

## CONSUMPTION OF HEAVY MEALS AFTER DINNER BY THE ADOLESCENTS: THE CONTRIBUTING FACTORS

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### ABSTRACT

**Background:** The practice of the consumption of heavy food after a main meal results in surplus of unwanted calories that could lead to obesity. This study aimed to determine the factors associated with the consumption of heavy meals after dinner by analysing the Adolescent Nutrition Survey (2017) results.

**Material and Methods:** A two-stage cluster, cross-sectional sample design was used to produce a representative sample of students in government schools across Malaysia with student ranging from 10 to 17 years old. Data collection was conducted from March to May 2017. A total of 40,047 students participated in the survey.

**Results:** Overall, 76.8% (95% CI: 75.29, 78.29) from the respondents took heavy meals after dinner. The prevalence is higher in male (79.9%, 95% CI: 78.33, 81.35), Malay (80.9%, 95% CI: 79.66, 82.13), rural school (80.1%, 95% CI: 78.63, 81.45) and those who studied in both morning and afternoon sessions (78.6%, 95% CI: 76.31, 80.70). The adjusted odds ratio is higher among rural schools, males, Malays, afternoon session, and thin adolescents.

**Conclusion:** Majority of the students took heavy meals after dinner. Being male, Malay, studying in rural schools, and studying in the afternoon session are associated with having heavy meals after dinner. Intervention aiming to increase awareness among adolescents should be implemented to reduce the risk of obesity.

**Keywords:** adolescent, heavy meal, post-dinner, associated factors, night eating

## 1.0 Introduction

Urbanisation in Malaysia has changed Malaysian lifestyles as well as eating patterns and behaviour (Ali & Abdullah, 2017). Urban surroundings involve many different factors that affect health, such as shift work, sleep, stress, as well as physical activity (Pot, 2018). People living in this environment are prone to change their meal pattern due to disrupted feeding schedules and different work hours (Garaulet & Gomez-Abellan, 2014). Moreover, young adults and university students are more likely to eat late at night because of the tendency to study late at night (Runfola, Allison, Hardy, Lock & Peebles, 2014; Choi, Cho, Kim & Bae, 2017). Having meals late at night has been considered as a disorder by American Psychiatric Association and it is called as Night Eating Syndrome (NES) (American Psychiatric Association, 2013).

A heavy meal after dinner can be defined as high calorie food taken after dinner time, usually past 10.00 pm. *Roti canai (paratha)*, *nasi lemak (rice dish cooked in coconut milk and pandan leaf)*, burger, and fried chicken are some of the examples of heavy meal (Institute for Public Health, 2017). Several studies have shown the impact of working at odd hours and night-eating syndrome to human health, with all linked to increase in weight (Antunes, Levandovski, Dantas, Caumo & Hidalgo, 2010; Gallant, Lundgren & Drapeau, 2012). Apart from that, there were studies that have shown how eating late at night are related to difficulty of body weight control, obesity, postprandial hyperglycemia, and hypertriglyceridemia (Baron, Reid, Van Horn & Zee, 2013; Bo et al., 2014; Tsuchida, Hata & Sone, 2013; Lee, 2016). Heavy meals after dinner is considered as an extra meal that provides extra calories and may cause daily calorie intake to exceed the daily calorie needs. The extra calories are then stored as fat in our body and result in weight gain (Kinsey & Ormsbee, 2015). Moreover, a study revealed that heavy night time snacking or a heavy meal after dinner can lead to changes in fat metabolism by increasing total and LDL cholesterol and reducing fat oxidation, thus further increasing the risk of obesity (Hibi et. al., 2012).

Although previous studies have shown the link between having heavy meals after dinner with health status, the research on adolescents particularly was lacking, especially among Malaysians. A study in United States found that higher energy intake between 6-8 pm was positively associated with overweight among children aged 6-11 years old, but not among adolescents aged 12-18 years old (Eng, Wagstaff & Kranz, 2009). An observation made by Gallant et al. (2012), found that children who ate late at night consumed more sodium and fat, as well as lesser fruit and vegetables. McCuen-Wurst et al. (2018), deduced that although men and women are susceptible to having meal after dinner, women tend to be more affected negatively. Similarly, Yahia et al. (2017) also found that physical activity did not affect the tendency of having meal after dinner.

This study aimed to determine the factors associated with the consumption of heavy meals after dinner by analysing the Adolescent Nutrition Survey (2017) results.

## 2.0 Material and Methods

The Adolescent Nutrition Survey (ANS) 2017 employed a two-stage cluster sample design to produce a representative sample of students in government schools from Year 4 (10 years old) to Form 5 (17 years old). The first stage of sampling involved a random selection of school from a list of eligible schools provided by Ministry of Education. Schools were selected systematically with probability proportional to enrolment size from Year 4 to Form 5. A total of 212 secondary schools and 99 primary schools were selected from every state across Malaysia. The second stage of sampling consisted of systematic random sampling of selected classrooms from each participating school. All students in the sampled classrooms were eligible to participate in the ANS with parental consent. Field data collection was conducted from March to May 2017 (Institute for Public Health, 2017).

A set of questionnaires were used to assess respondents' habitual food intake and it was done by face-to-face interview with the state/district nutritionist. Questions about students' meal pattern such as frequency of breakfast, lunch, dinner, and heavy meals after dinner were asked, and where did they take them were asked. All variable definitions, including the examples of heavy meal, were made clear for the respondents and they understood the terms before answering the question. For physical activity assessment, the Physical Activity Questionnaire for older Children (PAQ-C) was adapted from Kowalski et al. (2004). Respondents were asked about the frequency of physical activity during the past 7 days. Every question has their own scoring system which range from 0 to 5 and the total mean scores of PAQ-C was classified into two categories, physically active (score: 2.34-5.00) and not active (score: 1.00-2.33). For BMI status, height and weight of the respondents were assessed during data collection. The data obtained were later analyzed and the classification was based on BMI-for-Age z-score for adolescents aged 10-17 years old, with World Health Organization Growth Reference, 2007 as the reference.

### *Data Analysis*

Survey data were analyzed using SPSS version 21.0 (SPSS IBM, New York, NY). Descriptive statistics were used to describe the estimated prevalence of overall heavy meal consumption after dinner among adolescents in Malaysia and their sociodemographic profiles. Simple logistic and multivariate logistic regression analyses were done using SPSS. First, bivariate analyses was performed to determine the potential predictors of heavy meals after dinner. Second, all predictors and variables of interest that were significant at  $P < 0.25$  in Rao-Scott tests in the bivariate analysis were included in the initial multivariate logistic regression model. Third, after building up the initial multivariate logistic regression model, we evaluated the categorical predictors in the model by using the design-adjusted Wald test. All significant predictors and variables of interest were retained in the model. A final model was then created to include all those predictors that were significantly associated at significance level of  $P < 0.05$ . The findings were presented as adjusted odds ratio with 95% confidence interval (CI). Both analyses were done using complex sampling design to ensure that sample weights and study design were accounted for in the analyses.

### 3.0 Results

A total of 40,047 students, from year 4 to form 5 in primary and secondary school, participated in the survey throughout Malaysia. The characteristics of the adolescents and prevalence of heavy meals after dinner are described in Table 1. The majority of the respondents (76.8%, 95% CI: 75.29, 78.29) reported taking heavy meals after dinner in the past 7 days. Of these, 79.9% (95% CI: 78.33, 81.35) were males and 78.6% (95% CI: 76.31, 80.70) attended both the morning and afternoon school session. Additionally, 81.2% (95% CI: 79.85, 82.48) took fast food as their choice of meal after dinner. In terms of BMI, 75% (95% CI: 72.95, 76.93) of overweight adolescents had a heavy meal after dinner while among the underweight/thin, it was 80.2% (95% CI: 77.72, 82.43). Prevalence of having a heavy meal after dinner among the physically active was higher (78.7%, 95% CI: 77.18, 80.09) than physically inactive adolescents (74.7%, 95% CI: 72.93, 76.41).

**Table 1:** Socio-demographic characteristics of adolescents and the corresponding prevalence of heavy meal consumption after dinner (N= 40,047)

Socio-demographic characteristics	Prevalence (%)	95% CI (Lower, Upper)
<b>National</b>	76.8	(75.29, 78.29)
<b>Locality of school</b>		
Urban	74.4	(71.86, 76.77)
Rural	80.1	(78.63, 81.45)
<b>Gender</b>		
Male	79.9	(78.33, 81.35)
Female	73.8	(72.05, 75.39)
<b>Ethnicity</b>		
Malay	80.9	(79.66, 82.13)
Non-Malay	69.6	(67.11, 72.05)
<b>School Level</b>		
Primary	77.3	(74.05, 80.17)
Secondary	76.6	(75.00, 78.04)
<b>School Session</b>		
Morning	76.3	(74.45, 78.04)
Afternoon	76.0	(73.70, 78.24)
Morning & Afternoon	78.6	(76.31, 80.70)

**Physical Activity**

Active	78.7	(77.18, 80.09)
Not active	74.7	(72.93, 76.41)

**BMI Status**

Thinness (< -2SD)	80.2	(77.72, 82.43)
Normal ( $\geq -2SD$ to $\leq +1SD$ )	77.2	(75.49, 78.76)
Overweight ( $> +1SD$ to $\leq +2SD$ )	75.0	(72.95, 76.93)
Obese ( $> +2SD$ )	75.7	(73.62, 77.74)

Table 2 shows the factors associated with heavy meal consumption after dinner among the respondents. It is found that being non-Malay (adjusted OR= 0.619,  $p < 0.001$ ), female (adjusted OR= 0.655,  $p < 0.001$ ) and physically inactive (adjusted OR= 0.918,  $p = 0.002$ ) respondents had lower odds in practising heavy meals after dinner. Moreover, respondent who attended the morning school session (adjusted OR= 0.919,  $p = 0.004$ ) and being overweight (adjusted OR= 0.879,  $p < 0.001$ ) or obese (adjusted OR= 0.833,  $p < 0.001$ ) were shown to have lower odds in taking heavy meals after dinner. However, the respondents who studied at rural areas (adjusted OR= 1.212,  $p < 0.001$ ), who practised snacking behaviour (adjusted OR= 1.626,  $p < 0.001$ ) and had fast food for meals after dinner (adjusted OR= 4.010,  $p < 0.001$ ) had higher odds for practising heavy meals after dinner.

**Table 2:** The factors associated with the behaviour of taking heavy meals after dinner among the respondents

Socio-demographic characteristics	OR (95% CI)	P value	Adjusted OR (95% CI)	P value
<b>Locality of school</b>				
Urban	1		1	
Rural	1.348 (1.284, 1.416)	< 0.001	1.212 (1.150, 1.278)	< 0.001
<b>Gender</b>				
Male	1		1	
Female	0.684 (0.653, 0.718)	< 0.001	0.655 (0.621, 0.690)	< 0.001
<b>Ethnicity</b>				
Malay	1		1	
Non-Malay	0.517 (0.493, 0.543)	< 0.001	0.619 (0.586, 0.654)	< 0.001
<b>School Level</b>				
Primary	1.018 (0.967, 1.071)	0.496	NA	
Secondary	1		NA	

**School Session**

Morning	0.855 (0.810, 0.901)	< 0.001	0.919 (0.868, 0.974)	0.004
Afternoon	0.854 (0.781, 0.933)	< 0.001	1.018 (0.923, 1.124)	0.717
Morning & Afternoon	1		1	

**Physical Activity**

Active	1		1	
Not active	0.806 (0.767, 0.846)	< 0.001	0.918 (0.870, 0.968)	0.002

**BMI Status**

Thinness (< -2SD)	1.151 (1.039, 1.276)	0.007	1.094 (0.979, 1.222)	0.114
Normal ( $\geq$ -2SD to $\leq$ +1SD)	1		1	
Overweight (> +1SD to $\leq$ +2SD)	0.849 (0.796, 0.906)	< 0.001	0.879 (0.820, 0.943)	< 0.001
Obese (> +2SD)	0.890 (0.833, 0.952)	< 0.001	0.833 (0.774, 0.895)	< 0.001

\*p< 0.05 indicate statistically significant

OR: Odds Ratio

NA: Not Available

## 4.0 Discussion

Heavy meals after dinner in this study can be defined as meals taken after 10 pm or before bedtime which comprised of high fat or high calorie food (Institute for Public Health, 2017). Until today, major studies mainly focus on adults and children but studies that involves adolescents are lacking. Thus, this study focuses on adolescents as the particular group of interest due to adolescence being a period where unhealthy eating behaviours are likely to develop.

In this study, the prevalence of adolescents that took heavy meals after dinner is about 76.8%. This translates to about four in five adolescents who are taking heavy meals after dinner or heavy suppers. This figure shows that the majority of adolescents in Malaysia prefer to take high fat or high calorie food as their supper or snack before bedtime and this issue should be of concern to our society.

From this study, we found that non-Malay and female respondents had lowers odds in taking heavy meals after dinner. From the NHANES-III study in the United States, the results showed that men were more likely to exhibit night time eating than women (Striegel-Moore, Franko, Thompson, Affenito & Kraemer, 2006). The female respondents were less likely to practise heavy meals after dinner due to their own aesthetic thoughts as they are more concerned about their body image or body weight (Striegel-Moore, Franko, Thompson, Affenito & Kraemer, 2006; Voelker, Reel & Greenleaf, 2015; Del Mar Bibiloni, Pich, Pons & Tur, 2013). The socio-



cultural context and practice among non-Malay respondent may be the main factor that causes them to be less likely to have heavy meals after dinner. In a study done by Abdullah et al. (2016), found that non-Malays were found less likely to have snacking habit and it was significantly associated with healthy-based food pattern.

Apart from that, respondent with overweight or obese BMI category and attending the morning school session showed lower odds of practising heavy meals after dinner. It can be explained by adolescents attending morning school session need to sleep or rest earlier at night and therefore they will be less likely to take heavy meals after dinner. Meanwhile, the overweight adolescents were probably resisting the idea of eating more at night in fear of gaining more weight (Choi, Cho, Kim & Bae, 2017). In a childhood obesity study, intake of snacks was not associated with the degree of obesity at the baseline of treatment (Trier et. al., 2016). This shows the complexity of obesity in which it cannot be concluded simply as the result of excessive caloric intake or sedentary lifestyle. There are many other possible reasons that could influence the progress of obesity such as genetic, physiologic and environment factors. Eng et al. (2009), discussed that as children and teenagers grow up, their eating pattern changes. They may skip meals during the day and consumed more foods later in the night.

Some studies found that evening and night time appeared to be the peak of the endogenous circadian rhythm of hunger and this can increase the risk of taking a heavy dinner or heavy meals after dinner especially for those who are late night sleepers (Kinsey & Ormsbee, 2015; Baron, Reid, Kern & Zee, 2011; Morris et. al., 2015). A study revealed that chronically sleep-restricted adults or late night sleepers are more susceptible to weight gain due to the extra calorie consumption during late night and their greater daily caloric intake (Spaeth, Dinges & Goel, 2013). Besides, the lack of availability of healthy food at late night also contributes to adolescents choosing unhealthy calorie-dense food as their supper.

This study has several strengths and limitations of relevance to the interpretation of results. The strengths of this study include the large population-based sample size, ethnic diversity of the population-based sample, anthropometry measurement and extensive statistical analysis in order to examine factors that may confound or moderate the behaviour of heavy meals after dinner among adolescents. However, this study does not account for other confounding factor such as knowledge and attitude of adolescents towards heavy meals after dinner and adolescent's daily meal pattern or meal timing. These components may be crucial to examine the factors which contribute to developing heavy meal after dinner habit among adolescents. As a cross-sectional study, the findings cannot infer the causal relationship between the variables. The questionnaires were self-administered and the data was self-reported hence there may be bias in the data acquired.

## 5.0 Conclusion and recommendation

In conclusion, majority of the respondents took heavy meal after dinner in the past 7 days. Being male, Malay, living in rural areas and studying in the afternoon session are associated with having heavy meals after dinner. However, being overweight lowered the odds of having a meal after dinner. Intervention aimed at improving adolescents' awareness on healthy eating

and healthy lifestyle should be implemented at the family, school or international level in order to reduce the risk of obesity among adolescents.

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The authors declare that they have no potential conflicts of interest.

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## **Availability of data and materials**

The dataset of this manuscript belongs to the Ministry of Health Malaysia. At present, the data are not publicly available but can be obtained from the authors upon reasonable request and with the permission from the Director General of Health, Malaysia.

## **Ethics approval and consent to participate**

Ethical approvals were obtained from the Medical Research and Ethics Committee (MREC), Ministry of Health Malaysia. Written informed consent was obtained from the selected adolescents prior to the survey.

## **Consent for publication**

Not applicable



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