MEAL SKIPPING: PREDICTORS OF WEIGHT STATUS FROM A NATIONALLY REPRESENTATIVE ADOLESCENTS SAMPLE

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ABSTRACT

Background: Main meals which include breakfast, lunch, and dinner is crucial to ensure healthy growth and development of an adolescent. This study aims to determine the prevalence of main meals intake and its association with body weight among adolescents in Malaysia.

Materials and Methods: Data were obtained from the Adolescent Health Survey (ANS) 2017. This survey successfully recruited about 40,000 students from standard 4 to form 5 from randomly selected school in Malaysia. A set questions for habitual meal pattern practice were asked, and anthropometric, which is weight and height were also taken. Weighted sample analysis was applied as the data is representative of the population.

Result: Prevalence of daily consumption of breakfast, lunch and dinner among Malaysian adolescent was 30.0%, 47.7% and 52.8% respectively. About 10.1% of adolescent did not take breakfast at all in a week, and it was highest compared to lunch (2.9%) and dinner (3.1%). The prevalence of entire week breakfast skipper was higher in urban (11.2%) compared to rural (8.8%) and among female (11.1%) compared to male (9.1%). Logistic regression after adjusted for sociodemographic characteristics found those who skipped dinner, breakfast and lunch were significantly associated with overweight or obese by the odds 1.33, 1.17 and 1.16, respectively.

Conclusion: At this rapid growth phase, adolescents must be avoiding to skip main meals as it associated with overweight and obesity. Family, school and other related agencies must play a role in providing proper schedule and environment for adolescents to ensure they are not skipping any main meals.

Keywords: Meal skipping, weight status, adolescent, national survey, Malaysia

1.0 Introduction

Adolescent years are described as a period of rapid growth with biologic, psychosocial and emotional changes. These changes place increased in the nutritional needs of adolescents (Row L, 2005). This teenage population are at risk of nutritional deficiencies due to increasing demand for micronutrient needs which is essential for physical and mental growth (Serra-Majem L et al., 2002). However, undesirable lifestyle such as unhealthy eating habits and lack of physical activity have been implicated as causes of obesity (Stea TH et al., 2015).

Besides, adolescence is the period in which long term eating habits are established, and meal skipping can lead to poor health outcomes such as compromised nutritional status including higher Body Mass Index (BMI) (Rampersaud GC et.al, 2015; Woodruff SJ et.al, 2008). Eating behaviours that may influence body weight status and main meal skipping is one of them which received much attention recently. Meal skipping was defined as the omission of consuming one or more of the main meals (breakfast, lunch or dinner) throughout the day (Dubois L et al., 2009). However, skipping a meal is relatively a frequent behaviour during middle and late adolescent and this behaviour has been found as a norm in adolescents as they are getting more independence (Reicks M et.al, 2015).

Thus, regular meal consumption is imperative for optimal health and development during this life stage. Adolescents who have regular meal daily are more likely to have healthy weight, healthier dietary and eating pattern (Hammons AJ & Fiese BH, 2011). The regular omission of meals mainly the breakfast has been associated with reduced diet quality, imbalance intakes of total energy, low intake of vitamins/minerals, increased risk of central adiposity and also cardiometabolic diseases (Timlin MT & Pereira MA, 2007; Deshmukh-Taskar PR et al., 2010; Ma Y et al., 2003; Smith KJ et al., 2010). Several studies have examined the relationship between meal skipping and unhealthy dietary outcomes (Pedersen TP et al., 2013).

A few studies have reported on the meal skipping practice among adolescent in Malaysia with focus only on particular mealtime and only on a subpopulation sample (Tee ES et.al, 2018; Law LS et.al, 2013). Therefore, this study aimed to investigate the association between main meal skipping, which include breakfast, lunch and dinner with body weight status among adolescents in Malaysia. The finding will give a further understanding of adolescent eating habit and become a shred of evidence to policy marker to find an effective strategy to improve the nutritional status of Malaysian adolescents.

2.0 Materials and Methods

2.1   Study Design

The present study was part of a nationwide cross-sectional named Adolescent Nutrition Survey (ANS) conducted under the National Health and Morbidity Survey (NHMS) platform. This epidemiological study was designed to estimate the prevalence of dietary behaviour and nutritional status among adolescents in Malaysia.

2.2 Sample Population

The study population was adolescent aged 10 to 17 years old attending formal school in Malaysia. The sampling frame in this survey was a list of primary and secondary school student from the Ministry of Education (MOE). Students' enrolment data of 2016 from Standard 4 until Standard 6 (primary school) and Form 1 until Form 5 (secondary school) were used. There was 7926 primary, and 2688 secondary schools from public and private in 2016 includes in the sampling frame. The multistage stratified cluster sampling design was applied to ensure a nationally representative sample of the student at primary and secondary school. The sampling design was stratified into 13 states, and three federal territories and the cluster was randomly selected school and classes. After applying the complex sampling design, 99 primary schools and 212 secondary schools were selected from all 13 states and three federal territories of Malaysia. Both public and private schools were included in the sampling frame.

Based on the requirements for the objectives and logistics considerations, the optimum sample size required was 30,496 respondents for secondary schools and 14,000 respondents for primary schools. Therefore, each state and federal territory will contribute about 875 respondents from primary school and 1906 respondents from secondary school. The data collection for this survey was carried out from March until May 2017. The details description for methodology and recruitment of the respondent is available in this same supplement version manuscript and also in the technical report published from the Institute for Public Health (IPH, 2017). Ethical approvals of the study were obtained from the Medical Research Ethics Committee (MREC), Ministry of Health Malaysia (NMRR -16-698-30042) prior to conducting the study. Participants who agreed to participate and met the eligibility criteria were provided with study information and signed the consent form.

2.3 Data Assessment

The following question assessed the frequency of main meal consumption: typically, in a week, how many days do you eat breakfast, lunch and dinner? The responses were in the of the range from one to seven days, and there was also an option for 0 for no consumption of breakfast in a week. Breakfast, lunch and dinner skippers were defined as those who skip the meal even one day in a week.

Meanwhile, for nutritional status, data on body weight and height were measured for all respondents according to standard procedure. The WHO AnthroPlus software was used to identify the nutritional status of the respondent based on the WHO Standard Growth Chart 2017. According to WHO Standard Growth Chart 2017, individuals were classified as thinness, normal, overweight and obese when his or her z-score is below than -2sd, -2sd to +1sd, +1sd to +2sd and more than +2sd respectively (Onis MD et al., 2017).

2.4 Data Analysis

For the analysis, the frequency of main meal consumption per week was reclassified into three categories which are seven days in a week, one to six days in a week and zero-day in a week. The characteristics of the respondents were described as the prevalence of main meal intake across their sociodemographic status. Meanwhile, to investigate the relation between meal skippers for the main meal with nutritional status, binomial logistic regression analyses were

used. Odds ratios (ORs) with 95% confidence intervals (95% CI) were calculated as a measure of relative risk.

3.0 Result

3.1 Respondent characteristics

There were 40,087 adolescents aged ten until 17 years old took part in NHMS 2017 and answered on meal pattern questions. From the three age groups, 40% was from the age 13 to 15 years old, 29% from the age 10 to 12 years old and 31% from the age 16 to 17 years old. About 58% were from urban and 42% from the urban area. The proportion is quite balanced in term of sex, and Malay give the highest proportion in term of ethnicity. The prevalence of thinness, overweight and obese was 6%, 16% and 15% respectively (Table 3.1).

Table 3.1: Sociodemographic characteristics and BMI-for-age status of the respondents.

Sociodemographic characteristics	Number (%)
National	40087 (100)
Age (year)	
- 10 – 12	11650 (29.1)
- 13 – 15	16013 (39.9)
- 16 – 17	12424 (31.0)
Locality	
- Urban	23463 (58.5)
- Rural	16624 (41.5)
Sex	
- Male	19677 (49.1)
- Female	20410 (50.9)
Ethnicity	
- Malay	27692 (69.1)
- Chinese	6122 (15.3)
- Indian	1662 (4.1)
- Others	4611 (11.5)
BMI-for-Age (BAZ) status	
- Thinness	2548 (6.4)
- Normal	25239 (63.1)
- Overweight	6301 (15.7)
- Obese	5929 (14.8)

3.2 Prevalence of meal consumption

The Descriptive analysis found 30.0%, 47.7% and 52.8% of adolescents in Malaysia consumed breakfast, lunch and dinners daily. About 10.1% of adolescent did not take breakfast at all in a week, and it was highest compared to lunch (2.9%) and dinner (3.1%). The prevalence of not practising breakfast consumption for an entire week was higher in urban (11.2%) areas as compared to rural (8.8%) areas, and it was higher in female (11.1%) as compared to male (9.1%). Meanwhile, for lunch and dinner, about three out of 100 adolescents skipped that meal at all in a week. Those adolescents who skipped breakfast, lunch and dinner were found to have a high prevalence of overweight and obesity (Table 3.2).

Table 3.2: Prevalence of main meals intake by sociodemographic characteristics.

Sociodemographic characteristics	Main meals								
	Breakfast			Lunch			Dinner		
	7 days	1-6 days	0 day	7 days	1-6 days	0 day	7 days	1-6 days	0 day
National	30.0	59.9	10.1	47.7	49.4	2.9	54.6	42.3	3.1
Age (year)									
- 10 – 12	33.3	58.5	8.2	43.6	53.6	2.8	52.8	44.1	3.2
- 13 – 15	29.8	60.1	10.1	48.0	48.7	3.3	56.2	41.0	2.7
- 16 – 17	26.3	61.3	12.5	52.4	45.1	2.5	54.9	41.6	3.5
Locality									
- Urban	31.0	57.8	11.2	51.2	46.0	2.9	60.3	37.1	2.5
- Rural	28.6	62.6	8.8	43.1	53.9	3.0	40.7	49.2	3.9
Sex									
- Male	30.6	60.3	9.1	46.7	50.4	2.9	58.8	37.1	2.4
- Female	29.4	59.4	11.1	48.8	48.4	2.9	52.5	49.2	3.8
Ethnicity									
- Malay	26.1	63.8	10.1	42.3	54.7	3.0	46.1	50.6	3.3
- Chinese	43.4	44.9	11.7	70.0	27.3	2.7	84.4	13.8	1.8
- Indian	34.0	55.0	11.0	56.3	41.5	2.2	60.3	34.9	4.8
- Others	28.9	63.4	7.8	39.6	57.3	3.1	52.5	44.4	3.1
BMI-for-Age (BAZ) status									
- Thinness	34.1	57.5	8.3	50.0	47.3	2.7	58.0	39.3	2.7
- Normal	30.6	59.9	9.5	49.0	48.2	2.8	56.4	41.0	2.6
- Overweight	29.4	59.3	11.4	45.7	51.3	3.0	51.0	45.2	3.8
- Obese	26.2	61.6	12.2	43.3	53.2	3.5	49.5	45.9	4.6

3.3 Meal skipping associated with body weight status

Binary logistic regression found those who are breakfast skippers or dinner skipper were associated with thinness even though after adjusted for age, locality, sex and ethnicity as shown in table 3.3.1. Breakfast skippers, lunch skippers and dinner skippers also showed significant association with overweight or obese among adolescents in Malaysia. From binary logistic regression, after adjusted for age, locality, sex and ethnicity, those who skipped breakfast were 1.168 more likely to become overweight or obese. Similarly, those who skipped lunch and dinner were 1.157 and 1.329 more likely to become overweight or obese, respectively. Multiple meals skipper also more likely to become overweight or obese, as shown in table 3.3.2.

Table 3.3.1: Main meals skipping in predicting thinness among adolescents

Main meals skippers	Unadjusted			Adjusted*		
	OR	95% CI	p-value	aOR	95% CI	p-value
Breakfast skipper	0.878	0.805-0.958	0.003	0.893	0.818-0.976	0.012
Lunch skipper	0.962	0.886-1.043	0.348	0.943	0.867-1.026	0.175
Dinner skipper	0.875	0.805-0.950	0.002	0.874	0.801-0.952	0.002
Breakfast & lunch skipper	0.875	0.795-0.963	0.006	0.883	0.801-0.973	0.012
Breakfast & dinner skipper	0.861	0.784-0.946	0.002	0.972	0.792-0.961	0.006
Lunch & dinner skipper	0.907	0.835-0.986	0.022	0.900	0.825-0.981	0.017
Breakfast, lunch & dinner skipper	0.880	0.795-0.974	0.013	0.888	0.800-0.986	0.026

*Adjusted for age, locality, sex and ethnicity

Table 3.3.2: Main meals skipping in predicting overweight or obese among adolescent

Main meals skippers	Unadjusted			Adjusted*		
	OR	95% CI	p-value	aOR	95% CI	p-value
Breakfast skipper	1.144	1.090-1.200	0.0001	1.168	1.113-1.226	0.0001
Lunch skipper	1.175	1.125-1.227	0.0001	1.157	1.106-1.209	0.0001
Dinner skipper	1.294	1.239-1.352	0.0001	1.329	1.270-1.391	0.0001
Breakfast & lunch skipper	1.201	1.138-1.268	0.0001	1.219	1.154-1.288	0.0001
Breakfast & dinner skipper	1.249	1.183-1.318	0.0001	1.281	1.212-1.354	0.0001
Lunch & dinner skipper	1.281	1.223-1.340	0.0001	1.294	1.234-1.357	0.0001
Breakfast, lunch & dinner skipper	1.277	1.204-1.354	0.0001	1.307	1.230-1.388	0.0001

*Adjusted for age, locality, sex and ethnicity

4.0 Discussion

The findings revealed that breakfast was the most common meal skipped by adolescents as compared with other meal. A systematic review on 25 studies from several countries reported that breakfast the most frequently skipped meal which is between 14 to 88% compared to lunch 8 to 57% and dinner 4 to 57% (Pendergast FJ et al., 2016). The present study has shown an overall increase in meal skipping with increasing age for breakfast. The prevalence rates of meal skipping among adolescents vary between 3% and 10%, with older adolescents consistently reporting higher rates of meal skipping. The findings are in line with the study carried out in Norway as revealed that the older age of adolescents, the tendency of omitting the breakfast was higher as compared with other younger age groups (Aase A, 2011).

In term of sociodemographic, breakfast skipping was more common among females compared to males. A few studies revealed that more females skipped breakfast compared to other counterparts. The nationwide study among adolescent in Greece also reported the prevalence of female to skip breakfast is more than the male (Kapantais E et al. 2011). Our results are also consistent with the findings of an Australian survey conducted among adolescents which shown adolescents female tend to skip a main meal (Rosenrauch S et al., 2017). Mostly, adolescent skip breakfast might be due to one of the ways that they practice for weight reduction (Rosenrauch S et al., 2017; Lim H et al., 2014). A study among South Korean adolescent found the proportion of female subjects reporting their weight heavier was twice as high whereas male subjects and they more likely to follow unhealthy dieting practices such as skipping meals to reduce body weight (Lim H et al., 2014).

These findings resemble those of a previous study involving a national study on meal skipping which found that meal skipping was significantly related to weight status. In this study, skipping main meals were significantly associated with weight status, either thinness or overweight/obesity. The previous study reported the association between skipping meal and thinness mostly because of the weight loss plan, especially among female adolescent (Mishra SK et al., 2011). A review paper reported that the eating behaviours like dieting, fasting, skipping meals, and consumption of fast food are found to be high among adolescent girls both from western and non-western countries with one of the reasons is to control their body weight (Mallick N et al., 2014).

A nationwide cross-sectional study in Taiwan in 2005 have observed a positive association between meal skipping and overweight or obesity among Taiwanese adolescent. The same study also reported that breakfast skippers had significantly worse health-related QOL than breakfast eaters (Huang CJ et al. 2010). The previous study among Norwegian children and adolescent also found that they had higher odds of being overweight if they skip meals (Vik FN et al., 2010). A brief review, with emphasis on the breakfast meal highlight that 2 to 3 weeks randomized controlled trials do not show effects of breakfast skipping on weight change and prospective studies with 3.7–10 years follow-up, individuals who consume breakfast more frequently gain less weight (McCrory MA, 2014).

The pathway on how skipped meal contributes to the development of overweight and obesity remains uncertain. However, several mechanisms have been proposed based on the concept of decreased energy expenditure, increased daily total energy intake and increased energy storage. Breakfast skippers were found to have lower levels of physical activity than breakfast eaters in

adolescents, suggesting that decreased energy expenditure may very likely be a mediating mechanism of the association between breakfast skipping and obesity (Kapantais E et al., 2011; Toshinai K et al., 2001). Another study suggests that not just breakfast, other main meal skipping results in extended periods of fasting that may induce a pre-prandial rise in ghrelin and in turn trigger subsequent meal initiation (Mani BK & Zigman JM, 2017). It has thus been suggested that increased daily total energy intake is a possible mechanism mediating the relationship between meal skipping and overweight/obesity (Thompson-McCormick JJ et al., 2010).

A limitation of the present study is that the result was solely based on self-reported dietary behaviour. Despite this study limitation, the present study has numerous strengths such as the sample was national representative, the data collection managed by well-trained research assistants and survey creating system (SCS) application in tablet had been used for data collection. Thus, the findings from this study add to the evidence to support the need for main meal consumption in order to have a healthy weight.

5.0 Conclusion and recommendation

In conclusion, there is an association between skipping main meals and weight status among adolescent in Malaysia. However, the result for the association between skipping meals and thinness must be cautiously interpreted as it may lead to misleading info such as skipping meals can reduce body weight. Further research is welcome to give a clearer picture of the meal pattern situation among adolescent. The intervention such 'school healthy meal schedule' where the healthy meal was prepared and given at the appropriate time to the student may be promising to give positive effect to the student in term of their health and academic performance.

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Declaration

Author(s) declare that there is no conflict of interest with respect to the research, authorship, and /or publication of this article.

Authors contribution

Author 1: Supervise the data collection, cleaning the data, analysis the data, draft the manuscript and do the amendment,
Author 2: cleaning the data, analysis the data, draft the manuscript and do the amendment,
Author 3: analysis the data, draft the manuscript and review the manuscript,
Author 4: Principal investigator, manage data collection, cleaning the data and review the manuscript, and
Author 5: Supervise the survey, manage data collection and review the manuscript.

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