Research Article

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Journal of Childhood Obesity
ISSN 2572-5394

2019
Vol. 4 No. 2 : 1

The Prevalence of Overweight and Obesity and Its Association Factors among Malays' Adolescents: Findings from Seafood Consumption Survey in Peninsular Malaysia

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Citation: Nurul Izzah A, Nadia M, Wan Rozita WM, Tengku Rozaina TM, Rafiza S, et al. (2019) The Prevalence of Overweight and Obesity and Its Association Factors among Malays' Adolescents: Findings from Seafood Consumption Survey in Peninsular Malaysia. J Child Obes 4:2.

Abstract

Introduction: Overweight and obesity in Malaysia has been increasing for the past decades. The present study is to determine the prevalence of overweight and obesity among Malay adolescents involved in the "Seafood consumption survey in Peninsular Malaysia, 2008-2009". The relationship between obesity, socio-demographic and family-related characteristics were investigated. It also compared food patterns that are commonly consumed between obese and non-obese adolescents.

Methods: A population-based cross-sectional study was carried out to determine the prevalence of overweight and obesity among Malay school children aged 10-17 years in Peninsular Malaysia and to determine its' association with some demographic factors and food intake. A stratified two-stage cluster sampling design with proportional allocation was used. Data were collected through face-to-face interviews using pre-design validated questionnaires between February 2008 and May 2009. Weight and height were measured by the interviewers using SECA weighing machine and food intake was estimated with a 3-day dietary diary forms. The adolescent was classified as normal, overweight and obese in accordance with the age and gender-specific body mass index WHO reference 2007 for children 5-19 years old. Statistical analysis was carried out using SPSS version 16.

Results: The prevalence of overweight and obesity among subjects (n=484) was 12.4% and 11.6%, respectively. Male students were prone to obesity (14.5%) compared to females (9%). The results in the bivariate analysis showed that having an obese mother (OR=1.92; CI: 1.018-3.622; p=0.044), obese father (OR=2.69; CI: 1.055-6.883; p=0.038), and either one of the parents is obese, were significantly associated with obesity among adolescents (OR=2.178; CI: 1.184-4.004; p=0.012). Having obesity in another family member also increases the risk to 3.77 times for the adolescent to be obese (OR=3.768; CI: 1.703-8.336; p=0.001). Following the adjusted analysis using Multiple Logistic Regression (MLR), adolescents having an obese father (OR=5.599; CI: 1.086-28.884; p=0.04) and staying in the north region (OR=2.056; CI: 1.024-4.127; p=0.043) remained significant risk factors for adolescent obesity. Higher socioeconomic status with a household income of more than RM 3,000 increases the odds by two times (OR=2.240; CI: 1.005-4.994; p=0.049), of having an obese adolescent in the house. Obese adolescent consumed significantly (p=0.041) more food (1149 g) compared to non-obese (1036 g) and their consumption were higher during daytime (p=0.053; 1242 g), specifically during lunch (p=0.011; 791 g) and breakfast (p=0.061; 458 g). The most frequent food consumed by the obese adolescent was seafood, vegetables and fruits and they preferred flavoured/malt drinks with sugar and milk.

Conclusions: In this study, obese adolescents showed a strong association with household income, a region of residence and obesity in other family members and they consumed more food during the day-time.

Keywords: Overweight, Obesity, Malay adolescence, Association factors, Food pattern, Malaysia

Received: June 26, 2019; **Accepted:** September 06, 2019; **Published:** September 13, 2019

Introduction

Overweight and obesity is an increasing problem worldwide [1]. Globally, it is estimated that 1.9 billion adults were overweight and of these 600 million were obese [1]. Childhood obesity is also among the most serious public health challenges of the 21st century where around one in 10 young people aged 5–17 years are overweight or obese [2]. These level increasing rapidly in many countries and regions in recent years [2]. The number of adolescents with obesity problems was higher in developing countries when compared to the developed countries and this is due to change in lifestyle and dietary habits [3]. Obesity in adolescents would probably persist to adulthood and may increase the risk of health as a result of being obese [4] unless they adopt and maintain healthier patterns of eating and exercise [5]. According to the American Academy of Child and Adolescent Psychiatry (AACAP), obesity is easy to recognize but difficult to manage, as these days the numbers had increased of up to 12.7 million (17%) of obese children. The most common obesity factors are various genetic socio-economic, demographic, cultural, religious, ethnical, territorial and other factors with differences in environmental factors such as fast-food consumption, family's income, mother's employment, parent's education level, prolonged TV watching time and playing video games [6-10]. The key-factors were lifestyle factors, mainly high-energy intake and reduced physical activity. In recent years, children's physical inactivity becomes more prominent as increasing technology and screen-based activity especially among school-age children [11]. However, differences in the way the studies were conducted as well as differences in population and cultural background of these studies caused inconsistency association between obesity and lifestyles [9].

In Malaysia, many studies have investigated childhood obesity and the Malaysian National Health and Morbidity Survey (NHMS) revealed the prevalence of obesity among children aged <18 years old at 11.9% in 2015 [12]. A higher prevalence of overweight was shown among primary school children (7-12 years) (9.9%), especially in males (21.9%) compared to females (18.1%) [10]. The rate seems lower among the secondary school students (13 to 17 years old) with prevalence at 11.4% and 8.2%, respectively but the results also showed higher rate in male (10.6%) compared to females (6.0%) with the highest in Malay adolescent (12.9%) compared to the Indians (7.1%) and the Chinese (5.9%) [13]. There are several factors likely to be associated to this condition but are varies according to demographic, social, economic, genetic, psychological, environment and individual factors [14-17]. So far, the primary focus of obesity in childhood research in this country is only on obesity or single lifestyle behaviours. While the relationship between obesity, the multiple backgrounds inclusive the family lifestyle and behaviour remain scattered [18]. The importance of childhood obesity and its association with dietary intake has also been recognised but research on this area is still limited. The national nutrition and dietary intake data for children under 12 years was only published in 2013 and recent publications only reporting on a selective dietary profile from designated areas [19-21]. The present study is to determine the prevalence of overweight and obesity among Malay adolescents involved in the "Seafood consumption survey in Peninsular Malaysia, 2008-2009. The relationship between obesity and socio-demographic factors that include their family-related characteristics were investigated. It also compared food intakes and patterns between obese and non-obese adolescents involved in this study. Thus, identifying the modifiable determinants that are influencing obesity among adolescents in Malaysia will help in developing effective prevention and treatment programs for adolescent obesity. It is also important to understand children's dietary patterns and later developed appropriate methods to encourage healthy eating habits among them.

Materials and Methods

Study design and subjects

A household-based, cross-sectional study was conducted and data were collected through interviews using pre-design questionnaires in Peninsular Malaysia between February 2008 and May 2009. The sampling frame used for the selection of study subjects' household addresses was based on the National Household Sampling Frame (NHSF), Department of Statistics, Malaysia [22]. This sampling frame was made up of Enumeration Blocks (EBs) created for the 2000 Population and Housing Census. These EBs are geographical contiguous areas of land with identifiable boundaries. On average, each EB contains about 80 to 120 living quarters. Generally, all EBs were formed within gazetted boundaries particularly administrative districts, or local authority areas. Details on the calculation of sample size and questionnaires for the whole study entitled "Seafood consumption survey in Peninsular Malaysia, 2008-2009" were as described elsewhere [23]. The calculation was based on consumption survey data for the Selangor population, where the adult population of Selangor consumed fish at 16.2% (153 g/person/day compared to 944 g/person/day total food) [24]. Additionally, factors of two different areas (urban and rural), three major ethnics (Malay, Chinese and Indian) and two different age groups were used at the final stage. A number of 2,496 subjects were required in order to obtain 95%

confidence interval and 5% margin of error. Taken into account a 20% dropped-off rate, 2,996 subjects were identified from 1,500 household addresses received from the NHSF.

A minimum count of two adults and all adolescents' ages between 10 to 17 years in each household were selected in this survey. At the end of the survey, the final count of 2,675 adults had completed the questionnaire. A number of 890 children/adolescents participated in the survey and only 484 Malay adolescents completed the questionnaires. We had identified a few participations of adolescents from other races as well (Chinese and Indians), but due to their low counts, we decided to exclude them from the analysis, to avoid bias or unrepresentative subjects in this study. In **Figure 1**, the household addresses of study subjects as a whole plotted throughout Peninsular Malaysia using Quantum GIS 2.8.1 (**Figure 1**). The response rate for the Malay adolescent was 80.7% (484 Malay adolescents completed the questionnaire from 600 Malay adolescents participated in the survey) and sample characteristics are shown in **Table 1**.

Questionnaire

The study instrument used was a set of questionnaires, which had been validated prior to the study by distributing the questionnaire to other researchers who were not involved in the study. The questionnaires consisted of two parts. The first part was nine pages self-administered questionnaires which consist of socio-demographic information section as well as questions on pattern of fish consumption, frequency of fish consumption and finally section of knowledge, perception and practices towards fish consumption, while the second part was the three copies of 24-hour dietary diary forms. In this section, subjects were asked to record food and drinks they consumed at every meal of the day. The form was divided into six meal sections (breakfast, morning tea, lunch, afternoon tea, dinner and supper), they have to record the time, places, and with whom they took their meal. They were also required to record types of food and drinks, the portion size and cooking style.

The interviewers/research assistants were trained to review and understand the questionnaires. During training, they were taught

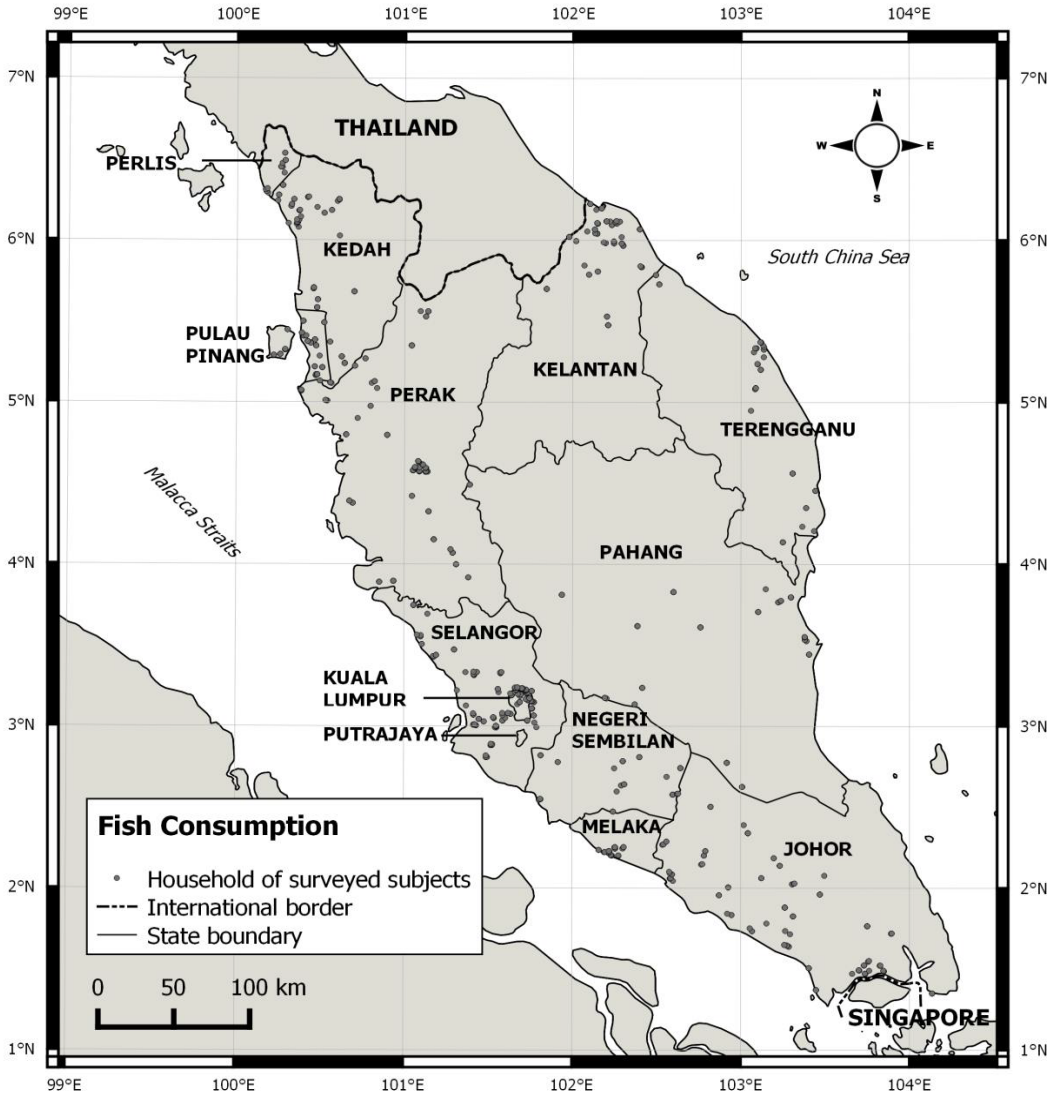

Figure 1 The household addresses of study subjects plotted throughout Peninsular Malaysia using Quantum GIS 2.8.1.

Table 1: Demographic characteristics of study population (N=484).

Socio-demographic variables	Malay
Age (year ± SD)	13.5 ± 2.2
Height (cm ± SD)	151.8 ± 11.9
Body weight (Kg ± IQR)	45.0 ± 17.0
BMI (kg/m² ± IQR)	
Adolescent	19.0 ± 5.3
Mother	28.3 ± 6.2
Father	25.7 ± 5.9
Gender (%)	
Male	47.1
Female	52.9
Years of education (year ± SD)	7.55 ± 2.2
Household income (%)	
≤ PM3,000	68.6
≥ PM3,001	13.3
Mean household number (± SD)	6.4 ± 2.2
Region of residence (%)	
East	29.8
North	31.4
Middle	21.1
South	17.8
Note: IQR is the interquartile range. SD is the standard deviation	

how to give instructions to subjects. They were equipped with a set of questionnaire tools to help the subjects record the type of foods they consumed. The questionnaire tools included pictures of serving dishes, fish commonly found in Malaysia and common household measures like standard measuring cups, bowls, ladles and spoons. The self-administrated questionnaire was given between 9.00 am to 6.00 pm but sometimes interviewers had to visit at night in case subjects were not home during daytimes. Parents were requested to assist their children who were involved in answering questions in the questionnaires and filling the 24-hour dietary diary forms. Interviewers were also re-checked all food recorded in dietary diary forms to verify types and amounts of food consumed by subjects.

The portion weight of food was referred to the local food atlas "*Atlas Makanan: Saiz pertukaran dan Porsi"* [25-26] and Nutrient and composition of Malaysian foods [27]. If the food consumed was not listed in all these references, at least five different food samples were purchased from different sources (stalls, restaurants and etc.,) were obtained and mean values were calculated as the weight of that particular food. The collections of the three days dietary diary were conducted during weekdays and weekends.

Anthropometric measurements

The height and weight of study subjects were measured using calibrated SECA digital weighing machine. Body Mass status classification was according to international reference values developed the World Health Organisation (WHO): BMI-for-age (5-19 years) [28]. The age of each child at the time of the survey was rounded off to the nearest half-year. The Body Mass Index (BMI) is calculated using a persons' weight and height to find out if they are either underweight, of a healthy weight, overweight or obese. The BMI calculation is following the formula: Bodyweight (in kilograms)/height (in meter). A child's body fat changes with age and the amount of body fat differed between girls and boys as they mature. Thus, BMI for children is known as BMI-for-age, includes gender and age. The BMI number is a plot on the appropriate BMI-for-age growth chart (for either boys or girls) to find the weight status category for the calculated BMI-for-age percentile. The weights status category based on percentile range were: underweight - less than 5th percentile, healthy weight - 5th percentile to less than 85th percentile, overweight-85th to less than 95th percentile and obese - equal to or greater than the 95th percentile.

The BMI was calculated using the formula of body weight (kg) divided by square roots of height (m^2). The WHO criteria for obesity based on the BMI guidelines [29] as a reference in this study that used the following range: underweight (BMI 18.5 Kg/m^2), normal (BMI 18.524.9 Kg/m^2), overweight (BMI 25.029.9 Kg/m^2) and obese (BMI 30 Kg/m^2).

Data analysis

Data analyses were conducted using SPSS for windows version 16.0 (SPSS Inc.). The data included demographic characteristics of the respondents, different categories of food consumption by types of food, meal and drinks, and by the time of serving. After data entry, a check was made for any discrepancies including coding numbers, typo error, etc. At the initial stage, descriptive statistics were conducted to assess data normality using the one-sample Kolmogorov-Smirnov test and/or the skewness of descriptive statistics was controlled between -1 to +1, whichever is true. Normally distributed numerical results were expressed as mean ± SD, and the categorical results were expressed in percentage (%). However, numerical data that were not normally distributed were expressed as median ± IQR (Interquartile Range). Differences between groups were assessed using Student's *t* test and one-way ANOVA with equal variances assumed using LSD, for normally distributed data. Conversely, for non-normal distributed data, differences between groups were assessed using the Mann-Whitney *U* and Kruskall-Wallis test. Multiple Logistic regression analysis was used to identify the association between risk factors of obesity. A level of significance at 0.05 is set to determine the result is statistically significant.

Results

The socio-demographic characteristic inclusive the mean age (13.5 ± 2.2 years), height (151.8 ± 11.9 cm) and body weight (45 ± 17 Kg) of the study subjects. The mean BMI of the study subjects was 19 ± 5.3 kg/m^2 (**Table 1**). The mothers had higher BMI compared to fathers (**Table 1**). A gender percentage among subjects was about equal, 47.1%: 52.9% for males and females, respectively. The mean education years were 7.55 ± 2.0 years where most of the subjects we are studying in a secondary school. More than half (68.6%) of the subjects earned the household incomes of RM 3,000 and below. Only 13.3% of them received more than the amounts with only 3 households earned around RM 20,000 per month. The mean number of households was

6.4 ± 2.2 with 4-5 children lives with their parents. Most of our study subjects were staying in the northern region of Peninsular Malaysia (31.4%), followed by the east (29.8%), middle region (21.1%) and the southern region (17.8%) (**Table 1**).

This study revealed an overall prevalence of obesity among study subjects at 11.6%. Additionally, 12.4% of them were overweight and more than half (56%) of the subjects were having normal BMIs but another 20% were underweight. Many younger subjects (10-12 years) were overweight and obese when compared to the older ones (≥ 13 years old. More boys (14.5%) were obese compared to the girls (9%) and many overweight and obese adolescent lives in a household with higher incomes (≥ RM 3,000). Many of the obese subjects resided in the northern (16.4%) and middle (14.7%) regions of Peninsular Malaysia (**Table 2**).

The crude/bivariate and multivariable logistic regression (MLR) analyses of the association between the prevalence of obesity and non-obese Malay adolescent and their socio-demographic characteristics were shown in **Table 3**. In bivariate analysis, adolescent age and household numbers were not associated with obesity. Gender was found to be marginal significant at

Table 2: Prevalence of overweight and obese by selected socio-demographic factors (N=484).

Socio-demographic variables	n	Underweight	Normal	Overweight	Obese
Age	**n (%)**				
10-12 years	176	42 (24.0)	88 (50.0)	26 (14.9)	19 (10.8)
≥ 13years	308	55 (17.8)	183 (59.4)	34 (11.0)	37 (12.0)
Gender					
Male	228	49 (21.5)	118 (51.8)	28 (12.3)	33 (14.5)
Female	256	48 (18.8)	153 (59.8)	32 (12.5)	23 (9.0)
Years of education					
4-6 years	178	41 (23.3)	88 (50.0)	30 (16.9)	19 (10.8)
7-11 years	306	56 (18.2)	183 (59.4)	30 (9.8)	37 (12.0)
***Household income**					
≤ PM3,000	332	68 (20.5)	193 (58.1)	39 (11.7)	32 (9.6)
≥ PM3,001	64	8 (12.5)	36 (56.2)	10 (15.6)	10 (15.6)
***Household number**					
≤ 4/household	97	15 (15.5)	51 (52.6)	17 (17.5)	14 (14.4)
≥ 5/household	371	80 (21.6)	212 (57.1)	40 (10.8)	39 (10.5)
Region of residence					
East	144	34 (23.6)	84 (58.3)	15 (10.4)	11 (7.6)
North	152	28 (18.4)	79 (52.0)	20 (13.2)	25 (16.4)
Middle	102	20 (19.6)	54 (52.9)	13 (12.7)	15 (14.7)
South	86	15 (17.4)	54 (62.8)	12 (14.0)	5 (5.8)
Total	484	97 (20.0)	271 (56.0)	60 (12.4)	56 (11.6)

Note: *n for certain socio-demographic variables are less than 484 due to missing information.

Table 3: Bivariate and Multivariable Logistic Regression (MLR) analyses of the association between the prevalence of obesity and non-obese Malay children and their socio-demographic characteristics (N=484).

Socio-demographic variables	Obese n (%)	Non-obese n (%)	Bivariate analysis			MLR		
			*p- value	OR	95% CI	*p- value	OR	95% CI
Age								
10-12 years old	19 (10.9)	155 (89.1)	0.737	0.904	0.494-1.619	0.839	1.074	0.540-2.135
≥ 13 years old (ref)	37 (11.9)	273 (88.1)						
Gender								
Male	33 (14.5)	195 (85.5)	0.062	1.714	0.974-3.017	0.201	1.549	0.793-3.027
Female (ref)	23 (9.0)	233 (91.0)						
Household income								
≥ RM3,001	10 (15.6)	54 (84.4)	0.077	1.733	0.771-3.674	0.049	2.24	1.005-4.994
≤ RM3,000 (ref)	32 (9.6)	300 (90.4)						
Household (hh) number								
≤ 4/hh	39 (10.5)	332 (89.5)	0.28	0.697	0.366-1.382	0.433	1.36	0.631-2.931
≥ 5/hh (ref)	14 (14.4)	83 (85.6)						
Region of residence (%)								
North	31 (9.3)	301 (90.7)	0.025	0.524	0.297-0.931	0.043	2.056	1.024-4.127
Others (ref)	25 (16.4)	127 (83.6)						

p=0.062 with the male odds ratio of 1.736 showed a higher risk of obese compared to female adolescents. Household income was not a significant factor in the bivariate analysis. However, in MLR, household income of more than RM3000 is more than two times the risk (OR=2.240; CI: 1.005-4.994; p=0.049) to have an obese adolescents in the house. Adolescents staying in the northern region also showed a higher risk of being obese compared to another region (OR=2.056; CI: 1.024-4.127; p=0.043) (**Table 3**).

Association between the prevalence of obese and non-obese among Malay adolescent and their family-related factors showed some interesting findings (**Table 4**). The results in the bivariate analysis showed that having an obese mother (OR=1.92; CI: 1.018-3.622; p=0.044), obese father (OR=2.69; CI: 1.055-6.883; p=0.038), and either one of the parents is obese, were significantly associated with obesity among adolescents (OR=2.178; CI: 1.184-4.004; p=0.012). Having obesity in another family member also increases the risk to 3.77 times for the adolescent to be obese (OR=3.768; CI: 1.703-8.336; p=0.001). Following the MLR, it was found that only father's obesity increases the risk up to 5.59 of having an obese adolescent, thus strong risk factor of Malay adolescent obesity in this country.

Malay obese adolescents consumed significantly more food (p=0.041) during daytime (p=0.053), specifically at breakfast (p=0.06) and lunch (p=0.011) compared to the non- obese subjects (**Table 5**). Most frequent food consumed by the obese Malay adolescent in descending orders: seafood, vegetables, fruits, rice, Malaysian cakes or 'kuih', chicken and noodles. Frequencies of drinks consumed were double compared to plain water (**Table 6**).

Table 4: Bivariate and Multivariable Logistic Regression (MLR) analyses of the association between the prevalence of obesity and non-obese Malay children and their family related characteristics (N=484).

Socio-demographic variables	Obese n (%)	Non-obese n (%)	Bivariate analysis			MLR analysis		
			*p- value	OR	95% CI	*p- value	OR	95%CI
Mother's education level (school years)								
≤ 6 years	12 (0.6)	78 (22.0)	0.754	1.12	0.550-2.281	0.162	2.76	0.666-11.444
≥ 7 years	32 (9.0)	233 (65.6)						
Father education's level (school years)								
≤ 6 years	7 (2.5)	78 (27.5)	0.347	0.654	0.271-1.583	0.268	0.438	0.102-1.889
≥ 7 years	24 (8.5)	175 (61.6)						
Mother is obese	45 (12.2)	323 (87.8)	0.044	1.92	1.018-3.622	0.198	5.345	0.415-68.788
Father is obese	31 (10.8)	256 (89.2)	0.038	2.695	1.055-6.883	0.04	5.599	1.086-28.884
Either one of the parents is obese	48 (11.6)	367 (88.4)	0.012	2.178	1.184-4.004	0.565	0.442	0.082-2.395
Obesity in another family member	37 (10.5)	317 (89.5)	0.001	3.768	1.703-8.336	0.344	1.408	0.436-4.556
Mother is working out of home	47 (12.0)	344 (88.0)	0.893	0.953	0.474-1.916	0.568	0.437	0.026-7.345

Table 5: Food consumed (g/person/day) by non-obese and obese Malay adolescent (age 10-17 years) (N=484).

Food patterns (median ± IQR)	Non-obese (n=439)	Obese (n=45)	p- value
Intake of food by group			
*Cereal and grain products	752 ± 347	795 ± 329	0.475
#Meat, chicken, fish and products	190 ± 165	251 ± 156	0.101
#Vegetables & fruits	65 ± 116	65 ± 212	0.622
#Other miscellaneous	68 ± 96	166 ± 283	0.134
#Drinks	480 ± 470	580 ± 260	0.756
#Water	550 ± 400	580 ± 447	0.066
Intake of food and drinks per meal			
*Breakfast	381 ± 223	458 ± 217	0.061
#Morning tea	464 ± 193	400 ± 542	0.833
#Lunch	726 ± 250	791 ± 230	0.011
#Afternoon tea	386 ± 262	454 ± 230	0.964
*Dinner	652 ± 257	714 ± 272	0.176
#Supper	350 ± 173	-	-
Intake of food and drinks by time			
*Daytime	1131 ± 522	1242 ± 555	0.053
*Night-time	676 ± 279	714 ± 272	0.406
Total intake per day			
*Food	1036 ± 426	1149 ± 765	0.041
*Water & drinks	1039 ± 483	1130 ± 533	0.199
*Total intake	1604 ± 709	1933 ± 740	0.006
Note: * - Student t-test #- Mann-Whitney test			

Table 6: Frequencies of food consumed by the obese Malay adolescent (age 10-17 years) (n=45).

No	Food group	Description and example of food types inclusive in the group	*Frequencies
1	Rice	Cooked plain rice, chicken rice, fried rice, 'nasi lemak', 'nasi kerabu, etc.	24
2	Noodles	Fried noodle, curry noodle, fried 'koey teow', fried mee hoon', mee hoon soup, instant noodle soup.	19
3	Fruits	Local fruits such as banana, 'rambutan', water melon, oranges, tangerines	26
4	Vegetables	Varieties of vegetables cooked in Malaysian styles eg. Sauté, soup, tom yam, curry etc	33
5	Chicken	Cook in many ways, mostly fried chicken and curry.	20
6	Eggs	Half boiled egg, 'telur dadar', scrambled egg, 'telur mata kerbau', hardboiled egg.	6
7	Meat	Beef or mutton cooked in many ways eg, curry, 'rendang', 'sambal' etc.	4
8	Seafood	Fish and other seafood cooked in many ways eg fried fish, fish curry, fish cooked with soy souce, etc	41
9	Malaysian cakes	'Cucur udang', steamed buns or pau, banana fritters, curry puff, 'roti jala' etc	23
10	Bread	White bread and buns, with fillers or none.	7
11	Biscuits and cereal	Plain biscuits, cream crackers, biscuits with peanut butter and etc.	4
12	Sweets and nuts	Confectionaries, sweets and chocolates	4
13	Miscellaneous	Chicken nugget, beef burgers,	14
14	Drinks	All flavoured/malt drinks with sugar or milk	88
15	Plain water	Cold or warm water	46

*The frequency of food and drinks obtained from the subjects of the food consumption survey (3-day records).

Discussion

The present study utilized data from the seafood consumption survey in Peninsular Malaysia for the year 2008 to 2009 and explored the prevalence of overweight and obesity among Malay adolescents. In the beginning, many analyses underlying the study as a large set of recorded variables collected. Meal patterns among three major ethnics among Malaysian adults with respect to fish/seafood consumption and other related findings were published elsewhere [23]. In addition, pre-analysis of subsamples of children age 10-17 years old had already been analysed with regards to food consumption patterns and obesity [30]. During data entry and cleaning, we managed to capture 890 adolescents as we included all subjects aged 10 years old and above who were involved in this study. They comprised of Malays (n=600), Chinese (n=150) and Indians (n=80). At the final stage of data analysis, counts among the Chinese (n=20) and Indians (n=15) were declined due to incomplete questionnaires. The small numbers may not represent the adolescent's ethnicity of the country and the final decision is to exclude the other two ethnicities in the analysis. In this paper, the analysis was focused on Malay adolescents only and the data revealed the relationship between obesity and socio-demographic factors inclusive their family-related characteristics. The study managed to compare differences in food intake and patterns between obese and non-obese Malay adolescents studied. Other results captured were frequencies of food consumed by Malay obese adolescents.

Results from this study had identified associations between obesity with some risk factors in Malay adolescents in this country. The assessment regarding obesity among adolescent is important as obesity in childhood not only contributed to adult obesity but also chronic disease later in life [31]. The data indicated that about 12.4% of adolescents were overweight with higher in male obesity compared to the females. Household income, as well as the location of study, played a crucial factor in determining overweight and obesity among them. Moreover, family factors also attributed to obesity in which either one of the parents is obese or obesity in other family members, resulting in their child to be obese. The food intake for obese adolescents also was significantly higher when compared to non-obese adolescents. Daytime intake especially lunch and a lesser extent, breakfast also played a role in adolescent obesity. These factors were further discussed below.

The overall prevalence of obesity among adolescents from this study was 11.6% while combining both overweight and obesity was 24.0%. This finding noted an increasing trend from the previous study in Malaysia, with a prevalence of 7.2% and a combined prevalence at 21.8% [32]. Shariff et al. [2] reported on 9.5% prevalence of obesity among primary school children in urban areas whereas slightly lower in rural children (7%) [31]. Another study by Ramphal et al. [13] revealed that 19.6% of secondary school children, age 13-17 years old from Klang District Selangor were either at risk of overweight or obese. The results were comparable to the National Health Morbidity Survey III in 2006 where the overall prevalence of overweight children in this country was 19.9% [33]. A similar result (19.5%) was also shown from the study conducted in Kajang, Selangor [34] but higher prevalence was reported in Kapar (28.9% overweight; 12.7% obese) [35]. A recent study reported a prevalence of combination both overweight and obese at 29.6% among children in the urban areas around Kuala Lumpur and Selangor [36] wherein Selangor alone, 32.6% of study participants were either overweight or obese [37]. The findings were parallel with findings reported in the current nationwide longitudinal study in China where the childhood overweight/obesity rate increased by 10.4% in the last ten years. However, the majority of these children kept perceiving themselves as thin but only small portion of them (2%) rated themselves as fat [38]. In China, a greater increase in childhood overweight and obesity was shown in children with higher socioeconomic status particularly after the year 1997 [38]. In this country also, obesity prevalence was higher in rural areas but the trend has changed currently, in which the disparity between rural and urban obesity is lesser. However, both areas also showed a significant increase in the trend in obesity [39]. Similar situation was reported among adolescence in Slemani

City in the Kurdistan Region of Iraq where the combination rate is 31.9% with age, family income and body image dissatisfaction were the predictors for obesity [40]. While in United States, the obesity rate of child and adolescent was at increasing trend for the past few decades before reaching plateau in at 11.3% during year 2003 to 2004 and year 2005 to 2006 [41]. Recent study reported on the increased of the prevalence of overweight and obesity of up to 41.5% among adolescents age between 16 to 19 years-old and 4.5% meeting criteria for class III obesity [42]. Therefore, the findings from this study are consistent with other studies around the world that prevalence of overweight and obesity among adolescents is alarming. It has increased considerably in both the industrialized and developing countries.

Result from our study also showed that the prevalence of Malay obese adolescent affected male boys (14.5%) rather than girls (9%). This finding is corresponded with findings from many other studies as well, from either local or at the international levels [13,33,37,43-46]. In many Asian countries, boys were encouraged by their parents to take higher portion of energy-dense food compared to girls [33] and in addition to sedentary lifestyle practices created a positive energy balance, thus favours increasing weight among boys [33,46]. A review on gender differences on the prevalence of obesity among children had discussed different factors, which were body composition, patterns of weight gain, hormone biology and the susceptibility to certain social, ethnic, genetic and environmental factors [47]. They identified that girls have greater fat mass, distinctive fat distribution, more susceptible to family and environmental factors and less sensitive to insulin while boys are more physically active, have lower leptin levels and are protected from the obesity-genesis effects of some gene's variants [47]. Researches consistently found that girls preferred their body close to their actual weight status, desired a thin body image and wanted to lose weight to achieve their ideal [37] or in other words girls care more about their appearance and body image compared to boys [46,48]. There are also strong evident on depression leading to obesity and the association is stronger in young adulthood females [49].

High socio-economic status also been associated with an increased prevalence of obesity among adolescents in this study. In Malaysia, the low-income household group is classified based on an average monthly household income of RM 2848 [50]. Notwithstanding, finding from this study revealed that adolescence raised in a higher income family of more than RM3000 per household showed significant results for adolescent obesity. Globalization and urbanization lead to rapid development of Malaysian economic and these had changed the quality life of the populations when they are affordable to various food resources and also caused changes to their major demographic, behavioural, cultural and lifestyles [19,33,51,52]. In specific, these transformations had triggered changes in domestic arrangement with more wives' work, more families rely on foreign maids or external services such as nurseries, laundries and cooked food services [52-54]. These may lead to poor eating patterns due to unproper supervision from their parents towards consumption of good nutritional food choice. As a result, these adolescences consumed more unhealthy food as they tend to choose fast food [7]. Dietary transition had led to important changes due to increasing consumption of diet high in saturate fats, sugar, animal source-foods and refined foods but reduction in fruits, vegetables, pulses and milk [19-51]. However, findings from a study on food consumption patterns and nutrition transition in the South-East Asia revealed that the transition in this country could not be explained by the introduction of the western food (fast food) because their findings showed that practices of consuming these foods were minimal. Fast food was considered as snack foods by the populations and were consumed for recreational and leisure only. The study participants retained traditional diets with little or almost no change in food preferences between young and the older generations, but they did inject some changes in food recipes with more varieties of food consumed by the urban settlements [55]. Findings from this study showed some indication of similar situation when obese adolescents consumed almost double (166 ± 283 g/day/person) food categorised under other miscellaneous which inclusive fast food when compared to the consumption by the non-obese (68 ± 96 g/day/person) (**Table 5**). The difference is not significant ($p>0.05$), this might due to the high value of the dispersion among the obese adolescents which is measured in the interquartile range (IQR). This is somewhat an evident of poor eating patterns which already influenced the obese adolescents in the country.

Findings from this study revealed that many Malay obese adolescents resided in the northern region of Peninsular Malaysia and they consumed more food during daytime especially during breakfast and lunch. Most frequent food consumed by this group was seafood, vegetables, fruits, rice, Malaysian cakes, chicken and noodles. Their frequencies on intake of drinks were double when compared to plain water (**Table 6**). Result also showed that total food consumed per day by the obese group was 21% more compared to the non-obese adolescents. A database search was unsuccessful in identifying any related study reporting on food intake and/or preference by adolescents in the northern region alone. However, there are studies focused on dietary practices among adolescences in this country and reported that the adolescents eat three meals (breakfast, lunch and dinner) per day with most of them are not on special diet but eat almost everything [20]. They preferred either to eat at the western fast food restaurants or takeaway food and commonly having lunch at the hawkers if it is taken outside home with only small number of them eat vegetables once a day [20]. Malay adolescence either preferred the western cuisine or local food or traditional-based food patterns [21] with older adolescents preferred the healthy-based food as they have greater autonomy over their food intake and progressively start to make their own choice of food, also more concern on their body image [21]. Findings from the MyHeARTs study on dietary intake among adolescents from the central and the northern of Peninsular Malaysia highlights on higher energy intake by obese adolescents in rural settings when compared to their urban counterparts. They also consumed more sugar and fat compared the non-obese adolescents of the same geographical contingent [56]. In an earlier study, obese adolescents were reported to consumed higher intake of sugar and energy at 15.8% and 30%, respectively, compared to the normal weight adolescents [57]. Factors driving food choice

motives among some of these adolescent study subjects were price, convenience and sensory appeal but are not vary by ethnicities [58]. Adolescents preferred traditional food based on taste, appearance and price and family meals applied beneficial time for useful conversation within family members [57].

The following results indicated that family obesity was a strong predictor to obesity in adolescents. The strongest link was found with the obesity in father whilst obesity in mother and other family members also influenced the adolescents to be overweight or obese themselves. The odds of a child born into family with a father or other members with history of obesity developing to become obese were ranged between two to five and a half times greater than for children with no family history of obesity. These findings suggest that family history of obesity is consistently associated with the development in adolescents and is consistent with other studies [9,59-62]. Notwithstanding, results from a meta-analysis showed that this association is true only in children under the age of six as the childhood risk factor for obesity is declining over time when they get older as they begin to have more opportunities to make their own healthy lifestyle choices [60]. However, behavioural aspects and upbringing are shaped at home when children usually imitate their parents as role models. Unfavourable parental eating pattern and sedentary lifestyles might increase the risk of obesity in both parents and their children [63]. It is parents who determine types of food through purchasing as well as its preparation and they also decide either to cook high caloric, low-nutrient foods or healthy food with high in nutritional value [60].

Many studies have shown that the educational achievement of parents is associated with their children's nutritional status, also could be partially associated with the increased rates of obesity. Malaysian families across all ethnic's groups follow a patriarchal family structure and fathers are typically responsible for financially supporting the family [54]. Higher education level of father, could lead to a higher household income and these factors have been reported to be associated with higher purchasing power and food affordability, better quality of household assets, increased access to means of transportation, and less opportunity for exercise [61,64-65]. However, maternal education seems has important effect on child weight status because mother spent longer time with the children compared to father and is usually person who prepares the food [63-64]. Though, working mother may have less time with their children and may have less control over their food choices and eating habits but they may alter their children's preferences through greater purchasing ability for healthy and nutritious food and participation in structured sports [64]. In a positive manner, this will lead to higher nutritional awareness as well as better caring of children, a protective effect against overweight of children [37,65]. In Malaysia, women have become actively involved in the labour force, and expectations of fathers to be more involved in household cores and parenting have increased [65]. However, research indicated that father involvement in various activities of their children's life depending on their perception of their own father involvment when they were growing up and marital satisfaction, as well as higher education levels that bring them more open and accepting and having fewer children [66]. Although we did not include education qualification as a variable of interest, but indirectly higher education is associated with higher income [66].

Conclusion and Recommendations

In conclusion, the results of this study support previous work indicating that both the socio-demographic that inclusive family-related factors and food patterns have an important impact on the development of obesity in children. Creating awareness and educating parents especially the fathers on the importance of a healthy diet and its relation to obesity is obviously an important factor. This is because fathers could provide strong example of leadership and no one stands out more than a father to their children. The advantage of this study is that it explored association of food patterns and adolescent obesity factors. Several patterns had demonstrated significant association with adolescent obesity for example factors like total intake of food and drinks and large amount of food consumed during lunch. Other important finding such as Malay obese adolescents consumed heavier breakfast and total food during daytime, yet the association was only marginal. Food consumption pattern were collected using 24 hours record survey by means of three days dietary diaries, conducted throughout both rural and urban areas of Peninsular Malaysia, involved all adolescent age 10 and above from selected households and covered both the weekdays and weekends. Although good cooperation obtained from study subjects as we requested parents to support their children during satisfy the questionnaires and the response rate was at the acceptable rate, but many questionnaires are not fully completed especially the dietary dairy forms. Parents do face difficulties to track back foods and drinks consumed by the children in their absent especially during long period when they were away for schools/holidays. Finally, it is acknowledged that these results were somewhat delayed and may not reflect the current situation in 2019. Nevertheless, these results represent related surveillance study conducted in Malaysia and will therefore be the initiative for tracking important overweight and obesity factors among adolescents in the country. Despite numerous recommendations by other studies, the problem of obesity among adolescents is still worrying. We would like to recommend that longitudinal study such as cohort, should be conducted in future to determine the causal relationship. Community trials with intervention which involved multi-agencies and ministries together with parent teacher associations should be done to educate the adolescents and parents on the effects of obesity to the health.

Acknowledgement

The work described in this paper was carried out with financial support by the Ministry of Health Malaysia. Project number: NMRR 08-322-1477; NON-CAM-JPP-IMR-07-025. The authors would like to thank all subjects for their co-operation in this survey, Research Assistants who participated in the fieldwork and support staff of Environmental Health Research Centre, Institute for Medical Research who directly or indirectly supported the project. We would like to thank the Director-General of Health Malaysia for his permission to publish this article.

Ethical Approval

The project was funded by the Ministry of Health Malaysia (MOH), and the proposal was peer reviewed and approved by the Medical Research and Ethics Committee (MREC), Ministry of Health Malaysia. The consent form for the adolescents to be involved in the study was given by the researchers to the parents or guardians beforehand. The parents/guardians were informed that the information recorded will be kept confidential and only for the purpose of the study.

Conflict of Interest

The authors declare that they have no conflict of interest.

References

1. http://www.who.int/en/news-room/fact-sheets/detail/obesity-and-overweight Accessed on Jan 2018
2. http://www.euro.who.int/__data/assets/pdf_file/0019/339211/WHO_ObesityReport_2017_v3.pdf Accessed on Jan 2018
3. Gupta N, Goel K, Shah P, Misra A (2012) Childhood obesity in developing countries: Epidemiology, determinants, and prevention. **Endocr Rev** 33:48–70.
4. Duncan GE, Li SM, Zhou XH (2004) Prevalence and trends of a metabolic syndrome phenotype among U.S. adolescents, 1999–2000. Diabetes Care. 27:2438-43.
5. https://www.aacap.org/AACAP/Families_and_Youth/Facts_for_Families/FFF-Guide/Obesity-In-Children-And-Teens-079.aspx. Accessed date: 12 Jan 2018
6. Giammattei J, Blix G, Marshak HH, Wollitzer AO, Pettitt DJ (2003) Television watching and soft drink consumption associations with obesity in 11- to 13-year-old school children. **Arch Pediatr Adolesc Med** 157:882-6.
7. Anderson PM, Butcher KF. Levine PB (2003) Economic perspectives on childhood obesity. Chicago Federal Reserve Bank, Economic Perspect 27:30-48.
8. Li Y, Zhai F, Yang X, Schouten EG, Hu X, et al. (2007) Determinants of childhood overweight and obesity in China. British J Nutr 97:210-215.
9. Andegiorgish AK, Wang J, Zhang X, Liu X, Zhu H (2012) Prevalence of Overweight, obesity, and associated risk factor among school children and adolescents in Tianjin, China. Eur J Pediatr. 2012, 171:697-703.
10. Balkish MN, Mahmud SZ, Ambak R, Sallehuddin SM, Mutalip HA, (2013) Overweight among primary school-age children in Malaysia. Asia Pac J Clin Nutr 22:408-15.
11. Carson V, Hunter S, Kuzik N, Gray CE, Poitras VJ, (2016). Systematic review of sedentary behaviour and health indicators in school-aged children and youth: An update. Appl Physiol Nutr Metab 2016, 41:S240-S265.
12. National Health and Morbidity Survey (NHMS) (2015) Nutritional status of children (age <18 years old), nutritional status. Non-communicable diseases, risk factors & other health problems (Vol 2) Ministry of Health, Putrajaya.
13. Rampal GR, Mohd Sidik S, Rampal S, Daniel Wong YJ, Chow PL, et al. (2007) Prevalence of overweight among secondary school students in Klang District, Selangor. Malays J Nutr 13:1-8.
14. de Pinho L, Botelho ACC, Caldeira AP (2014) Association factors of overweight in adolescents from public schools in Northern Minas Gerais State, Brazil. Rev Paul Pediatr 32:237-43.
15. Lissner L, Wijnhoven TMA, Mehling K, Sjoberg A, Kunesova M, et al. (2016). Socioeconomic inequilities in childhood overweight: Heterogeneity across five countries in the WHO European childhood obesity surveillance initiative (COSI-2008). Int J Obes (Lond) 40:796-802.
16. Lindkvist M, Ivarsson A, Silfverdal SA, Eurenius E (2015). Associations between toddlers' and parents BMI, in relation to family socio-demography: A cross-sectional study. BMC Public Health 15:1252.
17. Terres NG, Pinheiro RT, Horta BL, Pinheiro KAT, Horta LL (2006) Prevalence and factors associated to overweight and obesity in adolescents. Rev Saude Publica 40: 627-33.
18. Yang WY, Burrows T, MacDonald-Wicks L, Williams LT, Collins CE, et al. (2017) Body weight status and dietary intakes of urban Malay primary school children: Evidence from the Family Diet Study. Children (Basel) 4:5.
19. Kac G, Perez-Escamilla R (2013) Nutrition transition and obesity prevention through the life-course. Int J Obes Suppl 3: S6-S8.
20. Lew K, Barlow PJ (2005) Dietary practices of adolescents in Singapore and Malaysia. Singapore Med J 46:282-8.
21. Abdullah NF, Teo PS, Foo LH (2016) Ethnic differences in the food intake patterns and its associated factors of adolescents in Kelantan, Malaysia. Nutrients 8:551.
22. Statistical Department of Malaysia 2001. Press Statement: Population distribution and basic demographic characteristics report population and housing census 2000.
23. Ahmad NI, Wan Mahiyuddin WR, Tengku Mohamad TR, Ling CY, Daud SF, et al. (2016) Fish consumption pattern among adults of different ethnics in Peninsular Malaysia. Food Nutr Res 60:32697.
24. Nurul Izzah A (2007) Risk assessment of selected pesticide residues by dietary intake among adults in the State of Selangor. Bangi, Selangor: Faculty of Science and Technology, National University of Malaysia.
25. Suzana S, Rafidah G, Noor Aini MY, Nik Shanita S, Zahara AM, et al. (2002) Atlas of Food Exchanges & Portion Sizes, (Ed 3) Universiti Kebangsaan Malaysia. Kuala Lumpur: MDC Publishers & Printers Sdn Bhd.
26. Suzana S, Noor Aini MY, Nik Shanita S, Rafidah G, Roslina A (2009) Atlas of Food Exchanges & Portion Sizes, (Ed 3) Universiti Kebangsaan Malaysia. Kuala Lumpur: MDC Publishers & Printers Sdn Bhd.
27. Tee ES, Noor MI, Azudin MY, Khatijah I (1997) Nutrient composition of Malaysian foods. ASEAN Sub-Committee on protein: Food habits research and development, Kuala Lumpur: Institute for Medical Research.
28. https://www.who.int/growthref/who2007_bmi_for_age/en/.
29. World Health Organisation. Expert Committee on physical status. Physical status: the use and interpretation of anthropometry. Report of a WHO expert Committee. WHO technical report series. 1995. No. 854. Geneva: WHO.

30. Izzah AN, Wan Rozita WM, Mohd Fairulnizal MN, Tengku Rozaina TM, Zarina Z, et al. (2011) The prevalence of overweight and obesity and its associated factors among students aged 10-17 years old: findings from the seafood consumption survey in Peninsular Malaysia, 2008-2009. MASO. Scientific Conference on Obesity-Towards healthy weight for life, Kuala Lumpur.

31. Ang CS, Chan KMJ (2016) A review of coronary artery disease research in Malaysia. Med J Malaysia 71:42-57.

32. Shariff AH, Sazlina SG, Shamsul AS (2007) Obesity among urban primary school children. JUMMEC 10:17-20.

33. Naidu BM, Mahmud SZ, Ambak R, Salehuddin SM, Mutalip HA, et al. (2013) Overweight among primary school-age children in Malaysia. Asia Pac J Clin Nutr 22:408-15.

34. Rezali FW, Chin YS, Mohd Yusof BN (2012) Obesity-related behaviours of Malaysian adolescents: A sample from Kajang district of Selangor state. Nutr Res Pract 6:458-65.

35. Umairah SN, Yahya BT, Datin M, Yusof SM (2012) Relationship between dietary pattern and body mass index among primary school children. Asian J Clin Nutr 4: 142-50.

36. Tee JYH, Gan WY, Tan KA, Chin YS (2018) Obesity and unhealthy lifestyle associated with poor executive function among Malaysian adolescents. PLoS ONE 13: e0195934.

37. Min J, Yan AF, Wang AHC, Wang Y (2018) Obesity, body image and its impact on children's eating and exercise behaviours in China: A nationwide longitudinal study. Prev Med 106:101-6.

38. Zhang YX, Wang ZX, Zhao JS, Chu ZH (2017) The current prevalence and regional disparities in general and central obesity among children and adolescents in Shandong, China. Int J Cardiol 227:89-93.

39. Qadir MS, Rampal L, Mohd Sidik, Md Said S, Ramzi ZS (2014) Prevalence of obesity and associated factors among secondary school students in SLemani City Kurdistan Region, Iraq. Malaysia J Med Halth Sci 10:27-38.

40. Ogden CL, Carroll MD, Flegal KM (2008) High body mass index for age among U.S. children and adolescents, 2003–2006. JAMA 299:2401-5.

41. Skinner AC, Ravanbakht SN, Skelton JA, Perrin EM, Armstrong SC (2018) Prevalence of obesity and severe obesity in US children, 1999-2016. Pediatrics 141:e20173459.

42. Sumarni MG, Muhammad Amir K, Ibrahim MS, Mohd. Rodi I, Izzuna Mudia MG, et al. (2006) Obesity among schoolchildren in Kuala Selangor: A cross sectional study, Trop Biomed 23:148–154.

43. Bong A, Jaafar S (1996) Obesity among years 1 and 6 primary school children in Selangor Darul Ehsan. Malays J Nutr 2:21-7.

44. Lee GY, Ham OK (2015) Factors affecting underweight and obesity among elementary school children in South Korea. Asian Nurs Res (Korean Soc Nurs Sci) 9:298-304.

45. Mazidi M, Banach M, Kengne AP, Lipid and Blood Pressure Meta-analysis Collaboration Group (2018) Prevalence of childhood and adolescent overweight and obesity in Asian countries: A systematic review and meta-analysis. Archives Med Sci 14:1185-203.

46. Winsniewski AB, Chernausek SD (2009) Gender in childhood obesity: Family environment, hormones and genes. Gend Med 6:76-85.

47. Mellor D, McCabe M, Ricciardelli L, Yeow J, Daliza N, et al. (2009) Sociocultural influences on body dissatisfaction and body change behaviours among Malaysian adolescents. Body Image 6:121-8.

48. Mannan M, Mamun A, Doi S, Clavarino A (2016) Prospective associations between depression and obesity for adolescent males and females- A systematic review and meta-analysis of longitudinal studies. PLoS One 11:e0157240.

49. Wan Mustapa WN, Mamun AA, Ibrahim MD (2018) Economic impact of development initiatives on low-income households in Kelantan, Malaysia. Soc Sci 7:118.

50. Popkin BM, Adair LS, Ng SW (2012) Now and then: The global nutrition transition: The pandemic of obesity in developing countries. Nutr Rev 70:3-21.

51. Hai ASE, Asbollah AZ, Kamari MN, Latif RA (2017) A study on eating habits in a small town of Kuala Lumpur. Int J Innovation Soc Sci 2.

52. Noraziah A, Mohd Azlan A (2012) The food consumption and eating behaviour of Malaysian urbanites: Issues and concerns. Geografia-Malays J Soc Space. 8.

53. Hossain Z. Parental beliefs and fathers' and mothers' roles in Malaysian families. In H Selin (Edn) (2013) Parenting Across Cultures: CChildrearing, Motherhood and Fatherhood in Non-Western Cultures, Science across Cultures: The History of Non-Western Science 7.

54. Lipoeto NI, Lin KG, Angeles-Agdeppa I (2012) Food consumption patterns and nutrition transition in South-East Asia. Public Health Nutr 16:1637-43.

55. Abdul Majid H, Ramli L, Ying SP, Su TT, Jalaludin MY, et al. (2016) Dietary intake among adolescents in a middle-income country: An outcome from the Malaysian health and adolescents longitudinal research team study (the MyHeARTs study). PloS One. 11:e0155447.

56. Muhammad NH, Karim MSA, Othman M, Ghazali H (2013) Relationships of socioeconomic level with eating behaviour of traditional food among adolescents. Mediterranean J Soc Sci 4:1320.

57. Mohd-Any AA, Mahdzan NS, Cher CS (2014) Food choice motives of different ethnics and the foodie's segment in Kuala Lumpur. British Food J 116:1879-96.

58. Lima NMS, Lal VS, Oliveira JS, Andrade MIS, Tavares FCLP, et al. (2017) Overweight among adolescents and nutritional status of their parents: A systematic review. Ciencia & Saude Coletiva. 22:627-36.

59. Kanciruk M, Andrews JW, Donnon T (2014) Family history of obesity and risk of childhood overweight and obesity: A meta-analysis. Inter Scholarly Sci Res Innovation 8:261-73.

60. Veltsista A, Kanaka C, Gika A, Lekea V, Roma E, et al. (2010) Tracking of overweight and obesity in Greek youth. Obes Facts 3:166-72.

61. Garipagaoglu M, Budak, N, Sü N, Akdikmen O, Oner N, et al. (2009) Obesity risk factors in Turkish children. J Pediatr Nurs 24:332-7.

62. Bahreynian M, Qorbani M, Khaniabadi BM, Motlagh ME, et al. (2017) Association between obesity and parental weight status in children and adolescents. J Clin Res Pediatr Endocrinenol 9:111-7.

63. Ahmad A, Zulaily N, Shshril MR, Syed Abdullah EFH, Ahmed A (2018) Association between socioeconomic status and obesity among 12-year-old Malaysian adolescents. PLoS One 13:e0200577.

64. Doustmohammadian A, Abdollahi M, Bondarianzadeh D, Houshiarrad A, Abtahi (2012) Parental determinants of overweight and obesity in Iranian adolescents: A national study. Ir J Pediatr 22:35-42.

65. Juhari R, Yaacob SN, Talib MA (2013) Father involvement among Malay Muslims in Malaysia. J Family Issues 34:210-29.

66. https://research.stlouisfed.org/publications/page1-econ/2017/01/03/education-income-and-wealth/