Association between Food Habits and Nutritional Status of Secondary School Students in Kuala Lumpur, Malaysia: Baseline Findings from Nuteen Project

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Summary Dietary habits and choice of food influences nutritional status of adolescence. Malnutrition have been associated with adolescents’ dietary habits that may predispose to chronic disease during their adulthood. The aim of this study is to determine the association between food habit and nutritional status of adolescents. In the baseline study, a total of 924 students from 10 secondary schools were randomly selected from a total of 62 secondary schools in Kuala Lumpur. The students were assessed on various dietary components including food habits using a structured questionnaire as well as for anthropometry measurements. All data were analyzed using SPSS 23. The prevalence of obesity was significantly higher among males compared to females (16.4% vs. 8.4%, X² = 25.42, p<0.001). Food habit exhibits an inverse association with z-score of body mass index for age (β = -0.107, 95% CI = -0.053, -0.013), especially via food habits such as often eat dinner (r = -0.102, p = 0.002), often have breakfast before school (r = -0.100, p = 0.002), often eat cake or dessert at meal (r = -0.110, p = 0.001), often drink eight glasses of water (r = 0.132, p < 0.001), often eat food from school canteen (r = -0.071, p = 0.031) and often bring own snack from home (r = -0.112, p = 0.001). This study suggested that the type of food and timing of meal should be considered to prevent obesity among adolescents.

Key Words food habit, nutritional status, secondary school, body mass index for age, Malaysia

Adolescence is a life phase which transitions between childhood and adulthood. It initiates the development of secondary sexual characteristics and ends after the achievement of adult status (1). The phase involves changes in physical, emotional, and cognitive functions (2). This is the second phase of rapid growth, catering to those with a lack of development before entering adulthood. Insufficient nutrient intake significantly impacted the growth in this period and delayed the onset of puberty, as nutrient needs are much higher for this group. In addition to unhealthy food, excessive food intake will negatively affect health as well (3).

The nutritional requirement for adolescents is the highest across the lifespan. In 2017, approximately 7 in 10 adolescents skipped breakfast regularly, 5 in 10 skipped lunch and 5 in 10 skipped dinner regularly. The reasons given for skipped breakfast was no time, no appetite and no food available. One in three Malaysian adolescents consumed carbonated soft drinks at least once daily and male adolescents consumed more frequently than the female adolescents (4). The previous study from Jawatankuasa Penyelarasan Kebangsaan untuk Makanan dan Pemakanan (5) found that adolescents did not meet the dietary requirements because of their unhealthy eating behaviours (6, 7). Unhealthy eating behaviours of adolescents include eating snacks that are high in sugar and fat and leading a sedentary lifestyle. There was only 45% of Malaysian students are physically active (4). Levels of physical activity tend to decrease among adolescents and this might carry on into adulthood (8). A sedentary lifestyle and unhealthy dietary practices are predictors of obesity among adolescents (9).

Higher intakes of unhealthy food which comprised of high calories, fat and sugar content, is associated with increased body weight and higher body mass index (10, 11). Umairah and colleagues (12) had stated that the prevalence of overweight adolescents has increased between 1997 and 2007 from 9.5% to 19.6%. Kelder and colleagues (13) estimated that students will suffer from obesity-related health complications (25 in every 100 students), according to the consistent yearly 1% increase in the number of overweight students. The initiation of various diseases in adolescence, and progressive obesity from childhood through adulthood, were reported in many current findings across several countries, especially in Malaysia. Therefore, it is very important that healthful nutrition and lifestyle behaviours are adopted at a young age (14). One of the causes of excessive adiposity among children and adolescents is the availability of energy-dense foods and beverages in their environment such as home and school.

There is a limited choice of healthy food sold in school.
Food Habits and Nutritional Status

School children (total energy consumption at school versus outside of school). Consistently, the consumption of energy-dense food provided more fat than food brought from home. Sweets, chocolate, and confections, are the most profitable items sold in the canteen. Food bought from the school can include chocolate bars, fast foods, and other unhealthy snacks, and instant noodles, also identified as unhealthy. In another study, food sold in the school selected foods associated with weight problems among school children. There were significantly higher percentages of fast foods and other foods, including snacks, deep fried snacks, sweet drinks, and assorted beverages sold in the school canteen, to improve the nutritional status of the participants. The underlying approach of this model begins by identifying strategies to reduce the proportion of high energy-dense foods and beverages sold in the school canteen, to improve the nutritional status of the adolescents.

A self-administrative questionnaire was distributed to each participating student. Socio-demographic information including date of birth, age, ethnicity, pocket money per month, parental educational level and parental occupation were assessed by self-report. Eating habits of the adolescents were assessed using a self-administered Eating Habits questionnaire which were adapted from (18, 19). A total of 28 questions were categorized into two parts, ie. frequency of different type of food consumed and food habits. The questionnaire assessed on various dietary components including food habits and nutritional status. Mean was calculated according to the frequency in a week, eg everyday intake was calculated as 5/7 d, 2–5 times per week as 3.5/7 d and once was 1/7 d. Body weight and height, waist circumference, hip circumference, and body fat percentages, were measured. Body mass index was calculated as kg/m² and nutritional status of the participants was classified based on WHO, 1995 (20) criteria. Body weight was measured by using a TANITA digital weighing scale to the nearest 0.1 kg and height was assessed by using a SECA body meter to the nearest 0.1 cm.

All statistical analyses were conducted using SPSS for Windows version 23. Descriptive statistics such as frequencies, means, standard deviations and percentage was used to describe all the variables. Chi square and multiple logistic regression was used for the analyses. A statistical probability level of \( p<0.05 \) was considered as significant.

RESULTS

Table 1 shows the distribution of demographic characteristics of students. Majority of study respondents were female (53.1%), 14 y old (36.1%), Malays (53.7%) and having monthly allowance of RM100–300 (40.5%). Majority of the parents’ of the study respondents were married (88.1%) and having secondary school background (58.4% for father and 55.6% for mother). Most of the fathers are professionals (51.6%), while most of the mothers are working as non-professionals (65.5%). Table 2 shows the body weight status between male and female students. There were 8 students aged 15 y in Form 2 and 8 students in Form 4 aged 17 y. The prevalence of obesity was significantly higher among males as compared to females (16.4% vs. 8.4%). \( X^2=25.42, p<0.001 \). Table 3 shows the responses and mean score of for each food habit. Based on the mean score, in average the students frequently eat lunch (mean = 0.797 ± 0.297) and eat dinner (mean = 0.795 ± 0.309). Only small proportion of students consume vegetables and fruits everyday (10.9% and 19.7%, respectively). Only 5.1% of the students brought own

MATERIALS AND METHODS

Nutritional Canteen Intervention for Teenagers (NuTeen) was a three-year randomised controlled intervention trial based on the Precede-Proceed Model in selected secondary schools in Kuala Lumpur among students, parents, teachers, and school canteen operators involving mixed quantitative and qualitative methods. Phase I of the study was conducted in 2015, while Phase II and Phase III were conducted in 2016 and 2017, respectively. The NuTeen study was approved by the Ministry of Education, Malaysia. This study was funded by the E Science Fund by Ministry of Science, Technology, and Innovation (MOSTI) (06-02-22-SF 0003). This intervention study was registered under clinical trial registry UMIN (R000030148 UMIN 000027702).

In Phase I, ten secondary schools were randomly selected from a total of 62 secondary schools in Kuala Lumpur. From each school, three classes were randomly selected from each form and all of these students were invited to participate. Students were defined as secondary school students aged between 13 and 17 y from forms 1, 2, and 4. Students in form 3 (15 y old) and form 5 (17 y old) who were involved in national examinations like Pentaksiran Tingkatan Tiga (PT3) or Sijil Peperiksaan Malaysia (SPM) were not included in this study. Sample size for this study was calculated based on Daniels (1999) formula using the prevalence of obesity among adolescents (11.9%) from National Health Morbidity Survey (NHMS, 2017). The estimated sample size was 950 adolescents with additional of 20% of drop-out rate. After eliminating missing data, a total of 924 samples were used for statistical analysis. Before informed consents were obtained from the participants, information sheets explaining the study purpose and its protocol were distributed and explained to them.

PRECEDE was used as a planning model for this study. The first half of the model PRECEDE consists of baseline data collection on the situational analysis, social, epidemiological, educational, and ecological assessment. The data were utilised to generate information as a guide to develop intervention strategies. The underlying approach of this model begins by identifying strategies to reduce the proportion of high energy-dense foods and beverages sold in the school canteen, to improve the knowledge, attitude, and practice of healthy eating for subsequent improvement in the nutritional status of the adolescents.

A self-administrative questionnaire was distributed to each participating student. Socio-demographic information including date of birth, age, ethnicity, pocket money per month, parental educational level and parental occupation were assessed by self-report. Eating habits of the adolescents were assessed using a self-administered Eating Habits questionnaire which were adapted from (18, 19). A total of 28 questions were categorized into two parts, ie. frequency of different type of food consumed and food habits. The questionnaire assessed on various dietary components including food habits and nutritional status. Mean was calculated according to the frequency in a week, eg everyday intake was calculated as 5/7 d, 2–5 times per week as 3.5/7 d and once was 1/7 d. Body weight and height, waist circumference, hip circumference, and body fat percentages, were measured. Body mass index was calculated as kg/m² and nutritional status of the participants was classified based on WHO, 1995 (20) criteria. Body weight was measured by using a TANITA digital weighing scale to the nearest 0.1 kg and height was assessed by using a SECA body meter to the nearest 0.1 cm.

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Table 1. Distribution of demographic characteristics of students and parents.

| Variables | Frequency (n=924) | Percentage (%) |
|-----------|-------------------|----------------|
| Gender    |                   |                |
| Male      | 433               | 46.9           |
| Female    | 491               | 53.1           |
| Age (y)   |                   |                |
| 11        | 319               | 34.5           |
| 14        | 334               | 36.1           |
| 15        | 8                 | 0.9            |
| 16        | 255               | 27.6           |
| 17        | 8                 | 0.9            |
| Ethnicity |                   |                |
| Malay     | 496               | 53.7           |
| Chinese   | 292               | 31.6           |
| Indian    | 116               | 12.6           |
| Others    | 20                | 2.2            |
| Pocket Money (RM) |       |                |
| <100      | 502               | 54.3           |
| 100–300   | 374               | 40.5           |
| 301–500   | 26                | 2.8            |
| 501–700   | 3                 | 0.3            |
| >700      | 19                | 2.1            |
| Parent’s marital status (n=686) |       |                |
| Single    | 26                | 3.7            |
| Married   | 622               | 88.1           |
| Separated/divorced | 38 | 5.4 |
| Father’s educational level |       |                |
| No formal education | 13 | 1.4 |
| Primary   | 47                | 5.1            |
| Secondary | 540               | 58.4           |
| Diploma   | 165               | 17.9           |
| Bachelor degree | 125 | 13.5 |
| Masters degree and above | 34 | 3.7 |
| Mothers educational level |       |                |
| No formal education | 13 | 1.4 |
| Primary   | 61                | 6.6            |
| Secondary | 514               | 55.6           |
| Diploma   | 188               | 20.3           |
| Bachelor degree | 118 | 12.8 |
| Masters degree and above | 30 | 3.2 |
| Father’s occupation |       |                |
| Professional | 477 | 51.6 |
| Non-professional | 447 | 48.4 |
| Mother’s occupation |       |                |
| Professional | 319 | 34.5 |
| Non-professional | 605 | 65.5 |

*Missing 238.

Table 2. Body weight status between male and female students.

| Body Mass Index | Male n (%) | Female n (%) | X² | p-value |
|-----------------|------------|--------------|----|---------|
| Severe thinness | 12 (2.8%)  | 2 (0.4%)     | 25.42 | <0.001 |
| Thinness        | 12 (2.8%)  | 18 (3.7%)    |     |         |
| Normal          | 261 (60.3) | 348 (70.9%)  |     |         |
| Overweight      | 77 (17.8%) | 82 (16.7%)   |     |         |
| Obese           | 71 (16.4%) | 41 (8.4%)    |     |         |

snack or lunch box to school.

Table 4 shows the multiple linear regression analysis assessing the association between Food habit and body mass index for age. Food habit exhibit an inverse association with z-score of body mass index for age (β= -0.0107, 95% CI= -0.053, -0.013), especially via food habits such as often eat dinner (r = -0.102, p = 0.002), often have breakfast before school (r = -0.100, p = 0.002), often eat cake or dessert at meal (r = -0.110, p = 0.001), often drink eight glasses of water (r = 0.132, p < 0.001), often eat food from school canteen (r = -0.071, p = 0.031) and often bring own snack from home (r = -0.112, p = 0.001).

**DISCUSSION**

In this study, prevalence of obesity was significantly higher among males compared to females. The current finding was consistent with several studies conducted in Malaysia adolescents where they also found higher proportion of obese adolescents compared to female (21, 22). The higher prevalence of obesity among male adolescents may be due to higher dietary energy intake compared to female adolescents. This was evident in several studies including the national nutrition survey conducted in Malaysia which showed that a daily median energy intake of food among male was 1,489 kcal/d which was higher than median energy intake than female (1,445 kcal/d) (21). Similarly, another study reported that average intake of dietary energy among males was 1,774 kcal/d compared to females which was 1,595.2 kcal/d (24). Higher energy intake may enhance positive energy balance in the body, thus the consequence is an increase in body mass (25). An in vivo study showed that increased in dietary energy especially from fat may increase 50 percent of fat content in the body (23).

In this study, only small proportion of students consume vegetables and fruits every day. Studies consistently showed that low vegetables and fruits intake had increased the energy intake of adolescents (26, 27). A study suggested that increasing portion sizes of fruits and vegetables in an elementary school lunch program can increase fruit and vegetable consumption (28). Only 5.1% of the students brought own snack or lunch box to school. This is in contrast to a study conducted in U.K. which reported that over half of (>50%) of the adolescents brought home packed food or lunch box. However, the authors found that the total energy and nutrients from the home packed food or lunch box did not meet the nutrient based standard for adolescents (29). Food brought to school or prepared at home usually have higher dietary quality and usually wholesome food. Parents have to play important role in preparing homemade food to provide good quality of food as well as meet the recommended nutrient intake for adolescents. Food habit exhibit an inverse association with z-score of body mass index for age. It is hypothesized that a good food habit able to avoid weight gain and retained a health body mass index for age.

There are significant inverse association between
often eat dinner, often have breakfast before school, often eat cake or dessert at meal, often eat food from school canteen, often bring own snack from home and body weight status. Meal consumption patterns, such as meal frequency and breakfast consumption has become a significant contributing factor in childhood obesity. Breakfast skipping has been independently associated with obesity among children. In addition, reduction in the frequency of other meal consumption (lunch and dinner) positively related with childhood obesity (31). MyBreakfast Study from Malaysia found that overall prevalence of breakfast skipping and irregular break-

Table 3. Responses and mean score of weekly frequency of food habit.

| Food habit                                      | Frequency (weekly) n (%) | Mean  | SD    |
|------------------------------------------------|-------------------------|-------|-------|
|                                                | Never        | 1x    | 2–5x  | Everyday |
| Eating breakfast                               | 69 (7.5)     | 116 (12.6) | 240 (26.0) | 499 (54.0)  | 0.688   | 0.367  |
| Eating lunch                                   | 14 (1.5)     | 61 (6.6)   | 242 (26.2) | 607 (65.7)  | 0.797   | 0.297  |
| Eating dinner                                  | 24 (2.6)     | 65 (7.0)    | 220 (23.8) | 615 (66.6)  | 0.795   | 0.309  |
| Eating breakfast before going to school        | 164 (17.7)   | 129 (14.0)  | 227 (24.6) | 404 (43.7)  | 0.580   | 0.407  |
| Eating at least 2 servings or cups (300 g) of fruit | 134 (14.5)   | 339 (36.7)  | 350 (37.9) | 101 (10.9)  | 0.350   | 0.298  |
| Eating at least 3 servings or cups (225 g) of vegetables | 121 (13.1)   | 258 (27.9)  | 363 (39.3) | 182 (19.7)  | 0.434   | 0.337  |
| Eating a cake or a dessert at meals            | 341 (36.9)   | 374 (40.5)  | 160 (17.3) | 49 (5.3)    | 0.196   | 0.257  |
| Drinking beverage at meals                     | 113 (12.2)   | 151 (16.3)  | 222 (24.0) | 438 (47.4)  | 0.617   | 0.396  |
| Drinking 2 L or 8 glasses of water every day   | 82 (8.9)     | 133 (14.4)  | 353 (38.2) | 356 (38.5)  | 0.597   | 0.358  |
| Eating food from school canteen                | 91 (9.8)     | 205 (22.2)  | 441 (47.7) | 187 (20.2)  | 0.472   | 0.321  |
| Eating food at home                            | 122 (13.2)   | 124 (13.4)  | 218 (23.6) | 460 (49.8)  | 0.635   | 0.396  |
| Bring own snack or lunch box to school         | 513 (55.5)   | 239 (25.9)  | 125 (13.5) | 47 (5.1)    | 0.155   | 0.257  |

Table 4. Multiple Linear Regression assessing the association between food habit and body mass index for age.

| Food habit                                      | r      | p-value | Adjusted-βa | 95% CI        |
|------------------------------------------------|--------|---------|--------------|---------------|
|                                                |        |         |              | Lower bound   |
| Overall food habit                             | −0.107 | 0.007   | −0.01        | 0.01          |
| Eating breakfast                               | −0.062 | 0.059   | 0.018        | −0.110        |
| Eating lunch                                   | −0.031 | 0.351   | 0.017        | −0.118        |
| Eating dinner                                  | −0.120 | 0.002** | −0.091       | −0.320        |
| Eating breakfast before going to school        | −0.100 | 0.002** | −0.100       | −0.242        |
| Eating at least 2 servings or cups (300 g) of fruit | −0.040 | 0.221   | −0.015       | −0.157        |
| Eating at least 3 servings or cups (225 g) of vegetables | −0.035 | 0.285   | −0.022       | −0.152        |
| Eating a cake or a dessert at meals            | −0.110 | 0.001** | −0.077       | −0.242        |
| Drinking beverage at meals                     | −0.043 | 0.196   | −0.040       | −0.145        |
| Drinking 2 L or 8 glasses of water every day   | 0.132  | <0.001* | 0.162        | 0.149         |
| Eating food from school canteen                | −0.071 | 0.031*  | −0.057       | −0.202        |
| Eating food at home                            | 0.010  | 0.771   | 0.013        | −0.071        |
| Bring own snack or lunch box to school         | −0.112 | 0.001** | −0.086       | −0.250        |

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).
a Multiple linear regression.
fast consumption was associated with higher Body mass index for age z score and greater likelihood of being overweight and obese among adolescents especially in girls. This association is plausible as skipping breakfast able to enhance appetite for the next meal which consequently increase the energy intake creating the state of energy imbalance which is highly associated with increased body mass index. Study showed that children or adolescents who consume breakfast are more likely to get food high in fiber, calcium and other important nutrients (30). These type of breakfast food may improve postprandial glycaemic responses, insulin sensitivity and satiety (32).

The inverse association between having cake or dessert at meal with body weight status of adolescents could be explained based on the healthy ingredients used during cake or dessert making. Commonly children or adolescents prefer fruit based cakes or desserts such as carrot cake, banana cake, or pudding which composed of a small amount of starch and fiber mainly insoluble fiber. This could be a better option as low dense food (33). Adolescents often eat food from school canteen especially for lunch if there are extra classes or co-curricular activities in school. This was significantly associated with reduced body mass index. In UK (29) found that students taking school lunches on average had significantly higher intakes of energy, protein, carbohydrate. Vitamin C, folate, ferum and zinc compared to those bringing packed lunch to school. Higher density of energy and nutrients were consistently linked with increased body weight in several studies (34–36). Bringing own snack from home is associated inversely with weight status. Bringing snack from home would be ideal because food availability at home is controlled by parents. Parents will be more likely to prepare healthier snacks at home which comprised of low energy dense type of food or beverages which will not be contributing to the overall energy intake for development of obesity among adolescents (37–39).

CONCLUSION

This study suggested that the type of food (cake or dessert; food from canteen and own snack from home) and timing of meal (breakfast and dinner) should be considered to prevent obesity among adolescents. It is suggested that a healthy school food environment and parent’s commitment to provide healthy food may act as the most effective strategies to intervene the obesity among adolescents.

Disclosure of state of COI

The authors declare no conflict of interest.

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