consume more western influenced carbohydrates compared to Chinese participants who seem to enjoy more of local, traditional cuisine such as noodles and rice porridge.

The trend for sweet foods was difficult to analyse. Results showed that the Malay participants consumed artificially sweet foods in larger quantities and more often compared to Chinese participants, however these findings were not significant. The mean portion size intake and frequency intake for both groups for artificially sweet foods were considerably smaller, compared to the other categories of food. Amarra, Khor and Chan (2016) reported that most sugar intake is found in beverages such as tea and coffee as Malaysians like to enjoy them with sweetened condensed milk and added sugars. Therefore, we included the possibility that perhaps because we excluded sweetened beverages, this could have been where both groups enjoy their sugar intakes. Further, conducting a singular self-reported questionnaire was not sufficient to determine sugar intake levels. Multiple 24 hour recalls and a biomarker such as a 24-hour urinary sucrose and fructose excretion should be carried out concurrently to not only obtain an accurate measurement, but to also identify which food sources contained added sugar (Amarra, Khor & Chan, 2016).

The trends observed from the findings reveal that although Malay participants consume foods which are outside of the scope of Malay traditional cuisine, flavour components- especially spice and sweet tastes; are arguably influenced by frequent exposure with leads to the formation of a diet which is high in spice, sugar, and sodium. This diet does help explain as to why Malays are more prevalent than Chinese for diabetes, obesity, and other NCDs (Rampal, Rampal, Azhar, & Rahman, 2008; Sidik & Rampal, 2009; Wan Nazaimoon et al., 2013). There is little revelation towards Chinese participants' dietary habits apart from the unexpected finding of low sodium intake which contrasts with previous literature -whereby Chinese have higher amounts of sodium in their diet compared to Malays (Mirnalini et al., 2008). The lack of consistent differences could be due to a low sample size, When calculating sample size using G*Power3 (Faul, Erdfelder, Lang, & Buchner, 2007) to test the difference between the two group means using a two-tailed test, a medium effect size (d = .285), and an alpha of .01. Result showed that a total sample of 82 participants with two equal sized groups of n = 41, was required to achieve a power of .809, this means the study was underpowered and the results must be treated with caution.

The consumption patterns for both groups did not meet the RNI-especially the consumption for fruits and vegetables. This will be discussed further later, please refer to

Chapter 7. As the FFQ was conducted on university undergraduate students; the factor of accessibility and affordability could have limited participants' actual eating behaviours. University students are bound by the local eateries surrounding the university and are therefore restricted to what they can consume daily (Gan, Mohd Nasir, Zalilah, & Hazizi, 2011; Ganasegeran et al., 2012). For this reason, we propose that selection-and ultimately food intake would differ if foods desired by both groups were made accessible logistically and pricewise. We propose that a better indication of the eating behaviours of both groups would be achieved if we could account for situational variables that confine preferential selection.

Lastly, the FFQ takes approximately 90 minutes to complete. it could be argued that both groups of participants would have felt the questionnaire was too long, resulting in an inaccurate account of their eating habits as participants would be anxious to complete the questionnaire. Additionally, it could also be argued that participants are not good at estimating the portion size of their food. Participants could have under/overestimated the amount that they consume on a regular basis. It was suggested that for future studies, a combination of methods as previously addressed in the introduction be adopted in order to compile an accurate account of food consumption habits.

Chapter Three: Cultural Differences in the Selection of Having Either Cheesecake or Curry Laksa.

3.1. Introduction

The aim of this experiment is to investigate taste preferences for sweet, savoury or spicy foods by removing accessibility as a factor which could influence selection, using a two-alternative forced-choice task (2AFC). The 2AFC paradigm is typically used to discreetly measure factors underlying decision-making, related to food choice (Boek, Bianco-Simeral, Chan, & Goto, 2012; Charbonnier, Laan, Viergever, & Smeets, 2015a; Mojet, Christ-Hazelhof, & Heidema, 2001). Charbonnier et al. (2015) employed the 2AFC method to investigate preference for high- and low-calorie foods in a normal sample. Food images consisting of both sweet and savoury snacks of high and low caloric content were presented either in pairs of food (high- and low-calorie) and non-food stimuli or high- or low-calorie food stimuli. Participants were instructed to choose the product of which "you most want to eat at this moment" each time a food pair appeared and choose one of the products each time a non-food pair appeared.

The results showed that there was a greater preference for selecting food stimuli compared to non-food choices despite the absence of hunger among the participants. Furthermore, participants showed a surprisingly greater preference for low calorie foods than high calorie foods. Charbonnier et al. (2015) identified brain areas which had a greater activation when participants performed a 2AFC task between food (high- and low-calorie foods) and non-food stimuli using functional magnetic resonance imaging (fMRI). Charbonnier et al. (2015) proposed that participants chose more low than high calorie foods, because participants were in a fed state and physiologically not inclined to select foods which are high in energy content. The posterior part of the right superior temporal sulcus (STS) was the only brain region which was more active when high calorie choices were presented compared to when low calorie choices were presented.

Previous research has shown that ethnicity can influence eating behaviour due to specific food-related beliefs and predisposed preferences to certain food types (Kumanyika, 2008; Mela, 1999, see Chapter 1 for further information). This chapter focuses on how ethnicity (i.e., between Malay and Chinese) might influence food preferences, in terms of what food people find to be palatable when in a satiated mode. Additionally, we removed situational factors, such as accessibility to food, cost, and the social presence of others, that could influence food selection among participants (Birch, 2016; Robinson, Blissett, & Higgs, 2012).

Findings from our FFQ provided basis for us to investigate preferential food selection between the two ethnic groups further. Spicy foods were introduced as a preferred food in this study as it is believed that many Malay dishes contain levels of capsaicin (see Chapter 2 for further details). Capsaicin is defined as the main pungent ingredient in hot chilli peppers (Caterina et al., 1997), with its levels serving as an index of spiciness level in food. Both groups would select significantly more of spicy (e.g., chicken curry), savoury (e.g., hot dog bun) and sweet (e.g., chocolate) foods over control food items (i.e., fruit and vegetables). Both groups should exhibit the greatest preference for savoury foods compared to the other categories of food, more so for Chinese participants when compared to Malay participants.

These predictions stem from literature that show both the Malay and Chinese population consume a diet, which is high in caloric content specifically in the intake of rice and fatty foods, but low in the intake of fruits and vegetables (Hasnan & Ahmad, 2014; Norimah et al., 2008). In a food pairing of spicy foods with the other categories (savoury, sweet), it is open to which foods would be selected the most by either ethnic group. This is because savoury foods are present in both ethnic groups' traditional cuisines.

3.2. Method

3.2.1. Design

Ethnicity was the between-subjects factor (Malay vs Chinese) and four categories were the within-subjects factor (spicy vs savoury vs sweet vs control). The dependant variable was which category of foods were selected by the participants.

3.2.2. Participants

Power analysis was conducted using G*Power3 (Faul, Erdfelder, Lang, & Buchner, 2007) to test the difference between the groups using a two-tailed test, a medium effect size (d= .50), and an alpha of .05. Result showed that in order to get a power of .82, a sample size of twenty-eight participants, with fourteen participants per ethnic group.

Thirty students from the University of Nottingham Malaysia Campus volunteered for this experiment. Participants comprised of fifteen Chinese (nine females and six males) and fifteen Malay (ten females and five males) students with an age range from 17-22 years (M =

19.43, *SD* = 1.14). All participants were instructed to have a meal before participating in the experiment. This measure was carried out to ensure that physiological signals such as hunger would be removed as a factor which could influence food choice (Charbonnier et al., 2015). Participants received monetary compensation (RM5) in exchange for their participation in the experiment. All participants had normal or corrected to normal vision and did not have colour-blindness. Informed consent was obtained from all participants. The experimental procedures were approved by the Faculty of Science Research Ethics committee, University of Nottingham Malaysia.

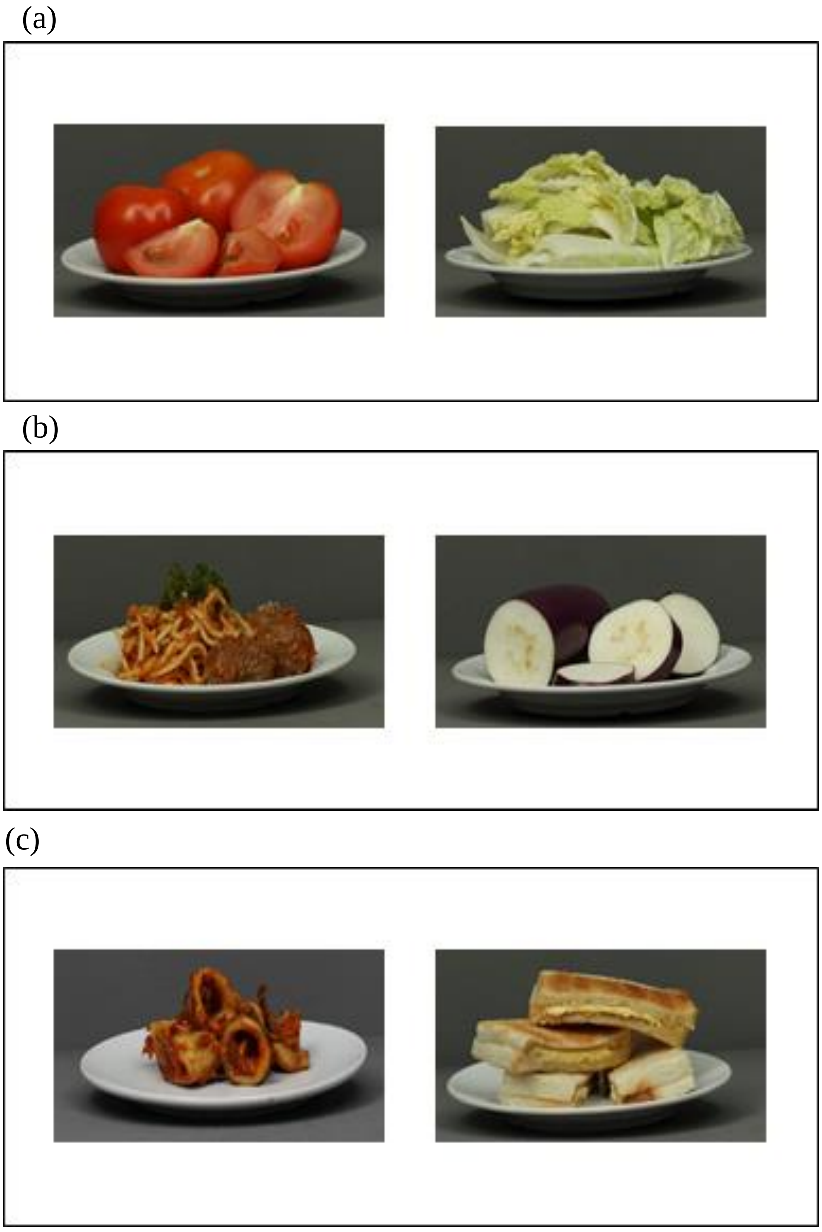
3.2.3. Stimuli

A total of 160 images of four types of food-stimuli were used and were divided into four experimental blocks each containing 40 trials. Nutritional content of stimuli from all categories is included in Appendix B (Table 1-4b). There were two types of experimental trials which were 120 mismatched (20 sweet and savoury, 20 savoury and spicy, 20 spicy and sweet, 20 controls and savoury, 20 controls and spicy, 20 controls and sweet pairings), and 40 matched (10 spicy, 10 savoury, 10 sweet, 10 control) trials. The mismatched trials consisted of image pairs which were categorically different (e.g., spicy and sweet food). The matched trials consisted of image pairs which were categorically the same (e.g., sweet and sweet food). Each experimental block consisted equal numbers of the mismatched and matched trials.

The images collected were photographs of spicy food, savoury food, and sweet food (see Appendix B Table 1-4b for dietary composition of the savoury, spicy, sweet, and the control food items respectively). All stimuli used in the experiment are included in Appendix B (Figure 6).

Images of raw vegetables and fruits served as control items. All images of food-stimuli were scaled to 861 x 440 pixels and were presented side by side on the screen. Figure 1 (a-b) shows two examples of the control trials. Figure 1c shows a mismatched trial in the experiment. Figure 1c shows an example of a mismatched trial (spicy vs. sweet). Curried squid on the left and kaya toast on the right.

Figure 11: Examples of control trials (a) of a control trial/matched trial for control items; condition was control vs. control. Cut up and whole pieces of tomato on the left and *chinese cabbage* on the right and (b) of a control trial/mismatched; condition was savoury vs. control. (c) mismatched trial; condition was spicy vs. sweet.

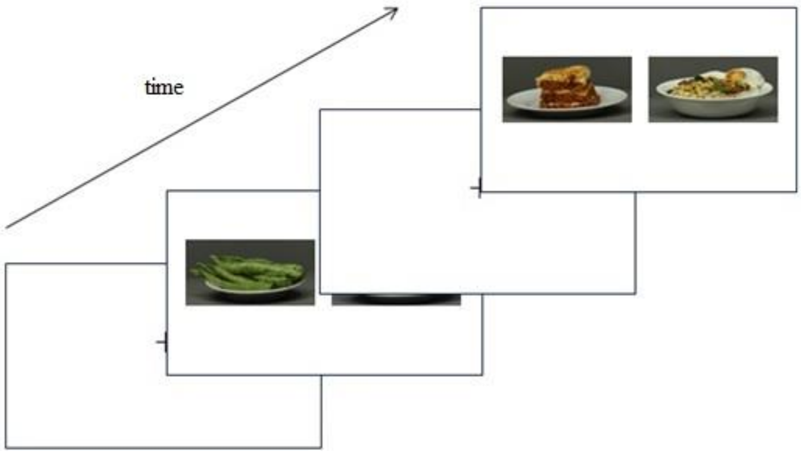


Matched trials were created was to ensure that participants did not prefer specific foods as we aimed to measure preferences in taste (i.e., savouriness, spiciness, sweet and not specific types of food). Control trials show food pairing compositions of food stimuli from the spicy, savoury and sweet food category with a food stimulus from the control category or both from the control category.

3.2.4. Procedure

Participants first gave their informed consent before completing six practice trials which were images pairs of spicy vs. savoury, savoury vs. sweet, sweet vs. spicy, control vs. spicy, control vs. savoury, and control vs. sweet. Each trial began with a fixation cross which lasted for 1000 milliseconds. A pair of images were displayed on the screen until participants responded by choosing their preferred food item. Participants were told to respond as quickly as possible. Participants were asked to select either key 'f' to indicate their selection of the food stimuli which was shown on the left of the screen or key 'j' to indicate their selection of the food stimuli which was shown on the right of the screen. For example; if the condition of the trial was savoury and spicy, 'f' was selected to refer to the image on the left (savoury food image) and 'j' was selected to refer to the image on the right (spicy food image).All image pairs were displayed at random. The position of the images was counterbalanced, and the order of the trials was randomized individually for each participant. Figure 12 shows an example of the experimental trials starting with a fixation cross.

Figure 12: An example of the experimental trials on the 2AFC task.



3.3. Results

There were no cut-offs for minimum and maximum time it took to respond as both groups took too long to respond. The median of reaction times was 1795ms (Malay: 1885 ms, Chinese:1803 ms). A one-way between-subjects ANOVA and t-tests were conducted to measure to see if any group differences emerged. Participants from both groups did not differ significantly in their RTs for the 2AFC task, $F(1, 28) = .589$, $p = .449$, $\eta_p^2 = .021$, suggesting that both groups did not differ in their response time to the food pairings. Table 18 shows the means, standard deviation, standard error of mean, and range for RTs of Chinese and Malay participants in this study. The median time for Chinese participants was 1771 ms, compared to a median of

1834 ms for Malay participants. No further analysis was carried out due to the RTs of both groups being too varied.

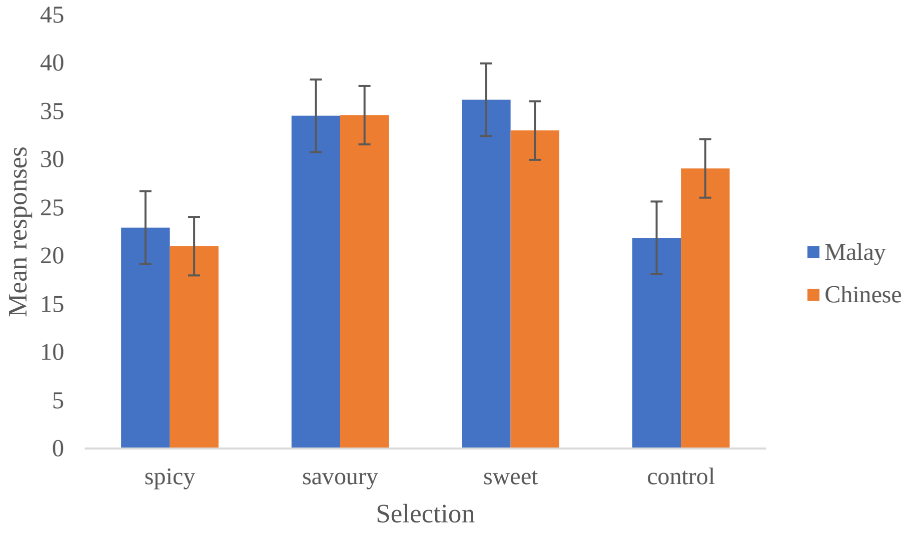
Table 18: RTs in ms for both groups on the 2AFC task.

	Mean, standard deviation	Standard error	Range
Total	(*M* = 1844, *SD* = 290.9)	53.12	1299 - 2475
Malay	(*M* = 1885, *SD* = 328.6)	84.85	1462.04 - 2475.46
Chinese	(*M* = 1803, *SD* = 252.4)	65.18	1298.53 - 2328.91

A 2 (group: Chinese or Malay) × 4 (category: spicy, savoury, sweet or control) ANOVA found no significant difference between the groups for total selections of category, $F(1, 28) = 1.519$, $p = .228$. A main effect of category was observed, $F(3, 84) = 18.11$, $p < .001$, $\eta_p^2 = 0.374$. No interaction between category selections and ethnicity was found, $F(3, 84) = 2.357$, $p = .078$, $\eta_p^2 = .049$. Post hoc tests (Bonferroni) showed that selections between the groups differed significantly between spicy and savoury ($p < .001$, $d = 1.076$), spicy and sweet ($p < .001$, $d = 1.124$), savoury and control ($p = .004$, $d = 0.695$), and between sweet and control food pairings ($p < .001$, $d = 0.803$).

Both groups made significantly more selections for savoury foods (*M* = 34.57, *SD* = 7.147) compared to spicy foods (*M* = 21.97, *SD* = 8.160). Additionally, both groups made significantly more selections for savoury over the control foods ($t(29) = 3.807$, $p < .001$), and selected sweet foods more than spicy foods ($t(29) = 6.157$, $p < .001$). Figure 13 shows the mean responses of category selection for both groups.

Figure 13: Mean responses of category selection for both groups.



3.4. Discussion

The aim of the 2AFC task was to establish which tastes were preferred the most and least for both groups of participants. Additionally, the task aimed to show differences in preferential selection of foods made by the two groups according to food category type. It was predicted that both groups would have the most preference for the savoury foods compared to the other categories, and there would be a higher preference for spicy foods among the Malay participants. The Chinese participants were predicted to have lower selections of sweet food items but a higher selection for the savoury food items compared to Malays. Lastly, it was predicted that both groups would make the lowest selections of the control food items for both between and within group selection.

One of the main findings shows that savoury foods were preferred over spicy foods for both Chinese and Malay participants. This finding is in line to the prediction which stems from the logic that although either group may display a general liking towards spicy foods, it would be impossible for them to always want spicy foods above other types of foods. This could be because spicy foods causes symptomatic gastroesophageal reflux (Nebel et al., 1976), which deters them from consuming spicy foods on a regularly. Studies have shown that capsaicin-containing chilli peppers have been proven to induce abdominal burning and heightened rectal perception among normal adults (Caterina et al., 1997; Gonlachanvit et al., 2009). Elements of spicy foods are in direct contrast to components of TCM (traditional Chinese medicine) under the principles of food abstention that heat producing food, such as pepper and hot chilli peppers, should be avoided, and the intake of certain foods should suit geographical location (eating spicy, warm or hot-tasting foods under cold and wet conditions) (Weng & Chen, 1996). This is supported by higher selections for the control foods in comparison among the Chinese participants. It suggests that the Chinese participants exhibit the least preference towards spicy foods.

The Malay participants showed a greater preference for spicy foods in comparison to the Chinese participants, although this difference was not significant. This finding could be attributed to Malay participants having fewer restrictions when it comes to diet as compared to the traditional Chinese diet. Essentially, Malays decide what is to be eaten based on the religion of Islam, which do not highlight on the taste properties of food but rather on the prohibition of foods (Radzi et al., 2010). This liking towards spicy foods held by the Malay participants reflects the nutritional composition of Malay foods comprising higher levels of capsaicin compared to Chinese cuisine. Consequently, this rationale is supported by the concept of familiarity that the Malay participants have been more exposed to spicy tasting foods socially through their cultural diet compared to the Chinese participants (Ling, 2002).

The differences in preferential selection for sweet tasting foods between the Malay and Chinese participants were observed. Firstly, it was a surprising find that the selection for savoury and sweet items by the Chinese participants did not vary a great deal which was not in line with our hypothesis on the notion that Chinese generally are not inclined towards sweet-tasting foods. Secondly, preference among Chinese participants towards more natural sweet tasting foods (i.e. fruits), is supported by higher intakes of fruits consumed by Chinese (4.21%) compared to the Malays (3.62%) in the recent MANS 2014 (Aris et al., 2014; Institute for Public Health, 2014). The Malay participants having the highest selection for sweet foods emphasizes the general inclination Malays have towards sweet tasting foods. These findings are supported by higher intake of confectionary-specifically artificially sweetened foods, such as cake and ice cream, among the Malays compared to Chinese (Aris et al., 2014) in the recent MANS 2014 (Zainuddin et al., 2016).

Preference among the Chinese participants in this study for more savoury tasting foods compared to the Malay participants is supported through the composition of Chinese cuisine which is high in sodium and lack of capsaicin. In past literature, it was reported that Chinese had a higher intake of sodium compared to Malays (Aris et al., 2014; Institute for Public Health, 2014). The lack thereof of spicy foods in the traditional Chinese diet is emphasized further through their overall preference in selecting more savoury foods than the other categories of foods. Moreover, preferential selection for savoury or salty tasting food among the Chinese participants is reflected through higher selections for savoury foods when paired with sweet foods.

Overall, both groups made more selections for the foods which contained higher caloric content. Although the stimulus was controlled for caloric content (i.e. a balanced selection of foods with high and low caloric content), comparatively the foods in the control category were lower in caloric content but higher in nutritional value. The results from this experiment suggest that Malaysians, even in a satiated state, would still make more unhealthier choices for foods.

As the 2AFC task involves a forced decision, it could be argued that participants could have picked a food they did not like out of the lack of choice given. Additionally, participants could have selected foods which they were not of their preference due to their total dislike towards the other food it was paired with. An indication of this is seen in preferential selections between spicy foods and the control items among the Chinese participants. Another assumption was participants could distinguish between the different categories of food and make an informed decision on their preferential selection. Although we were able to gain insight into preferences of tastes between the two groups, we should investigate participants' ability to categorize different food categories and how flavourful they find the foods to further understand whether their selections were informed. It was suggested that both groups could identify foods differently, based on sensory properties of the food itself and their prior knowledge, i.e., familiarity, with the food they see.

Chapter Four: “You say spicy, I say sweet.”: Identifying Cultural Differences Among Malaysians in a Food Categorization Task.

4.1. Introduction

As we rely on specific visual cues when selecting food, we are therefore heavily dependent on the visual properties of foods, such as perceived texture and colour, to provide us with vital information during selection (Clydesdale, 1993; Sørensen, Møller, Flint, Martens, & Raben, 2003). Studies have shown that colour influences our perception on the intensity of flavour (i.e. perceived saltiness or sweetness), with significantly higher ratings of flavour intensity given for foods which were more vibrant in colour compared to foods which were less colourful (Zampini, Sanabria, Phillips, & Spence, 2007). For instance, the intensity of the colour red in foods was shown to be positively correlated with significantly higher ratings of spiciness (Shermer & Levitan, 2014).

In Malaysia, studies have identified poor diet practices as a cause (Hussein, Taher, Gilcharan Singh, & Chee Siew Swee, 2015; Wan Abdul Manan et al., 2012) to the imminent rise of NCDs, such as obesity, diabetes, and hypertension (Letchuman et al., 2010; Tee, 1999; Zaini, 2000). The over-consumption of foods which are high in fat, sugar, and salt has been observed in the two biggest ethnic groups in Malaysia (Ismail, 2002; Mirnalini et al., 2008; Norimah et al., 2008; Pon et al., 2006): Malays and Chinese. This study investigates cross-cultural differences in identifying different foods by asking participants to first categorize, and then to rate their level of palatability of the categorized food. By measuring their responses, we might be are able determine cultural differences in palatability, and this could give us insight into future food selections made by both groups.

The visual imagery used in this study were images of food-stimuli which are categorically different according to spice levels, savoury tasting, sweet, and what will be later explained as the bland-tasting (control) foods. In contrast to previous studies, where the concept of taste has extensively focused on the five basic tastes (savoury, sweet, bitter, sour and umami), this study also measures responses towards spicy foods, which cannot be explained by any of the five basic tastes. One of the aims is to establish whether or not a positive relationship between spicy foods categorizations and higher ratings of palatability for Malays, whose traditional diet is heavily incorporated with spice (Shazali et al., 2013; Shazali et al., 2015), compared to Chinese participants. Furthermore, it is proposed that Chinese participants would be better at categorizing salty foods compared to the Malay participants due to their diet which has a higher sodium content (Mirnalini et al., 2008). Based on past literature and findings from the 2AFC task (refer to chapter 3), there would be no difference in categorizing salty tasting foods between the groups. Malay participants should be better at categorizing sweet foods and provide higher ratings of palatability compared to Chinese participants due Malays having a higher sugar content in their daily diet when compared to Chinese (Mirnalini et al., 2008).

4.2. Method

4.2.1. Design

A 2 (group: Chinese vs. Malay) × 4 (category: spicy vs. sweet vs. savoury vs. control) mixed design was carried out with group as the between-subjects factor and category as the within-item factor. The dependant variable is the type of flavour category participants select (i.e., categorising an item as being "sweet") for each image and how flavourful they rate each image from a scale of 1 to 5.

4.2.2. Participants

Power analysis was conducted using G*Power3 (Faul, Erdfelder, Lang, & Buchner, 2007) to test the difference between the two group means using a two-tailed test, a medium effect size (d= .50), and an alpha of .05. Result showed that a total sample of 24 participants with two equal sized groups of n = 12, was required to achieve a power of .82.

Thirty participants from the University of Nottingham Malaysia with an age range from 18-25 years (*M* = 20.37, *SD* = 1.85) took part in this experiment. The 20 Chinese (10 females and 10 males) and 20 Malay (13 females and 7 males) participants involved in this study did not take part in any of the previous experiments. All participants were instructed to have a meal before participating in the experiment to ensure that physiological signals, such as hunger, is not a precondition to a food craving (Hill, 2007). All participants had normal or corrected to normal vision and did not have colour-blindness. Informed consent was obtained from all participants. Participants received monetary compensation (RM5) in exchange for their participation in the experiment. The experimental procedures were approved by the Faculty of Science Research Ethics committee, University of Nottingham Malaysia.

4.2.3. Stimuli

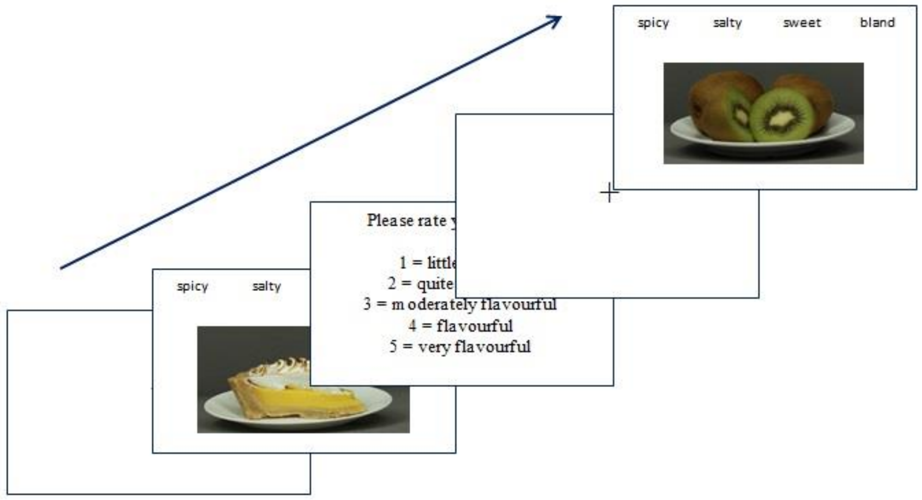
The same set of images from Chapter 4 were used, resulting in a total of 160 image. The images consisted of 40 savoury/salty-tasting foods, 40 sweet foods, 40 spicy foods and 40 ‘control’ foods (raw fruits and uncooked vegetables). Control foods were categorized as naturally sweetened foods for fruits and naturally bitter or flavourless tasting foods. All images were scaled to 861 x 440 pixels.

4.2.4. Procedure

Participants were required to categorise images of food stimuli according to what they thought was considered spicy, savoury, sweet, or as bland (these were the control items of uncooked vegetables and fruit) items. The categorisation task consisted of 160 experimental trials which were divided into 4 blocks. There were 3 practice trials which were excluded from analysis. Each block had 40 experimental trials; the images of the food-stimuli were presented at random without replacement. Each trial began with a fixation cross which lasted for 1000 milliseconds followed by an image of the food-stimuli presented at the centre of the screen and the 4 taste words which was shown until a response was given. Participants were required to respond to the food stimuli by categorising the image of the dish with pressing keys ‘1’, ‘2’, ‘3’ and ‘4’ to signify ‘spicy’, ‘salty’, ‘sweet’ and ‘bland’ respectively. Labels ‘spicy’ were indicative of spicy tasting food, ‘salty’ for salty tasting or savoury foods, ‘sweet’ were for sweet tasting foods, and ‘bland’ were for the control food items. Participants were also instructed to respond as quickly as possible.

Participants were then required to rate on a scale of 1-5 on how flavourful (1 being ‘little flavour’ to 5 being ‘very flavourful’) they believe the food in the image to be. An example of one experimental trial is shown in Figure 14. The order of trials was randomised individually for each participant.

Figure 14: An example of one experimental trial on the food categorization task.



4.3. Results

4.3.1. Reaction Times

Participants were told to respond as quickly as possible. There were no cut-offs for minimum and maximum time it took to respond as both groups took too long to respond. The median for each reaction time per category were spicy: 2082ms, savoury: 2954ms, sweet: 2204 and control: 2355. The RTs for both Malay and Chinese participants ranged from 781.3-5355 milliseconds and were considered too varied to make any firm conclusions and will not be discussed further.

4.3.2. Categorization Errors

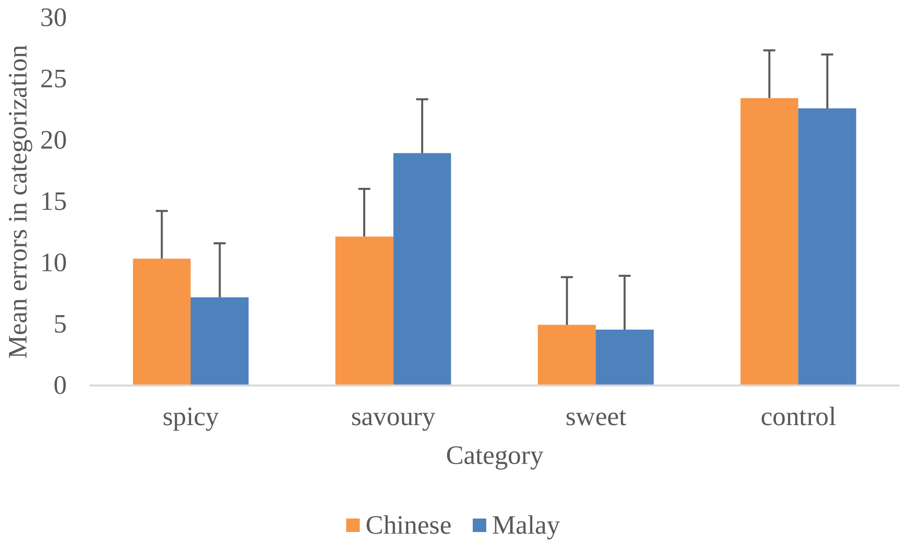
A 2 (group: Chinese or Malay) × 4 (category: spicy, savoury, sweet or control) ANOVA found that there was no main effect of group type in categorizing the food-stimuli $F(1, 38) = 0.386$, $p = .538$, $\eta_p^2 = 0.010$. There was a main effect of category, $F(2.00, 76.255) = 99.877$, $p < .001$, $\eta_p^2 = 0.688$. Pairwise comparisons (Bonferroni) showed that mean errors differed significantly between categories spicy and savoury ($p < .001$), with larger errors made for the savoury category. In the spicy and sweet category, there were more errors in categorising spicy foods compared to the sweet foods, ($p < .001$).

For the savoury and sweet condition, significantly larger errors were made in categorising savoury foods, ($p < .001$). Significantly larger errors were made in categorising the control food items in the savoury and control ($p < .001$), sweet and control ($p < .001$) and the spicy and control ($p < .001$) conditions. Figure 3 shows the mean categorisations made by each group across the four categories.

An interaction between category type and group was observed, $F(2.00, 76.255) = 7.197$, $p = .001$. Simple main effects analysis showed that a significant difference between the groups for spicy ($p < .001$) and savoury ($p = 0.001$) foods. The Malay participants ($M = 18.95$, $SD = 8.08$) made significantly more errors in categorizing the savoury foods than Chinese participants ($M = 12.15$, $SD = 5.54$). The Chinese participants made significantly more errors in categorizing spicy foods ($M = 10.35$, $SD = 5.25$), than the Malay participants ($M = 7.20$, $SD = 3.43$).

There were no significant differences between the groups in categorizing sweet or the control foods. Figure 15 shows the mean errors in categorisation for both groups across all food category types. Results show that both groups had difficulty in categorising both the spicy and savoury foods.

Figure 15: Mean errors in categorization for both groups.



5.2.5.4. Flavour Ratings for Accurate Categorisation

A 2 (group: Chinese or Malay) × 4 (food-stimuli: spicy, savoury, sweet or control) ANOVA showed group type did not influence ratings across categories ($F(1, 38) = 1.482$, $p = .231$, $\eta_p^2 = 0.038$). A main effect of category type was observed, $F(2.219, 84.325) = 75.417$, $p < .001$, $\eta_p^2 = 0.695$. Pairwise comparisons (Bonferroni) showed significant differences in ratings between the spicy and savoury ($p < .05$, with higher ratings given for spicy), spicy and control ($p < .001$, with higher ratings given for spicy), savoury and sweet ($p = .019$, with higher ratings given for sweet), savoury and control ($p < .001$, with higher ratings given for savoury), and sweet and control ($p < .001$, with higher ratings given for sweet) categories.

According to Table 19; both groups provided the lowest ratings for the food items in the control category, which was expected. The highest ratings given by both groups was for the spicy category. There was no interaction between group type and ratings provided for each category (*p*s > 0.05).

Table 19: Ratings on food categories by both groups.

	Spicy		Savoury		Sweet		Control	
	Malay	Chinese	Malay	Chinese	Malay	Chinese	Malay	Chinese
Mean	3.85	3.7	3.45	3.25	3.75	3.5	2.3	1.85

Std. Deviation	0.5871	1.129	0.5104	0.9105	0.4443	1.051	1.081	0.6708

4.4. Discussion

One of the aims of the categorization task was to examine cross-cultural attitudes towards spicy foods. Given the levels of capsaicin present in traditional Malay cuisine, it was as previously hypothesised that the Malay participants would exhibit the highest preference for spicy foods compared to the other categories in addition to a greater preference for spicy foods compared to the Chinese participants. Both groups, however, rated spicy foods as the most flavourful compared to the other categories of food.

The Chinese participants found spicy foods to be higher in flavour compared to the other categories of food. It is proposed that although the Chinese participants might not consume spicy foods on a regular basis, they provided higher ratings of palatability. Two reasons have been put forward to help explain this claim. The teachings within TCM whereby spice is not encouraged due to its ‘heaty’ effects on the human body (Li & Hsieh, 2004; Pandey, Rastogi, & Rawat, 2013; Wang & Lu, 1992). According to Chinese culture, ‘heaty’ foods or drinks, like chili, spicy beef, and turmeric fish, make the body hot and should be avoided which could have been a deterrent for selection among the Chinese participants (Wong, 1981). In contrast, ‘cold’ foods, such as fruits and vegetables, possess ‘cooling’ effects on the human body and provides nourishment for better health. Therefore, although the Chinese participants were less familiar with the spicy foods, they found components of the food to be flavourful in taste. Secondly, the appearance of spicy foods could have influenced perceived palatability. As the colour of foods aids in predetermining our expectations of flavour and taste (Reddy & Sasikala, 2013), the spicy foods in the present study were perceived to be more flavourful to both groups as they were more red in hue compared to the other categories of food.

The concept of perceived palatability can also help explain ratings attributed to the sweet food items. Both groups attributed the second highest ratings (first was for spicy foods) to the sweet foods. Categorisation of the sweet foods was easier for both groups as there were the fewest errors in categorising sweet foods compared to foods from the other categories. As compared to the other categories of food, the sweet food items were more variant in colour-indicating perceived sweetness of the food. The addition of colouring to the sweet foods could have provided both groups of participants with the knowledge of sweetness (Sørensen et al., 2003) ,which is exhibited by higher ratings given to the sweet food items.

The Chinese participants tended to categorise food images as being, savoury-regardless of category, suggesting that they have a general inclination towards savoury tasting foods compared to other categories of food. Studies have shown the rate of hypertension among Chinese Malaysians is proportionally higher compared to their prevalence to other NCDs -such as diabetes and obesity (Abougalambou, Abougalambou, Sulaiman, & Hassali, 2011; Rampal et al., 2008). Additionally, the high intakes of salted fish and vegetables among Chinese has been highlighted as a risk factor for gastric cancer (Goh et al., 2007).

There were no significant differences between the groups in both errors and levels of palatability. This finding was not in line with our previous prediction of the Malay participants having a higher predisposition towards sweet foods compared to the Chinese participants. Lastly, both groups of participants have the least accurate categorisations and provided the lowest ratings of palatability for the control food items. Although it could be argued that some of the control food items were not conventionally referred to as 'bland'-for example durian; nevertheless; both groups of participants rated the control foods as the least flavourful. These findings are in line with existing research highlighting the infrequent consumption of fruits and raw vegetables by Malaysians (Yen, Tan, & Feisul, 2015). However, it is argued whether it would be a fair comparison to link the control food items which lacked ingredients, to the other categories of food which consists of many ingredients.

However, a point to consider is whether existing biases reside within the groups of participants. As mentioned previously, justification for the Malay participants mis-categorising most food images as spicy or sweet is reflective of their diet which is high in spice and sugar. Simultaneously, it does not rule out the possibility that participants mis-categorised foods due to their general inclination/bias towards specific categories of food and not because they were able to identify and distinguish between foods which share similar sensory properties but are different in taste (i.e., savoury and spicy foods.) We put forward the question that due to familiarity towards a specific food (i.e., spicy foods for Malays) could create a semantic link, that could lead to interference towards foods that might be less salient and this lack of a strong relationship between the two would lead to greater errors towards a “target” stimuli.

Chapter Five: Implicit Measures of Cultural-Biases in the Characterisation of Foods: A Semantic Priming Experiment on Young Malaysian Undergraduates.

5.1. Introduction

Visual cues such as colour and the texture of food provides us with information about its taste without having to consume it (Sørensen et al., 2003, Afshari-Jouybari & Farahnaky, 2011). Spence (2018) suggests that our perception of foods, which affects current and future food selection, is heavily reliant in the way we characterise tastes according to visual cues. Koch and Koch (2003) found that participants rated red coloured solutions to be sweeter than green coloured solutions in a colour-flavour association task. In addition, participants associated the colour green to sourness compared to red which was more associated with sweetness. In a study by Yusop, O'Sullivan, Kerry and Kerry (2008), participants rated chicken fillets with a deeper red marinade to be higher in 'hotness' compared to chicken fillets with a lesser hue of red in the marinade in a visual ratings task.

In the absence of obvious visual clues, we rely on prior knowledge when identifying taste characteristics of food. Successful identification of a food is dependent on accurate characterisation of related taste components in the food e.g., green cruciferous vegetables indicate a bitter taste, rendering the dish to be slightly bitter-tasting, or familiarity with the dish itself, which are both influenced by our previous encounters with foods. Cervellon and Dube (2005) have shown that our encounters with food are heavily influenced by our ethnic identity i.e., our culture, that a divergence in their consumption behaviour, media usage and taste is influenced by their cultural identity.

Traditional cuisines worldwide are visually different from one another (Hutchings, 2011). Western cuisine comprises of foods which are mostly brown and green which is visually contrasting to the paler shades of food in traditional Chinese cuisine (Ri & Hsieh, 2004, Hutchings, 2011). Visual characteristics of Malay food usually appears in a thick gravy and looks spicy (Raji, Karim, Ishak & Arshad, 2017). Due to familiarity with our own cultural cuisine, we are aware of specific taste properties associated with our own culture. Therefore, we can identify flavour principles associated with a cuisine i.e., the identification of rendang or nasi lemak in Malay cuisine as spicy (Raji et al. 2017). In this study, we aim to explore the mechanism participants adopt in identifying foods when primed with a semantically related stimulus.

Semantic priming is the observation that a response to a target is faster when preceded by a semantically related prime compared to an unrelated prime (Kimura, Wada, Goto, Tsuzuki, Cai, Oka & Dan, 2009). Semantic priming may occur because the prime partially activates related words or concepts within the participants' memory network, which then facilitates their later processing or recognition. Responses on the foods which are similar in taste to each group's traditional cuisine should be faster and result in less errors than foods which are less similar in taste. We assessed taste characterisation of foods between cultures among undergraduate students using a modified semantic priming paradigm. Participants will be primed with a series of food images which are followed by the names of foods as target words. Participants would have to decide if the target words presented are spicy, salty, sweet or bland tasting.

The aim of this experiment is to measure whether the prime (i.e., image of a sweet dish) facilitates or interferences with the accuracy in characterising the target words. We hypothesised that the Chinese participants would make higher errors than Malay participants in the spicy and sweet condition. When the prime presented is a spicy food, we expect that the Malay participants will have lesser errors than Chinese participants in characterizing onset delay of target words of spicy foods. In the savoury condition, Chinese participants would have lesser errors than Malay participants in characterizing savoury target words when the prime presented was a savoury food. There was no base rate used for comparison.

5.2. Method

5.2.1. Design

A 2 (ethnicity: Chinese vs. Malay) × 4 (prime: spicy vs. sweet vs. savoury vs. control) × 4 (Target: spicy vs. sweet vs. savoury vs. control) mixed design was carried out with ethnicity as the between-subjects factor, with prime and target as the within-item factors. There are two dependent variables which are reaction times (RTs) taken to respond to the target word and performance on the experimental task. Performance is measured by number of errors made in accurate categorization of the target words.

5.2.2. Participants

Power analysis was conducted using G*Power3 (Faul, Erdfelder, Lang, & Buchner, 2007) to test the difference between two independent group means using a two-tailed test, a medium effect size (d = .50), and an alpha of .05. Result showed that a total sample of 24 participants with two equal sized groups of n = 12 was required to achieve a power of .82. Forty-three students from The University of Nottingham Malaysia with an age range from 17-25 years took part in this experiment. Participants comprised of 22 Chinese (13 females and 9 males) and 21 Malay (12 females and 9 males) students. Participants were of an age range from 18-25 years (*M* = 19.65, *SD* = 1.92). All participants were instructed to have a meal before participating in the experiment to ensure that physiological signals, such as hunger would be removed as a factor which could manipulate food choice (Boutelle, Kuckertz, Carlson, & Amir, 2014; Mogg, Bradley, Hyare, & Lee, 1998).

All participants had normal or corrected to normal vision and did not have colour-blindness. Informed consent was obtained from all participants. The experimental procedures were approved by the Faculty of Science Research Ethics committee, University of Nottingham Malaysia. Participants involved in this study were not allowed to participate in the other experiments carried out by the researcher. Participants received monetary compensation (RM5) in exchange for their participation in the experiment. Participants were given the opportunity to ask the experimenter any questions they had on the experiment prior to starting the experimental trials.

5.2.3. Stimuli

160 images of various types of food-stimuli served as the prime in this experiment, the same images used in chapters 3 and 4. 40 dishes of spicy food, savoury food, sweet food, and control food items were photographed with the same grey scale background. All foods were positioned on a white plate and were scaled to 861 x 440 pixels. The names of each food-stimulus which were photographed for the prime were used as target words. Participants who volunteered for this study were not involved in previous experiments.

Target words for all conditions were statistically checked for character length, showing no significant differences of target word length from each category ($F(3, 117) = 2.56$, $p = .06$). Table 20 shows the descriptive statistics for word length for each category.

Table 20: Descriptive statistics for word length per category.

Category	Descriptive Statistics
control	*M* = 7.93, *SD* = 2.63
spicy	*M* = 9.3, *SD* = 2.46
savoury	*M* = 8.15, *SD* = 2.67

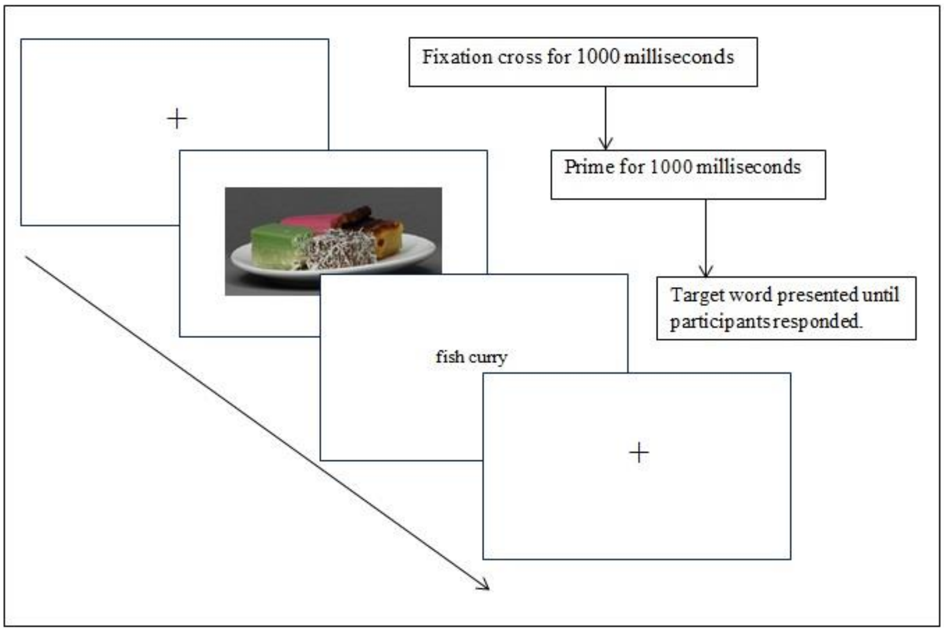
sweet	*M* = 8.93, *SD* = 2.44

Food combinations were arranged as prime presented first and then the target word presented after. For example, the condition sweet_savoury, the sweet image was the prime and the savoury word was the target word. Food dishes were selected based on availability and foods which are available in Malaysia, and because they were equally likely to be familiar to both groups. The prime and the target word could be from the same food category (i.e., spicy food image paired with spicy target word) or not from the same food category (i.e., spicy food image paired with a savoury, sweet, or a control target word).

5.2.4. Procedure

Each experimental trial began with a fixation cross which lasted for 1000 milliseconds. An image of a prime was presented for 1000 milliseconds immediately followed by a target word. The target word was shown until a response was given. Participants were instructed to respond as quickly as possible. Participants responded to the target word by selecting one out of four keys: ‘1’, ‘2’, ‘3’ and ‘4’ signifying ‘spicy’, ‘salty’, ‘sweet’ and ‘fruit or vegetables as the control condition, respectively. The order of the trials was randomised for each participant. Figure 16 shows the sequence of one experimental trial for either condition. Four practice trials were given before the experimental trials. There were 160 experimental trials. Participants had the opportunity to clarify any questions before they begun the experiment. Participants were not informed of the nature of the experiment and were only debriefed after completing the experimental trials.

Figure 16: Experimental trial for a mismatched condition.



5.3. Results

5.3.1. Reaction Times (RTs)

Participants were told to respond as quickly as possible. There were no cut-offs for minimum and maximum time it took to respond. The median for each reaction time to respond to target words across categories were spicy = 3872.31 ms, savoury = 4014.25 ms, sweet = 3132.73 ms, control = 3643.63 ms. The RTs for both Malay and Chinese participants ranged from 1569-3658 milliseconds and were considered too varied (M = 2362, SD = 554.7) to make any firm conclusions and will not be discussed further.

5.3.2. Errors

A 2 (group: Malay or Chinese) × 4 (prime: spicy, savoury, sweet or control) × 4 (target word: spicy, savoury, sweet or control) factorial design was used. There was no significant difference between the groups for total number of errors on the task, $F(1, 41) = 3.872$, $p = .056$, $\eta_p^2 = 0.086$. A main effect for prime was observed $F(2.65, 108.67) = 26.573$, $p < .001$, $\eta_p^2 = 0.393$, but no interaction between prime and ethnicity. A main effect for target word was observed ($F(2.067, 84.747) = 105.372$, $p < .001$, $\eta_p^2 = 0.720$), with an interaction between target word and ethnicity, $F(2.067, 84.747) = 5.497$, $p = .005$, $\eta_p^2 = 0.118$. Simple main effects analysis showed that there was a significant difference in total number of errors between the groups when the target word presented was of a savoury food stimulus, p = 0.004. Chinese participants (M = 3.273, SD = 2.511) had significantly lesser errors in characterizing savoury target words than Malays (M = 5.238, SD = 2.644). There were no other significant differences between the groups in characterising the spicy, sweet or control target words.

An interaction between prime and target word was found, $F(2.882, 118.150) = 2.651$, p = .054, $\eta_p^2 = 0.061$. Simple main effects analysis showed that both groups had significantly more errors in classifying savoury target words for mismatched conditions, and spicy target words when the prime was of savoury food stimulus. Table 21 shows the results from the simple effect analysis for each finding. No interaction between prime, target word, and group was observed (p = .190).

Table 21: Simple main effect analysis of prime × target word.

Prime	Target word	*p*
spicy	savoury	0.016
savoury	spicy	0.051
sweet	savoury	0.036
control	savoury	< .001

5.4. Discussion

Priming should have increased the accessibility of semantically related concepts and reduced errors when the prime and target matched. Results showed higher errors when the prime and target words belonged to the spicy and savoury food categories. Malay participants were more susceptible to prime presentation when the prime was a spicy food, as indicated by a higher mean of errors compared to the Chinese participants. The Chinese participants were better at characterizing savoury foods when the target word presented were savoury foods, as a lower mean of errors compared to the Malay participants indicates this finding. Both groups had difficulty distinguishing between the spicy and savoury foods. Both groups had difficulty in characterising savoury foods when the prime was sweet and of the control foods, which suggests the prime was considered to be distantly semantically related to the target words. No firm conclusions on the RTs both groups took in characterization of target words as the reaction times were quite varied.

Both groups had the highest errors when the prime was a control item. A possible factor of this is due to the nature of the control items which were essentially foods which were uncooked, unprocessed, and without artificial flavourings or colour added so there was no strong semantic link to the dishes with multiple cooked ingredients. Some items in the control category included raw vegetables such as potato, ginger, cabbage, lemongrass, which indicates that there was not a strong relationship when prime presentation was a control food item. This finding supports the notion that generally, fruit and vegetable intake among Malaysians are lower than the recommended amount. Also, this finding is in line with our findings from the FFQ where intake of fruits and vegetables was also low. Therefore, food items in the control category would be familiar to both groups but were not salient enough to elicit any priming.

In any case, participants responses to the control food items suggests familiarity which is exclusive to a bias towards fruits and vegetables. It is surprising, yet again, that our findings reflect that both groups of participants had difficulty in characterising familiar foods when the control items were the prime as the control items were the least consumed among both groups (Yen et al., 2015). To solidify this argument, we propose that other tenets in food object recognition be assessed. Literature has shown that memory is vital in both assessing a bias and measuring familiarity of food objects (Tiggemann, Kemps, & Parnell, 2010). If both groups of participants were to make more accurate recognition towards the control food items, it would indicate that the control food items were salient enough to elicit a bias in recognising other foods. Therefore, we aim to measure if saliency towards familiar foods is enough to impede cognitive performances, indicating a strong liking in addition to just familiarity.

Chapter Six: "1...2...3 Plates of Fries.": Recognizing Repetitions among Familiar and Unfamiliar Foods on a Continuous Memory Task.

6.1. Introduction

Food choice is modulated by physiological and psychological factors, such as hunger and memory (Köster, 2009; Köster, 2003; Mojet, Christ-Hazelhof, & Heidema, 2001). The role of memory not only exists as an element on its own in the subject of food choice (Berthoud, 2002), but it is also relevant to the process of learning. For example, an individual has paired eating a food to gastrointestinal upset leading them to avoid this food in the future. Therefore, for successful learning to occur, memory needs to exist as a precondition (Beauchamp & Mennella, 2011; Köster, 2009).

Memory towards food stimuli would be better when familiarity is higher, or when the individual has a bias for the food (Tiggemann et al., 2010). Mela (2001) proposed the concept of 'familiarity breeds liking' as one of the methods we adopt when selecting food. Individuals are least likely to consume novel foods when the foods are unfamiliar to their traditional cuisine (Pieniak et al., 2009; Verbeke & Lo, 2005, see Chapter 1 for details about Malaysian diet). Areas of research which have looked at the relationship between food and memory include the assessment of cravings among a normal sample (Meule, Skirde, Freund, Vögele, & Kübler, 2012; Tiggemann et al., 2010) and inhibited eating among a sample with eating disorders (Dickson et al., 2008). Research has shown humans have problems recognising objects when objects are less identifiable to them. It is hypothesized that although participants can identify the stimulus as food, they would have a greater difficulty in distinguishing between a familiar and non-familiar food due to their exposure to the food. Studies exploring recognition memory have used adaptations of the recognition memory task or the *n*-back task (Owen, McMillan, Laird, & Bullmore, 2005).

The current study investigates if exposure and familiarity towards certain foods leads to a better performance in recognising repetitions between familiar and non-familiar foods. It is the commonly held belief that the less often an individual is exposed to a certain food, the less likely the individual would be familiar with it, and therefore the prevalence of intake of the food would be infrequent (Muhammad, Abdullah, Salehuddin, Zahari, & Sharif, 2015; Tuorila, Meiselman, Bell, Cardello, & Johnson, 1994; Birch, McPhee, Shoba, Pirok, & Steinberg, 1987). Food preferences have been shown to be associated positively to food consumption patterns (Drewnowski et al., 1999). Therefore, the lack of exposure both groups have towards certain categories of food would be prominent in recognition accuracy of those food items. This investigation localises on the traditional perspective to the role of food memory and its relatedness to regular eating behaviour. If a food is regularly consumed, there is a greater chance that repetitions of the food will be detected compared to non-regularly consumed foods.

Findings from previous experiments (see Chapter 3); found a relationship between the number of accurate categorizations and foods which were readily available and exposed to either group. An example of this was Chinese participants categorised most foods, regardless of category, as savoury- which can be explained by the propensity of savoury/salty-tasting food in traditional Chinese cuisine and in a Chinese's daily diet. Therefore, this study explores the relationship between past familiarity by measuring recognition of repetitions of familiar and non-familiar foods.

As such, participants in the present study will carry out a recognition memory task to which they were required to make old or new discriminations to new stimuli, stimuli repeated for the first time, or stimuli repeated for the second time. Participants were exposed to four types of food images ranging from spicy, sweet, savoury, or control food items. Depending on the ethnic group of the participant, some foods should be more familiar, and this would result in better recognition of repeated familiar foods compared to repetitions of unfamiliar foods. All food-stimuli used in this experiment were dishes available in Malaysia. It is hypothesised that Chinese participants would be able to make more accurate discriminations in identifying the repetitions for savoury foods compared to the other food categories. In comparison, Malay participants would be more susceptible in discriminating repetitions of spicy and sweet tasting food stimuli more than the savoury and control food items.

6.2. Method

6.2.1. Design

A 2 (ethnicity: Chinese vs. Malays) × 4 (category: spicy vs savoury vs sweet vs control) mixed design was carried out with ethnicity as the between-subjects factor and category type as the within-subjects factor. Performance in recognition accuracy was assessed by the number of accurate responses for 'new' and 'old' images as well as reaction time. Signal detection theory will also be applied to measure their sensitivity in recognising the different food categories.

6.2.2. Participants

Power analysis was conducted using G*Power3 (Faul, Erdfelder, Lang, & Buchner, 2007) to test the difference between two independent group means using a two-tailed test, a medium effect size (d = .50), and an alpha of .05. Result showed that a total sample of 22 participants with two equal sized groups of n = 11 was required to achieve a power of .81. Forty-eight participants (24 Malaysian Chinese: 19 females, 5 males & 24 Malaysian Malay: 16 females, 8 males) from the University of Nottingham Malaysia campus took part in this experiment. Participants were aged 18-27 years old (M = 20.25, SD = 2.06). All participants were instructed to have a meal before participating in the experiment to ensure that physiological signals, such as hunger would be removed as a factor which could manipulate food choice (Charbonnier et al., 2015). All participants had normal or corrected to normal vision and did not have colour-blindness. Informed consent was obtained from all participants. Participants received monetary compensation (RM5) in exchange for their participation in the experiment. The experimental procedures were approved by the Faculty of Science Research Ethics committee, University of Nottingham Malaysia.

6.2.3. Stimuli

Additional images of food items (see Appendix F Figure 1) as well as images from the previous experiments were used. All images were reviewed by 10 number of participants who did not take part in experiment to select suitable images. The panel of raters rated all food images in terms of i) attractiveness (1 being least attractive to 5 being most attractive), ii) familiarity (1 being least familiar to 5 being most familiar), iii) liking (yes or no), iv) wanting (1 being not likely to 3 being very likely), and v) flavourful (1 being least flavourful to 5 being most flavourful). The panel of raters were also asked to categorize the food images on what they thought the food tasted like (i.e. whether they thought the food looked spicy). Ambiguous food images which had low attractiveness, low flavour rating or low familiarity were not used in the experiment. This procedure resulted in 156 food images being selected.

Twelve images of non-food stimuli were also included as filler items. These filler items were images of everyday non-consumable objects, such as scissors or a book. For a full stimuli list of non-food items, refer to Appendix E (Figure 2). Ten images were used for the practise trials. Images used in the practice trials were not included for the experimental trials. For a full list of images used in the practise trials, refer to Appendix E (Figure 3). To view the full list of images used in the experimental trials, refer to Appendix E (Figure 4). Presentation of stimuli was controlled using E-Prime software version 2.0 (Pavlopoulos, Soldatos, Barbosa-Silva, & Schneider, 2010).

6.2.4. Recognition-Food Frequency Questionnaire

The Recognition-Food Frequency Questionnaire (R-FFQ, adapted from Loy et al., 2011) was presented to participants to evaluate if familiarity with certain foods would result in better performance (accuracy and reaction time) in the recognition task. The R-FFQ included all the food items used in the recognition memory task. The dietary intakes of foods were assessed by measuring frequency intake and portion size of the foods.

The STAI and TFEQ was included as a measure to exclude other possible factors, such as eating disorders, that could have influenced recognition of the food stimuli on the experimental task. A copy of the R-FFQ (including the STAI and TFEQ) was included in Appendix E (Section 2). Unlike the other experiments (Chapter 2-4), the TFEQ was used in this experiment as we are investigating food consumption and therefore specific eating behaviours should be measured in accordance to the results of the R-FFQ. An image of each food was shown with two questions measuring dietary patterns. The R-FFQ consists of questions on portion size and the frequency of times the food is eaten. The scale used for portion size ranged from 1-7 and size was dependant on the food. If participants had responded ‘Never’ to the question addressing frequency intake, participants were then required to state reasons why they had never eaten the food.

6.2.5. Procedure

The task started with eighteen trials to familiarize participants with the experiment, followed by three experimental blocks, with an option to take a break between the blocks, stimuli from one block were not repeated across blocks. Participants were encouraged to ask any questions after these practice trials. Participants were instructed to pay attention to each stimulus, to respond as quickly and accurately as possible by making old/new discriminations using the selected keystrokes after every trial.

Old/New discriminations were made by either pressing the ‘N’ key (labelled new) or ‘V’ key (labelled old) on the keyboard. Participants were seated 60 centimetres away from the computer screen. For every trial, participants were presented with a blank screen for 500 ms, a fixation cross for 500 ms, and a target stimulus that remained on the screen until a response was made. The target stimuli were images of spicy, savoury, sweet, and control food items, the filler items would be the non-food images. Target stimuli would be presented once (new), twice (R1) or thrice (R2). For each block, there were new stimuli, some of which would be repeated after 4-7 intervening items (R1) and some would be presented for a second time after 36-39 intervening items (R2). There were 3 experimental blocks with each experimental block consisting of 124 experimental trials (372 experimental trials in total) (refer to Kassim, Rehman and Price, 2018). Table 22 shows the target stimuli presented per condition. There were 12 filler items. Participants then completed the TFEQ and the R-FFQ.

Table 22: Number of new, R1 and R2 items per category.

Target Stimulus			
	New	R1	R2
Spicy	24	21	18
Savoury	54	51	18
Sweet	54	51	18
Control	24	21	18

6.3. Results

6.3.1. Reaction Times (RTs)

Participants were instructed to respond as quickly as possible. The RTs for both Malay and Chinese participants ranged from 1563-7806 milliseconds (median=2985). For further information on the RTs for both groups, please refer to Appendix E (Section 1 and Table 1) but these will not be discussed further due to the variation being too high to make any firm conclusions.

6.3.2. Recognition Accuracy

The effects of repetition on percentage accuracy was explored using a 2 (group) × 4 (food category: spicy, savoury, sweet, and control) × 3 (target: new, R1, and R2) repeated-measures ANOVA. Performance on the recognition task was not influenced by group type, $F(1, 46) = 3.00$, $p = 0.09$, $\eta_p^2 = 0.061$. There was a main effect of food category ($F(3, 138) = 23.774$, $p < .001$, $\eta_p^2 = 0.334$), and a main effect of target ($F(1.23, 56.51) = 8.460$, $p = 0.003$, $\eta_p^2 =$

0.155). Participants performed the poorest in the spicy condition and had significant differences in accuracy in the savoury, sweet and control conditions (*ps* < 0.001). Performance in the control condition was also better compared to the performance in the savoury condition ($p = 0.006$). Participants performance improved from the new to the R1 and R2 trials, with significant differences observed between the new and R2 trials ($p = 0.030$), and between R1 and R2 trials ($p < 0.001$).

No interaction between food category and group was observed ($F(3, 138) = 1.474$, $p = 0.224$, $\eta_p^2 = 0.021$)) and no target × group interaction was found ($F(1.23, 56.51) = 0.126$, $p = 0.775$, $\eta_p^2 = 0.002$). No category × target × group interaction was observed, $F(3.77, 173.20) = 0.794$, $p =0.524$, $\eta_p^2 = 0.015$.

A category × target interaction was observed, $F(3.77, 173.20) = 6.082$, $p < 0.01$, $\eta^2 = 0.115$. Simple main effects showed that there was an effect of category on performance accuracy in the new (($F(3, 126.68) = 18.680$, $p < 0.001$) and R2 trials ($F(3, 126.68) = 3.288$, $p = 0.022$). Results indicate that recognition for spicy foods increased at R2 and had the poorest recognition when presented for the first time. All the other food types increased in accuracy at R2, but base rate level for spicy foods was lower to start with. A summary of each group's mean percentage of accurate recognition for each target presentation in each category is included in Table 23.

Table 23: Percentage Accuracy

	Chinese			Malay		
	New	R1	R2	New	R1	R2
Spicy	81.25	82.94	90.51	74.31	80.95	87.73
Savoury	91.19	86.11	93.98	83.83	84.09	89.58
Sweet	90.97	87.09	92.82	87.35	85.19	89.81
Control	93.06	87.7	98.38	87.67	80.16	91.2

6.3.5. *d'* Results

Signal Detection Theory (SDT) has been widely applied to calculate participant's response during a task when the signal is present (i.e., a hit) and when the signal is absent (i.e., *noise*) (Abdi, 2007). SDT was carried out to check that participants' responses reflected their choice and was not due to a response bias.

To compensate for zero errors, when calculating the probability of saying yes, 0.5 was added to the top and 1 to the bottom of the equation for all cases (Snodgrass & Corwin 1988). Participants having a more accurate performance is indicative of a higher *d'* score, whereby there is a higher hit rate and a low false alarm rate. Participants hit and false alarm rates on the new, R1 and R2 trials were used to calculate discriminability index (*d'*). A summary showing the classification of data according to SDT on the recognition task was included in Table 24.

Table 24: Classification of participant's response according to Signal Detection Theory (SDT).

Signal	Response	Classification
Signal present	Hit	Target presented ONCE (new target), participant got it right & responds 'N' for new.
	Miss	Target presented ONCE (new target), participant got it wrong & responds 'V' for old.
Signal absent	False Alarm	Target presented more than ONCE (twice or thrice/ R1 or R2 target), participant responds 'N' for new when it is old.
	Correct Rejection	Target presented more than ONCE (twice or thrice/ R1 or R2 target), participant responds 'V' for old.

Mean *d'* data was computed to determine the effects of group type on responses across all four categories. The data was examined using a 2 (group) × 4 (food category: spicy, savoury, sweet, and control items) repeated-measures ANOVA. Group had no effect on the responses given ($F(1, 46) = .776$, $p = .383$). Category influenced performance ($F(2.55, 117.39) = 33.34$, $p < .001$, $\eta_p^{2\,=}$ 0.420), with significant differences found between the spicy and savoury ($p < .001$), spicy and sweet ($p < .001$), and spicy and control ($p < .001$) *d'* scores.

Both groups recorded the lowest *d'* scores in the spicy category (*M* = 2.03, *SD* = .74) compared to the savoury (*M* = 2.82, *SD* = .64), sweet (*M* = 2.7, *SD* = .87), and control category (*M* = 2.75, *SD* = .9). Highest *d'* scores were reported for the savoury category, however, scores were not significantly different from the *d'* scores in the sweet or control category (*ps* > .05).

Results showed a category × group interaction ($F(2.55, 117.39) = 5.7$, $p = .002$, $\eta_p^2 =$ 0.110). Simple main effect analyses found that there was an effect of group type in the control category, $F(1, 46) = 4.38$, $p = .04$. The Chinese participants were significantly better at detecting the control food items compared to Malay participants. There were no further interactions between group and other food categories. Total *d'* data of both groups for all categories is included in Table 25.

Table 25: Total d' data for both groups across all categories.

	Chinese		Malay	
Category	Mean	SD	Mean	SD
spicy	2.14	0.57	1.917	0.871
savoury	2.712	0.676	2.926	0.586
sweet	2.779	0.752	2.616	0.976
control	3.015	0.666	2.49	1.032

6.3.6. R-FFQ Results

6.3.6.1. Group Differences in Frequency Intake

To calculate differences in the frequency intake of foods on the R-FFQ, a 2 (group) × 4 (food category: spicy, savoury, sweet, and control items) repeated-measures design was carried out. There was no effect of group on frequency intakes, $F(1, 46) = 0.352$, $p = 0.556$, $\eta_p^2 = 0.008$. A main effect of category was observed ($F(2.44, 112.29) = 41.720$, $p < .001$, $\eta_p^2 = 0.458$), with a category × group interaction found ($F(2.44, 112.29) = 3.279$, $p = 0.032$, $\eta_p^2 = 0.036$). A summary showing the average frequency intake of both groups is included in Appendix E (Table 2).

6.3.6.2. Group Differences in Portion Size

Group differences in the portion size of foods on the R-FFQ, a 2 (group) × 4 (food category: spicy, savoury, sweet, and control items) repeated-measures design was carried out. Results

showed a main effect of category, $F(3, 138) = 5.57$, $p = .001$, $\eta_p^2 = 0.104$. A category × group interaction was observed ($F(1, 46) = 7.203$, $p = .01$, $\eta_p^2 = 0.135$), but no interaction between category type and ethnicity was found.
A summary showing the average portion size of both groups is included in Appendix E (Table 2).

6.3.6.3.

Group Differences in the Average Consumption Quotient
The average consumption quotient (reported findings from the average frequency intake multiplied by the average portion size) was calculated for each food category. Values for average consumption ranged accordingly for each category.

Separate one-way between-subjects ANOVA was carried out to investigate group differences in the average consumption quotient. Results showed that Malay participants reported a significantly higher average consumption quotient for spicy (F (1, 46)= 12.76, $p < .001$), savoury ($F(1, 46) = 8.71$, $p = .005$), and sweet foods (F (1, 46)= 6.77, $p = .01$), compared to Chinese participants on the R-FFQ. There were no significant group differences in the average consumption for the control food items (F (1, 46)= 1.46, $p = .23$). A summary showing the average consumption of both groups is included in Appendix E (Table 2).

6.3.6.4. Group Differences in Foods Reported as 'Never Eaten' in the R-FFQ.
A one-way between-subjects ANOVA showed group differences for food items in the control category ($F(1, 46) = 5.98$, $p = .02$). Malays ($M = 4.25$, $SD = 3.3$) reported more of the control items than Chinese participants ($M = 2.25$, $SD = 2.27$) as being 'never eaten'. No other significant group differences for the spicy, savoury, and sweet food categories were observed. A summary of number of 'never eaten' food items across all four categories for each group is included in Appendix E (Table 3). Additionally, reasons given from both groups for the food reported as never eaten were compiled and included in Appendix E (Table 4).

6.3.6.5. Relationship between Recognition Memory Task Performance and the Average Consumption Quotient.
D' scores on the recognition task were compared to participant reporting in the R-FFQ to evaluate if frequent consumption of types of food would enhance performance on the recognition memory task. In turn, could low intakes of food types be associated to poorer recognition (i.e. lower *d'* scores) on the task?

There was no relationship between the average consumption of spicy, savoury, sweet, or the control foods and performance on the recognition memory task (*p*s > .05). A summary showing the relationship between performance on the task and average consumption quotient of the four food categories is included in Appendix E (Table 5).

6.3.6.6. Relationship between Recognition Memory Task Performance and Frequency Intake.
There was no significant correlation observed between the recognition performance and the reported average frequency intake between the groups. No relationship was found within groups for performance on the recognition task and reported frequency intake of foods on the R-FFQ.

6.3.6.7. Relationship between Recognition Memory Task Performance and Portion Size.
A significant positive correlation was found between the average portion size for spicy foods and recognition performance on the spicy food trials in Chinese participants ($r = .48$, $p = .02$). This indicates that the larger portion size consumed by Chinese participants, the better they perform on the recognition memory task. There were no other significant correlations found between recognition performance and type of food category for both groups.

6.3.6.8. Relationship between Recognition Memory Task performance and Foods 'Never Eaten' on the R-FFQ.

Foods reported as 'never eaten' on the R-FFQ were compared to *d'* scores on the recognition task to investigate the relationship between high familiarity (higher *d'* scores) and a lower reporting of foods 'never eaten'. It was hypothesised that the less familiar participants are with the food stimuli; the more errors they would make on the recognition task.

Results of the Pearson correlation indicated that there was a significant negative correlation between the 'never eaten' control foods and *d'* scores in the control condition, $r = -.30$, $p = .04$. Chinese participants were better at recognition on the task with a lower average of 'never eaten' control foods on R-FFQ. In contrast, Malay participants performed poorer on the task due to a higher average of the 'never eaten' control foods. No other correlations between 'never eaten' foods reported on the R-FFQ and performance on the recognition task was observed between the groups.

6.4. Discussion

Previously, it was hypothesized that the more familiar participants are with the food category; the higher the repetitions of the familiar foods are recognised, compared to less familiar-or non-regularly consumed foods. The Chinese participants would make more accurate discriminations in identifying the repetitions for savoury foods compared to the other food categories. The results, however, showed no relationship with familiarity (reported average consumption quotient, frequency intake, and portion size on the R-FFQ) and performance on the recognition memory task for Chinese participants for the savoury food items. Chinese participants showed the highest accuracy in recognition for the control food items which was significantly different from the other food categories.

In contrast to our earlier predictions, Malay participants were not more susceptible in discriminating repetitions of spicy and sweet food stimuli more than the savoury and control food stimuli. Although Malay participants exhibited the lowest *d'* scores in recognition for the spicy food items, scores were not significantly different from scores in recognizing the other food categories. In addition, there was no clear relationship seen between intakes of spicy foods and performance on the recognition memory task. However, group differences were more obvious in the R-FFQ. Malay participants reported significantly higher intake of spicy, savoury, and sweet foods compared to the Chinese participants which is reflective of existing literature of Malays having a higher energy intake on a daily basis (Mirnalini et al., 2008) and a higher prevalence of obesity and diabetes (Mohamad & Mokhtar, 1996; Wan Nazaimoon et al., 2013) compared to Chinese Malaysians.

The average consumption of both groups of participants across the four categories did not correlate with their performance on the recognition memory task. These findings were not in line with our earlier prediction whereby if a food is commonly consumed (as reported in the R-FFQ) it would be reflected in more accurate performance on the task (higher *d'*). However, the average portion size of spicy foods reported by Chinese participants correlated significantly with their recognition performance of spicy food items. We were not able to establish a connection between habitual intakes of high/low caloric foods from all categories to overall performance on the memory task.

Chinese participants performed better at the task as they were more familiar with the control food items-which were images of uncooked vegetables and fruits. In contrast, the Malay participants were poorer in comparison because of their low intakes i.e., lack of familiarity with the control food items. These findings also reflect existing literature which illustrates Chinese consuming more fruits and vegetables in their daily diet than Malays in a nationwide survey (Aris et al., 2014). Although the literature also states that consumption of sweet foods is higher among Malays, and sodium intakes are higher among Chinese, we were unable to make a connection between food consumption of savoury and sweet foods with recognition performance. There was also no connection between consumption and recognition of the spicy food items. It was proposed that variation in the stimuli set heavily influenced participants' perception in recognizing the different categories of food- hence recollection on the frequency in repetition was affected.

Similar performances in recognition accuracy for both Chinese and Malay participants towards savoury and sweet items are in support to the existing literature where high calorie savoury and sweet tasting foods are most likely to be desired than other types of food (Charbonnier et al., 2015; Grier & Kumanyika, 2008; Meule et al., 2012). In this experimental design, the effect of ethnicity was not clear cut as although both groups differed in their accuracy for recognising savoury, sweet, and spicy foods, this difference was only significant for the control food items. For alternative explanations into this occurrence, we would need to evaluate the concept of taste-recognition memory (Bermúdez-Rattoni, 2004) and associative learning (Mela, 2012).

Chapter 7: General Discussion

7.1. Overview

The present study aimed to investigate environmental and underlying psychological factors which influences the relationship Malaysian undergraduates have with food. By exploring the different mechanisms of psychological factors, such as learning (Mela, 1999, 2012), we can provide insight to how groups in Malaysia are able to differ in taste perception and overall food selection. Mechanisms, such as associative pairing and familiarity, are influenced heavily by culture. It is through culture/ethnic identity, that specific teachings are reflected through various aspects of food. This includes the method of food preparation, ingredients used, and the overall taste profile of food (Axelson, 1986; Komatsu, 2008; Zellner, Garriga-Trillo, Rohm, Centeno, & Parker, 1999). For example, in Malaysia, a typical Malay cuisine is high in sugar and spicy tasting. In contrast, Chinese cuisine is less spicy, less sweet but high in sodium content.

According to recent statistics, Malaysia faced an increase in the prevalence of NCDs, such as a 43% increase in the rate of hypertension, an 88% increase in the prevalence of diabetes and a 250% increase in obesity from the year 1996 to 2006 (Non-Communicable Disease Section, Disease Control Division, Ministry of Health, 2010). Health-related issues, such as hypertension, smoking, diabetes, high cholesterol and a high BMI, have been ranked from highest frequency to the lowest in The Second Burden of Disease for Malaysia as greatest causative factors to both disability adjusted life-years (DALY) and deaths.

Studies conducted in Malaysia have shown that even obesity and overweight issues are affecting the lower age groups. An increased prevalence in children from ages 6 to 12 years being overweight amplified from 11.0% to 12.8% and a spike in levels of obesity from 9.7% to 13.7% from the years 2002 and 2008 respectively (Ismail, Ruzita, Norimah et al., 2009). In addition, this growing epidemic is prevalent among the ethnic groups in Malaysia. Among Chinese, the rate of hypertension is higher compared to Malays, whom in turn possess a higher prevalence of obesity, diabetes, and cardiovascular diseases in comparison (Abougalambou et al., 2011; Dunn, Tan, & Nayga, 2012; Wan Nazaimoon et al., 2013).

7.2. Main Findings

Chapter	Groups Findings		General Findings
	Chinese	Malay	
Chapter 2: Cross-Sectional FFQ	Significantly lower intake of all foods. *	Higher frequency intake of spicy, savoury, and artificially sweetened food. *	Intakes of fruits and vegetables did not meet RNI for the respective age group.
Chapter 3: Forced Choice task	-	-	Low selections for control food items. More selections for high caloric content foods.
Chapter 4: Categorisation	Significantly more errors categorising spicy foods than Malay participants.*	Significantly more errors categorising savoury foods than Chinese participants.*	Lowest ratings for control food items. * Highest ratings for spicy foods. *
Chapter 5: Semantic Priming		-	Both groups made significantly more errors in characterizing target words (spicy and savoury) after onset of prime (spicy and savoury)*
Chapter 6: Recognition Memory	Higher accuracy in recognition for control food items. *	Higher average consumption quotient for spicy, savoury and sweet	Recognition performance improved from new to R1, R1 to R2 trials. *

	Positive correlation between average portion size for spicy foods and recognition performance on the spicy food trials. *	foods on the R-FFQ. *	Group differences in ‘never eaten’ control foods intake on R-FFQ. * Negative correlation between the ‘never eaten’ control foods and *d’* scores. *

*indicates levels of significance ($p < .05$).

7.2.1. Summary of the Cross-Sectional Food Frequency Questionnaire

The FFQ was carried out to evaluate dietary eating behaviours of Chinese and Malay undergraduates residing in Malaysia. Given the distinction in the two groups’ traditional diet, it was predicted that differences in the consumption of spicy, savoury, and sweet foods would be prominent between the groups. Malay participants had a higher intake of spicy tasting foods for both frequency and portion size compared to Chinese participants. Malay participants also consumed higher intakes for both sweet and savoury tasting items compared to Chinese participants, reflecting the literature of a higher tendency for Malays to develop obesity (Dunn et al., 2012; Kee et al., 2008) and diabetes (Hussein et al., 2015) than Chinese. Additionally, results showed that Malay participants consumed more of spicy, sweet, and salty foods compared to Chinese participants who consumed more fruits and vegetables in comparison.

Cumulatively, findings from the FFQ show that the intake of sodium among Chinese participants (i.e., sodium intake for both frequency and portion size) was lower than that of Malay participants. Although the sample size of this questionnaire was underpowered, as the sample size for Malay participants was fewer than Chinese participation in the FFQ, this difference was still detected.

The difference in intake of artificially sweetened food items with Malay participants having both higher portions and more frequent consumption than Chinese participants shows us that the affinity for sweet-tasting foods is higher among the Malay participants. These results reflect previous findings, whereby Malays consume more added sugar (54.0±19.9 gm/day) than Chinese Malaysians (29.8±15.4 gm/day) (Nik Shanita, Norimah & Abu

Hanifah, 2012). Arguably, Malay cuisine has a wider variety of sweet desserts than traditional Chinese cuisine, so we theorise that perhaps the Malay participants have a greater exposure and experience to sweet tasting foods in comparison. In addition, other foods which are not necessarily considered as sweet meats, such as rendang and satay (both traditionally Malay foods), possess strong sweet tasting flavours. Therefore, it raises the question to whether constant exposure (which leads to consumption) of traditional foods would cause taste thresholds for sugar among Malay would increase. In comparison, the opposite trend in traditional Chinese cuisine, which uses little sugar in both their desserts and savoury meals, could have caused significantly lower intakes of sweet foods among Chinese participants in comparison to the Malay participants.

The eating behaviours of both groups, which was measured by frequency intake and portion size, did not meet the recommendations of protein and fruits and vegetables for the RNI as specified by the Malaysian Dietary Guidelines. The consumption behaviour of both groups seems to suggest that they are not eating the required macro and micronutrient levels required to sustain a healthy body. A factor to consider is that the price of fruits and vegetables are generally higher compared to snack foods or meals, therefore selection and intake for fruits and vegetables would be low in our sample size.

In addition, both groups reported eating foods which are high in caloric content when they were feeling happy or stressed. Specifically, both groups reported eating sweet foods, such as chocolate, cake and ice-cream, when they happy or feeling stressed. However, Malay participants made an indication to favour eating savoury foods when they were stressed, a finding which is contrasting to consumption habits of Chinese when they are feeling stressed. For future studies, it would be worth identifying what both groups eat when experiencing a stressor, as both participants completed the STAI in conditions without an external stressor.

Lastly, we need to consider the method of self-reported questionnaires when it comes to participants providing their own account for their dietary intake. Previous literature has highlighted that participants under-report their energy and nutrient intake, resulting in inaccurate findings (Zainuddin et al., 2019). A combination of self-report questionnaires, 24 dietary recall, and food diaries would have been a better measure to assess eating behaviour. In addition, biomarkers such as a 24-hour urinary sucrose and fructose excretion is required to identify food sources of sugar intake (Amarra, Khor & Chan, 2016). The FFQ used in this experiment was too long to complete (approx. 90 minutes) which could have caused the participants to report inaccurately in order to complete the survey.

7.2.2. Summary of the Forced-Choice Task

This experiment draws a parallel between foods commonly preferred and the ethnic group of an individual. Insight into what the various ethnic groups in Malaysia crave could provide a basis for developing future interventions in decreasing the consumption of high caloric foods as well as increasing awareness so Malaysians can improve their unhealthy eating practices. Malay participants made the most selections for sweet items (31.3%) followed by the savoury (29.9%), spicy (19.8%) food items and the lowest selection for the control items (18.9%) among all the categories. Chinese participants made the most selections for the savoury items (29.4%), followed by the sweet (28.0%), the control (24.7%) and the lowest selections for spicy items (17.8%) among all the categories. Overall, both groups exhibited low preferences for the control foods, which was not novel as the control items were raw vegetables and fruits. Chinese participants showed the highest preference for the savoury food items compared to the other food categories while the Malay participants showed a greater preference for sweet foods than they do for savoury tasting foods. The distinction between a constituent of a snack food and a meal is determined by how hungry the participant is, therefore, it is proposed future studies carried out with participants in a hungry state to assess if the same pattern of results would surface.

The selection for sweet and savoury tasting foods more than spicy foods (which is reflected through a higher mean selection for both sweet and savoury foods as compared to the spicy foods), suggests that both groups do not regard spicy foods as a food that is preferred often in comparison to the other food categories. For future studies, it would be worth investigating whether actual consumption of the selected/preferred food would occur. The intensity of liking for the selected/preferred choice and whether its degree is of a magnitude large enough to lead to consumption is what defines the unhealthy eating practices amongst Malaysians. Moreover, it would be insightful for future studies to explore the relationship between the most commonly craved food amongst Malaysians and the types of foods which are most advertised in Malaysia.

However, as this is a novel study, it is argued that the 2AFC task, which lasted for thirty minutes, could have not been cognitively demanding enough to warrant an innate drive to seek out energy-dense foods (to reach homeostasis). The findings from this study helps to shed some light into the types of foods preferred by both ethnic groups. It is proposed that future research be developed to examine whether virtual selection of these foods can lead to consumption, which is essential in fully understanding food selection among Malaysians.

7.2.3. Summary of the Categorization and Ratings Task

Cross-cultural differences in classifying foods according to taste categories were explored in this chapter. By measuring accuracy in categorisation for both groups, we provided some insight into cultural differences in palatability as well as differences in categorisation abilities. The results showed that although mis-categorisation errors of spicy foods were not significant between the groups, Malay participants more often thought that other foods were spicy, than the Chinese participants. Both groups, however, rated spicy foods as the most flavourful compared to the other categories of food. Though Chinese participants gave higher ratings for spicy foods, we put forward the question to why then spicy foods are not preferred among the Chinese participants. Perhaps a flaw in experimental design was, instead of asking groups to rate the flavour of the food, ratings of liking towards the food should have been measured.

It is debatable whether perceived palatability or the aesthetically pleasing visual properties of the sweet food items allowed both groups to categorise accurately. Both groups also mis-categorised the sweet food items comparatively less often to the spicy, savoury and the control foods. This finding implies that participants associate bright colours in foods with a stronger intensity in sweetness, which is reflective of past literature where participants provided higher ratings for both flavour intensity and sweetness to foods when the degree of colourants used is high compared to paler sweet foods (Spence et al., 2010; Zampini et al., 2007).

Regardless of category, Chinese participants categorised food images as being savoury which signifies the application prior knowledge and familiarity with salty foods. In contrast, Malay participants mis-categorised most food images as spicy or sweet regardless of category. It is suggested that frequent, repeated exposure of spicy tasting and sweet foods in a typical Malay's diet explains mis-categorisation of foods as either spicy or sweet. According to the findings by Yen et al. (2015), Chinese participants had the highest prevalence of consuming fruits and vegetables, whilst Malays were found to have the lowest prevalence of consuming both fruits and vegetables. Additionally, Chinese participants reported the highest intake of fruits compared to the other ethnicities (Malays, Indians, Others) who took part in the study. These findings explain the responses of both groups in the present study in categorising the control food items. Both groups mis-categorised and provided lower ratings for the control food, which reflect existing literature of the low consumption of fruits and vegetables among Malaysians (Yen et al., 2015).

8.2.4. Summary of the Semantic Priming Task

This study measures the tendency to selectively attend to stimuli which appears salient to each of the two groups respectively. For Chinese participants; the salient foods would be the savoury foods, while spicy foods would be more salient to the Malay participants. By adopting a modified Semantic priming task, participants had to categorise target words after being primed with an image of a food dish. Overall, the RTs measured in this experiment were too varied to make any conclusive findings. Results showed that Malay participants were susceptible to a spicy prime, however, it led to greater errors. Chinese participants seemed to be better at visually assessing the spiciness of foods-as threat related stimuli emphasized in TCM as causing adverse effects on the human body (Ma, 2015; Weng & Chen, 1996). There were only slight differences between the two groups in categorising savoury foods. The Chinese participants made less errors when the prime was a savoury food item; however, this distinction between the groups were not as large as previously hypothesized.

Both groups had difficulty when attending to target words of other food categories when the prime was a control food item. The semantic relationship between onset of target word and the prime of control food items is distant, emphasizing the lack of familiarity participants had towards the control food items. This finding reflects our findings from the FFQ where habitual intake of fruits and vegetables were low and the least selections for the control food items in the 2AFC task.

Malay participants had higher errors when attending to incongruent target words for the sweet foods. Additionally, past studies have mentioned that Malaysians possess an inclination towards sweet foods (Sia et al., 2013)- but among Malays this liking is higher; as indicated by a higher consumption on a daily basis (Norimah et al., 2008; Wan Abdul Manan et al., 2012). Chinese participants also had difficulty attending to incongruent target words when the prime was a sweet food. Both groups' susceptibility in the presence of a sweet prime could be explained through a general liking to crave something sweet after a meal. As mentioned, both groups were satiated prior to carrying out the experiment. It is hypothesised that through SSS, similarly eaten foods (in which case it would be either a spicy or a savoury food) would have caused a decline in savoury tasting foods-and an increased inclination towards sweet-tasting foods (Wilkinson & Brunstrom, 2016). In which case, since participants were instructed to have a meal prior to carrying out the experiment, an increased preference for sweet tasting foods occurred due to the body's renewal in appetite (Higgs, Williamson, Rotshtein, & Humphreys, 2008; Sørensen et al., 2003) instead of a cultural bias.

7.2.5. Summary of the Recognition Memory Task

As many spicy foods in Malaysia are mostly curry or sambal based (Muhammad et al., 2013; Omar et al., 2015), it can be argued that most of the spicy dishes were not visually different from one another, hence, it could have impaired participant's ability to accurately recollect on whether the target (spicy) was presented. Additionally, distinction of the savoury and spicy food items was difficult therefore weakening recognition abilities for both groups. Malay participants were not able to recognise repetitions of the spicy foods as effectively as they did the savoury and sweet food items, which suggests that other factors are be involved during recollection.

In taste memory, food-related cues are associated directly to consequences upon its ingestion (Bermúdez-Rattoni, 2004). Therefore, if a positive outcome or a safe signal is established with a food eaten, it encourages the probability of future consumption while a negative outcome creates a long-term aversion. In TCM, there is great emphasis on the effects of eating spicy or 'hot' foods, whereas any similar emphasis on the harms of ingesting spicy foods is not mentioned in traditional Malay cooking (Li & Hsieh, 2004; Nor et al., 2012). It is proposed that overall concerns for health and well-being of the body discourages Chinese participants from spicy foods as compared to the Malay participants who place a greater emphasis on flavour.

SDT results showed that both groups performed the poorest when the category was spicy food. The difference between both groups' performance on recognition of the spicy food items and the other categories of the food-stimuli was significant; further suggesting that other factors occur during the detection of certain foods, such as the visual properties of the food itself. For instance, the spicy food images collected for this study were food images which looks spicy meaning there would be some indication of a presence of spice such as the colour of the dish as red. We proposed that because spicy foods are so prominent in Malay cooking; the generic foods which we collected for the study were not considered to be visually 'spicy' looking enough to elicit the response we had anticipated.

Results from the R-FFQ show Malay participants reported more control foods as 'never eaten' compared to Chinese participants reaffirms previous experiments (Chapter 3) and the literature that Malays tend to eat lesser amounts of fruit and vegetables compared to Chinese, and in general (Norimah et al., 2008; Yen et al., 2015). Apart from the correlation of low spicy food intake and *d*'scores on the spicy trials for Chinese participants, there was no other correlation linking foods reported on the R-FFQ and recognition abilities on the task. The lack of a strong relationship between R-FFQ findings performance on the task indicates that cultural familiarity with foods was not causal to recollection performance of both groups. Although we were unable to formulate a clear association between familiarity and recollection, we were able to gain more understanding in the recollection of salient foods impeding the effects of a cultural biases on recognition performance.

7.3. Limitations of Present Study

Classification of the food stimuli, especially the amount of sugar in a food, should have been measured using more stringent methods such as High-Performance High Chromatography with a refractive index detector. These methods measure the type and amount of sugar and have been used in a previous study to determine the specific content and type of sugars in selected commercial and traditional kuih within Klang Valley (Azizah, Shanita & Hasnah, 2015). Other studies which have adopted this method in measuring sugar include identifying the amount of sugar in honey (Khalil, Sulaiman & Gan, 2010), and commercial fruit juices marketed in Malaysia (Lee, Sakai, Manaf, Roghi & Saad, 2014). As most studies in the past measures on already known sweet tasting foods, it would be interesting to identify the accurate measurement of sugar in savoury and spicy foods. As mentioned previously, traditional Malay foods such as rendang and satay are a combination of spicy, savoury and sweet tastes. By assessing the amount of sugar in other savoury or spicy foods, we would be able to provide a supportive argument to the inclination towards sweet foods among Malays, as past research has shown that with constant exposure, thresholds for future sugar intake increases, which results in an unhealthy dietary practice (Holt, Cobiac, Beaumont-Smith, Easton & Best, 2000).

Visual properties of the images, such as the appeared texture, colour and shape of the food dishes, have been shown to influence preference and selection (Imram, 1999). In food studies, the colour of a food represents a product-intrinsic cue in informing people on the flavour of the food itself (Spence, 2015). Moreover, is the perception that if the colour of the food presented is not in its usual and expected form, it signifies the food is of a lesser quality (Hutchings, 2011; Wu & Sun, 2013). Zampini, Sanabria, Phillips, and Spence (2007) showed that participants made lower flavour discriminations for fruit-flavoured liquids which were coloured ‘inappropriately’ compared to liquids which were coloured appropriately. It was also found that participants reported lower ratings of flavour intensity for liquids which were inappropriately coloured compared to appropriate, and even for the colourless liquids. Zampini et al. (2007) found that the congruent or ‘appropriate’ visual cues of the liquid presented overrides awareness of the liquid tasted and eventually influenced participants’ flavour perception (Zampini et al., 2007). As all food stimuli had to be edited (i.e. changes in hue, brightness and contrast), this measure could have affected appearance of the food to which participants may have perceived as less palatable.

Information on participants’ medical history was not collected for this study. Anthropometric measurements such as BMI, were not considered for any of the experiments. We did not account for any of the participants having diabetes or if they were considered obese in the present sample. Implications of not taking these measures includes the possibility of an underlying bias towards sweet or very salty high caloric foods. Studies have shown a that individuals who are obese or have a high BMI (within their age group) possess a stronger inclination for sweet-tasting foods (Kumanyika, 2008) and a visual attention bias to food cues (Castellanos et al., 2009; Werthmann et al., 2011). In addition, obesity has been associated with a higher prevalence in emotional eating (Lazarevich, Irigoyen Camacho, Velázquez-Alva, & Zepeda Zepeda, 2016), which could have affected participants’ detection and selection of high-caloric foods. Specifically, the cultural bias that we sought to measure could have been influenced by an already pre-existing food-bias caused by having diabetes or diagnosed as clinically obese. On the other hand, it has also been found in other studies that leaner participants controlled their eating habits more. They reported less sugary and fatty foods but higher cravings and frequency intake for foods high in sugar and salt than obese people (Cox et al., 1998; Sia et al., 2013). Although the exact relationship between BMI status and intake of sweet foods is still ambiguous, it is, nevertheless a factor that should have been considered when measuring food selection.

Gender has been shown to influence food preference within a normal sample (Boek et al., 2012; Sia et al., 2013). As more than half of the participants involved in the present study were females and unequally divided over the groups, this could have been a confounding factor towards our findings. Firstly, studies have shown that female college students tended to select healthier choices for food compared to males who prioritised cost and taste in comparison (Boek et al., 2012). We did not measure motives for food choice i.e., price vs. healthy eating, but this factor could have varied between the sample. Secondly, biological differences between the genders posed as another factor that could have affected our results. A measure that we did not consider was individual phases in the menstrual cycle amongst the female participants. In food studies, the different phases within the menstrual cycle affects appetite regulation amongst females; which influences selection and their recordings on food intake (Sørensen et al., 2003). Expanding on this, studies have shown that the propensity of selecting sweet foods is higher and more frequent just before the menstrual cycle begins due to fluctuations in oestrogen (Cohen, Sherwin, & Fleming, 1987; Pelchat, 1997; Sia et al., 2013).

Studies conducted in Malaysia have showed that sodium and protein (meat, and animal products) intake is significantly higher among males than females across all age groups (Gan et al., 2011; Mirnalini et al., 2008; Wan Abdul Manan et al., 2012). In a study by Sia et al. (2013), Malaysian females also reported more cravings of sweet foods compared to males. In addition, Chinese females were reported to consume more fruits and vegetables daily compared to Chinese males (Wan Abdul Manan et al., 2012). Although results from self-reported questionnaires showed that sweet food intake did not differ by gender (Sia et al., 2013), it suggests that Malaysian females under-report their sugar consumption due to body consciousness and over-report their consumption of fruits and vegetables.

Expanding on this study, it was proposed that gender differences in eating behaviour is associated to the gender disparity in developing of NCDs in Malaysia. A cross-sectional study carried out among Malaysians (n=17,211) in an age range of 15 to over 40 years (M = 36.9, SD = .02) showed gender differences in the prevalence of developing metabolic syndrome (Rampal et al., 2016). Rampal et al. (2016) showed that the risk of developing metabolic syndrome was higher among Malaysian females than Malaysian males. Additionally, related studies showed that Malaysian women had a significantly higher rate of hypertension, diabetes and chronic renal failure compared to Malaysian males who were more likely to have a history of myocardial infarction (Lee et al., 2013). A within-ethnic groups comparison showed that Malay women were higher in the prevalence of obesity compared to Malay men (Dunn et al., 2012).

Among university students, which are the target sample for this research, it was proposed that there is a distinction between males and females in the types of food they choose to eat. Rodin (1992) identifies that both males and females adhere to the growing ideology of the 20^{th} century western culture's perception on aesthetic appearance. It was highlighted that the female body type has become increasingly waif-like whereas the male body type has been depicted to become increasingly muscular. As a result, we hope to make a more accurate account of consumption of foods amongst Malaysian females which does not involve self-reported questionnaire. By measuring participants' performance on an attentional bias task towards sweet foods, we will be able to get a clearer picture of Malaysian females' cravings and selection of foods.

The rationale to why RTs were too long and varied to be taken into consideration in culminating our findings was that both groups were told that they had to perform a task. It is argued that because of this, participants felt that they had to carry out the task carefully to avoid making mistakes. Additionally, they were not aware that RTs would be recorded, it is speculated that perhaps participants would have been faster at responding on all experimental tasks. However, the risk of informing participants that their RTs were being recorded could have resulted in a higher miss rate in responses. Although the sample size collected for the individual experiments were small, Malay participants showed a higher affinity towards spicy and sweet foods, compared to Chinese participants. For future studies, we propose to include health questionnaires in order to accurately assess food selection of Malays and Chinese in Malaysia. After addressing the limitations of this investigation, we conclude that our experiments in this investigation only highlights that there is a basis for furthering this research topic with focus placed on comparing food selection to health status.

7.5. Future Studies

7.5.1. Assessing Food Preferences Among Malaysian Indians

For future studies, other ethnic groups residing within Malaysia should be investigated. Literature shows that the prevalence of diabetes (Letchuman et al., 2010) and abdominal obesity (Kee et al., 2008) are high amongst Indians. Zaini (2000) proposed that

Indians in Malaysia are at the greatest risk in developing this disease in comparison to other ethnic groups (Zaini, 2000). In addition, the risk of developing metabolic syndrome is highest amongst Malaysian Indians compared to Malays, Chinese and indigenous groups in Malaysia (Rampal et al., 2016). Basic taste principles of Indian cuisine include the heavy usage of spices, such as garam masala, cumin, turmeric and cardamom. Primarily, Indian cuisine takes on an Ayurveda approach which is a type of traditional medicinal system (Pandey et al., 2013).

Similar to TCM principles, the Indian cuisine follow key rules regarding raw materials used in their cuisine by classifying certain foods accordingly such as as *ushna* (hot food), *tampu* (cold food) and *sama* (neutral) (Radzi et al., 2010). Most Indians in Malaysia practice Hinduism and believe that being vegetarian occasionally creates a harmonious element in the human body. Ingredients, such as milk and ghee, is used excessively in Indian cuisine for both sweet and savoury dishes (Radzi et al., 2010). Given the extremely high nutritional value of ingredients used within Indian cuisine, it is unsurprising that Malaysian Indians face a high prevalence of NCDs caused by high intakes of fat and sugar. We propose to carry out an investigation measuring the dietary intakes of Malaysian Indians from two age groups (<25 and >25 years) to explore this phenomenon.

7.5.4. Traditional Food Preparation and Dietary Intakes Among Malaysians

By investigating different food preparation methods in both Chinese and Malay cuisine in an urban sample, we can assess whether adhering to one's traditional cuisine poses beneficial or a risk to one's own health. It is proposed that a comparative study be conducted in measuring nutritional statuses between rural and urban samples to assess both macro- and micronutrient content. Basis for this study stems from literature in Malaysia stating that through urbanisation, most young Malaysians opt to have more FAFH than FAH meals (Lee & Tan, 2006; Radam et al., 2006) out of convenience.

Through urbanisation, many of the younger generations lack the knowledge and skill to prepare meals, let alone adopting traditional methods in food preparation. As a result, the over-usage of prepacked and processed foods has shown to pose many health risks, especially on the younger generation (Nor et al., 2012). Additionally, knowledge transfer of traditional cooking methods between the generations includes the loss of knowledge of ingredients which are beneficial in improving one's nutritional status (Li & Hsieh, 2004; Nor et al., 2012; Shazali, Nor, et al., 2013). The usage of more herbs and plant-based ingredients in traditional

Malay cuisine (Adnan & Othman, 2012), and the balance obtained from adhering to TCM (Li & Hsieh, 2004; Wang & Lu, 1992) are methods in which if adopted appropriately, may improve the nutritional status of Malaysians.

However, the debate on whether adopting traditional cooking methods and eating traditionally prepared foods is still ongoing. For example, as rendang is cooked for approximately 6-7 hours over a heat of 80-95ºC, the total nutrient content of the dish deteriorates due to its prolonged preparation method which causes the dish to be high in fat but low in actual protein composition (Rini, Azima, Sayuti, & Novelina, 2016). This method of food preparation is not only extremely time-consuming, but it also degrades the total nutrient content and adds more saturated fat to the dish. Traditional kuih, which is listed among the top 10 daily consumed foods across all ethnic groups in Malaysia, contributes to 8.1% of added sugar per serving among the urban population (Nik Shanita et al., 2012). On the other hand, studies have shown the advantages of adhering to one's own traditional cuisine-mode of preparation included (Manderson, 1981; Shazali, Salehuddin, Zahari, & Nor, 2016). It is proposed that further investigation should be developed in promoting healthier food preparation methods, whether adhering strictly to traditional cuisine or abandoning it entirely, or would an ideal solution be a combination of both.

7.5.5. Food Consumption and Emotional Eating

Past research has demonstrated the variability of eating patterns of an individual in response to a stressor (i.e. an external stimulus). For instance, Macht (2008) displayed in his study that eating behaviour among individuals vary in response negative emotions. Restrained eaters consume a higher volume of food when experiencing negative moods or when in fear as compared to non-restrained eaters showing a decrease in food intake in the similar situation (Herman & Mack, 1975; Messick, 1985). Van Loan (1997) defines restrained eating as the intent to limit food intake to prevent weight gain or to promote weight loss. In contrast, non-restrained eating is carried out by normal eaters or normal-weight persons whose emotional and restrained eating scores fall within the normal range (Macht, 2008). It is unclear whether restrained eaters increase or decrease their consumption of high-caloric content or fatty foods.

The emotional state of the individual is another prevailing factor in the variation of eating behaviour within an individual. Van Strien, Frijters, Bergers, and Defares (1968) elucidate that emotional eaters tend to consume food which is sweeter and is high in fat and caloric content in response to emotional stress as opposed to non-emotional eaters. Emotional eating; otherwise known as binge-eating, is known to serve as a mechanism to cope with negative emotions for individuals who are emotional eaters (Bruch, 1973; Kaplan & Kaplan, 1957). Pohjanheimo, Paasovaara, Luomala and Sandell (2010) discriminated between a hedonistic and a traditional eater by applying the Schwartz value theory (Schwartz, 1996). Briefly, the Schwartz value theory (Schwartz, 1996) outlines basic human values that makes a culture and highlights measures taken to maintain values, rituals, and beliefs within a cultural group. Principles include openness to change, conservatism, self-enrichment and self-transcendence motives which benefits the individual and the cultural group they identify with (Schwartz, 2006). Pohjanheimo et al. (2010) made the distinction that traditional individuals are more motivated by health and health concerns, natural content, familiarity and ethical concern orientations as opposed to hedonistic individuals who are more motivated by sensory appeal in comparison. By determining this distinction, we hypothesise that the selection of foods taken by the participant is not influenced by the classification of the participant rather the palatability preference of the participant, which is influenced by the sensory qualities of the food.

7.5.6. Cross-Cultural Differences in Visual Attention for Familiar and Novel Food Items.

There has yet to be an eye-tracking study looking at differences in visual attention allocation between cultures. It is proposed that if both ethnic groups would find foods familiar to their diet as salient, logically they would exhibit a bias and allocate more attention compared to non-familiar foods. Eye movements differ according to high-cognitive function tasks whereby features of the scene allow the observer to meet the demands of the task using the information readily available (DeAngelus & Pelz, 2009). Yarbus's (1976) found that there were fewer saccades between the regions of interest and significantly lower fixations given to the background elements when his observer was observing a task-specific scene (Yarbus, 1967).

7.6. Conclusion

The overall findings collected from the present study provides insightful information into food selection and eating behaviours of Malaysian undergraduates from Malay and Chinese origin. As such, this study serves as an insight into investigating other components which influence food choice. Furthermore, the findings collected throughout the course of this investigation would be beneficial for policymakers and the relevant governing bodies gain insight into tackling the NCDs problem in Malaysia as well as improve on future dietary interventions among Malaysians.

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Appendix A

Table 1: Nutritional Composition of foods in Category A (Grains).

Question	Food	Portion Size	Calories	Carbohydrate (g)	Protein (g)	Sodium (mg)	Fat (g)	Potassium (mg)	Dietary Fibre (g)	Sugars (g)	Cholesterol (mg)
1	Rice	185g	675	148	13	9	1	0	2	0	0
2	Porridge	1 cup	1703	226	86	7576	52	36	9	6	0
3	Glutinous Rice	1 cup	1243	174	72	1056	42	2701	36	110	0
4	Yellow Noodles	100g	524	71	21	886	16	0	2	0	56
5	Noodles	1 cup	213	40	8	11	2	45	2	1	53
6	Pasta	72g	1386	90	68	1144	83	2563	12	14	1340
7	Sago	1 cup	45	7	0	170	2	0	0	6	0
8	Bread	1 slice	69	13	3	148	1	71	2	6	0
9	Bun	1 bun	400	33	18	964	22	614	6	15	65
10	Roti Canai	1 slice	390	39	17	710	10	271	6	18	30
11	Chapatti	1 piece	429	86	11	3	6	124	12	28	0
12	Thosai	1 piece (91g)	193	21	0	0	0	0	0	0	0
13	Cereal	1 cup	101	24.28	1.88	266	0.03	33	0	0	0
14	Instant Oats	1 packet	3280	488	55	4919	126	1089	18	294	240
15	Pizza	1 slice	80	12	4	265	5	0	1	1	10
16	Corn	1 cup (141g)	185	36	5	6	2	0	4	5	0

Table 2: Nutritional Composition of foods in Category B (Meat and Meat Products).

Question	Food	Portion Size	Calories	Carbohydrate (g)	Protein (g)	Sodium (mg)	Fat (g)	Potassium (mg)	Dietary Fibre (g)	Sugars (g)	Cholesterol (mg)
17	Chicken										
	i) meat (breast)	65.5g	98.91	1.24	12.05	27.51	5.11	205.01	0	1.77	0
	ii) drumstick	1 drumstick	143	7	16	200	5	0	1	1	0
	iii) wing	85g	85.68	0	6.54	21.8	6.62	88.36	0	1.15	0
	iv) thigh	175g	300	0	23.2	70.98	23.07	399.94	0	4.91	0
18	Beef	113g	258	0	28	88	15	0	0	0	94
19	Mutton	1 serving	1249	168	32	497	53	23	8	8	129
20	Burger Patty	1 round piece (74.30g)	187.24	3.64	16.72	309.09	11.74	401.96	0	0	0
21	Sausage	1 serving (2	80	4	7	150	5	0	0	2	0
22	Nugget	100g	331	13	51	432	8	358	7	0	119
23	Ball										
	i) Chicken	100g	167	18	11	672	6	0	3	0	6
24	Duck	99g	140	0	28	0	3	0	0	0	143

Table 3: Nutritional Composition of foods in Category C (Fish and Seafood).

Question	Food	Portion Size	Calories	Carbohydrate (g)	Protein (g)	Sodium (mg)	Fat (g)	Potassium (mg)	Dietary Fibre (g)	Sugars (g)	Cholesterol (mg)
25	Ball										
	i) Prawn	1 serving (5 balls)	142	7	14	1045	7	0	2	0	0
	ii)Crab	1 ball	20	2	2	144	0	0	0	1	2
26	Sea Fish (Mackerel)	100g	245	0	23	1	6	0	0	0	0
27	Fresh Water (Ikan Haruan)	100g	1772	41	39	1750	149	70	0	1	745
28	Anchovies	1/2 cup (27.89g)	72.24	0.28	15.81	101.24	0.86	189.37	0	0	0
29	Canned Fish										
	i) Tuna	198g	150	0	33	180	1	75	0	0	10
	ii) Salmon	100g	360	78	8	785	2	0	4	0	0
	iii) Sardine	1 container	204	2	20	572	13	0	0	0	65
30	Shellfish										
	i) Kerang	1 serving (20 small units)	200	6	9	150	15	0	4	0	0
	ii) Lala / clams	6 units	64	2	11	49	1	340	0	0	30
	iii) Siput / mollusks	100g	69	1	9	223	3	99	0	1	108
31	Prawn	1 serving (85g)	90	1	17	126	1	157	0	0	129
32	Fresh Squid	28g	26	1	4	12	0	0	0	0	66
33	Dried Squid	28g	87	1	17	170	1	0	0	0	247
34	Crab	170g	145	0	28	850	2	455	0	0	140
35	Dried Fish	1 slice (40g)	71	0	16.04	1263.2	0.76	48.8	0	0	0
36	i) Fishball	100g	100	7	15	0	1	0	0	0	0
	ii)Fishcake	50g	170	24	2	60	7	0	1	12	0
37	Fish Cracker (Keropok Lekor)	100g	381	27	32	80	16	555	9	0	70

Table 4: Nutritional Composition of foods in Category D (Fish and Seafood).

Question	Food	Portion Size	Calories	Carbohydrate (g)	Protein (g)	Sodium (mg)	Fat (g)	Potassium (mg)	Dietary Fibre (g)	Sugars (g)	Cholesterol (mg)
38	Chicken Egg	1 medium sized	63	0	6	62	4	61	0	0	164
39	Duck Egg	1 egg	130	1	9	102	10	155	0	1	619
40	Quail Egg	1 serving (5 eggs)	174	8	21	659	7	281	1	4	36

Table 5: Nutritional Composition of foods in Category E (Pulses).

Question	Food	Portion Size	Calories	Carbohydrate (g)	Protein (g)	Sodium (mg)	Fat (g)	Potassium (mg)	Dietary Fibre (g)	Sugars (g)	Cholesterol (mg)
41	Baked Beans	1 cup	680	116	8	852	2	346	6	17	3
42	Beancurd (Tofu)	1 ounce (28g)	20	0	0	3	1	0	0	0	0
43	Dried Beancurd (Fuchuk)	1 serving (101g)	650	78	48	12628	17	1022	15	27	140
44	Fermented Soya Bean (Tempe)	1 serving (100g)	85	12	1	63	4	0	1	0	7
45	Ground nuts	1 serving (20 nuts)	900	130	43	2445	21	1155	18	8	100

Table 6: Nutritional Composition of foods in Category F (Milk and Milk Products).

Question	Food	Portion Size	Calories	Carbohydrate (g)	Protein (g)	Sodium (mg)	Fat (g)	Potassium (mg)	Dietary Fibre (g)	Sugars (g)	Cholesterol (mg)
46	Fresh Milk	1 cup	146	11	8	98	8	349	0	13	24
47	Milk Powder	1 serving (100g)	510	39	24	0	28	0	0	0	0
48	Evaporated Milk	1 cup	200	24	16	280	4	800	0	24	40
49	Condensed Milk	1 cup	982	166	24	389	27	1135	0	166	104
50	i)Yoghurt	1 cup	130	9	23	95	0	350	0	9	0
	ii) Curd	1 serving	482	13	22	287	37	661	2	7	683
	iii) Lassi	227g	154	17	8	81	4	256	0	18	22
51	Cheese	1 slice	19	1	0	5	2	0	0	0	0

Table 7: Nutritional Composition for Category G (Vegetables).

Question	Food	Portion Size	Calories	Carbohydrate (g)	Protein (g)	Sodium (mg)	Fat (g)	Potassium (mg)	Dietary Fibre (g)	Sugars (g)	Cholesterol (mg)
52	Green Leafy vegetables										
	i) Spinach	1 cup (30g)	7	1	1	24	0	0	1	0	0
	ii) Lettuce	1 cup (55g)	7	1	1	3	0	0	1	1	0
	iii) Watercress	100g	11	1	2	41	0	330	1	0	0
	iv) Asparagus	100g	20	4	2	2	0	202	2	2	0
	v) Cabbage	100g	25	6	1	18	0	170	3	3	0
	vi) Kale	28g	14	2	1	11	0	137	1	1	0
53	Bean sprout	1 cup	62	12.18	6.23	12	0.37	305	0	0	0
54	Broad Beans	80g	74	9	6	0	1	0	5	1	0
55	French Beans	1 cup (184g)	631	118	35	33	4	0	46	0	0
56	Green Peas	1 cup (145g)	117	21	8	7	1	0	7	8	0
57	Carrot	1 cup (128g)	52	12	1	88	0	0	4	6	0
58	Beetroot	1 cup (136g)	58	13	2	106	0	0	4	9	0
59	Cucumber	1 cup pared (133g)	16	3	1	3	0	0	1	2	0
60	i) Pumpkin	1 cup (116g)	30	8	1	1	0	0	1	2	0
	ii) Squash	100g	45	12	1	4	0	352	2	2	0
61	Broccoli	1 cup (71g)	20	4	2	19	0	0	0	0	0
62	Eggplant	1 cup (82g)	20	5	1	2	0	0	3	2	0
63	Okra	1 cup	40	8	1	0	0	0	0	0	0
64	Sweet Potato	1 cup (133g)	114	27	2	73	0	0	4	6	0
65	Salted and dried vegetables	1 cup (148.30g)	59.32	11.42	2.22	2762.8	0.59	2657.54	1.93	0	0
66	Coleslaw	1 serving (99g)	147	13	2	267	11	0	0	0	5
67	Tomato	1 cup (158g)	25	5	2	66	0	0	1	0	0
68	Pepper (Capsicum)	100g	140	29	2	90	6	85	9	10	0
69	Young corn	100g	81	18.59	2.62	241	1	195	0	0	0
70	Mushroom	1 cup	15	2.3	2.16	4	0.24	223	0	0	0

Table 8: Nutritional Composition for Category H (Fruits and Juice).

Question	Food	Portion Size	Calories	Carbohydrate (g)	Protein (g)	Sodium (mg)	Fat (g)	Potassium (mg)	Dietary Fibre (g)	Sugars (g)	Cholesterol (mg)
71	Apple	1 cup (110g)	53	14	0	0	0	0	1	11	0
72	Banana	1 cup (225g)	200	51	2	2	1	0	6	28	0
73	Durian	1 cup (243g)	357	66	4	5	13	0	9	0	0
74	Grapes	1 cup (151g)	104	27	1	3	0	0	1	23	0
75	Guava	1 cup (165g)	112	24	4	3	2	0	9	15	0
76	Jackfruit	1 cup (165g)	155	40	2	5	0	0	3	0	0
77	Lime	1 piece	20	7	0	0	0	75	2	0	0
78	Longan	100g	60	15	1	0	0	266	1	0	0
79	Lychee	190g	361	53	22	377	7	332	3	5	25
80	Mandrin (oranges)	1 medium sized	50	2	1	30	4	0	0	1	15
81	Mango	1 cup (165g)	107	28	1	3	0	0	3	24	0
82	Orange	1 cup (170g)	107	26	2	3	1	0	8	0	0
83	Papaya	1 cup (140g)	55	14	1	4	0	0	3	8	0
84	Pear	100g	57	15	0	1	0	116	3	10	0
85	Peach	175g	68	17	2	0	0	333	3	15	0
86	Persimmon	1 whole fruit	118	31.23	0.97	2	0.32	270	0	0	0
87	Pineapple	1 cup (165g)	82	22	1	2	0	0	2	16	0
88	Pomelo	190g	1050	115	55	2529	61	2152	22	44	160
89	Rambutan	1 fruit	7.4	1.9	0.1	1	0	3.8	0.1	0	0
90	Starfruit	1 cup (cubes)	356	42	26	1360	11	0	8	8	46
91	Watermelon	1 cup (154g)	46	12	1	2	0	0	1	10	0
92	Honeydew	1 cup (177g)	64	16	1	32	0	0	1	14	0
93	Duku	100g	152	29	4	0	2	0	3	22	0
94	Ciku	1 cup	200	48	1	29	3	465	13	0	0
95	Tinned Fruit	205g	110	26	0	0	0	0	2	24	0
96	Dried Fruit	1 cup	440	92	0	80	6	0	4	76	0

Table 9: Nutritional Composition for Category I (Confectionary).

Question	Food	Portion Size	Calories	Carbohydrate (g)	Protein (g)	Sodium (mg)	Fat (g)	Potassium (mg)	Dietary Fibre (g)	Sugars (g)	Cholesterol (mg)
97	Local cakes: rice or glutinous rice based. Sweet kuih such as seri muka, kuih lapis, kuih koci, dodol										
	i) seri muka	1 piece (99g)	192.06	35.94	3.56	114.84	3.76	255.42	0.2	0.99	0
	ii) kuih lapis	1 piece (87g)	131.8	28.8	1.9	0	1	0	0	0	0
	iii) kuih koci	1 piece (82g)	164	32.55	4.67	1.64	7.38	2.3	0	0	
	iv) dodol	1 piece (22g)	70.84	14.72	0.64	1.76	1.03	8.14	0.02	0.35	0
98	Local cakes: wheat based e.g. curry puff, pau etc.										
	i) curry puff	1 piece (40g)	128	0	1.9	68	5.6	66	0.1	0	17
	ii) pau	1 bun	430	59	32	766	7	1484	11	40	35
99	Local sweets: milk basede.g. ladoo, gulab jamun, jalebi, rasmalai										
	i) ladoo	1 piece (70g)	309.4	38.57	4.48	46.2	15.26	12.6	0.07	0	0
	ii) gulab jamun	1 ball	340	23	48	151	5	1339	6	4	119
	iii) jalebi	1 piece	72	12	2	23	2	113	2	4	0
	iv) rasmalai	1 piece	289	65	7	160	1	505	4	30	0
100	Cake	1 piece (23g)	100.05	13.13	1.63	81.65	4.55	8.74	0	0.23	0
101	Biscuit	1 serving (7 pieces)	74	11	1	0	3	0	0	0	0
102	Sweets (celebrations)	100g	213	7	8	842	17	201	0	8	21
103	Chocolates	1 serving (7 blocks)	200	23	3	40	11	0	0	22	10
104	Ice Cream (vanilla)	1/2 cup	58	17	3	58	8	143	1	15	32
105	Shaved Ice with Flavouring										
	i) Ice Kacang (ABC)	500g	258	32	5	68	1	0	0	31	8
	ii) Cendol	1 cup	493	59	45	3843	3	104	3	6	112
106	Sweet Potato Soup	1 cup	114	31	0	4	0	72	0	28	0
107	White Fungus Desert	1 bowl	160	5	15	310	9	0	0	5	45
108	i) Jelly (raspberry jello)	1 cup	160	38	4	160	0	0	0	38	0
	ii) Custard	100g	237	11	25	730	8	0	3	3	39
109	Crackers	1 serving (7 pieces)	74	11	1	0	3	0	0	0	0
110	Brownies	1 serving (100g)	115	18	1	88	5	42	1	10	5
111	Popcorn	1 serving (1 1/4 cup)	130	23	1	190	4	0	2	8	0
112	Cookies (chocolate chip)	1 cookie (10g)	45	7	1	38	2	0	0	0	0
113	Doughnut	1 piece	77	10	1	77	4	0	8	5	20
114	Cream Caramel	1 serving	120	21	1	160	3	0	0	0	0
115	Kaya Toast	1 portion	215	38	6	26	4	74	0	0	16
116	Marshmallow	1 serving (100g)	318	81.3	1.8	80	0.2	5	0.1	57.56	0
117	Waffles	4 inch sq (33g)	103	16	2	241	3	0	0	0	5
118	Rice Pudding	1 serving (25g)	2998	390	57	2839	148	731	6	252	328
119	Cupcakes	1 unit (83g)	246	47	3	112	6	0	0	34	15

Table 10: Nutritional Composition for Category J (Savoury Snacks).

Question	Food	Portion Size	Calories	Carbohydrate (g)	Protein (g)	Sodium (mg)	Fat (g)	Potassium (mg)	Dietary Fibre (g)	Sugars (g)	Cholesterol (mg)
120	Thenkuzhal Murukku	23.6g	583	84	24	288	20	0	2	9	0
121	Goldfish Crackers	25 crackers (30g)	180	16	11	500	8	0	0	1	25
122	Potato Chips	1 serving (28g)	158	15	2	138	10	336	1	1	0
123	Masala Peanuts	1 serving (100g)	625	20	24	489	50	0	10	4	0
124	Xiang Bing	2 pieces	211	9	29	567	4	0	0	0	56
125	Nian Gao	1 serving (85.7g)	467	48	28	0	18	0	0	0	0
126	Keropok (Fish or Prawn Crackers										
	Fish	30g	2377	124	224	6965	65	815	9	20	570
	Prawn	1 serving	67	10	1	110	3	0	0	0	0
127	Corn Chips, Tortilla Chips (including Twisties)										
	Corn chips (Fritos	32 chips (28g)	431	55	28	685	12	320	6	22	0
	Tortilla Chips	100g	501	63	7	528	26	197	7	1	0
	Twisties	1 serving	134	17	2	285	6	80	0	1	1

Table 11: Nutritional Composition for Category K (Spreads).

Question	Food	Portion Size	Calories	Carbohydrate (g)	Protein (g)	Sodium (mg)	Fat (g)	Potassium (mg)	Dietary Fibre (g)	Sugars (g)	Cholesterol (mg)
128	Jam	1 tsp	19	5	0	0	0	0	2	9	0
129	Egg Jam (Kaya)	1 tbsp	45	7	1	5	2	0	0	6	15
130	Butter	1 tbsp	102	0	0	2	12	3	0	0	31
131	Margerine	1 tbsp	90	0	0	105	11	0	0	0	0
132	Peanut Butter	1 tbsp	70	3	3	48	6	68	1	1	0
133	Cream Cheese	1 tbsp	30	1	1	54	2	37	0	1	8
134	Sugar	1 tbsp	48	12	0	0	0	0	0	12	0
135	Honey	1 tbsp (21g)	64	17	0	1	0	0	0	17	0

Table 12: Nutritional Composition for Category L (Flavourings).

Question	Food	Portion Size	Calories	Carbohydrate (g)	Protein (g)	Sodium (mg)	Fat (g)	Potassium (mg)	Dietary Fibre (g)	Sugars (g)	Cholesterol (mg)
136	Sambal Belacan	1 tsp (12g)	9	2	0	171	0	0	0	0	0
137	Budu	10ml	1656	183	78	3326	63	933	24	37	210
138	Cencaluk	100g	758	88	24	958	28	702	17	45	288
139	Thick Soya Sauce	1 tbsp (15ml)	790	81	34	1580	36	0	8	6	60
140	Thin soya sauce	1 tbsp (15ml)	2514	231	63	375	169	201	22	150	635
141	Chili sauce	1 tbsp (17g)	20	5	0	230	0	0	0	3	0
142	Oyster sauce	1 tbsp	20	4	0	560	0	0	0	3	0
143	Heko / Petis	1 tsp	379	7	20	1273	30	0	2	3	210

Table 13: Foods eaten when stressed.

Category		Ethnic Group Malay	Ethnic Group Chinese	Total
0	Count	2.00	16.00	18.00
	% within column	5.6 %	20.0 %	15.5 %

Category		Ethnic Group Malay	Chinese	Total
1	Count	3.00	7.00	10.00
	% within column	8.3 %	8.8 %	8.6 %
2	Count	0.00	1.00	1.00
	% within column	0.0 %	1.3 %	0.9 %
3	Count	1.00	10.00	11.00
	% within column	2.8 %	12.5 %	9.5 %
4	Count	20.00	36.00	56.00
	% within column	55.6 %	45.0 %	48.3 %
5	Count	0.00	1.00	1.00
	% within column	0.0 %	1.3 %	0.9 %
7	Count	10.00	8.00	18.00
	% within column	27.8 %	10.0 %	15.5 %
9	Count	0.00	1.00	1.00
	% within column	0.0 %	1.3 %	0.9 %
Total	Count	36.00	80.00	116.00
	% within column	100.0 %	100.0 %	100.0 %

Table 14: Foods eaten when happy.

Contingency Tables

Category		Ethnic Group Malay	Chinese	Total
0	Count	3.00	10.00	13.00
	% within column	8.3 %	12.5 %	11.2 %
1	Count	7.00	19.00	26.00
	% within column	19.4 %	23.8 %	22.4 %
2	Count	0.00	1.00	1.00
	% within column	0.0 %	1.3 %	0.9 %
3	Count	9.00	11.00	20.00

Contingency Tables

		Ethnic Group		
Category		Malay	Chinese	Total
	% within column	25.0 %	13.8 %	17.2 %
4	Count	13.00	33.00	46.00
	% within column	36.1 %	41.3 %	39.7 %
5	Count	0.00	2.00	2.00
	% within column	0.0 %	2.5 %	1.7 %
6	Count	0.00	1.00	1.00
	% within column	0.0 %	1.3 %	0.9 %
7	Count	4.00	3.00	7.00
	% within column	11.1 %	3.8 %	6.0 %
Total	Count	36.00	80.00	116.00
	% within column	100.0 %	100.0 %	100.0 %

Section 1

The Food Frequency Questionnaire Instructions and Demographic Information

This study aims to investigate the eating habits of university students in Malaysia. All responses will be strictly anonymous and confidential. No individual feedback will be given. Your participation is highly appreciated.   This questionnaire comprises of 3 different surveys. The "Food Frequency Questionnaire", the "Three-Factor Eating Questionnaire" and the "State vs Trait Anxiety Inventory" will be the order of presentation.

Age

Gender

○ Male (1)

○ Female (2)

Nationality

____

Ethnic Group

○ Chinese (1)

○ Indian (2)

○ Malay (3)

○ Others (4)

For each of the listed food item, please indicate how often you eat it whether it is by the day, week or month. You can do so by clicking on the circles underneath an answer to dot them. For each of the item eaten, please indicate how much you eat at each sitting/per meal. Please refer to the photo to get an idea of how much a portion will look like.
Move the cursor along the scale to indicate the portion you had per serving.

Frequency Question: How often do you eat this food?

- ○ Never (1)
- ○ Once a day (2)
- ○ 2-5+ times a day (3)
- ○ Once a week (4)
- ○ 2-5+ times a week (5)
- ○ Once a month (6)

Portion Size Question: When you eat this food, how much do you eat per sitting?

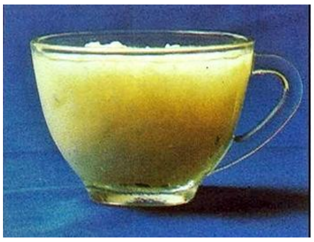
Cup/Portion	

Figure 1: Food Images in the FFQ.

Rice: Showing one scoop (50g)

Noodles / Flat Rice Noodle aka Kuehteow / Laksa / Laksam: Showing 2/3 cup

Porridge: Showing one cup



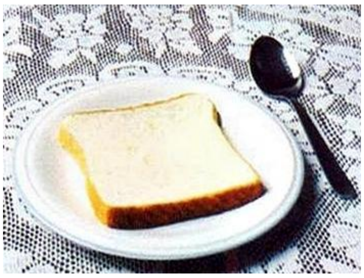
Pasta / Spaghetti: Showing 1 portion

Glutinous rice: Showing 1 portion

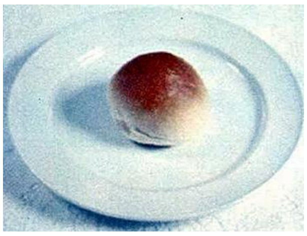
Sago: Showing 1 cup

Yellow Noodles / Shell Pasta / Instant Noodles: Showing half cup

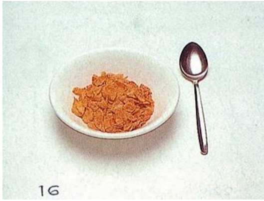
Bread: Showing 1 slice



Bun: Showing 1 piece

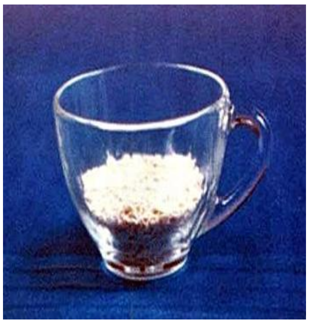


Cereal: Showing 1 portion



Roti canai: Showing 1 portion

Instant oats: Showing 0.5 cup



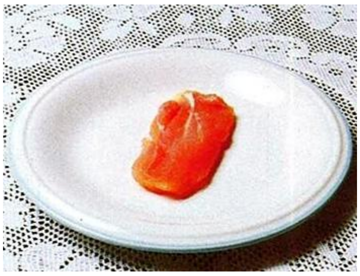
Chapatti: Showing 1 portion

Pizza: Showing 1 slice

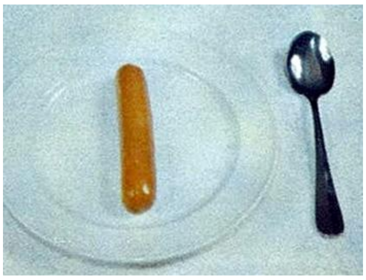
Thosai: Showing 1 portion

Corn: Showing 1 whole

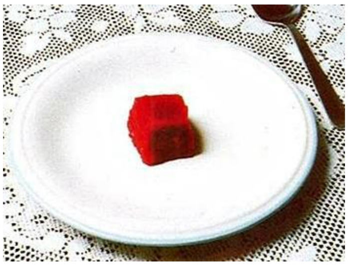
Chicken meat: Showing 1 piece of meat (38g)



Sausage: Showing 1 piece

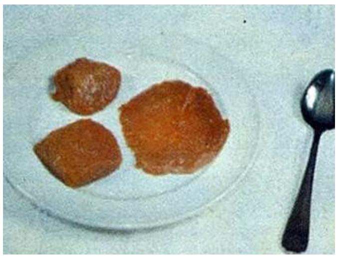


Beef: Showing 1 piece



Nugget: Measure by piece

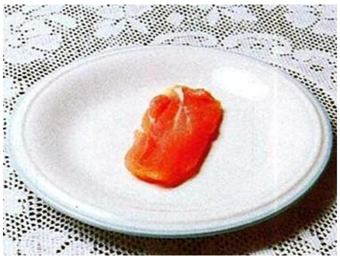
Mutton: Showing 3 pieces

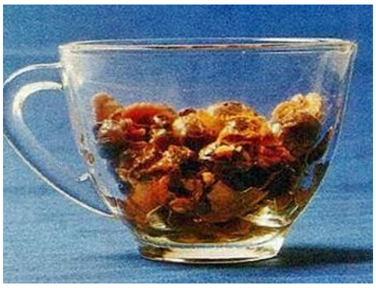
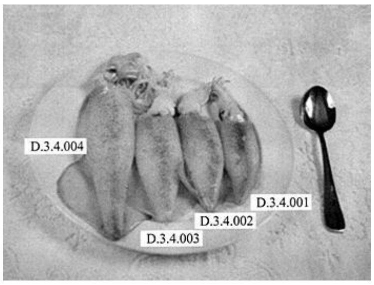


Chicken balls / Crab balls / Prawn balls: Showing 1 portion (10 piece or 0.5 cup)

Burger Patty: Showing 2 piece

Duck: Showing 1 piece (38g)



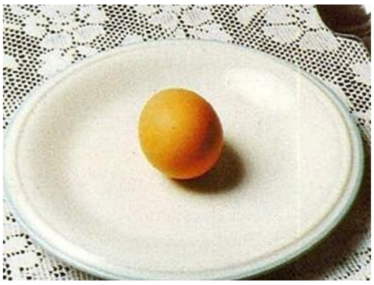
Sea fish: Showing Mackerel (Ikan kembong) 	Shellfish (Kerang, lala, siput) Showing 1 portion 
Fresh water fish: Showing Snakehead Murrel (Ikan haruan) and size of 1 portion 	Prawn: Showing 1 portion 
Anchovy (Ikan bilis): Showing 1 portion (1/3 cup) 	Fresh squid: Use the medium size (D3.4.002) as reference 

Canned fish (Tuna, Salmon, Sardine): Measure by tin

Dried squid: Showing 1 piece

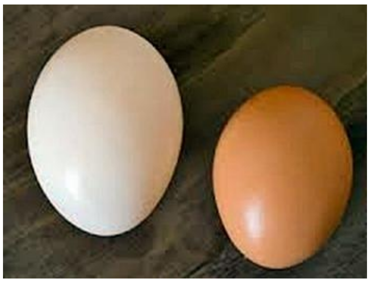
Crab: Showing 1 piece

Chicken egg: Showing 1 piece



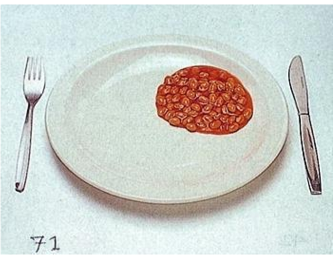
Dried fish: Measure by piece

Duck egg (Salted egg): Showing 1 piece (white egg)



Fish ball / Fish cake:
Showing 1 portion (or 10 pieces in half a cup)

Quail egg: Showing 6 pieces

Fish cracker (Kerepok lekor): Measure by piece 	Baked beans: Showing 1 portion 

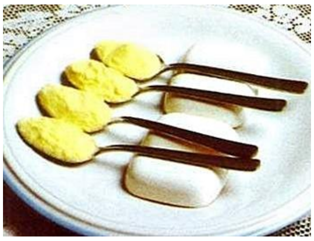
Beancurd / Tofu: Showing 1 piece

Dried beancurd (fuchuk): Showing 1 portion

Fermented soya beans (Tempeh): Showing 1 portion

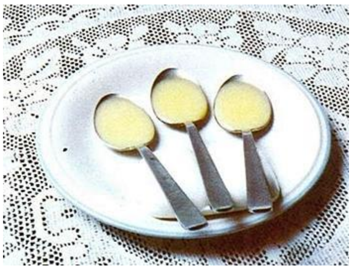
Groundnuts: Showing 1/3 cup

Milk powder: Measure by dessert spoon



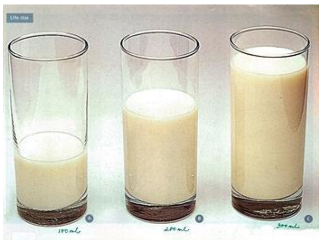
Evaporated milk: Showing 2/3 cup (104g)

Condensed milk: Showing 3 dessert spoon



Yogurt / Curd / Lassi / Sour milk: Showing 1 glass

Fresh milk: Measure by glass

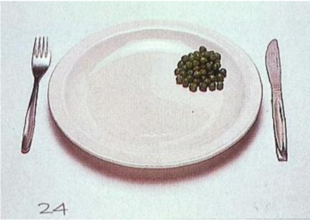


Cheese: Showing 2 slices

Green leafy vegetables:

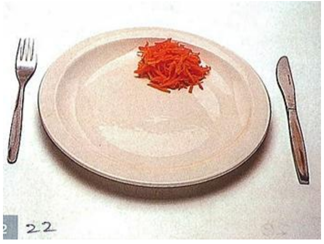
Size of 1 portion will be as shown in the middle column (lettuce, cabbage)

Green peas: Showing 1 portion



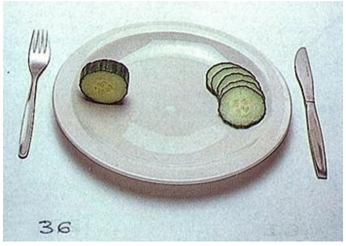
Bean sprout

Carrot: Showing 1 portion



Broad beans

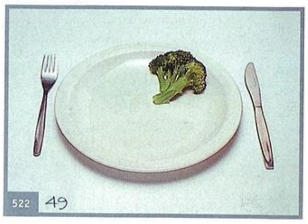
Beet root

French beans 	Cucumber: Showing 1 portion 

Pumpkin / Squash: Showing 1 cup

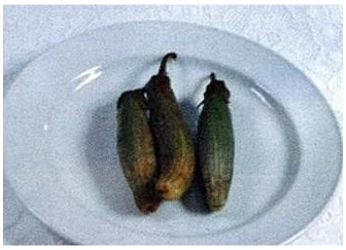
Sweet potato: Showing 0.5 cup

Brocolli: Showing 1 portion

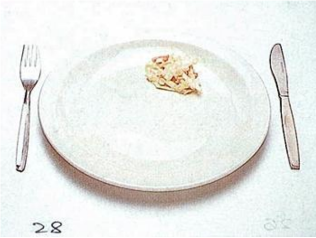


Salted and dry vegetables: Showing 1 sauce plate

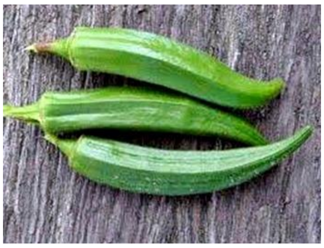
Eggplant / Brinjal / Aubergine: Showing 3 pieces



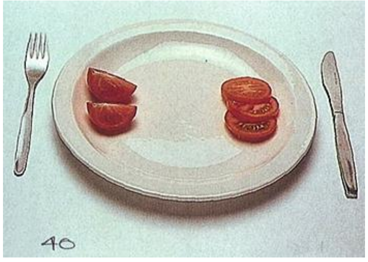
Coleslaw: Showing 1 portion



Okra / Lady finger / Bhindi: Showing 3 pieces



Tomato: Showing 1 portion



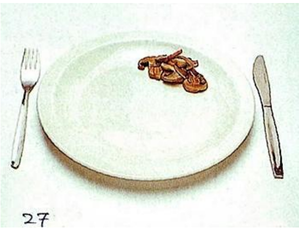
Pepper: Measure by slices

Durian: Showing 3 pieces

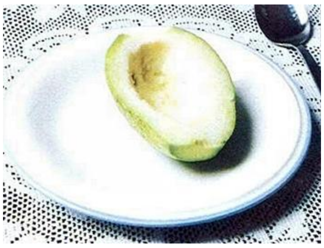
Young corn

Grapes: Showing 1 portion

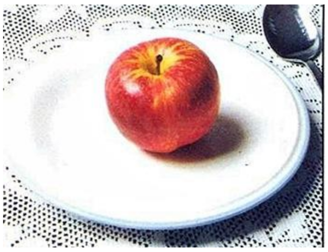
Mushroom (wet or dry): Showing 1 portion



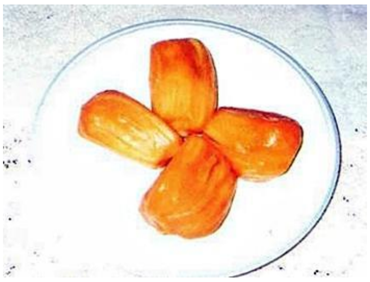
Guava: Showing 1 piece



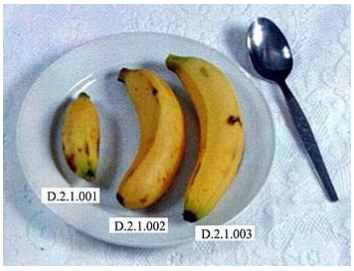
Apple: Measure by 4 slices



Jackfruit: Showing 4 pieces



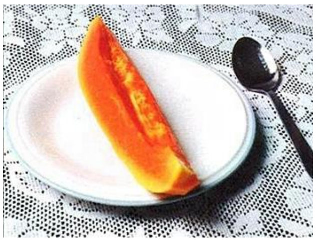
Banana: Use the medium size (D2.1.002) as reference



Lime: Showing 0.5 piece

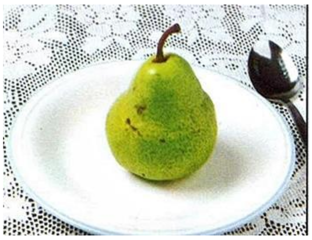
Longan: Showing 3 pieces

Papaya: Showing 1 slice

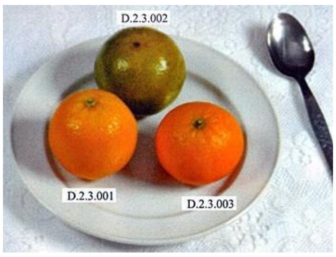


Lychee: Showing 5 pieces

Pear: Showing 1 whole

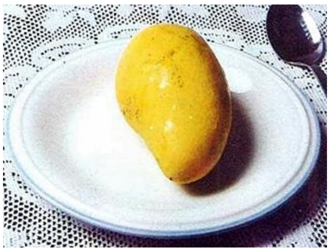


Mandarin: Use the medium size (D.2.3.001) as reference



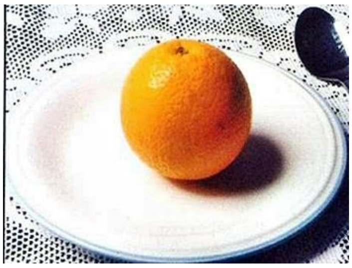
Peach: Measuring by 1 whole

Mango: Showing 1 whole

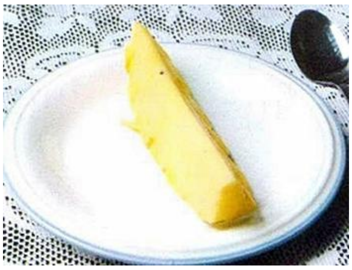


Persimmon: Showing 1 whole

Orange: Showing 1 whole



Pineapple: Showing 1 slice



Pomelo / Grapefruit: Showing 1 piece

Duku / Langsat / Loquat: Showing 1 portion (6 pieces)

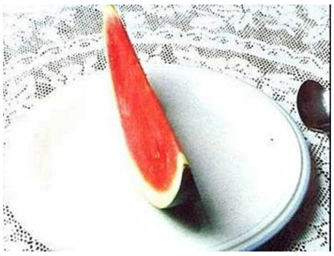
Rambutan: Showing 1 portion (approximately 7 pieces)

Ciku: Showing 1 whole

Starfruit: Showing 2 whole medium

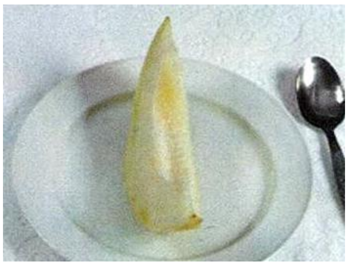
Tinned fruit

Watermelon: Showing 1 slice



Dried fruit

Honeydew: Showing 1 slice



Sweet kuih: rice or glutinous rice based.

Local cakes: wheat based

e.g. curry puff, pau etc.: Showing a variety.

Using 1 piece as 1 portion.

Sweets: Using a handful as 1 portion

Chocolates: Using 3 pieces as 1 portion

Local sweets: milk based

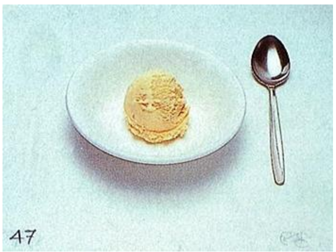
e.g. ladoo, gulab jamun, jalebi, rasmalai

Showing a variety. Using 2 pieces of any

sweets in whatever combination as 1

portion.

Ice cream: Showing 1 scoop (47g)



Cake: Showing 1 piece (58g)

Shaved iced with flavoring (including Ice kacang, ABC, cendol)

Biscuit: Showing 1 portion (3 pieces)

Brownies: Showing 1 portion (2 pieces)

Sweet potato soup: Showing 1 bowl

Popcorn: Using a handful as 1 portion

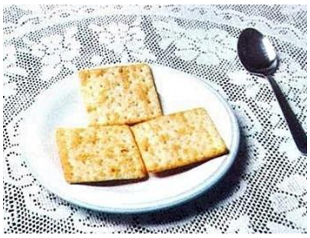
White fungus dessert: Showing 1 bowl

Cookies: Showing 1 portion (3 pieces)

Jelly / Custard: Using 1 piece as 1 portion

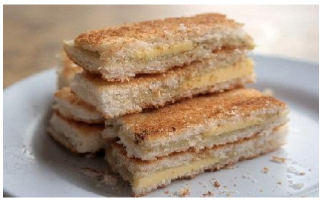
Doughnut: Using 1 piece as 1 portion

Crackers: Showing 1 portion (3 pieces)



Cream Caramel / Flan: Showing 1 portion

Kaya Toast: Showing 1 portion (4 pieces)



Goldfish Crackers: Showing 1 portion

Marshmallows: Showing 1 portion (1 cup)

Potato Chips: Showing 1 portion

Waffles: Showing 1 plate

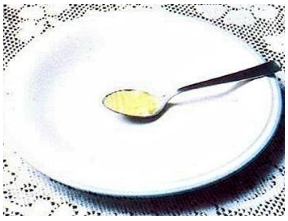
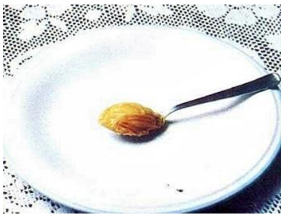
Masala Peanuts: Using 1 handful as 1 portion

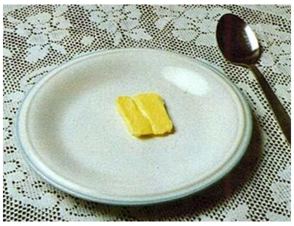
Rice Pudding: Showing 1 portion

Salted Pretzels: Using 1 piece as 1 portion

Cupcakes: Showing a variety. Using 1 piece as 1 portion.

Xiang Bing: Using 1 piece as 1 portion

Thenkuzhal Murukku: Showing 1 portion 	Nian Gao: Using 1 piece as 1 portion 
Keropok (Fish or Prawn Crackers): Using 3 pieces as 1 portion 	Margarine: Showing 1 teaspoon 
Corn Chips, Tortilla Chips (including *Twisties*): Showing 1 portion 	Peanut butter: Showing 1 dessert spoon 
Jam: Showing 1 dessert spoon 	Cream cheese: Showing 1 block (Estimate 1/2 a block as 1 serving) 
Egg jam (Seri kaya): Showing 1 dessert spoon 	Sugar: Showing 1 teaspoon 

Butter: Showing 1 dessert spoon 	Honey: Showing 2 teaspoon 

Sambal belacan

Oyster sauce

Budu, food enhancer

Fish sauce

Cencalok shrimp paste

Heko, Petis, food enhancer

Thick sauce

Chili sauce and ketchup

Thin sauce


Additional Questions in the FFQ

Do you eat any other food more than once a week?

- [ ] Yes (1)
- [ ] No (2)

If yes, please list below:

Do you take any vitamins, minerals, fish oils, fiber or any other food supplements?

○ No (1)

○ Yes (2)

If yes, please provide the details

	Name and Brand	Quantity at one time	Frequency

	Name and Brand (1)	Dose (in pill) (1)	Daily (1)	Weekly (2)	Monthly (3)	Less often (4)
Supplement 1 (1)						
Supplement 2 (2)						
Supplement 3 (3)						

Are you currently on any special diet? If yes, please explain more.

____

What is your typical order for Indian Food?

Main dishes 1 (1) ____

Side dishes 1 (2) ____

Frequency 1 (3) ____

What is your typical order for Chinese Food?

Main dishes 1 (1) ____

Side dishes 1 (2) ____

Frequency 1 (3) ____

What is your typical order for Malay Food?

Main dishes 1 (1) ____

Side dishes 1 (2) ____

Frequency 1 (3) ____

Are there other types of ethnic food that you have? If so, what is your typical order for it?

Main dishes 1 (1) ____

Side dishes 1 (2) ____

Frequency 1 (3) ____

What foods do you eat when you are feeling stressed? Please enter your response in the text box below.

What foods do you eat when you are feeling happy? Please enter your response in the text box below.

Three Factor Eating Questionnaire

Please indicate if the following statements are True or False.

T1 When I smell a sizzling steak or see a juicy piece of meat, I find it very difficult to keep from eating, even if I have just finished a meal.

- ○ True (1)
- ○ False (2)

T2 I usually eat too much at social occasions, like parties and picnics.

- ○ True (1)
- ○ False (2)

T3 I am usually so hungry that I eat more than three times a day.

- ○ True (1)
- ○ False (2)

T4 When I have eaten my quota of calories, I am usually good about not eating any more.

- ○ True (1)
- ○ False (2)

T5 Dieting is so hard for me because I just get too hungry.

○ True (1)

○ False (2)

T6 I deliberately take small helpings as a means of controlling my weight.

○ True (1)

○ False (2)

T7 Sometimes things just taste so good that I keep on eating even when I am no longer hungry.

○ True (1)

○ False (2)

T8 Since I am often hungry, I sometimes wish that while I am eating, an expert would tell me that I have had enough or that I can have something more to eat.

○ True (1)

○ False (2)

T9 When I feel anxious, I find myself eating.

○ True (1)

○ False (2)

T10 Life is too short to worry about dieting.

- True (1)
- False (2)

T11 Since my weight goes up and down, I have gone on reducing diets more than once.

- True (1)
- False (2)

T12 I often feel so hungry that I just have to eat something.

- True (1)
- False (2)

T13 When I am with someone who is overeating, I usually overeat too.

- True (1)
- False (2)

T14 I have a pretty good idea of the number of calories in common food.

- True (1)
- False (2)

T15 Sometimes when I start eating, I just can't seem to stop.

- ○ True (1)
- ○ False (2)

T16 It is not difficult for me to leave something on my plate.

- ○ True (1)
- ○ False (2)

T17 At certain times of the day, I get hungry because I have gotten used to eating then.

- ○ True (1)
- ○ False (2)

T18 While on a diet, if I eat food that is not allowed, I consciously eat less for a period of time to make up for it.

- ○ True (1)
- ○ False (2)

T19 Being with someone who is eating often makes me hungry enough to eat also.

- ○ True (1)
- ○ False (2)

T20 When I feel blue, I often overeat.

- ○ True (1)
- ○ False (2)

T21 I enjoy eating too much to spoil it by counting calories or watching my weight.

- ○ True (1)
- ○ False (2)

T22 When I see a real delicacy, I often get so hungry that I have to eat right away.

- ○ True (1)
- ○ False (2)

T23 I often stop eating when I am not really full as a conscious means of limiting the amount that I eat.

- ○ True (1)
- ○ False (2)

T24 I get so hungry that my stomach often seems like a bottemless pit.

- ○ True (1)
- ○ False (2)

T25 My weight has hardly changed at all in the last ten years.

- ○ True (1)
- ○ False (2)

T26 I am always hungry so it is hard for me to stop eating before I finish the food on my plate.

- ○ True (1)
- ○ False (2)

T27 When I feel lonely, I console myself by eating.

- ○ True (1)
- ○ False (2)

T28 I conscoiusly hold back at meals in order not to gain weight.

- ○ True (1)
- ○ False (2)

T29 I sometimes get very hungry late in the evening or at night.

- ○ True (1)
- ○ False (2)

T30 I eat anything I want, any time I want.

- True (1)
- False (2)

T31 Without even thinking about it, I take a long time to eat.

- True (1)
- False (2)

T32 I count calories as a conscious means of controlling my weight.

- True (1)
- False (2)

T33 I do not eat some foods because they make me fat.

- True (1)
- False (2)

T34 I am always hungry enough to eat at any time.

- True (1)
- False (2)

T35 I pay a great deal of attention to changes in my figure.

- ◯ True (1)
- ◯ False (2)

T36 While on a diet, if I eat a food that is not allowed, I often then splurge and eat other high calorie foods.

- ◯ True (1)
- ◯ False (2)

Please answer the following questions by circling the number above the responsethat is appropriate to you.

T37 How often are you dieting in a conscious effort to control your weight?

- ◯ rarely (1)
- ◯ sometimes (2)
- ◯ usually (3)
- ◯ always (4)

T38 Would a weight fluctuation of 5 lbs affect the way you live your life? (5 lbs is approximately 2.3 kg)

- not at all (1)
- slightly (2)
- moderately (3)
- very much (4)

T39 How often do you feel hungry?

- only at mealtimes (1)
- sometimes between meals (2)
- often between meals (3)
- almost always (4)

T40 Do your feelings of guilt about overeating help you to control your food intake?

- never (1)
- rarely (2)
- often (3)
- always (4)

T41 How difficult would it be for you to stop eating halfway through dinner and not eat for the next four hours?

- ○ easy (1)
- ○ slightly difficult (2)
- ○ moderately difficult (3)
- ○ very difficult (4)

T42 How conscious are you of what you are eating?

- ○ not at all (1)
- ○ slightly (2)
- ○ moderately (3)
- ○ extremely (4)

T43 How frequently do you avoid 'stocking up' on tempting foods?

- almost never (1)
- seldom (2)
- usually (3)
- almost always (4)

T44 How likely are you to shop for low calorie foods?

- unlikely (1)
- slightly unlikely (2)
- moderately likely (4)
- very likely (5)

T45 Do you eat sensibly in front of others and splurge alone?

- never (1)
- rarely (2)
- often (3)
- always (4)

T46 How likely are you to consciously eat slowly in order to cut down on how much you eat?

- unlikely (1)
- slightly likely (2)
- moderately likely (3)
- very likely (4)

T47 How frequently do you skip dessert because you are no longer hungry?

- almost never (1)
- seldom (2)
- at least once a week (3)
- almost every day (4)

T48 How likely are you to consciously eat less than you want?

- unlikely (1)
- slightly likely (2)
- moderately likely (3)
- very likely (4)

T49 Do you go on eating binges though you are not hungry?

- never (1)
- rarely (2)
- sometimes (3)
- at least once a week (4)

T50 On a scale of 0 to 5, where 0 means no restraint in eating (eating whatever you want, whenever you want it) and 5 means total restraint (constantly limiting food intake and never 'giving in'), what number you you give yourself?

0
eat whatever you want, whenever you want it

1
usually eat whatever you want, whenever you want it

2
often eat whatever you want, whenever you want it

3
often limit food intake, but often 'give in'

4
usually limit food intake, rarely 'give in'

5
constantly limiting food intake, never 'giving in'

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)

T51 To what extent does this statement describe your eating behaviour?

'I start dieting in the morning, but because of any number of things that happen during the day, by evening I have given up and eat what I want, promising myself to start dieting again tomorrow.'

1
not like me

2
little like me

3
pretty good description of me

4

describes me perfectly

○ 1 (1)

○ 2 (2)

○ 3 (3)

○ 4 (4)

State-Trait Anxiety Inventory

Please indicate your answer by selecting on responses provided.

How do you feel RIGHT NOW, at this moment: whereby 1 = not at all

2 = somewhat

3 = moderate

4 = very much

S1 I feel calm

○ 1 (1)

○ 2 (2)

○ 3 (3)

○ 4 (4)

S2 I feel secure

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)

S3 I am tense

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)

S4 I feel strained

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)

S5 I feel at ease

- ○ 1 (1)
- ○ 2 (2)
- ○ 3 (3)
- ○ 4 (4)

S6 I feel upset

- ○ 1 (1)
- ○ 2 (2)
- ○ 3 (5)
- ○ 4 (3)

S7 I am presently worrying over misfortunes

- ○ 1 (1)
- ○ 2 (2)
- ○ 3 (3)
- ○ 4 (4)

S8 I feel satisfied

- ○ 1 (1)
- ○ 2 (2)
- ○ 3 (3)
- ○ 4 (4)

S9 I feel frightened

- ○ 1 (1)
- ○ 2 (2)
- ○ 3 (3)
- ○ 4 (4)

S10 I feel comfortable

- ○ 1 (1)
- ○ 2 (2)
- ○ 3 (3)
- ○ 4 (4)

1 = not at all

2 = somewhat

3 = moderate
4 = very much

S11 I feel self-confident

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)

S12 I feel nervous

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)

S13 I am jittery

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)

S14 I feel indecisive

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)

S15 I am relaxed

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)

S16 I feel content

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)

S17 I am worried

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)

S18 I feel confused

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)

S19 I feel steady

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)

S20 I feel pleasant

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)

How do you generally feel?

1 = not at all

2 = somewhat

3 = moderate

4 = very much

S21 I feel pleasant

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)

S22 I feel nervous and restless

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)

S23 I feel satisfied with myself

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)

S24 I wish I could be as happy as others seem to be

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)

S25 I feel like a failure

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)

S26 I feel rested

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)

S27 I am "calm, cool and collected"

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)

S28 I feel that difficulties are piling up so that I cannot overcome them

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)

S29 I worry too much over something that really doesn't matter

- ○ 1 (1)
- ○ 2 (2)
- ○ 3 (3)
- ○ 4 (4)

S30 I am happy

- ○ 1 (1)
- ○ 2 (2)
- ○ 3 (3)
- ○ 4 (4)

How do you generally feel?

1 = not at all

2 = somewhat

3 = moderate

4 = very much.

S31 I have disturbing thoughts

- ○ 1 (1)
- ○ 2 (2)
- ○ 3 (3)
- ○ 4 (4)

S32 I lack self-confidence

- ○ 1 (1)
- ○ 2 (2)
- ○ 3 (3)
- ○ 4 (4)

S33 I feel secure

- ○ 1 (1)
- ○ 2 (2)
- ○ 3 (3)
- ○ 4 (4)

S34 I make decisions easily

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)

S35 I feel inadequate

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)

S36 I am content

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)

S37 Some unimportant thought runs through my mind and bothers me

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)

S38 I take disappointments so keenly that I can't put them out of my mind

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)

S39 I am a steady person

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)

S40 I get in a state of tension or turmoil over my recent concerns and interests

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)

Appendix C

Table 1: Nutritional Composition for Savoury Food Items.

Food	Portion Size	Calories	Carbohydrate (g)	Protein (g)	Sodium (mg)	Fat (g)	Potassium (mg)	Dietary Fibre (g)	Sugars (g)	Cholesterol (mg)
Prawn Crackers (CALBEE)	1 serving (14g)	67	10	1	110	3	0	0	0	0
Goldfish Crackers	1 serving (25 crackers)	65	11	1	0	0	0	0	5	0
Salted Mackerel with black beans	1 cup	415	0	25	6052	34	707	0	0	129
Garlic Fried Rice	2 cups	317	45	8	44	11	96	1	0	142
Chicken wing (fried with flour)	1 wing	256	0	10	0	24	0	0	0	0
Deep Fried Squid	1 serving (100g)	175	8	18	306	7	279	0	0	260
Boiled Egg Noodles	1 cup	213	40	8	11	2	45	2	1	53
Mushroom Quiche	1 serving (127.57g)	199	0	0	267	10	0	0	0	114
Cheeseburger (Single meat patty, regular)	1 burger	319	32	15	500	15	164	0	0	50
French Fries	1 serving (100g)	226	35	3	40	10	0	3	1	0
Floured Fried Prawns	1 prawn	27	1	2	54	1	22	0	0	20
Super Rings	1 serving (100g)	175	16.8	2.5	340	8.4	0	0	0	0
Beef Fillet Steak	1 serving (127.57g)	170	0	22	440	8	0	0	0	70
and Thigh Grilled	1 serving (113.40g)	227	0	30	300	17	200	0	0	160
and Tomato Sauce	1 cup	300	46	18	965	13	593	3	10	57
Chicken Sausages	1 serving (2 links)	80	4	7	150	5	0	0	2	0
Fried Fishball	1 serving (2 balls)	60	2	5	270	1	0	0	1	10
Porridge with	1 bowl	277	8	25	2536	14	486	3	2	220
Hotdog	1 bun	130	21	4	200	2	0	1	3	0
(KRAFT White	1/2 cup	190	49	10	580	3	0	2	7	10
Chicken Satay	1 serving (80g)	121	0	13	208	7	0	0	0	0
Chicken Nuggets (MCDONALDS)	1 serving (4 nuggets)	190	12	9	360	12	12	1	0	25
Cheesy Wedges (KFC)	1 set	310	35	5	0	17	0	0	0	0
Sweet and Sour Fish (Tilapia)	1 serving (113.40g)	120	9	18	75	2	0	0	8	45
Fried Maggi Mee	1 serving (401g)	312	25	6	977	23	740	6	14	0
Beef Stew (can)	1 serving	218	16	11	947	12	404	3	2	37
Tandoori Chicken Thigh	1 piece	227	8	27	0	10	0	0	0	0
Coleslaw (creamy)	1 serving (99g)	147	13	2	267	11	0	0	0	5
Mashed Potato and gravy (KFC)	1 bowl (525g)	680	77	26	2130	32	0	6	3	55
Tuna Sandwich	1 sandwich	320	0	16	290	6	0	3	3	0
Weetameal Crackers (JACOB'S)	1 serving (7 pieces)	74	11	1	0	3	0	0	0	0
Lasagne	1 serving (100g)	137	13	7	333	7	194	1	3	0
Oriental Mix Nuts	1 cup	876	30.4	23.8	16	80	825	14.1	0	0
Caesar Salad	1.5 cup	153	5	6	0	15	0	0	0	0
Meat Pie	1 serving	450	56	9	720	21	0	4	0	25
Big Mac (MCDONALDS)	1 serving (1 sandwich)	550	46	25	970	29	0	3	9	75
Twisties (cheddar)	1 serving (27g)	134	17	2	285	6	80	0	1	1
Cheesy Pretzel	1 serving (1 pocket)	470	73	20	1050	10	0	2	14	50
fried anchovies	1 tablespoon, (5g)	16	0.2	1.4	0	1.1	0	0	0	0
duck egg	1 egg (60g)	80	1	7	350	6	0	0	0	200
soy sauce (KIKKOMAN)	1 tablespoon	10	0	2	920	0	0	0	0	0
spring onion (tops and bulbs)	1 cup	32	7	2	16	0	276	3	2	0
fried anchovies	1 serving (27g)	125	0	14	1250	8	210	0	0	20
rice porridge	1 serving (100g)	30	0	0	0	0	0	0	0	0
total	1 bowl	277	8	25	2536	14	486	3	2	220

Table 2: Nutritional Composition for Spicy Food Items

Food	Portion Size	Calories	Carbohydrate (g)	Protein (g)	Sodium (mg)	Fat (g)	Potassium (mg)	Dietary Fibre (g)	Sugars (g)	Cholesterol (mg)
Sambal ikan bilis	1 serving (40g)	126	0	11.3	171	8.4	131	0	0	1.5
Kimchi	1/2 cup	11	36	24	4	0	4	55	0	0
Tom Yam Soup with Seafood	1 bowl (668g)	285	7	22	2,639	19	0	3	0	237
Green Curry Chicken	1 serving (200g)	368	2	33	239	6	256	0	0	85
Chicken curry	1 bowl (200g)	279	8	37	305	10	0	1	5	96
Spicy Tapioca Chips (kerepek ubi pedas)	1 serving (100g)	524	69	2	356	26	0	0	0	0
Mutton Briyani	1 cup	387	51	24	552	10	0	5	14	48
Kangkung Belacan	1 portion	339	7	8	0	31	0	0	0	22
Prawn Noodle with Soup, prawns and bean sprouts	1 bowl (574g)	294	49	19	2422	2	0	3	0	40
Mee Goreng Mamak	2 cups	661.2	96	22	0	21	0	0	0	0
Assam Pedas (Fish)	1 portion	124	2	21	532	4	0	0	0	61
Sambal Petai	1 g	0.9	0	0.1	2.5	0.1	0	0.1	0	0.2
Stir Fried Okra wth Chili	1 serving	41.8	5.6	2.1	6.2	1.9	171.4	2.5	2.9	0
Nachos with Salsa Dip, Beans and Cheese	1 plate	475	33	14	700	20	0	9	15	34
Fish Head Curry	1 serving (414g)	385	0	18	0	2	481	0	0	103
Fish with Chili Paste (Ikan kembong goreng berlada)	1 piece (80g)	215	0	12.4	56	18	287	0	0	0.8
Rojak buah with Chili	1 serving	443	51	16	680	20	0	0	0	28
Laksa Johor	1 bowl	418	0	25	0	9	0	0	0	0
Currypuff	1 piece (40g)	128	0	1.9	68	5.6	66	0.1	0	17
Nasi Lemak	1 packet	494	80	13	838	14	206	7	0	76
Crab Curry	1/2 cup	132	21							
Spicy Fish	1 plate	189	12	25	0	5	0	0	0	0
Spicy Tau Chu Sauce	1 tbsp	26	8	1	450	0	0	0	0	0
Mustard	1/2 tsp	262	53	11	789	3	1157	12	8	0
Nasi Kunyit with Beef Rendang										
Nasi Kunyit	1 serving (311.5g)	378	55	23	491	9	636	8	12	50
beef rendang	200g	650	46	43	9	33	0	4	0	0
Yong Tau Fu	1 bowl	400	12	11	936	20	0	9	0	45
Dried Chilis	1 cup (37g)	120	26	4	34	2	0	0	0	0
Vege Balls Chili										
vegetable balls	1 ball	249	34	4	328	12	0	0	0	0
Sambal plain Belacan (SINGLONG)	1 tsp (12g)	9	2	0	171	0	0	0	0	0
Shredded Fish	1 serving (146.2g)	368	1.7	28	459	29.2	0	0	0.3	0
turmeric chicken	1 portion (247g)	301	29	16	512	10	501	1	14	230
okra with chili sauce										
okra	1 cup	40	8	1	0	0	0	0	0	0
chili sauce	1 serving (16g)	20	5	0	160	0	0	0	4	0
fried chili fish	1 serving (130g)	220	31	9	274	8	277	2	0	210
chili padi	1 serving (45g)	181	11	10	365	11	115	0	1	225
sambal squid (using brown squid)	4 small pcs (80g)	807	67	52	1781	35	0	1	0	108
chili bawal	1 serving (80g)	2311	488	64	1819	15	1979	35	254	39
bone soup (sup tulang)	1 serving (934g)	937	0	81	410	67	743	0	0	296
green chili liver	1 serving (454g)	230	21	20	1501	7	0	1	0	360

Table 3: Nutritional Composition for Sweet Food Items

Food	Portion Size	Calories	Carbohydrate (g)	Protein (g)	Sodium (mg)	Fat (g)	Potassium (mg)	Dietary Fibre (g)	Sugars (g)	Cholesterol (mg)
Egg Tart	1 serving (30g)	188.9	5.5	4.8	0	9.5	0	0.45	9.5	0
Chocolate Cake	1 slice (95g)	300	29	5	0	9	0	1	33	0
Brownies	1 serving (100g)	115	18	1	88	5	42	1	10	5
Shortbread Biscuits (TESCO)	1 biscuit	95	11	1	0	5	0	0	0	0
Oreos	1 cookie	100	13	1	70	5	0	1	9	0
Chocolate Chip Cookies (CHIPS MORE)	1 cookie (10g)	45	7	1	38	2	0	0	0	0
Red Velvet Cake	1 slice (167g)	580	77	5	460	29	0	0	59	60
Cadbury Milk Chocolate	1 serving (7 blocks)	200	23	3	40	11	0	0	22	10
Lollipops (CHUPA CHUPS)	1 unit (12g)	46	12	0	7	0	0	0	10	0
Sugar Doughnut	1 piece	77	10	1	77	4	0	8	5	20
Cinnamon roll (CINNABON)	1 roll	880	127	13	830	36	0	2	59	20
Bread and Butter Pudding	1 serving (110g)	360	52	6	140	12	0	1	26	0
Cream Caramel Pudding	1 serving	120	21	1	160	3	0	0	0	0
Macaroons **(3cm across)**	1 serving	152	16.6	2.4	0	9	0	0.9	11	0
Pavlova	1 slice	210	29	3	23	0	0	0	30	0
Sticky Date Pudding	1 serving (133g)	313	53	5	0	9	0	0	0	0
Cupcakes with frosting	1 unit (83g)	246	47	3	112	6	0	0	34	15
Chocolate Chip Muffins	1 unit	360	47	5	320	17	0	0	30	0
Mini Chocolate bread (DELIFRANCE)	3 mini units	250	30	5	250	13	0	2	8	30
Caramel Popcorn	1 serving (1 1/4 cup)	130	23	1	190	4	0	2	8	0
Deep Fried Banana	1 serving (136g)	460	82	6	329	14	595	6	34	0
Muesli Bar (Strawberry Yoghurt Topp, UNLCE TOBY'S)	1 bar (31.3g)	140	20	2	10	5	0	2	9	0
Pop Tarts (Frosted S'mores KELLOGG'S)	1 pastry (52g)	200	36	3	210	5	0	1	19	0
Lcm'c Rice Bubbles (KELLOGG'S)	1 bar (22g)	93	17	1	81	2	10	0	7	0
Banana Split (with 2 scoops of ice0cream)	1 serving	671	121.18	11.1	244	24.28	67	7.9	86.69	62
Cheesecake (1/6 of a 17 oz cake)	1 piece	257	20.4	4.4	166	18	72	0.3	0	44
Tiramisu	1 serving (100g)	283	24.41	4.77	85	18.2	129	0.9	16.82	167
Lemon Meringue Pie	1 serving (100g)	285	39.1	3.8	242	12.9	65	0	0	53
Cotton Candy	1 serving (100g)	394	98	0	38	0.2	5	0	62.9	0
Raisins	1 cup	434	114.81	4.45	16	0.67	1086	5.4	85.83	0
Mango Pudding (jelly)	1 serving (100g)	47	9	1	25	1	99	2	0	2
Marshmallows	1 serving (100g)	318	81.3	1.8	80	0.2	5	0.1	57.56	0
Strawberry sundae (MCDONALDS)	1 sundae	290	51	4	0	7	0	1	45	0
Kaya on Toast (Hainanese Kaya)	1 portion	215	38	6	26	4	74	0	0	16
Chocolate Lava Cake	1 serving (113.40g)	264	29	3	42	16	0	0	22	96
Iced Gems	1 serving (25g)	99	22	1	0	1	0	0	13	0
Baklava	1 piece (2"x1.5")	334	29	5	293	23	0	2	10	36
Sago (with gula melaka)	1 serving (1/4 cup)	199	26	1	9	11	0	0	0	0
Apple Pie	1 serving (28.35g)	75	10	1	60	4	22	0	0	0
kueh (bingka ubi, brown coconut kueh, green n white kueh, kueh lapis)										
Ondeh-ondeh	1 ball	18	3	0	39	1	264	0	0	0
Kuih Lapis	1 piece (87g)	131.8	28.8	1.9	0	1	0	0	0	0
Bingka Ubi	1 piece (100g)	220	44.5	1.2	0	4.2	0	0	0	0

Table 4a: Nutritional Composition for Vegetables (Control Items).

Food	Portion Size	Calories	Carbohydrate (g)	Protein (g)	Sodium (mg)	Fat (g)	Potassium (mg)	Dietary Fibre (g)	Sugars (g)	Cholesterol (mg)
Pak Choi (Chinese cabbage)	1 cup (70g)	9	2	1	46	0	0	1	1	0
Spinach	1 cup (30g)	7	1	1	24	0	0	1	0	0
Spring onion (tops and bulbs)	1 cup	32	7	2	16	0	276	3	2	0
Broccoli	1 cup (71g)	20	4	2	19	0	0	0	0	0
Carrots	1 cup (128g)	52	12	1	88	0	0	4	6	0
Potato	1 spud (184g)	200	46	4	15	0	0	4	3	0
Pumpkin	1 cup (116g)	30	8	1	1	0	0	1	2	0
Eggplant	1 cup (82g)	20	5	1	2	0	0	3	2	0
Corn	1 cup (141g)	185	36	5	6	2	0	4	5	0
Onion	1 cup (160g)	160	15	2	6	0	0	3	7	0
Cucumber	1 cup pared (133g)	16	3	1	3	0	0	1	2	0
Tomato (orange)	1 cup (158g)	25	5	2	66	0	0	1	0	0
Cabbage	1 cup (89g)	22	5	1	16	0	0	2	3	0
Beetroot	1 cup (136g)	58	13	2	106	0	0	4	9	0
Sweet Potato	1 cup (133g)	114	27	2	73	0	0	4	6	0
nak choy	1 cup (88g)	38	8	3	22	0	0	3	2	0
Ginger	1 tsp	9	2	0	0	0	17	1	2	0
Kidney beans (canned)	1 cup (256g)	215	41	13	758	2	0	14	5	0
Lettuce (butterhead)	1 cup (55g)	7	1	1	3	0	0	1	1	0
French Beans	1 cup (184g)	631	118	35	33	4	0	46	0	0
Peas	1 cup (145g)	117	21	8	7	1	0	7	8	0
Baby corn	100g	81	18.59	2.62	241	1	195	0	0	0
Garlic	100g	203	0	9	23	1	545	0	0	0
mushrooms	1 cup	15	2.3	2.16	4	0.24	223	0	0	0
taugeh	1 cup	62	12.18	6.23	12	0.37	305	0	0	0
tauhu	1 ounce (28g)	20	0	0	3	1	0	0	0	0

Table 4b: Nutritional Composition for Fruits (Control Items).

Food	Portion Size	Calories	Carbohydrate (g)	Protein (g)	Sodium (mg)	Fat (g)	Potassium (mg)	Dietary Fibre (g)	Sugars (g)	Cholesterol (mg)
Apple	1 cup (110g)	53	14	0	0	0	0	1	11	0
Orange	1 cup (170g)	107	26	2	3	1	0	8	0	0
Watermelon	1 cup (154g)	46	12	1	2	0	0	1	10	0
Pineapple	1 cup (165g)	82	22	1	2	0	0	2	16	0
Avocado	1 cup/serving (230g)	384	20	5	18	35	0	16	1	0
Ciku/Sapodilla	1 cup	200	48	1	29	3	465	13	0	0
Kiwi	1 cup (177g)	108	26	2	5	1	0	5	16	0
Rambutan	1 fruit	7.4	1.9	0.1	1	0	3.8	0.1	0	0
Jackfruit	1 cup (165g)	155	40	2	5	0	0	3	0	0
Durian	1 cup (243g)	357	66	4	5	13	0	9	0	0
Guava	1 cup (165g)	112	24	4	3	2	0	9	15	0
Grapes	1 cup (151g)	104	27	1	3	0	0	1	23	0
Cherries	1 cup (138g)	87	22	1	0	0	0	3	18	0
Banana	1 cup (225g)	200	51	2	2	1	0	6	28	0
Mango	1 cup (165g)	107	28	1	3	0	0	3	24	0
Papaya	1 cup (140g)	55	14	1	4	0	0	3	8	0
Dragonfruit/Pitaya	1 serving	48	9	2	60	0	0	1	8	0
Mata Kuching	100g	60	15	1	0	0	266	1	0	0
Strawberries	1 cup (152g)	49	12	1	2	0	0	3	7	0
Raspberries	1 cup (123g)	64	15	1	1	1	0	8	5	0
Honeydew	1 cup (177g)	64	16	1	32	0	0	1	14	0
Apricot	1 cup (155g)	74	17	2	2	1	0	0	0	0
Coconut	1 piece (45g)	159	6.8	1.5	9	15	0	0	0	0
Limau	1 piece	20	7	0	0	0	75	2	0	0
Persimmon	1 whole fruit	118	31.23	0.97	2	0.32	270	0	0	0
Plum	1 whole fruit	30	104	0.46	0	0.18	104	0	0	0
Pomegranate	1 whole fruit	105	26.44	1.46	5	0.46	399	0	0	0

Figure 17: Food Stimuli used in experiments 2 to 6.

Table 5: Responses per ethnic group for each food pairing.

	Malay		Chinese	
Spicy vs. sweet	spicy	sweet	spicy	sweet
	24.0%	76%	29.3%	70.7%
Savoury vs. sweet	savoury	sweet	savoury	sweet
	48.4%	51.3%	51.6%	48.7%
Spicy vs. savoury	spicy	savoury	spicy	savoury
	55.1%	47.2%	44.9%	52.8%

Table 6: Results for Comparisons between Categories

Spicy vs. savoury

A 2 (ethnicity) x 2 (selection: spicy, savoury) repeated measures design was carried out to investigate group preference for the spicy vs. savoury condition. Results show that there was no main effect for ethnicity $F(1, 28) = 0$, $p = 1$. There was no interaction between selection and group, $F(1, 28) = 1.40$, $p = .25$. There was a main effect for selection $F(1, 28) = 23.99$, $p < .001$. Participants made significantly more selections for the savoury foods ($M = 24.45$, $SD = 65.89$) than spicy foods ($M = 13.23$, $SD = 35.74$). The Malay participants made more selections for spicy foods ($M = 7.53$, $SD = 3.54$) than the Chinese participants ($M = 6.13$, $SD = 2.92$). In comparison, the Chinese participants selected more savoury foods ($M = 13.33$, $SD = 3.54$) than the Malay participants ($M = 11.93$, $SD = 3.22$), although these differences were not significant.

Spicy vs. sweet

A 2 (ethnicity) x 2 (selection: spicy, sweet) repeated measures design was carried out to investigate group preference for the spicy vs. sweet condition. Results show that there was no main effect for ethnicity $F(1, 28) = 1.96$, $p = .17$. There was no interaction between selection and group, $F(1, 28) = 0.90$, $p = .35$. There was a main effect for selection $F(1, 28) = 91.07$, $p < .001$. Participants selected sweet foods ($M = 27.48$, $SD = 74.01$) significantly higher than spicy foods ($M = 10.0$, $SD = 27.04$). Chinese participants selected more spicy foods ($M =$

5.73, *SD* = 2.84) than the Malay participants (*M* = 4.60, *SD* = 2.44). Consequently, the Malay participants selected more sweet foods (*M* = 14.53, *SD* = 2.23) than the Chinese participants (*M* = 13.87, *SD* = 2.95). However, these differences were not significant.

Savoury vs. sweet

A 2 (ethnicity) x 2 (selection: savoury, sweet) repeated measures design was carried out to investigate group preference for the savoury vs. sweet condition. Results show that there was no main effect for ethnicity $F(1, 28) = .34$, $p = .57$. There was no main effect for selection, $F(1, 28) = 1.71$, $p = .20$. There was no interaction between selection and group, $F(1, 28) = .18$, $p = .68$. Chinese participants did, however, select slightly more of the savoury items (*M* = 10.93, *SD* = 4.25) compared to the Malay participants (*M* = 10.27, *SD* = 3.17). In contrast, the Malay participants made slightly more selections for sweet foods (*M* = 9.07, *SD* = 3.08) compared to the Chinese participants (*M* = 9.07, *SD* = 3.08); again, these differences were not significant.

Appendix D

Table 1: RTs for Malay and Chinese on the food categorisation task

	Spicy		Savoury		Sweet		Control	
	Malay	Chinese	Malay	Chinese	Malay	Chinese	Malay	Chinese
Mean	2212.71	2211.37	3132.54	2687.05	2323.39	2235	2305.3	2333.04
SE	174.92	138.71	201.66	210.87	203.84	115.29	165.61	109.87
SD	677.45	537.23	781.04	816.68	789.47	446.52	641.39	425.53

Appendix E

Section 1

The following sections show additional analysis carried out on RTs of both groups on the attentional bias task. As mentioned, the analysis was not included in the results section for this chapter as the RTs for both groups were too varied.

RTs for Prime vs. target

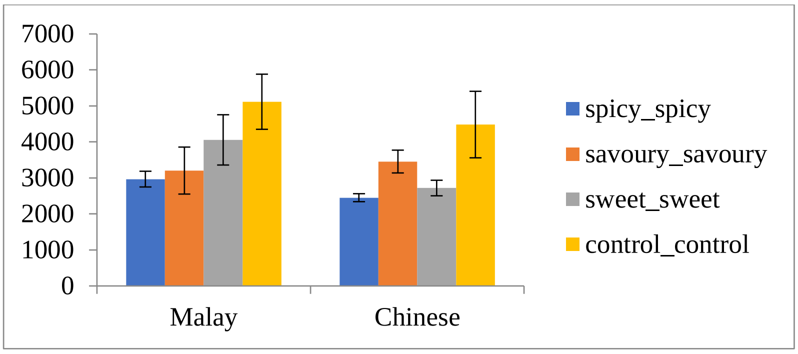
A 2 (group: Malay or Chinese) by 4 (prime: spicy, savoury, sweet or control) by 4 (target word: spicy, savoury, sweet or control) factorial design was used to calculate the reaction times (RTs) for correct trials per condition. Results show that there was a main effect for group $F(1, 29) = 11.99$, $p = .002$, with Chinese participants having shorter RTs (M = 3390, SD = 653.8) than Malays (M = 4392, SD = 941.1). There was no interaction between prime and group $F(3, 87) = 1.544$, $p = .21$.

There was no main effect for target word ($F(3, 87) = 0.436$, $p = .73$) and no interaction between target word and group ($F(3, 87) = 1.178$, $p = .32$). No interaction between prime, target word, and group was found, $F(9, 261) = 1.730$, $p = .082$. There was a main effect for prime $F(3, 87) = 4.069$, $p = .009$. There was an interaction between prime and target word $F(9, 261) = 10.203$, $p < .001$. To clarify these trends, additional analyses were carried out on processing times partitioned by matched and mismatched trials.

Matched Condition

A 2 (group: Malay or Chinese) by 4 (spicy vs. savoury vs. sweet vs. control) repeated measures design was used on RTs. Results show that there was a main effect of matched, $F(2.08, 60.36) = 4.993$, $p = .009$. Pairwise comparisons (Bonferroni) showed that participants responded significantly faster to spicy trials compared to the control trials ($p = .006$), no other categories differed significantly (ps > 0.05). There was no interaction between the matched condition and group ($F(2.08, 60.36) = 0.68$, $p = .52$), and there was no main effect for group, $F(1, 29) = 1.91$, $p = .18$. Figure 3 shows the RTs for accurate categorization per ethnic group.

Figure 3: RTs for accurate categorization in matched conditions (denoted as prime_ target word) per group.



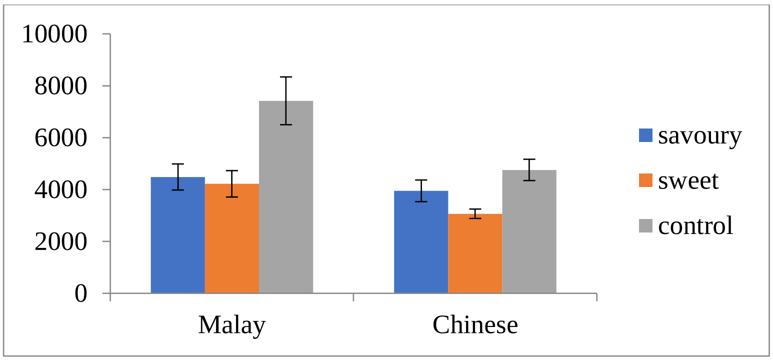
RTs for Mismatched Conditions

Analysis for the mismatched conditions was carried out according to the type of prime that was paired for each category.

RTs for Mismatched Conditions when prime: Spicy

A 2 (group: Malay or Chinese) by 3 (target word: savoury, sweet, and control) repeated measures design was carried out to measures differences in RTs. There was a main effect of group, $F(1, 29) = 8.145$, $p = .008$. Chinese participants were significantly faster ($M = 3925$, $SD = 1066$) than Malays ($M = 5375$, $SD = 1709$) in accurate categorisation on the task. There was a main effect of target word, $F(2, 58) = 14.511$, $p < .001$. Pairwise comparisons (Bonferroni) showed RTs were significantly different between the control and savoury trials $p = .001$), and the control and sweet trials $p < .001$). There was no interaction between target word and ethnicity, $F(2, 58) = 2.67$, $p = .08$. Figure 4 shows the RTs for each target word when the prime was a spicy food stimulus.

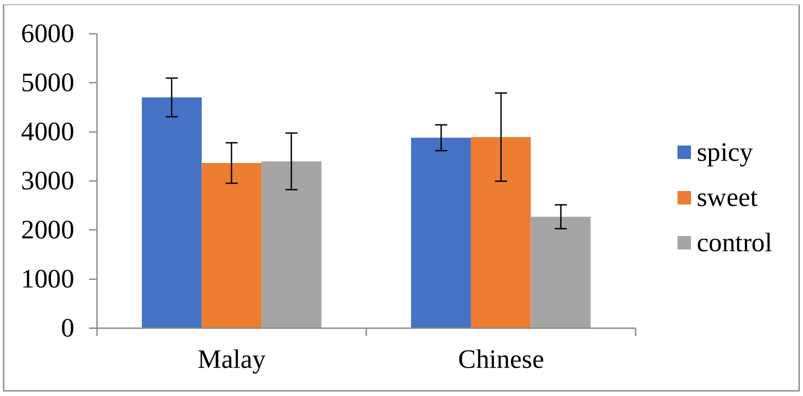
Figure 4: RTs for each group when the prime was a spicy food stimulus for all mismatched target words (savoury, sweet, and control).



RTs for Mismatched Conditions when prime: Savoury

A 2 (group: Malay or Chinese) by 3 (target word: spicy, sweet, and control) repeated measures design was carried out to measures differences in RTs. Results show that there was no main effect of group, $F(1, 29) = .86$, $p = .36$. A main effect of target word was evident ($F(1.49, 43.11) = 5.15$, $p = .003$), but no interaction between target and group ($F(1.49, 43.11) = 1.88$, $p = .17$). Pairwise comparisons (Bonferroni) shows RTs differed significantly between spicy and control trials ($p < .001$). Figure 5 shows the RTs for each target word when the prime presented was savoury food.

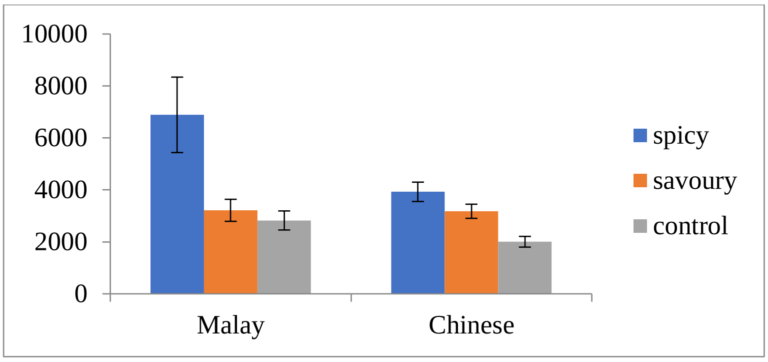
Figure 5: RTs for each group when the prime was a savoury food stimulus for all mismatched target words (spicy, sweet, and control).



RTs for Mismatched Conditions when prime: Sweet

A 2 (group: Malay or Chinese) by 3 (target word: spicy, savoury, and control) repeated measures design was carried out to measures differences in RTs. There was a main effect of group, $F(1, 29) = 5.77$, $p = .02$. Malays were slower ($M = 4308$, $SD = 1938.4$) than Chinese participants ($M = 3036$, $SD = 834$). A main effect of target word was found in this condition, $F(1.34, 38.79) = 11.37$, $p < .001$. No interaction between target word and ethnic group was found ($F(1.34, 38.79) = 2.71$, $p = .1$). Figure 6 shows the RTs for each target word when the prime presented was a sweet food stimulus.

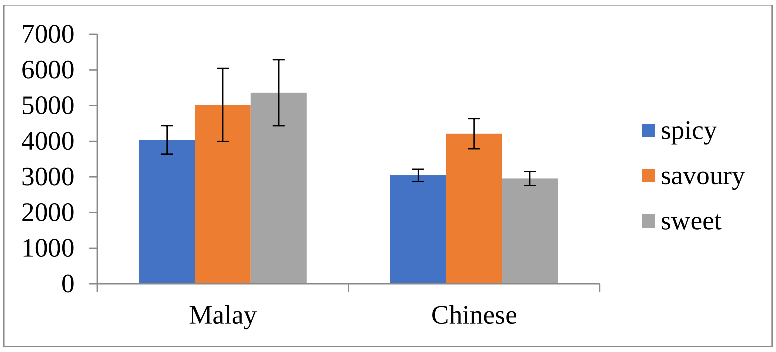
Figure 6: RTs for each group when the prime was a sweet food for all mismatched target words (spicy, savoury, and control).



RTs for Mismatched Conditions when prime: Control

A 2 (group: Malay or Chinese) by 3 (target word: spicy, savoury, and sweet) repeated measures design was carried out to measures differences in RTs. Results showed that there was a main effect of ethnicity, $F(1, 29) = 8.1$, $p = .01$. The Malay participants had significantly higher RTs than Chinese participants. There was no main effect of target word, $F(2, 58) = 1.59$, $p = .21$ and no interaction between group and target word, $F(2, 58) = 1.04$, $p = .36$. Figure 7 shows the RTs for each target word when the prime presented were the control items.

Figure 7: RTs for each group when the prime was the control items for all mismatched target words (spicy, savoury, and sweet).



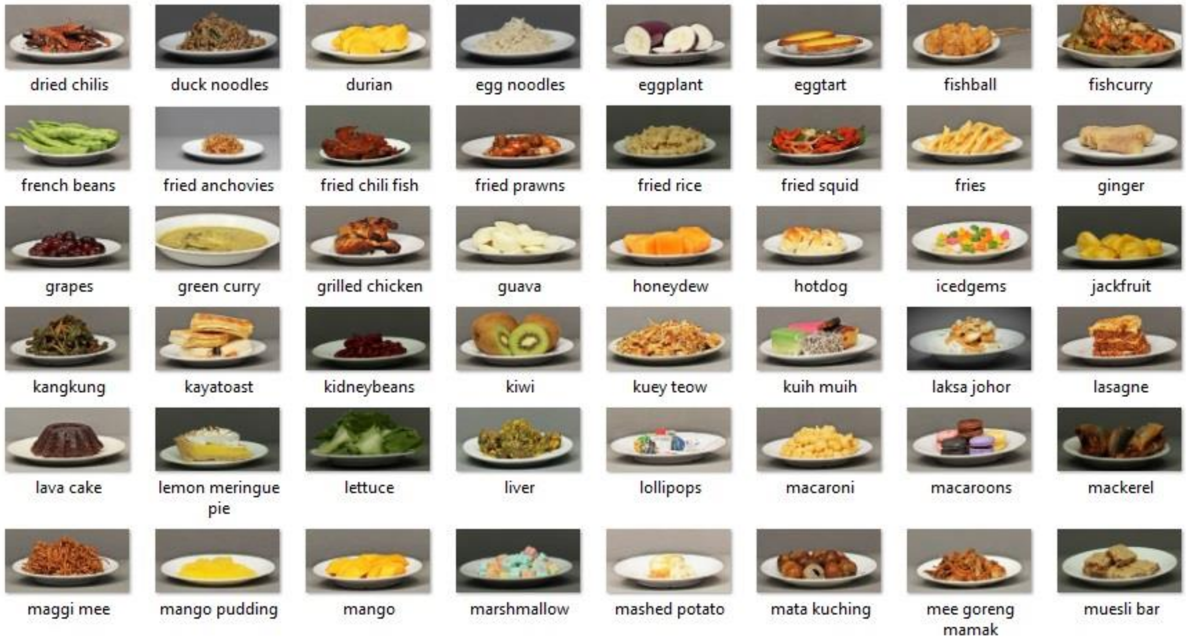
Appendix F

Figure 1: Additional images added to stimuli set.

Figure 2: Images of filler items (non-food items).

Figure 3: Stimuli set for food items used in the practice trials.

Figure 4: Stimuli set for food items used in the experimental trials.



Section 1

A 2 (group) x 4 (food category: spicy, savoury, sweet and control items) x 3 (target: new, R1, and R2) repeated measures ANOVA showed no significant difference in RTs (measured in milliseconds) for group type in accurate recognition of the target presentation, $F(1, 46) = .12$, $p = .73$.

Category type influenced RTs for both groups on the recognition task ($F(2.49, 114.33) = 13.67$, $p < .001$), with post-hoc t-tests showing differences in RTs between categories spicy and control ($t(46) = 4.94$, $p < .001$), savoury and control ($t(46) = 5.65$, $p < .001$), and sweet and control ($t(46) = 3.45$, $p = .007$). No interaction between category type and group was found, $F(2.49, 114.33) = 2.21$, $p = .1$.

Target presentation affected the RTs on the recognition task, ($F(1.9, 87.46) = 14.36$, $p < .001$). Post hoc t-tests showed recognition for both groups was faster from a newly presented target and target presented after a long delay (R2), ($t(46) = 4.65$, $p < .001$) and between a target presented after a short delay (R1) and a target presented after a long delay (R2), ($t(46) = 4.17$, $p < .001$). However, there was no interaction between RTs of target presentation and group type ($F(1.9, 87.46) = .36$, $p = .69$).

An interaction between target presentation and category type was observed ($F(4.16, 191.36) = 3.11$, $p = .02$). With reference to Table 4, both groups had the lowest RTs in recognizing control food items when presented at R2. No interaction between RTs of target, category, and group was found, ($F(4.16, 191.36) = 1.41$, $p = .23$).

Table 1: The mean RTs for each target stimulus by both groups in milliseconds.

	Chinese			Malay		
	New	R1	R2	New	R1	R2
Spicy	3567.72	3440.35	3033.48	3427.5	3339.29	3157.22
Savoury	3421.74	3378.81	3235.84	3468.21	3084.56	3164.02
Sweet	3311.10	3364.94	3171.94	3206.63	3134.11	2783.32
Control	3095.77	3081.11	2625.93	3271.16	3227.39	2514.14

Table 2: The average frequency intake, portion size, and average consumption quotient for both groups across the four categories on the R-FFQ.

	average frequency		average portion		average consumption	
	Chinese	Malay	Chinese	Malay	Chinese	Malay

	average frequency		average portion		average consumption	
	Chinese	Malay	Chinese	Malay	Chinese	Malay
M (SD) Spicy	2.17 (0.48)	2.46 (0.59)	1.13 (.34)	1.54 (.66)	2.54 (.83)	3.92 (1.7)
Min-Max Spicy	1 to 3	1 to 3	1 to 2	1 to 3	1 to 5	2 to 9
M (SD) Savoury	2.38 (.5)	2.54 (.51)	1.21 (.42)	1.5 (.83)	3.08 (.72)	4.46 (2.17)
Min-Max Savoury	2 to 3	2 to 3	1 to 2	1 to 4	2 to 5	2 to 10
M (SD) Sweet	2.38 (.5)	2.38 (.5)	1.29 (.46)	1.96 (.86)	3.33 (.96)	4.79 (2.57)
Min-Max Sweet	2 to 3	2 to 3	1 to 2	1 to 4	2 to 6	2 to 13
M (SD) Control	3.17 (.48)	3 (.72)	1.25 (.53)	1.71 (1.04)	3.96 (1.43)	4.79 (3.06)
Min-Max Control	2 to 4	2 to 4	0 to 2	0 to 5	2 to 9	1 to 15

Table 3: Mean number of food items per category as 'never eaten' for both groups in the R-FFQ.

	Spicy		Savoury		Sweet		Control	
	Chinese	Malay	Chinese	Malay	Chinese	Malay	Chinese	Malay
Mean	7.83	5.25	8.67	7.63	7.54	9.08	2.25	4.25
Std. Deviation	5.61	3.72	6.25	4.16	3.86	6.14	2.27	3.3
Sum	188	126	208	183	181	218	54	102

Table 4: Reasons for 'Never Eaten' foods in the R-FFQ.

Reasons for Never Eaten	Sweet	Savoury	Spicy	Control	Total
Don’t like it					456
Allergy					46
Unhealthy					55
Never tried					163
Expensive					56
Unavailable					103

Don't know	56
Unfamiliar	227
Religious	58
Health	12
Too Sweet	30
Too Spicy	99
Other	34

Table 5: Correlations between performance on the task and average consumption quotient of the four food categories.

		Pearson's r	
control average consumption	- savoury average consumption	0.769	***
control average consumption	- sweet average consumption	0.624	***
control average consumption	- spicy average consumption	0.760	***
control average consumption	- d' control	-0.116	
control average consumption	- d' salty	0.193	
control average consumption	- d' spicy	0.044	
control average consumption	- d' sweet	-0.061	
savoury average consumption	- sweet average consumption	0.883	***
savoury average consumption	- spicy average consumption	0.799	***
savoury average consumption	- d' control	-0.194	
savoury average consumption	- d' salty	0.248	
savoury average consumption	- d' spicy	0.018	
savoury average consumption	- d' sweet	-0.057	
sweet average consumption	- spicy average consumption	0.731	***
sweet average consumption	- d' control	-0.138	
sweet average consumption	- d' salty	0.237	
sweet average consumption	- d' spicy	0.048	
sweet average consumption	- d' sweet	0.045	
spicy average consumption	- d' control	-0.160	
spicy average consumption	- d' salty	0.215	

		Pearson's r	
spicy average consumption	- d' spicy	-0.002	
spicy average consumption	- d' sweet	-0.021	
d' control	- d' salty	0.496	***
d' control	- d' spicy	0.720	***
d' control	- d' sweet	0.815	***
d' salty	- d' spicy	0.639	***
d' salty	- d' sweet	0.618	***
d' spicy	- d' sweet	0.694	***

* p < .05, ** p < .01, *** p < .001

Section 2: R-FFQ

Demographic Information

Age

____

Gender

- Male
- Female

Nationality

____

Ethnic Group

- Chinese (1)
- Malay (3)

Instructions, Questions and Food Images used in the R-FFQ

For each of the listed food item, please indicate how often you eat it whether it is by the day, week or month. You can do so by clicking on the circles underneath an answer to dot them. For each of the item eaten, please indicate how much you eat at each sitting/per meal. Please

refer to the photo to get an idea of how much a portion will look like.
Move the cursor along the scale to indicate the portion you had per serving.

A) Frequency Question: How often do you eat this food?

- ○ Never (1)
- ○ 1-2 times a year (2)
- ○ 1-2 times a month (3)
- ○ Once a week (4)
- ○ 2-5+ times a week (5)
- ○ Once a day (6)
- ○ 2-5+ times a day (7)

B) Portion Size Question: When you eat this food, how much do you eat per sitting? (response needed if 'NEVER' is NOT SELECTED)

	0 1 2 3 4 5 6 7 8 9 10
PORTION/CUP	

C) Why have you not eaten this food before? (response needed if 'NEVER' is SELECTED)

____

Apple: 1 portion

Apple Pie: 2 portions

Assam Pedas: 1 portion

Avocado: 2 portions

Baklava: 1 plate

Banana: 1 portion

Fried Anchovies: 1 plate

Banana Split: 1 portion

Beef Rendang: 1 portion

Beef Stew: 1 portion

Beetroot: 2 portions

Big Mac: 1 portion

Banana Fritters: 3 portions

Biscuits: 1 plate

Bone Soup: 1 portion

Caramel Pudding: 3 slices

Bread Pudding: 1 portion

Carrots: 2 portions

Briyani: 1 portion

Cheese Crackers: 1 plate

Broccoli: 1 plate

Cheese Platter: Showing a combination. 1 portion is approximately 3 slices

Brown Squid: 3 portions

Cheeseburger: 1 portion

Brownie: 1 portion

Cheesecake: 1 slice

Cabbage: 1 plate

Cherries: 1 plate

Chicken Curry: 1 portion

Chocolate Bread: 3 portions

Chicken Rice: 1 portion

Chocolate Cake: 1 slice

Chicken Wings: 2 portions

Ciku: 4 portions

Chilli Padi: 1 plate

Cinnamon Roll: 1 portion

Chilli Tofu: 1 portion

Coleslaw: 1 plate

Chinese Cabbage: 1 plate

Cookies: 1 plate

Chocolate: 2 portions

Corn: 2 portions

Cotton Candy: 1 portion

Doughnut: 1 portion

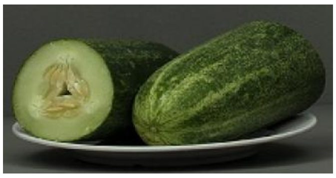
Crab: 1 portion

Dragon Fruit: 1 plate

Crackers: 1 plate

Dried Chilli: 1 plate

Cucumber: 1 portion is 4 slices



Duck Noodles:m1 portion

Cupcake: 2 portions

Durian: 1 plate

Curry puffs: 1 portion is 2 pieces

Egg Noodles: 1 plate

Date Pudding: 1 portion

Eggplant: 1 portion is 2 slices

Egg Tart: 2 portions

Fried Prawn: 1 plate

Fish Curry: 1 portion

Fried Rice: 1 plate

Fried Fish balls: 2 portions

Fried Squid: 1 portion

Fish and Chips: 1 portion

French Fries: 1 portion

French Beans: 1 plate

Ginger: 1 portion is 2 slices

Fried Chilli Fish: 1 portion

Fried Kuey Teow: 1 portion

Grilled Chicken: 1 portion

Guava: 1 plate

Hash Browns: 3 portions

Honeydew: 1 plate

Grapes: 1 plate

Green Curry: 1 portion

Jackfruit: 1 plate

Kangkung: 1 portion

Kaya Toast: 3 portions

Kidney Beans: 1 plate

Hot Dog: 1 portion

Curried Squid: 1 plate

Iced Gems: 1 plate

Kiwi: 2 portions

Kuih Muih: 1 plate

Lollipop: 3 portions

Laksa Johor: 1 portion

Macaroni: 1 portion

Lasagne: 1 portion

Macaroon: 3 pieces is 1 portion

Lava Cake: 1 portion

Mackerel: 1 plate

Lemon Pie: 1 slice

Maggi Mee: 1 portion

Lettuce: 1 plate

Mango: 2 portions

Liver Rendang:1 portion

Muffins: 2 portions

Mango Pudding: 1 plate

Mustard: 1 tablespoonful

Marshmallow: 1 plate

Nachos: 1 portion

Mashed Potato: 1 portion

Nasi Kunyit: 1 portion

Mata Kuching: 1 plate

Nuggets: 1 plate

Mee Goreng: 1 portion

Nuts: 1 plate

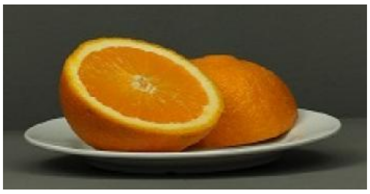
Muesli Bar: 2 portions

Okra: 1 plate

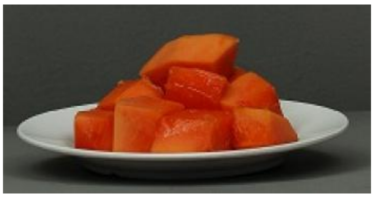
Onion Rings: 1 portion

Onions: 4 portions

Orange: 1 portion



Papaya: 1 plate



Pavlova: 3 pieces is 1 portion

Peas: 1 plate

Pepper Chicken: 1 plate

Pickled Chilli: 1 portion is 1 tablespoonful

Oreos: 1 plate 	Pie: 1 portion is 2 small pies 

Pineapple: 1 plate

Pizza: 2 slices

Popcorn: 2 portions

Poptart: 3 portions

Porridge: 1 portion

Potato Wedges: 1 portion

Prawn Crackers: 1 plate

Prawn Noodles: 1 portion

Prawn Sambal: 1 plate

Pretzel: 1 portion

Potato: 2 portions 	Pumpkin: 1 portion 

Quiche: 1 slice

Salad: 1 portion

Raisins: 1 plate

Sambal: 1 plate

Rambutan: 1 plate

Sambal Petai: 1 plate

Raspberries: 1 plate

Sandwich: 1 portion

Red Velvet Cake: 1 slice

Satay: 1 plate

Rojak Buah: 1 portion

Shredded Fish: 1 portion

Spaghetti: 1 portion

Spicy Fish: 1 portion

Spicy tauchu: 1 tablespoon

Sausages: 2 links represent 1 portion

Super Rings: 1 portion

Tandoori Chicken: 1 plate

Tapioca Chips: 1 plate

Tomato: half a tomato is 1 portion

Spinach: 1 plate

Tom Yum: 1 portion

Steak: 1 portion

Twisties: 1 plate

Vege Balls: 3 portions

Vegetarian pau: 1 portion