

Evaluation of diet quality and its associated factors among adolescents in Kuala Lumpur, Malaysia

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BACKGROUND/OBJECTIVES: This study aims to determine contribution of meal frequency, self-efficacy for healthy eating, and availability of healthy foods towards diet quality of adolescents in Kuala Lumpur, Malaysia.

SUBJECTS/METHODS: This study was conducted among 373 adolescents aged from 13 to 16 years old. Diet quality of the respondents was assessed using the Healthy Eating Index for Malaysians. Meal frequency, self-efficacy for healthy eating, and availability of healthy foods were assessed through the Eating Behaviours Questionnaire (EBQ), self-efficacy for healthy eating scale, and availability of healthy foods scale, respectively.

RESULTS: The majority of the respondents (80.7%) were at risk of poor diet quality. Males (mean = 34.2 ± 8.2%) had poorer diet quality than females (mean = 39.9 ± 9.0%) ($t = -5.941, P < 0.05$). Malay respondents (mean = 36.9 ± 8.7%) had poorer diet quality than Indian respondents (mean = 41.3 ± 10.0%) ($F = 2.762, P < 0.05$). Age ($r = 0.123, P < 0.05$), self-efficacy for healthy eating ($r = 0.129, P < 0.05$), and availability of healthy foods ($r = 0.159, P < 0.05$) were positively correlated with the diet quality of the respondents. However, meal frequency was not correlated with the diet quality of the respondents. Multiple linear regression analysis showed that being a male, being a Malay, low self-efficacy for healthy eating, and low availability of healthy foods contributed significantly towards poor diet quality among respondents.

CONCLUSIONS: In short, sex, ethnicity, self-efficacy for healthy eating, and availability of healthy foods were associated with diet quality among adolescents. Health practitioners should take into consideration of differences in sex and ethnicity during implementation of nutrition-related intervention programs. Self-efficacy for healthy eating and availability of healthy foods should be included as important components in improving diet quality of adolescents.

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INTRODUCTION

Adolescents have been reported to have the poorest diet quality compared to the other age groups [1]. In the United States (US), about one in three male (31.8%) and female (33.5%) adolescents have poor diet quality [2]. In Alberta, Canada, about 42.0% of adolescents have poor diet quality [3]. Several studies have found that the consumption of milk, fruit, and vegetables decreases while the consumption of fast food and sugar-sweetened beverages increases among adolescents [4-6]. In Malaysia, the majority of the adolescents (96.3%) did not meet the recommended intakes of fruit and vegetables [7]. In contrast, the percentage of energy intake from fat among adolescents in Malaysia was found to be more than 30.0% regardless of body weight status [8]. In other words, Malaysian adolescents consumed a diet high in fat but low in fruit and vegetables.

Since inadequate or excess intake of nutrients is associated with the health, growth, and development of adolescents [9,10], factors that associated with the diet quality of adolescents need to be determined in order to improve their nutritional status. Several studies have applied Social Cognitive Theory (SCT) to determine the factors associated with diet quality indicators among adolescents [11,12]. The SCT comprises three main factors, namely personal, behavioural and socio-environmental [13]. In this study, the personal, behavioural and socio-environmental factors including meal frequency, self-efficacy for healthy eating, and availability of healthy foods, have been found to be associated with diet quality or diet quality indicators among adolescents [14-16]. Woodruff *et al.* [14] reported that low meal frequency was associated with poor diet quality among adolescents aged from 13 to 17 years old in Ontario and Alberta, Canada. In addition, the previous studies showed

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that high self-efficacy to make healthful food choices improved milk intake while high self-efficacy to eat fruits improved fruits intake among adolescents [15,16]. Other than that, high home availability of fruit and vegetables was associated with increased intakes of fruit and vegetables among adolescents [12].

To the best of our knowledge, there were very limited studies that have determined the contribution of meal frequency, self-efficacy for healthy eating, and availability of healthy foods towards diet quality of adolescents. Although many studies in Malaysia have reported several aspects of the diet of adolescents such as dietary intake and eating behaviours, there is no published study concerning diet quality among adolescents in Malaysia. Therefore, the present study is aimed to assess diet quality of adolescents and determine the contribution of meal frequency, self-efficacy for healthy eating, and availability of healthy foods towards diet quality among Malaysian adolescents.

SUBJECTS AND METHODS

Research design and sampling method

This cross-sectional study was conducted in year 2013 among adolescents in Kuala Lumpur, Malaysia. Multi-stage sampling was used for the selection of respondents. Three secondary schools in Kuala Lumpur that met the inclusion criteria of a national secondary school, multiracial composition, and consists of male and female students with aged of 13 to 16 years old were randomly selected from 70 secondary schools in Kuala Lumpur. Six classes from each school were randomly selected. All students in the selected classes were invited to participate in this study. The approvals from the Medical Research Ethic Committee of the Faculty of Medicine and Health Sciences, University Putra Malaysia (IRB number: UPM/FPSK/100-9/2-JKEUPM), the Ministry of Education, and the State Education Department of Kuala Lumpur were obtained before the data collection. An information sheet that explained about the study was distributed to the students and their parents. The consent to be involved in this study was obtained from both the students and their parents. A total of 373 out of 520 students participated in this study, with a response rate of 71.7%. The reasons of non-participation among students were involved in other school activities, absenteeism, and did not receive permission from their parents.

Dietary intake of respondents

A 2-day Dietary Recall (a weekday and a weekend) was used to determine the food consumption and intakes of nutrients among respondents. Respondents were interviewed concerning type of foods, amount of foods and beverages taken, food and beverage brand names, and food preparation method. Household measurements were used to help the respondents to estimate quantity of food and beverages consumed. The Nutritionist Pro™ Diet Analysis software was used to assess energy and nutrient intakes of the respondents.

Diet quality of respondents

The diet quality of the respondents was assessed using the Healthy Eating Index for Malaysians (HEI) (Table 1) [17]. The HEI consisted of nine components. The intakes of all HEI components

were assessed using 2-day Dietary Recall. The components one to seven assessed person's degree of compliance with the food groups intake recommended by Malaysian Dietary Guidelines for Children and Adolescents (MDG) [18]. Components eight and nine assessed compliance with the recommendation of percentage of energy from fat and sodium intake by MDG. The scores for each component ranged from 0 (for lack of compliance) to 10 (for full compliance). The score was calculated proportionately for the in between responses. The total score of the HEI was obtained by summing up the score of each component and a composite score in percentage for the HEI was calculated. The composite score in percentage for the HEI was calculated using the following formula: (total score of 9 components/ 9×10) $\times 100\%$. The possible composite score of the HEI range from 0 to 100, with high score indicates good diet quality. Based on sensitivity and specificity analyses, the composite score for the HEI was divided into two categories which were at risk of poor diet quality ($\leq 46.0\%$) and low risk of poor diet quality ($> 46.0\%$) [19]. The sensitivity of the HEI was determined based on its ability in identifying respondents with a nutritionally inadequate diet. The inadequacy in the diet among the respondents was assessed using Mean Adequacy Ratio (MAR). The MAR of $\leq 75.0\%$ was used as a cut-off for inadequate diet [19]. With a cut-off point at 46, the composite score of the HEI had a high ability in identifying respondents with an inadequate diet. The HEI composite score of equal or less than 46.0% gave a sensitivity of 82.2% and a specificity of 35.5%. Prior to the data collection, a validity study was conducted among 292 students in Kajang, Selangor aged from 13 to 16 years old to determine the validity of the HEI. The validity of the HEI was determined by correlation analyses between composite score of the HEI and adequacy of nutrient intakes. The composite score of the HEI was significantly and positively correlated with adequacy of protein ($r = 0.134$, $P < 0.05$), calcium ($r = 0.304$, $P < 0.05$), thiamine ($r = 0.123$, $P < 0.05$), riboflavin ($r = 0.265$, $P < 0.05$), vitamin A ($r = 0.183$, $P < 0.05$), and vitamin C ($r = 0.283$, $P < 0.05$) intakes, indicating that it can be used to assess diet quality.

Meal frequency of the respondents

Three items from the self-administered Eating Behaviours Questionnaire (EBQ) were used to assess the frequency of meal consumption among the respondents [20]. The meal frequency was assessed based on the number of days in a week that they took breakfast, lunch, and dinner. The responses ranged from 0 to 7 days for all items.

Self-efficacy for healthy eating of respondents

The self-efficacy for healthy eating among respondents was assessed using the self-efficacy for healthy eating scale from the Project EAT Survey [21]. The self-efficacy for healthy eating scale consisted of six items. The respondents were asked whether they were confident that they could change or maintain their eating patterns. All items were scored using a 4-point of scale. All scores for each item were summed up. The scores for self-efficacy for healthy eating ranged from 0 to 24, in which a high score indicates high self-efficacy for healthy eating.

Availability of healthy foods at home

The availability of healthy foods at home was assessed using the availability of healthy foods scale from the Project EAT Survey [22]. It consisted of five items. The respondents were asked whether healthy foods such as fruit, vegetables, fruit juice, milk, and whole meal bread were available at their home. For each item, a score of '3' was assigned to 'always' while a score of '0' was assigned for 'never'. The score for each item was summed up to obtain the total score. The scores for availability of healthy foods ranged from 0 to 15. A higher score indicates high availability of healthy foods.

Statistical analysis

The data analysis was performed using SPSS for Windows version 21.0 software (SPSS, Inc. Chicago, IL, USA). Univariate analysis was used to report the descriptive data such as mean, median, and standard deviation for continuous variables and frequencies and percentages for categorical variables. The correlations between continuous variables were determined using Pearson Product-Moment Correlation analysis. Independent Samples T-test and One-Way ANOVA were used to compare differences between the means of the variables. Non-parametric test (Mann-Whitney U Test) was used to compare the differences between the medians of the variables for the data that were not normally distributed. Multiple linear regression analysis was used to determine contribution of the meal frequency, self-efficacy for healthy eating, and availability of healthy foods towards the diet quality. A statistical level of $P < 0.05$ was considered as significant.

RESULTS

Socio-demographic characteristics

Of the total respondents, 35.1% were males and 64.9% were females. Age of the respondents ranged from 13 to 16 years old, with a mean age of 14.3 ± 1.2 years old. The majority of the respondents were Malays (54.4%), followed by Chinese (34.3%), Indians (8.8%) and other ethnic groups (2.5%).

Mean score of the healthy eating index

The composite scores of the HEI among the respondents ranged from 16.7% to 65.6%, with a mean composite score of $37.9 \pm 9.1\%$ (Table 1). Males (mean = $34.2 \pm 8.2\%$) had significantly lower mean composite score of the HEI than females (mean = $39.9 \pm 9.0\%$), indicating poorer diet quality in males than females ($t = -5.941, P < 0.05$). Malay respondents (mean score = $36.9 \pm 8.7\%$) had significantly lower composite score of the HEI than Indian respondents (mean score = $41.3 \pm 10.0\%$) ($F = 2.762, P < 0.05$). Hence, Malay respondents had poorer diet quality than Indian respondents. The poultry, meat, and egg component (8.4 ± 2.7) had the highest mean score, followed by sodium (6.4 ± 4.5), cereal and grains (5.5 ± 2.0), percentage of energy from total fat (3.8 ± 4.4), vegetables (3.3 ± 2.5), and fish (2.8 ± 3.2) components. The legumes component (1.6 ± 2.7) had the lowest mean score among the respondents. Meanwhile, both fruit and milk and milk products components had a median score of 0.0. Based on diet quality category, the majority of the respondents (80.7%) were at risk of poor diet quality while the remaining 19.3% had a low risk of poor diet quality (Fig. 1).

Meal frequency, self-efficacy for healthy eating and availability of healthy foods among respondents

The mean frequency of breakfast consumption among the

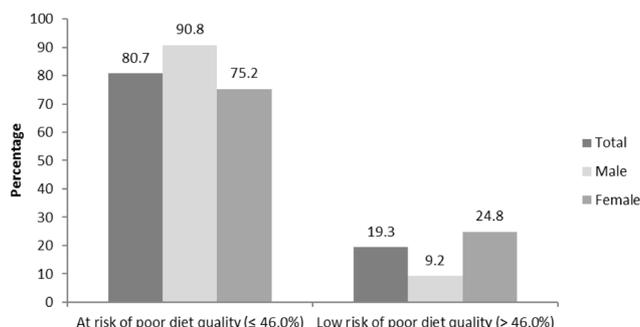


Fig. 1. Distribution of respondents by diet quality category (n = 373). Chi-square analysis with significance at $P < 0.05$ ($\chi^2 = 12,350, P < 0.05$)

Table 1. Composite score and component scores for HEI for Malaysians among the respondents (n = 373)

HEI component	Possible range of score	Criteria for minimum score of 0	Criteria for perfect score of 10	Respondents			t-value/ Z-value	
				Range of score among respondents	Total (Mean \pm SD/ Median)	Male (Mean \pm SD/ Median)		Female (Mean \pm SD/ Median)
HEI composite score ¹⁾	0 to100	-	-	16.7-65.6	37.9 ± 9.1	34.2 ± 8.2	39.9 ± 9.0	-5.941*
Cereals and grains ¹⁾	0 to10	0 serving	6-9 servings ⁴⁾	0-10	5.5 ± 2.0	5.5 ± 1.9	5.4 ± 2.1	0.334
Vegetables ¹⁾	0 to10	0 serving	3 servings	0-10	3.3 ± 2.5	3.7 ± 2.5	3.1 ± 2.4	2.012*
Fruit ²⁾	0 to10	0 serving	2 servings	0-10	0.0 ³⁾	0.0 ³⁾	0.0 ³⁾	-2.652
Milk and milk products ²⁾	0 to10	0 serving	2-3 servings ⁴⁾	0-10	0.0 ³⁾	0.0 ³⁾	1.0 ³⁾	-2.562*
Poultry, meat, and egg ¹⁾	0 to10	0 serving	1-2 servings ⁴⁾	0-10	8.4 ± 2.7	8.0 ± 2.9	8.6 ± 2.6	-1.899
Fish ¹⁾	0 to10	0 serving	1-2 servings ⁴⁾	0-10	2.8 ± 3.2	1.6 ± 2.0	3.4 ± 3.6	-6.212*
Legumes ¹⁾	0 to10	0 serving	1 serving ⁴⁾	0-10	1.6 ± 2.7	1.8 ± 2.9	1.6 ± 2.6	0.711
% of energy from total fat ¹⁾	0 to10	$\geq 35\%$ energy from fat	$\leq 30\%$ energy from fat	0-10	3.8 ± 4.4	3.4 ± 4.4	3.9 ± 4.4	-1.041
Sodium ¹⁾	0 to10	$\geq 2,200-2,300$ mg ⁴⁾	$\leq 2,000$ mg	0-10	6.4 ± 4.5	5.1 ± 4.7	7.1 ± 4.2	-4.154*

¹⁾Independent samples T-test analysis with significance at $P < 0.05$.

²⁾Mann-Whitney U test analysis with significance at $P < 0.05$.

³⁾Median value was reported as data were not normally distributed.

⁴⁾Sex and age specific

* $P < 0.05$

Table 2. Meal frequency, self-efficacy for healthy eating and availability of healthy foods among the respondents (n = 373)

Factors	Total (Mean ± SD)	Male (Mean ± SD)	Female (Mean ± SD)	t-value
Meal frequency				
Breakfast	4.9 ± 2.4	5.2 ± 2.1	4.7 ± 2.6	2.015*
Lunch	5.8 ± 1.9	5.9 ± 1.8	5.8 ± 2.0	0.851
Dinner	5.9 ± 2.0	6.0 ± 1.9	5.8 ± 2.0	1.337
Self-efficacy for healthy eating	15.5 ± 3.8	15.4 ± 3.5	15.6 ± 4.0	-0.432
Availability of healthy foods	9.42 ± 2.95	9.53 ± 2.97	9.36 ± 2.95	0.521

Independent samples T-Test analysis with significance at $P < 0.05$,
* $P < 0.05$

Table 3. Factors that contributed towards diet quality of the respondents (n = 373)

Variables	Unstandardized Coefficients	Standardized Coefficients	t-value	ΔR^2
	B	Beta		
Constant	34.222	-	15.193	-
Being a male	-5.883	-0.308	-6.333*	0.087
Availability of healthy foods	0.351	0.114	2.214*	0.028
Being a Malay	-2.416	-0.132	-2.634*	0.014
Self-efficacy for healthy eating	0.242	0.101	2.014*	0.010

$R = 0.372$, $R^2 = 13.9\%$, Adj. $R^2 = 0.129$; $F = 14.756$, $P < 0.05$

* $P < 0.05$

respondents was 4.9 ± 2.4 days per week. The mean frequencies of lunch and dinner consumption among the respondents were 5.8 ± 1.9 days per week and 5.9 ± 2.0 days per week, respectively. The total score for self-efficacy for healthy eating among the respondents ranged from 1.0 to 24.0, with a mean score of 15.5 ± 3.8 . Meanwhile, the total score of availability of healthy foods among the respondents ranged from 0.0 to 15.0, with a mean score of 9.2 ± 3.0 (Table 2).

Factors associated with diet quality

There was a significant positive correlation between age and diet quality of respondents ($r = 0.123$, $P < 0.05$). The frequency of breakfast ($r = 0.038$, $P > 0.05$), lunch ($r = 0.068$, $P > 0.05$), and dinner consumption ($r = 0.010$, $P > 0.05$) were not significantly correlated with the diet quality of the respondents. The total score for self-efficacy for healthy eating ($r = 0.129$, $P < 0.05$) and availability of healthy foods ($r = 0.159$, $P < 0.05$) were weakly and positively correlated with the diet quality of the respondents. Based on the step-wise linear regression method, four variables were significantly contributed towards the diet quality of the respondents ($F(4, 368) = 14.756$, $P < 0.05$) after adjusted for all other variables (Table 3). Being a male ($t = -6.333$, $P < 0.05$), low availability of healthy foods ($t = 2.214$, $P < 0.05$), low self-efficacy for healthy eating ($t = 2.014$, $P < 0.05$), and being a Malay ($t = -2.634$, $P < 0.05$) contributed towards the poor diet quality among the respondents. Being a male, being a Malay, self-efficacy for healthy eating, and availability of healthy foods explained about 13.9% of the variances in the diet quality of the respondents. Among male respondents, low self-efficacy for healthy eating contributed significantly towards poor diet quality ($t = 2.023$, $P < 0.05$) ($F(1, 129) = 4.091$, $P < 0.05$) (data were not reported in the table). The self-efficacy for healthy eating contributed towards 3.1% of the variances in the diet

quality of the male respondents. As for females, low availability of healthy foods ($t = 2.226$, $P < 0.05$), younger age ($t = 3.188$, $P < 0.05$), and being a Malay ($t = -2.230$, $P < 0.05$) contributed towards the poor diet quality among the respondents ($F(3, 238) = 8.793$, $P < 0.05$) (data were not reported in the table). About 10.0% of the variances in the diet quality of female respondents were explained by the availability of healthy foods, age, and being a Malay.

DISCUSSION

Adolescents need a good quality diet to support their physical growth and prevent the development of diet-related chronic diseases later in life [23-25]. Although it is important to have a good quality diet, high prevalence of poor diet quality has been observed among the respondents. Particularly, the majority of the respondents did not meet the recommended intakes of vegetables, fruit, milk and milk products, fish, and legumes. In contrast, most of the respondents exceeded the recommended intake for percentage of energy intake from fat. In other words, the diet of the respondents was high in fat but low in the intakes of vegetables, fruit, milk and milk products, fish, and legumes. Low availability of fruit and vegetables at home and taste preferences might be one of the reasons for the low intakes of fruit and vegetables among adolescents [12]. The presence of the lactose intolerance problem and poor health or nutrition attitude may explain the low intake of milk and milk products among adolescents [16]. The prevalence of respondents with poor diet quality in the current study was higher than other studies conducted among adolescents [2, 26]. For instance, Goodwin et al. reported that about one in three American adolescents (males: 31.7%; females: 35.5%) aged from 11 to 18 years old had poor diet quality [2]. Meanwhile, about 16.9% of adolescents aged 10 to 18 years old from seven governorates in Egypt had poor diet quality [26]. The inconsistency in the findings between the studies is probably due to the different cut-off points used to define poor diet quality. In addition, inconsistent findings between studies are possibly due to the differences in the study population and location. Kim et al. reported that there was a significant difference in the score of several diet quality components between adults in China and the US [27]. This indicated that food consumption patterns might differ across the study population and location.

This study found that being a male contributed significantly towards the poor diet quality among the respondents. This finding was in line with a study among adolescents in the US [26]. Male respondents were less likely to meet the recommended intakes of milk and milk products and fish than female. Similarly, males were less likely to meet the recommendation for sodium intake compared to females. The differences in diet quality between male and female adolescents are possibly due to the different factors that contribute towards the diet quality of males and females [22]. Particularly, low self-efficacy for healthy eating was factor that contributed towards the poor diet quality among male respondents. Meanwhile, the factors that contributed towards the poor diet quality among female respondents were low availability of healthy foods, of a younger age, and being a Malay. The present study found that availability

of healthy foods at home did not contribute to the diet quality of male adolescents. The non-significant association might be due to the low food preference of males towards the healthy foods such as fruits and vegetables. The findings from the latest Malaysia National Health and Morbidity survey showed that more male adolescents consumed less than two serving of fruits per day (92.1%) compared to females (89.7%) [7]. Hence, it is possible that the male adolescents in this study had a low preference for healthy foods such as fruit, and, hence, less likely to consume these food groups even if these foods were available at home.

The present study found that diet quality of the respondents differed by ethnicity. Malay respondents had poorer diet quality than the Indian respondents. Based on dietary recall of the respondents, Malay respondents were more likely to consume high energy dense food such as fried chicken, fried rice, and curry puff and consumed less varied diet than Indian respondents. In contrast, Indian respondents normally consumed mixed dishes such as dhal that comprised legume and various vegetables. Goodwin *et al.* [2] reported that Non-Hispanic Black adolescents in the US had two times higher odds of having poor diet quality than Non-Hispanic White adolescents. Each of the ethnic groups has their own preferences and cultural practices. Thus, differences in the diet quality between ethnic groups might be due to the cultural differences in the types of food consumed and food preparation method [29]. Our findings showed that low self-efficacy for healthy eating contributed towards the poor diet quality among the respondents. This finding was in line with other studies conducted among adolescents in which self-efficacy was associated with the intakes of diet quality indicators such as fruit and milk intake [15,30]. The association between self-efficacy and dietary intake may be explained by the factors that influenced self-efficacy [31]. For example, there is a high likelihood for an individual to have confidence in meeting the nutritional requirements for those who practiced healthy eating and came from environment where healthy eating is common. In other words, the association between self-efficacy for healthy eating and diet quality might be dependent on factors that influence the self-efficacy of respondents.

Other than self-efficacy for healthy eating, the current study found that availability of healthy foods was significantly associated with the diet quality of the respondents. In particular, lack of availability of healthy foods contributed significantly towards poor diet quality among the respondents. Similarly, several studies have reported that lack of availability of healthy foods was associated with low intake of diet quality indicators among adolescents [12,30]. Haerens *et al.* [30] reported that low availability of healthy foods was associated with low fruit intake among Belgium female adolescents. Consistently, Neumark-Sztainer *et al.* [12] stated that home availability of fruit and vegetables was the strongest determinants of fruit and vegetables intake among adolescents in Minnesota, US. The availability of healthy foods was associated with diet quality because adolescents tend to perceive more barriers to eat healthy foods when healthy foods are not available in their home [30]. Perceive barriers to eat healthy foods results in low intake of healthy foods, which, in turn, poor diet quality among adolescents.

Therefore, parents are encouraged to provide various healthy foods and make them easily available for their children in their home.

Additionally, the meal frequency particularly breakfast, lunch, and dinner did not significantly contribute towards poor diet quality among the respondents. Similarly, Acar Tek *et al.* [23] reported that the frequency of meal intake was not associated with the diet quality among adolescents aged from 14 to 18 years old in Ankara, Turkey. Neumark-Sztainer *et al.* [12] also stated that there was no significant direct effect observed between the frequency of meal and the diet quality indicators particularly fruit and vegetables intake after controlling other variables such as home availability of fruits and vegetables and taste preferences in the analysis. Assessing the frequency of meal consumption based on the number of days per week does not represent the type or amount of food consumed by the respondents. Although respondents consume breakfast, lunch, and dinner every day, it does not indicate that their meals consist of a variety of food groups or meet the recommended intakes of food groups and nutrients suggested by the national dietary guideline. This might be a possible reason for the lack of a significant association between the meal frequency and the diet quality of the respondents.

Based on our findings, being a male, being a Malay, self-efficacy for healthy eating and availability of healthy foods were significantly contributed towards 13.9% of variances in the diet quality of the respondents. Being a male (8.7%) was the strongest factors that contributed towards the diet quality of the respondents, followed by availability of healthy foods (2.8%), being a Malay (1.4%), and self-efficacy for healthy eating (1.0%), respectively. To the best of our knowledge, this is the first study that assessed diet quality of adolescents in Malaysia and determined the contribution of meal frequency, self-efficacy for healthy eating, and availability of healthy foods towards the diet quality. However, there were several limitations in the current study. This study is a cross-sectional survey and unable to determine cause and effect relationships. Besides, this study has been conducted among adolescents in Kuala Lumpur. Thus, results from this study cannot be generalized to the whole adolescent population. Moreover, 2-day Dietary Recall used to assess dietary intakes of adolescents might not represent respondent's usual intake. There was a likelihood of under-reporting or over-reporting of intakes among the respondents due to inaccuracy during diet recall. Other than that, the HEI used in this study was low in specificity. The sensitivity and specificity are inversely related. It has low specificity because this study focused on ability of the HEI in identifying respondents with a nutritionally inadequate diet. In order to prevent malnutrition, it is crucial to identify those with nutritional risk. Other studies who wish to determine high specificity should have aimed to identify those with nutritionally adequate diet instead of those who are nutritionally inadequate diet.

As a conclusion, the current study shows that there was a high prevalence of adolescents that had poor diet quality. Being a male, being a Malay, low self-efficacy of healthy eating, and low availability of healthy foods contributed towards the poor diet quality among adolescents. The high prevalence of poor diet quality among the respondents indicates that there is a

need to improve diet quality of adolescents. Since there was a difference in diet quality between sex and ethnic groups, health practitioners and policy makers should take these aspects into consideration during implementation of nutrition-related intervention programs in Malaysia. Besides, self-efficacy for healthy eating and availability of healthy foods should be included as important components in improving diet quality of Malaysian adolescents.

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