

RELATIONSHIP BETWEEN SOCIO-ENVIRONMENTAL
FACTORS, PERSONAL FACTORS, FRUITS AND
VEGETABLES INTAKE AMONG ADOLESCENTS IN
KELANTAN

by

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Dissertation submitted in partial fulfillment
of the requirements for the degree
of Bachelor of Health Science (Honours) (Nutrition)

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CERTIFICATE

This is to certify that the dissertation entitled “RELATIONSHIP BETWEEN SOCIO-ENVIRONMENTAL FACTORS, PERSONAL FACTORS, FRUITS AND VEGETABLES INTAKE AMONG ADOLESCENTS IN KELANTAN” during the period from Sept 2015 to June 2016 under my supervision. I have read this dissertation and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation to be submitted in partial fulfillment for the degree of Bachelor of Health Science (Honours) (Nutrition).

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DECLARATION

I hereby declare that this dissertation is the result of my own investigations, except where otherwise stated and duly acknowledged. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at Universiti Sains Malaysia or other institutions. I grant Universiti Sains Malaysia the right to use the dissertation for teaching, research and promotional purposes.



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Date: 26/06/16
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LIST OF ABBREVIATIONS

Abbreviation/Symbol	Definition
BMI	Body Mass Index
cm	centimeter
EAT	Eating Among Teens
FAOSTAT	Food and Agriculture Organization of the United Nations
F-EAT	Families and Eating and Activity in Teens
FFQ	Food Frequency Questionnaires
g	Gram
kg	kilogram
m ²	meter square
ml	milligram
SCT	Social Cognitive Theory
STPM	Sijil Tinggi Pelajaran Malaysia
USA	United States of America
WHO	World Health Organization
x	multiply by
<	less than
≥	more or equal to

ABSTRAK

Pengambilan buah-buahan dan sayur-sayuran yang kurang mencukupi merupakan isu kesihatan global yang berterusan dan ianya berhubungkait dengan pelbagai penyakit kronik. Walaubagaimanapun, kekurangan pemahaman dan ilmu pengetahuan berkenaan dengan faktor-faktor yang mempengaruhi amalan pemakanan buah-buahan dan sayur-sayuran masih berkekalan di Malaysia, terutamanya dalam kalangan remaja. Justeru, objektif kajian ini bertujuan untuk mengkaji dan memahami hubungkait antara faktor sosio-persekitaran, faktor individu dan amalan pemakanan buah-buahan dan sayur-sayuran dalam kalangan remaja di negeri Kelantan, Malaysia. Sejumlah 223 responden telah dipilih secara rawak daripada golongan pelajar yang masih belajar di lima buah sekolah menengah di negeri Kelantan. Data dikumpul berdasarkan soal selidik sendiri dan komponen antropometri termasuk ketinggian dan berat badan responden telah dikumpulkan untuk mengira Indeks Jisim Badan (*Body Mass Index*). Berdasarkan keputusan kajian, lebih separuh daripada responden (69.5%) mengambil sekurang-kurangnya lima kali buah-buahan dan sayur-sayuran dalam pemakanan harian. Kebanyakan responden (68.2%) mempunyai berat badan optimum. Kelaziman berat badan berlebihan dan obesiti adalah sebanyak 11.7% dan 10.8% masing-masing. Mengikut analisis data kategorikal, didapati tiada hubungkait yang ketara antara Indeks Jisim Badan dan amalan pemakanan buah-buahan ($\chi^2 = 0.92, p > 0.05$), keadaan yang sama dapat dilihat dalam hubungkait antara Indeks Jisim Badan dan amalan pemakanan sayur-sayuran ($\chi^2 = 0.27, p > 0.05$). Dalam analisis pelarasan, kesemua faktor sosio-persekitaran serta faktor individu termasuklah sikap dan kesedaran terhadap pemakanan

dan kesihatan, dan keseimbangan berat badan atau tubuh badan telah menunjukkan hubungkait yang ketara dengan pemakanan buah-buahan dan sayur-sayuran. Namun demikian, faktor citarasa individu dalam kajian ini bercanggah dengan kajian-kajian yang dibandingkan, tiada hubungkait yang ketara ditunjukkan dengan pemakanan buah-buahan dan sayur-sayuran ($r=-0.03$, $p>0.05$). Secara kesimpulan, intervensi atau rancangan-rancangan pemakanan komuniti boleh menyerapkan faktor sosio persekitaran dan faktor individu bagi mengalakkan pemakanan buah-buahan dan sayur-sayuran dalam kalangan remaja di Malaysia.

ABSTRACT

Low fruits and vegetables consumption is a persistent problem worldwide that has been linked with various chronic diseases. However, there is limited knowledge on factors that influence fruits and vegetables consumption in Malaysia, especially for the adolescent group. Hence, the objective of this study was to examine the relationship between socio-environmental factors, personal factors and adolescent's fruits and vegetables consumption in Kelantan, Malaysia. A total of 223 respondents were randomly selected from 5 secondary schools in Kelantan. Data were collected by self-report questionnaire and height and weight was measured to calculate body mass index (BMI) of respondents. Out of expectation, more than half of the respondents (69.5%) consumed fruits and vegetables ≥ 5 times per day. Among the respondents, 68.2% were in normal body weight status. The prevalence of overweight and obesity were 11.7% and 10.8%, respectively. In categorical analysis, no significant associations were observed between BMI and fruits consumption ($\chi^2 = 0.92$, $p > 0.05$) and also BMI and vegetables consumption ($\chi^2 = 0.27$, $p > 0.05$). In correlation analysis, socio-environmental factors including home availability of fruits and vegetables, parental modeling, parental support for healthy eating, peer support for healthy eating and family meal patterns as well as personal factors including health or nutrition attitudes and weight or body concerns showed significant relationship with fruits and vegetables consumption. However, taste preferences inconsistent with other studies, did not showed significant correlation with fruits and vegetables consumption ($r = -0.03$, $p > 0.05$). In conclusion, nutrition interventions could incorporate

socio-environmental factors as well as personal factors to improve fruits and vegetables consumption among adolescents in Malaysia.

CHAPTER 1: INTRODUCTION

1.1 Background of the study

Diets rich in fruits and vegetables are widely recommended for their health-promoting properties (Slavin & Lloyd, 2012). Fruits and vegetables provide essential nutrients for human body including vitamins, minerals, fiber and phytochemicals, which are important for good health (Centers for Disease Control and Prevention, 2013, 2015). Besides, fruits and vegetables food group is also widely known as important to promote healthy weights and may help reduce the risk of some types of cancer and other chronic diseases (Centers for Disease Control and Prevention, 2015).

However, low fruits and vegetables consumption is now a persistent problem, where there were an estimated 6.7 million deaths worldwide attributed to inadequate fruit and vegetable consumption (Lim *et al.*, 2013). Malaysian Dietary Guidelines recommend at least five serving, which is approximately 400g of variety non-starchy vegetables and fruits every day. Among the five servings recommended, two servings are for fruits and three servings for vegetables (Ministry of Health Malaysia, 2010).

Fruit and vegetable consumption among Malaysian is approximately 150g for fruits and 78g for vegetables per capita per day according to the statistics from the Food

and Agriculture Organization of the United Nations between 1980 and 2003 (FAOSTAT, 2009). The combined fruit and vegetable intake of 228g per day was far below the 400g equivalent to 5 servings that are recommended by Malaysian Dietary Guidelines and WHO dietary guidelines. This suggests that Malaysian is not consuming enough fruit and vegetable as recommended.

In previous studies among adolescents, factors that have been found to be correlated with fruit and vegetable consumption include age, gender, socioeconomic position, preferences, parental intake, parental modeling, family rules and parental encouragement, home food availability /accessibility and family support (Pearson, Biddle, & Gorely, 2009; Rasmussen *et al.*, 2006; Shokrvash *et al.*, 2013).

In Malaysia, there is lack of studies on the factors affecting fruits and vegetables intake except for the study that examines socio-demographic factors on fruits and vegetables consumption among Malaysians (Yen, Tan, & Nayga Jr, 2011) and the study that examines personal and environmental factors on fruits and vegetables consumption behavior among adults in Malaysia (Othman *et al.*, 2012). There is no recent study on the correlation of fruits and vegetables intake among adolescent group. Identifying correlation of fruits and vegetables intake may be significant in increasing overall consumption (Pearson *et al.*, 2009).

1.2 Problem statements

Low consumption of fruits and vegetables has been linked with various chronic diseases, such as type 2 diabetes mellitus, cardiovascular diseases and certain cancers (Ministry of Health Malaysia, 2010). Besides, low fruits and vegetables consumption was ranked as the 4th and 17th risk factors for burden of disease attributable respectively in the most recent Global Burden of Disease 2010 (Lim *et al.*, 2013).

Diet high in fat but low in fruits and vegetables are normally consumed by Malaysian adolescents (Rezali *et al.*, 2015). Low fruits and vegetables consumption are a common problem among adolescents. In Malaysia, majority of the adolescents with approximately 96.3% did not meet the recommended intakes of fruits and vegetables (Institute for Public Health, 2011). According to Peltzer and Pengpid (2012), there is 76.3% of adolescents in five Southeast Asian countries who had fruits and vegetable consumption of less than five servings per day.

The same problem happened in United States, where there are only 0.9% of adolescents meeting the recommendations for fruits and vegetables (Kimmons, Gillespie, Seymour, Serdula, & Blanck, 2009). In addition, according to Centers for Disease Control Prevention (2011), the median number of times per day that high school students in United States consumed fruits and vegetables was 1.2 for both. There was 28.5% of high schools students consumed fruit less than 1 time day and 33.2% of high school

students consumed vegetables less than 1 time per day (Centers for Disease Control Prevention, 2011). Due to the infrequent fruits and vegetables intake among adolescents, it highlights the need for effective interventions to increase overall consumption.

To develop effective interventions to increase fruits and vegetables consumption, the identification of potentially modifiable correlates is needed. As limited evidence exist pertaining to adolescents fruits and vegetables intake in Malaysia, thus, this study aims to investigate the relationship between environmental factors (fruit and vegetable availability/ accessibility, parental modeling , parental support for healthy eating, peer support for healthy eating and family meals patterns) and personal factors (taste preferences, body mass index, weigh/ body concerns and heath/ nutrition attitudes) with fruit and vegetable intake among adolescents in Kelantan, Malaysia.

1.3 Significance of study

Adolescence is a complex time period along with changes in social influences (Pearson *et al.*, 2009). During adolescence, good nutrition is the key to positive growth and development early in life (Zhylyevskyy, Jensen, Garasky, Cutrona, & Gibbons, 2013). Furthermore, since dietary patterns formed during adolescence tend to persist into adulthood, adequate nutritional intake by young people sets the stage for maintaining good health later on (Zhylyevskyy *et al.*, 2013). Moreover, development of healthy eating habits is important in adolescence to decrease risk in adulthood (Newby, 2007).

Hence, increasing fruit and vegetable intake among adolescents is an important public health issue (Rasmussen *et al.*, 2006). A better understanding of various factors shaping dietary patterns is important for developing program to address poor eating habits (Zhylyevskyy *et al.*, 2013). Findings from this study could suggest nutrition interventions to improve fruits and vegetables intake among adolescents in Malaysia.

1.4 Objectives of study

1.4.1 General objective

To assess the relationship between socio-environment factors, personal factors and adolescent's healthy eating behavior.

1.4.2 Specific objectives

- 1) To determine fruits and vegetables consumption among respondents.
- 2) To determine body weight status among respondents.
- 3) To determine the association between fruits and vegetables consumption and body mass index (BMI) among respondents.
- 4) To examine the relationship between socio-environmental factors and fruits and vegetables consumption among respondents.
- 5) To examine the relationship between personal factors and fruits and vegetables consumption among respondents.

1.5 Research questions

1. How is the fruits and vegetables consumption among the adolescent population in Kelantan?
2. What are the factors related to the fruits and vegetables consumption among adolescents in Kelantan?

1.6 Hypotheses

1.6.1 Null hypotheses (H_0)

1.6.1.1 Null hypothesis I

There is no association between body mass index (BMI) and fruits and vegetables consumption among adolescents in Kelantan.

1.6.1.2 Null hypothesis II

There is no relationship between socio-environment factors, personal factors and fruits and vegetables consumption among adolescents in Kelantan.

1.6.2 Alternative hypothesis (H_a)

1.6.2.1 Alternative hypothesis I

There is association between body mass index (BMI) and fruits and vegetables consumption among adolescents in Kelantan.

1.6.2.2 Alternative hypothesis II

There is relationship between socio-environment factors, personal factors and fruits and vegetables consumption among adolescents in Kelantan.

1.7 Theoretical Framework

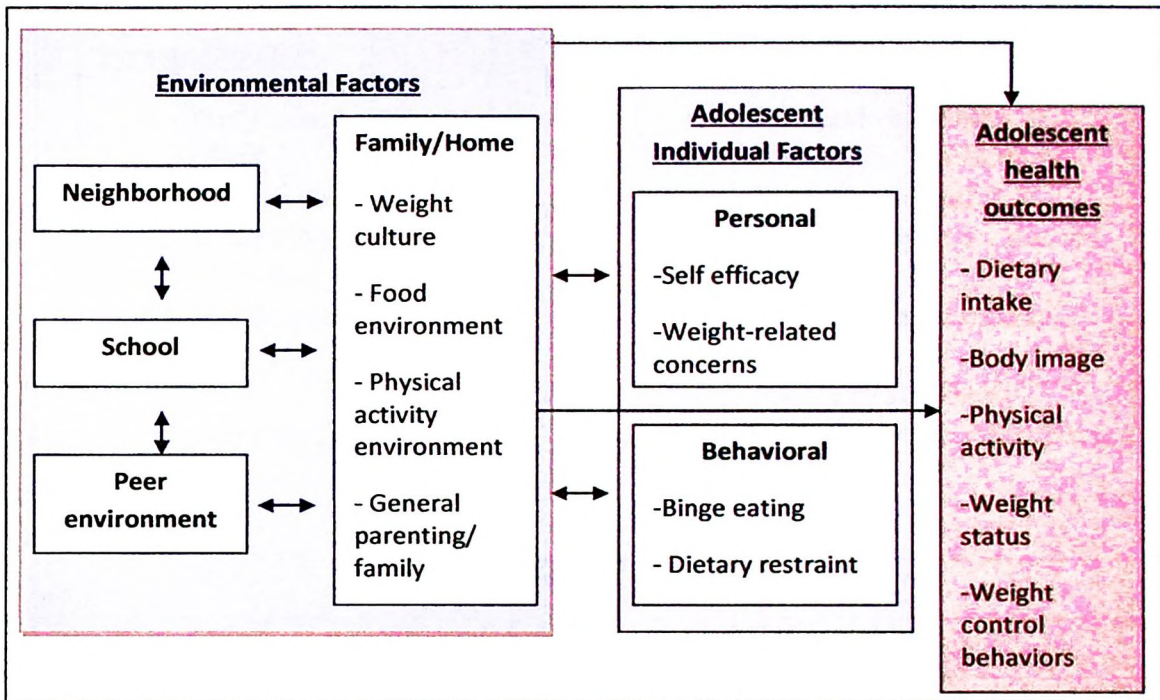


Figure 1.1. Theoretical framework from project Families and Eating and Activity in Teens (F-EAT) (Bruening, MacLehose, Loth, Story, & Neumark-Sztainer, 2012b).

Project Families and Eating and Activity in Teens (F-EAT) designed to investigate influences within the family and home environment on eating, physical activity and weight related behaviors of adolescents (Regents of the University of Minnesota, 2015). The conceptual framework of this study will be adapted from this theoretical framework.

1.8 Conceptual Framework

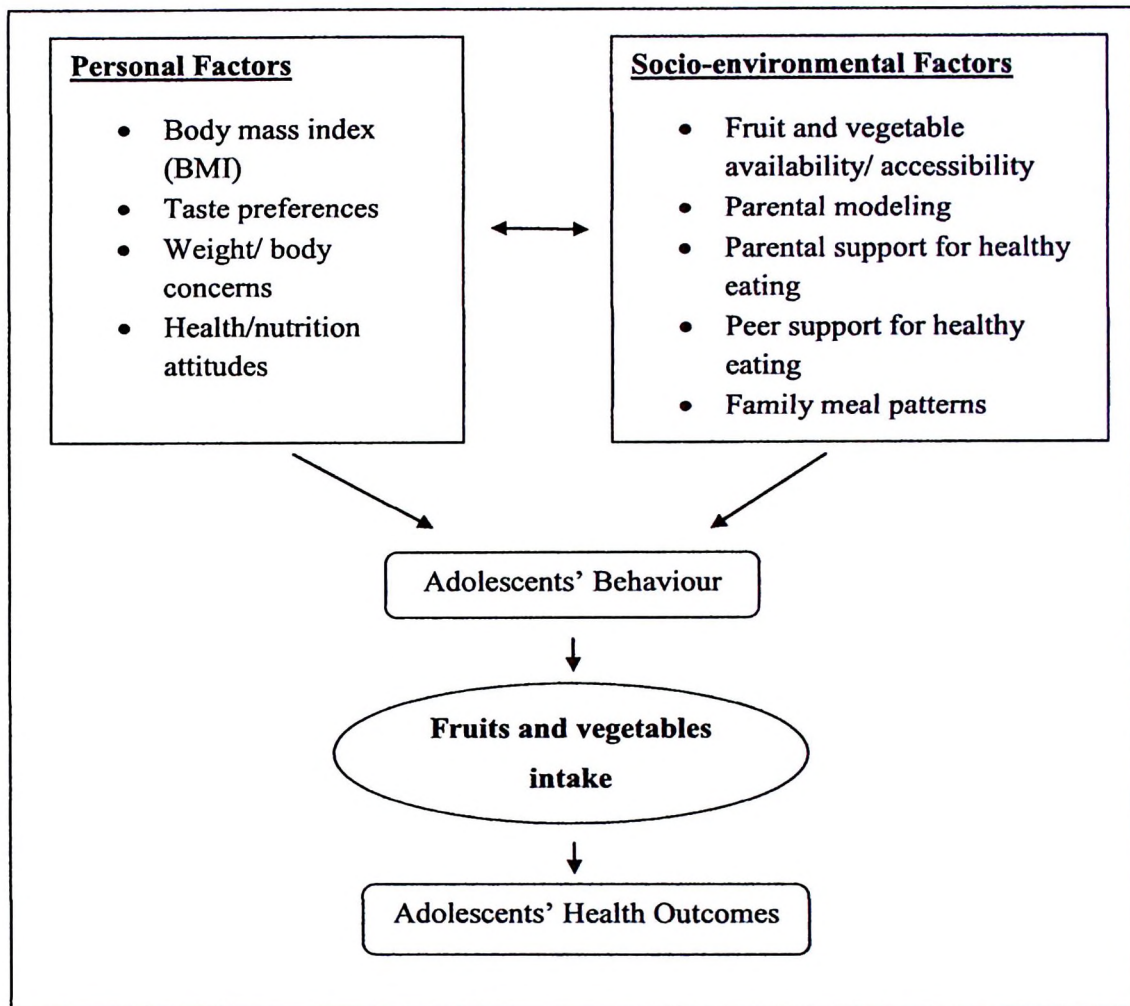


Figure 1.2. Conceptual framework of the study

Figure 1.2 denotes the conceptual framework of this study. This conceptual framework was guided by the theoretical framework from project F-EAT as shown in figure 1.1, as well as modified from Social Cognitive Theory (SCT) developed by Bandura (1997). This theory explained the reciprocal effects between environmental, personal and behavioral factors. Environment factors and personal factors from SCT are components

that will be focused in this study to examine their relationship with fruits and vegetables intake among adolescents. Personal factors (BMI, taste preferences, health/nutrition attitudes and weight/body concerns) and socio-environmental factors (fruit and vegetable availability/accessibility, parental modeling and parental support for healthy eating, peer support for healthy eating and family meals patterns) are the dependent variables, whereas fruits and vegetables intake is the independent variable in this study.

CHAPTER 2: LITERATURE REVIEW

2.1 Adolescence and nutrition

According to World Health Organization, adolescence is defined as the period in human growth and development that occurs after childhood and before adulthood, which is from the ages of 10 to 19. Adolescence is also defined as the period from puberty, which the generative organs become capable of exercising the function of reproduction to maturity (Lew & Barlow, 2005). In addition, adolescence is characterized by rapid physical growth as well as hormonal, cognitive and emotional changes (Al-Otaibi, 2015).

Adolescence is challenging, vulnerable and opportunity phase of life. This is the age that easily affected by the socio-environments, such as peer group and family. Unlike children, adolescents are normally not fed, but they eat what and when they want (Lew & Barlow, 2005), thus they are easily affected by personal factors too.

In general, there is an increase in nutrient requirements during the rapid growth and development of adolescence (Lew & Barlow, 2005). The rapid change in physical growth and psychosocial development place adolescents into a nutritionally vulnerable group with poor eating behaviors that do not meet dietary recommendations (Savidge, Ball, Worsley, & Crawford, 2007). Most of this young people consume not enough fruits and vegetables, too much saturated fat and more energy than they need (Yngve *et al.*, 2005).

Adolescents' eating behaviors continue to develop as they broaden their social networks and assume greater independence (M. Bruening *et al.*, 2012a). Dietary habits and food preferences which affect energy consumption and nutrient intake are normally developed during adolescence (Ministry of Health Malaysia, 2013). Developing healthy eating and exercise habits during adolescence are foundations for good health in adulthood (World Health Organization, 2014).

The major health issues during adolescence are sexually transmitted infections including HIV, poor eating and exercise habits, tobacco and drug use and mental health which lead to illness or premature death later in life (World Health Organization, 2014). Promoting healthy practices and taking steps to better protect adolescents from health risk are important for the prevention of health problems in adulthood and for countries' future health and social infrastructure (World Health Organization, 2014).

Skipping meals especially main meals is a common eating behavior among adolescents in developed and developing country (Kotecha *et al.*, 2013). Furthermore, other eating patterns that normally notice among adolescents are meal skipping, snacking, eating away from home, fast food consumption and unconventional dietary patterns such as adopting vegetarian diet, specific weight loss diet and an overall reduction of food intake (Savige *et al.*, 2007).

According to Malaysian Dietary Guidelines, eating a variety of foods daily as guided by Malaysian Food Pyramid should provide all the nutrients necessary by the body. Protein, carbohydrate and fat are the three essential macronutrients that provide energy to the body (Malaysian Dietary Guidelines, n.d.). Vitamins and minerals are micronutrients that essential in assuring the proper functioning of the body and helps in promoting wound healing (Malaysian Dietary Guidelines, n.d.). Fiber and photochemical that commonly found in plants are important nutrients to the body too, which are protective against diseases (Malaysian Dietary Guidelines, n.d.).

2.2 Dietary practices and nutrients intake of Malaysian Adolescents

The dietary practices in adolescents are often less than ideal (Lew & Barlow, 2005). The bad dietary practices that normally see among Malaysian adolescents are consumption of fast food, deep fried food, snacks, sweetened drinks and alcohol (Lew & Barlow, 2005). There are roughly 75.3% Malaysian adolescents eat at western fast food restaurants, 89.5% consume snacks and confectionery and 49.4% drink alcohol among 100 Malaysian adolescents subjects in the study to examine dietary practices of adolescents in Singapore and Malaysia (Lew & Barlow, 2005).

Malaysian female adolescents are probable to be the most vulnerable to and at risk of practicing unhealthy eating behaviors, since this group tends to have greater

concerns over their body image and may alter their eating habits to achieve the ideal body image compare to the male adolescents (Ming, Ying, & Kassim, 2006).

There was a study conducted in Kuantan district, Pahang among 407 female adolescents to examine their eating behaviors. The study showed that meal skipping, snacking and practicing various weight loss behaviors were some of the unhealthy eating behaviors among Malaysian female adolescents (Chin & Mohd Nasir, 2009). There was about 47.4% of the adolescent girls skipped at least one meal a day and approximately 51.4% of subjects snacked between meals daily. There were 26.9% participants who choose fruits as snack in this study (Chin & Mohd Nasir, 2009).

2.3 Fruit and vegetable dietary recommendation

Fruit is defined as the sweet, fleshy edible part of a plant that arises from the base of the flower and surrounds the seeds (Ministry of Health Malaysia, 2010). Most of the fruits are consumed fresh and raw when they are ripe, it can also be eaten as canned fruits, dried fruits and fruit juice that preferably without added sugar and preservatives (Ministry of Health Malaysia, 2010).

Vegetable is defined as edible plants that usually collected and/or cultivated for their nutritional value for humans (World Health Organization, 2005). Vegetable includes

all fresh, green leafy vegetables, coloured vegetables (such as red spinach), fruit vegetables (such as melons and pumpkin), bean vegetables, cruciferous vegetables, ulam-ulam and also the edible plant stems (such as asparagus and celery) (Ministry of Health Malaysia, 2010).

Fruits and vegetables are placed at the second level of Malaysia food pyramid (Malaysian Dietary Guidelines, n.d.). Fruits and vegetables include a diverse group of plants foods that differ greatly in content of energy and nutrients (Slavin & Lloyd, 2012). However, they are generally low in energy density (Slavin & Lloyd, 2012). They are sources of many vitamins and minerals and other bioactive compounds such as phytochemicals when consume in varieties (Malaysian Dietary Guidelines, n.d.).

Most of the countries have dietary recommendations that include fruits and vegetables (Slavin & Lloyd, 2012). Recommendations of fruits and vegetables differ by country but public health agendas across the world share the common goals of increasing fruits and vegetables intake and promoting people to eat a variety of fruits and vegetables (Pearson *et al.*, 2009).

According to key message seven in Malaysian Dietary Guidelines for children and adolescents, it is recommended to consume variety and adequate amount of fruits and

vegetables every day. Malaysian Dietary Guidelines also suggested that population should consume at least 600g of non-starchy vegetables and fruits daily.

To achieve variety of fruits and vegetables, children and adolescents should choose dark green leafy vegetables and eat different colour of fruits and vegetables every day. Fresh fruits and vegetables are the most recommended. If dried fruits are chosen, unsweetened and unsalted variety are recommended. If canned fruits are chosen, it is recommended to serve without syrup. Fruit and vegetable juices should be prepared without added sugar and preservatives (Ministry of Health Malaysia, 2013).

To achieve adequate amount of fruits and vegetables every day, children and adolescents aged 7 to 18 years old is recommended to eat at least 3 servings of vegetables and 2 servings of fruits daily. Fresh fruits should be chosen over fruit juices. Fruit juices should not replace more than one serving of fruit according to Malaysian Dietary Guidelines. Fruits and vegetables should not include category of tubers, such as cassava and potatoes.

The examples of recommended serving size for one serving of fruits and vegetables are as shown in table 2.1 and table 2.2 below respectively (Malaysian Dietary Guidelines, n.d.).

Table 2.1: Serving size of fruits

One serving of fruit (15g carbohydrate per serving)	
Apple/ Chinese pear/ mango/ ciku	1 whole
Banana, berangan (medium size)	1 whole
Banana, emas	2 whole
Durian	3 pieces
Grapes	8 small
Guava/ pear	1/2 whole
Mandarin orange (small to medium)	1 whole
Papaya/ pineapple/ watermelon	1 slice
Prunes	4 small
Raisins	1 dessert spoon/10ml

Table 2.2: Serving size of vegetables

One serving of vegetables	
Dark green leafy vegetables with edible stem, cooked	1/2 cup
Fruit vegetables, cooked	1/2 cup
Ulam, raw	1 cup/ 200ml

2.4 Fruits and vegetables intake and its potential health benefits

Fruits and vegetables are important sources of nutrients, dietary fiber and phytochemicals that could promote health as well as reduction in disease risks (Boeing *et al.*, 2012). The antioxidant content in fruits and vegetables contribute to the reduction of systemic oxidative stress, possible in prevent chronic diseases (Carter, Gray, Troughton, Khunti, & Davies, 2010).

High intake of fruit and vegetables has been associated with a reduction in incidence of cancer and cardiovascular disease (Pomerleau, Lock, & McKee, 2006). There was strong evidence that increasing the fruit and vegetable intake reduces hypertension, coronary heart disease and stroke (Boeing *et al.*, 2012). Besides, there is possible evidence that the risk of certain eye diseases, dementia and the risk of osteoporosis are inversely associated with the consumption of fruits and vegetables (Boeing *et al.*, 2012).

There was a population-based cohort study in Netherlands showed higher fruit and vegetable intake, whether raw or processed was protective against coronary heart disease incidence (Griep, Geleijnse, Kromhout, Ocké & Verschuren, 2010). The risk of coronary heart disease incidence was reported 34% lower for subjects with a high intake of total fruit and vegetables compared with subjects that consume low intake of fruit and vegetable (Griep *et al.*, 2010).

There is also probable evidence that high consumption of fruits and vegetables will decrease the risk of cancer in general (Boeing *et al.*, 2012). In a recent meta-analysis conducted by Wang, Qin, Zhang, Song, and Zhang (2015), it was showed that fruits and vegetables consumption may have protective effect on lung cancer and the associations were stronger among females.

Furthermore, there is possible evidence that an increased in fruits and vegetables intake may prevent body weight gain (Boeing *et al.*, 2012). Since overweight is the most important risk factor for type 2 diabetes mellitus, an increased in fruits and vegetables intake might indirectly reduces the incidence of type 2 diabetes mellitus (Boeing *et al.*, 2012). However, independence of overweight, there is probable evidence reported in the review by Boeing and his colleagues that there is no influence of increased consumption on the risk of type 2 diabetes mellitus.

A meta-analysis reported by Carter and his colleagues also showed that there was no significant reduction in risk of type 2 diabetes incidence for consumption of fruit, vegetables or both. However, summary of review showed an increased intake of green leafy vegetables was associated with a 14% reduction in risk of type-2 diabetes, suggest that increasing daily intake of green leafy vegetables could significantly reduce the risk of type-2 diabetes (Carter *et al.*, 2010).

2.5 Factors that influence adolescents' fruit and vegetable intake

Personal and environmental factors are the main attributes to determine the consumption behavior (Othman *et al.*, 2012). Adolescents have their meals primarily at home. Thus, family is a potential resource that determines adolescents' healthy eating behavior (De Bourdeaudhuij *et al.*, 2006). Although adolescents consume majority of meals at home, unlike children, they have considerably greater independence and autonomy when

making their food choices. In addition, few personal factors have been examined extensively compared to family-related factors (Rasmussen *et al.*, 2006). Hence, personal factors should be focused too to examine the relationship with fruits and vegetables intake among adolescents.

Peer relationships or friends also play a relative influence during adolescence (Gifford-Smith, Dodge, Dishion, & McCord, 2005). However, there is a lack of studies examining if peer relationships are associated with adolescents' healthy eating behaviors such as fruits and vegetables intake (M. Bruening *et al.*, 2012a).

2.5.1 Environment Factors

According to Shokrvash *et al.* (2013), family support is an important contributing factor for daily adequate fruit and vegetables intake among adolescents. Male adolescents with low perceived emotional family support and female adolescents with low perceived practical family support were at risk of inadequate daily fruit and vegetable consumption (Shokrvash *et al.*, 2013). It is also found that male adolescents are at higher risk of getting less fruit and vegetables in the same study in Tabriz, Iran (Shokrvash *et al.*, 2013).

There is also another study among adolescents conducted in five Southeast Asian countries (India, Indonesia, Myanmar, Sri Lanka and Thailand) shows that lack of protective factors such as family-related factors including parental style, lack of caregiver bonding, connectedness and supervision were associated with inadequate fruits and vegetables intake (Peltzer & Pengpid, 2012). Furthermore, this study also found that physical inactivity such as sedentary leisure time behavior was associated with inadequate fruits and vegetables intake among adolescents (Peltzer & Pengpid, 2012).

There was a study on the association between parental report of the home food environment and adolescent's fruits and vegetables intake which showed that household availability was positively associated with fruit and vegetable intake among girls. However, there was no association found between household availability and fruit and vegetable intake among boys (Hanson, Neumark-Sztainer, Eisenberg, Story, & Wall, 2005). The study also examined parental intakes on adolescent's fruits and vegetables consumption. It is also shown that parental intakes were positively associated with fruits and vegetables for girls, but not positively associated with boys (Hanson *et al.*, 2005). However, parental intake is positively associated with dairy intake for boys but not girls (Hanson *et al.*, 2005). This might be due to other factors such as taste preferences between boys and girls adolescents.

Positive association between home environment factors and fruits and vegetables intake were also shown in a study on the major patterns of dietary intake in adolescents. Home environment factors including family meal frequency and home availability of healthy food are positively associated with the vegetable and fruit patterns and inversely associated with fast food pattern (Cutler, Flood, Hannan, & Neumark-Sztainer, 2011). Socioeconomic status was also found to be positively associated with fruits and vegetables among adolescents in this study (Cutler *et al.*, 2011).

In a review of quantitative study among children and adolescents aged 6 to 18, parental intake and home availability/ accessibility were the factors that greatly shown positive association on children's and adolescents' fruits and vegetables consumption (Rasmussen *et al.*, 2006). There is also a qualitative systematic review concluded that parental intake of fruit and vegetables and availability of fruits and vegetables at home are positively related to adolescents' fruits and vegetables intake (Krolner *et al.*, 2011).

There was another systematic review conducted to examine family correlates of fruit and vegetable consumption in children and adolescents shows that parental intake was positively associated with adolescents' fruits and vegetables intake (Pearson *et al.*, 2009). Parental occupational status was also found positively associated with fruits consumption among adolescent in this review (Pearson *et al.*, 2009).

There was also a previous study conducted which showed that home environment factors play a crucial role in shaping dietary intake and weight status in children (Couch, Glanz, Zhou, Sallis, & Saelens, 2014). Besides, there was a recent study support home food environments as an influential factor shaping the fruit and vegetable intake of children (Amuta, Jacobs, Idoko, Barry, & McKyer, 2015).

2.5.2 Personal factors

Preference is the personal factor that has been investigated most extensively on relationship of fruit and vegetable intake among adolescents (Rasmussen *et al.*, 2006). All of the papers analyzed in the review conducted by Rasmussen et al. (2006) among children and adolescents aged 6 to 18 years old showed positive association between preferences and fruits and vegetables intake. Other personal factors such as nutritional knowledge, attitude, intentions, self-efficacy and subjective norms were also shown positive association on fruits and vegetables intake among children and adolescents in majority of the studies (Rasmussen *et al.*, 2006).

There was a study showed that high fat and sugar-rich foods are among the most preferred foods among children and adolescents (Cooke & Wardle, 2005). However, most fruits and in especially vegetables have low-energy densities (Brug, Tak, te Velde, Bere, & de Bourdeaudhuij, 2008). In addition, many vegetables such as broccoli and cabbage have somewhat unpleasant bitter taste that to be barrier for consumption for

certain people. Thus, preferences for fruit and vegetable are not so easily learnt (Brug *et al.*, 2008).

In a longitudinal study conducted among 1495 adolescents in high school to examine the correlates of fruit and vegetable intake during the transition of adolescence to young adulthood, taste preferences was found positively associated with fruits and vegetables consumption among these adolescents (Larson *et al.*, 2008).

Self-efficacy, which prevents overeating and promotes healthy dietary habit is also an important personal factors influencing fruits and vegetables intake (Zhang & Fu, 2011). Fruit and vegetable self-efficacy is the ability to select, prepare and eat fruit and vegetable (Gallaway, Jago, Baranowski, Baranowski, & Diamond, 2007). This skills and abilities are to some extent dependent on practical knowledge (Brug *et al.*, 2008).

There was a study in Texas, USA among 11 to 14 year old boy scouts which showed that self-efficacy was found to be slightly significant predictor of vegetable only but not fruit and juice (Gallaway *et al.*, 2007). However, fruit, juice and vegetable preferences and availability were significantly associated with fruit, juice and vegetable consumption among this group. Gallaway *et al.* (2007) suggest that increased availability have higher impact on fruit, juice and vegetable consumption.