
PUBLIC HEALTH RESEARCH

Prevalence of Obesity and Screening for Diabetes among Secondary School Students

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ABSTRACT

Received	4 October 2017
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Introduction	There is an increasing trend of obesity in children and adolescent globally. The objectives of this study were to identify the prevalence of overweight and obesity among students from secondary schools and to determine the mean random blood sugar (RBS) for the overweight and obese students.
Methods	This was a cross sectional study. Two secondary schools that were scheduled for visit by the School Health Team, Taiping in July 2016 were included. A standardized data collection sheet was used to collect the data. Overweight and obesity were defined based on WHO 2007 reference for BMI-for-age criteria. Random blood glucose was checked for overweight and obese students.
Results	A total of 184 school students consented and participated. 128 (69.6%) were female and 90 (48.9%) were Malays. The mean weight and height were 56.21 kg and 1.61 m respectively with BMI of 21.49 kg/m ² . Overall, the prevalence of obese and overweight were 12.5% and 10.9% respectively. Among the 4 BMI groups, there were no significant difference found in sex (p=0.849) and races (p=0.536). However, there was significant difference (p=0.042) in mean RBS for obese and overweight students between races. RBS readings among overweight and obese students were within normal range with mean of 5.95 (0.67) mmol/l (range between 4.60 – 7.70 mmol/l).
Conclusions	The overall prevalence of overweight and obesity were comparable with other studies done in Malaysia. Nevertheless, there was no prevalence of Type II diabetes mellitus among them.
Keywords	Prevalence - Obesity - Overweight - Diabetes Mellitus - School Children.

INTRODUCTION

Current data shows an increasing trend of obesity in children and adolescent globally.^{1, 2} Obesity can lead to several co-morbidities which may affect their health during adulthood. The most important and common sequelae of obesity are diabetes mellitus, hypertension and cardiovascular impairment.

In 2010, Malaysia was ranked by World Health Organization (WHO) as the sixth for the highest prevalence of obesity among countries in Asia.³ They estimated that 60% of Malaysians were overweight with 38% of them were among children.

Managing obesity among the students has been identified as one of the program under the Ministry of Health (MOH) Malaysia. MOH has been working closely with the Ministry of Education (MOE) in implementing program such as awareness talk, Young Doctor Club (Module on Practice Healthy Eating), healthy eating initiative in school (HiTS), programme healthy lifestyle (C-HAT) and other integrated healthy school program.

Few studies had been conducted among secondary school students in Malaysia on overweight and obesity prevalence. A study done among students aged 13 to 15 years in Kajang, Selangor revealed a prevalence of overweight and obese was 19.5%.⁴ Another study done in Klang, Selangor showed that the prevalence of overweight among students aged 13-17 years was 8.2%.⁵

In Perak, a survey done among secondary students in Batang Padang showed the overall prevalence of overweight and obesity was 15.0% and 12.3% respectively.⁶ However, most studies were only looking at the anthropometric measurements of the students. This study aimed to measure the anthropometric measurement as well as random blood sugar among the overweight and

obese students in view of screening for possibility of diabetes mellitus.

The objectives of this study were to identify the prevalence of overweight and obesity among students from secondary schools under the coverage of School Health Team Taiping and to determine the mean random blood sugar (RBS) for the overweight and obese students. This finding will assist in the early diagnosis and referral of overweight and obese students with the possibility of diabetes for further investigation and management or diet counseling.

METHODS

This was a cross sectional study. The sampling frame consisted of a list of all the 16 secondary schools under the coverage area of School Health Team, Taiping. Two secondary schools that were scheduled for visit by the School Health Team, Taiping in July 2016 were included.

Data Collection

A standardized data collection sheet was used to collect the data. The variables that were obtained from the students were socio-demography (sex, ethnic group) and family history of obesity or diabetes among parents or siblings. Anthropometric measurements (weight and height) were measured and body mass index (BMI) was calculated.

Body Mass Index (BMI)

BMI was defined as weight (kg)/height squared (m²). WHO 2007 reference for BMI-for-age criteria was used to define overweight and obesity in this study since it is acceptable widely for the purpose of international comparison.³ Students with a BMI greater than the 85th percentile and the 97th percentile for age and gender were considered as overweight and obese respectively.

Table 1 Interpretation of BMI-for-age based on WHO 2007 criteria

≥ 97th percentiles	Obese
85th to < 97th percentiles	Overweight
15th to < 85th percentiles	Normal
< 15th percentiles	Under weight

Random Blood Sugar (RBS)

One drop of blood sample was taken from the finger prick for determination of random blood glucose using glucometer set for consented students who were found as overweight and obese. Overweight and obese students with RBS reading more than 11mmol/l were given a referral letter to the Paediatric Clinic, Taiping Hospital for further investigation to confirm on the diabetic status and further management. Those with RBS less than 11mmol/l were given a referral letter to be seen by a nutritionist in Taiping Health Clinic or to the

Paediatric Obese Clinic, Taiping Hospital for lifestyle modification and dietary counseling for weight reduction. All the subsequent referral to the nutritionist or pediatrician for further management was for ethical reason for proper clinical investigation and management, and not a part of this study.

Sample Size

The sample size calculation was done for single proportion formula. We need at least a total of 166 students to be screened and examined for the

anthropometric measurement to achieve 5% precision in estimating the prevalence of obesity which was about 12.3%.⁷

All students will be given the assent and consent form one week prior to the visit date. The students will be explained on the study and allow to ask question. The student will be asked to read and explain the consent form to the parents. The researcher will provide the contact number for the parents to make a call if there is any clarification or question about the study. If the parents/guardians are willing to let their children to participate, the consent forms must be signed and dated by them. The children must sign and date the assent form. The assent and consent form will be collected during the visit day.

Secondary school students aged 16 years old (Form 4) with no history of diabetic mellitus were included. Those who were absent from school during the school visit were excluded.

Data Analysis

Data analysis was done using SPSS version 21. Results for descriptive statistics were presented as frequencies with percentage for categorical data and mean with standard deviation (SD) for normally distributed numerical data. Fisher exact test and Mann-Whitney or Kruskal-Wallis test were

used for groups' comparison. A value of $P < 0.05$ was considered statistically significant.

Ethical Consideration

This study was registered with the National Medical Research Register (NMRR) and obtained an ethical approval from Malaysian Research Ethical Committee (MREC), Ministry of Health Malaysia with reference number of NMRR-16-591-30046.

RESULTS

Demographic Profiles

A total of 184 school students from 2 selected schools participated in our study. Their profiles were described in Table 2. According to the demography, 128 (69.6%) were female and nearly half of the students who involved in the study were Malay (90, 48.9%). 22 (12.0%) and 17 (9.2%) of them claimed to have family history of diabetes mellitus among their fathers and mothers respectively. 9 students (4.9%) reported to have either father, mother or at least one of the siblings who were overweight or obese. The mean weight and height for the students were 56.21 kg and 1.61 m respectively with BMI of 21.49 kg/m².

Table 2 Profiles of 184 students participated in the study

Variables	Frequency (%)	Mean (SD)
Sex		
Male	56 (30.4)	-
Female	128 (69.6)	-
Race		
Malay	90 (48.9)	-
Chinese	37 (20.1)	-
Indian	46 (25.0)	-
Others	11 (6.0)	-
Family history of diabetes mellitus		
Father	22 (12.0)	-
Mother	17 (9.2)	-
Siblings	0 (0.0)	-
Family history of overweight/obese		
Father	9 (4.9)	-
Mother	9 (4.9)	-
Siblings	9 (4.9)	-
Weight (kg)	-	56.21 (16.24)
Height (m)	-	1.61 (0.08)
BMI (kg/m ²)	-	21.49 (5.63)

BMI-for-age

Table 3 showed the distribution of BMI-for age based on sex and races of the students. Overall, the prevalence of obese and overweight among students participated in this study were 12.5% and 10.9% respectively. The highest prevalence of obesity was found among other races (18.2%)

while the lowest percentage was found among Chinese (5.4%). But the difference among races was not statistically significant with p value 0.536. Male has higher prevalence of obesity (14.3%) as compared to female with prevalence of 11.7%. However it was not significantly difference (p value 0.849).

Table 3 Distributions of BMI-for-age based on sex and races

Sex	Frequency (%)				Total	P value*
	Malay	Chinese	Indian	Others		
Total						
Underweight	24 (26.7)	11 (29.7)	18 (39.1)	4 (36.4)	57 (30.9)	0.536
Normal	44 (48.9)	18 (48.6)	17 (37.0)	5 (45.5)	84 (45.7)	
Overweight	8 (8.9)	6 (16.2)	6 (13.0)	0 (0.0)	20 (10.9)	
Obese	14 (15.6)	2 (5.4)	5 (10.9)	2 (18.2)	23 (12.5)	
Male						
Underweight	12 (30.0)	1 (50.0)	6 (46.0)	0 (0.0)	19 (34.0)	0.849**
Normal	20 (50.0)	0 (0.0)	3 (23.1)	0 (0.0)	23 (41.0)	
Overweight	2 (5.0)	0 (0.0)	4 (30.8)	0 (0.0)	6 (10.7)	
Obese	6 (15.0)	1 (50.0)	0 (0.0)	1 (100.0)	8 (14.3)	
Female						
Underweight	12 (24.0)	10 (28.6)	12 (36.4)	4 (40.0)	38 (29.7)	
Normal	24 (48.0)	18 (51.4)	14 (42.4)	5 (50.0)	61 (47.7)	
Overweight	6 (12.0)	6 (17.1)	2 (6.1)	0 (0.0)	14 (10.9)	
Obese	8 (16.0)	1 (2.9)	5 (15.2)	1 (10.0)	15 (11.7)	

*Fisher exact test was applied

** P value for overall difference between sex and BMI group

Random Blood Sugar (RBS)

RBS were measured for obese and overweight students. The results were shown in Table 4. Mean RBS was 5.95 (0.67) mmol/l. Obese students have higher mean of RBS (6.08 mmol/l) compared to overweight students (5.79 mmol/l) but the difference was not significant statistically, p value

0.167. The mean RBS between male and female students also were found not significantly difference (p value 0.764). On the other hand, the mean RBS were found to be significant differences between races with p value 0.042. Chinese has the lowest mean of 5.37 mmol/l while others measured the highest with mean of 6.15 mmol/l.

Table 4 Mean RBS for obese and overweight students (n=43)

Random blood sugar (mmol/l)	N	Mean (SD)	P value
Overall	43	5.95 (0.67) Min-4.60, Max-7.70	
BMI for age			
Obese	23	6.08 (0.71)	0.167*
Overweight	20	5.79 (0.59)	
Sex			
Male	14	6.02 (0.66)	0.764*
Female	29	5.92 (0.68)	
Race			
Malay	22	6.11 (0.72)	0.042#
Chinese	8	5.37 (0.43)	
Indian	11	6.01 (0.49)	
Others	2	6.15 (0.78)	

* Mann-Whitney test

Min - minimum

Kruskal-Wallis test

Max - maximum

DISCUSSION

Our findings support the growing concern about problems of overweight and obesity among students. To our knowledge, this study was among the few studies conducted in Malaysia looking at the prevalence of overweight and obesity among students and screened them for diabetes mellitus. In this study, the prevalence of overweight among the students was 10.9% and 12.5% of them were obese.

None of them has abnormal random blood glucose reading with mean RBS of 5.95 mmol/l.

The prevalence of obesity in this study was comparable to few studies done among secondary schools in other parts of Malaysia. A study done in 2011 in Selangor found that 12.1% of the students were obese while another study reported 12.3% prevalence of obesity among students in Batang Padang, Perak in 2015.^{6,7} These figures were higher as compared to a study done

earlier in 2007 which showed prevalence of 8.2% only.⁵ The increase in trend was also shown in the result of National Health and Morbidity Survey (NHMS). NHMS 2011 reported 3.9% of children below 18 years old were obese⁸ while NMHS 2015 reported the prevalence of 11.9%.⁹ However the big difference might be contributed by the different definition of obesity used for both surveys. NMHS 2011 used weight for age to define obesity while NMHS 2015 used BMI-for-age definition.^{8,9}

There were more obese and overweight male students compared to female students. Similar results were reported by other researchers in Malaysia^{7, 10} and other Asian as well as European countries.¹¹ It was suggested from studies among adolescent that females pay more attention to their food choice. They were more careful in food that could influences health and met the nutritional recommendations compared to adolescent males.¹² However we did not capture that information in our current study.

Among the race groups, this study revealed that the highest prevalence was among other races, followed by Malay, Indian and Chinese. Another study done in 2007 in Klang, Selangor⁵ reported almost identical trend. They reported that the prevalence of obesity was the highest in other races (13.6%), followed by Malay (10.7%), Indian (7.1%) and Chinese (5.9%). Nevertheless another study done in Selangor later in 2011⁷ showed different trend. It showed that the highest prevalence of obesity was recorded among Malays (14.0%), followed by Indian (9.6%), Chinese (7.4%) and other races with only 0.1% prevalence. There was also a study which reported the highest prevalence of obesity among Indians, followed by Chinese then Malays.¹⁰ Further exploration on the cultural difference, dietary habit, family inheritance and socio economic factors need to be done to definitely answer the trend of obesity among races in Malaysia.

Children are getting more obese and suffer from cardiovascular disease and Type II diabetes mellitus.^{13, 14} With the rising worldwide prevalence of childhood obesity, Type II diabetes mellitus has emerged as a new threat to the pediatric population and future generations of adults. There was reported study which showed that 5.3% of overweight and obese students suffered from metabolic syndrome.¹⁵ Another report has recorded that the prevalence of Type II diabetes mellitus and metabolic syndrome among overweight school children in Thailand were 2.2% and 3.2% respectively.¹⁶

During the literature search, we found very limited study was previously done looking at the blood sugar level among overweight and obese students in Malaysia. We found that RBS readings among our overweight and obese students were within normal range. A study done in India

reported that 3.8% of their overweight and obese students had Type II diabetes mellitus¹⁷ while another study among Emirates students showed that 0.87% of the students were diabetic.¹⁸ Both studies used Oral Glucose Tolerance Test (OGTT) to measure the blood glucose level. However we used Random Blood Glucose to test for diabetes among our students (using glucometer device). The reason was because the session was done in school where the students need to be handled independently without the parents/guardian around. We want to minimize the invasive procedure and the time taken for the test. Eventually, in the study procedure, subsequently all the overweight and obese students were referred either to the nutritionist or pediatrician for proper clinical investigation and management if indicated.

There was other limitation to this study worth mentioning. In this study we did include only Form 4 students aged 16 years. Due to the age limit, the comparison between other different ages of students in the secondary school could not be done. The Form 4 students were chosen as the study sample since they did not sit for any major exam during the study period and were considered big enough to be handled independently during school time.

CONCLUSION

The overall prevalence of overweight and obesity were comparable with other studies in Malaysia and there was no prevalence of Type II diabetes mellitus among them. Yet the overweight and obesity among the adolescents will present a new challenge for all the health care professionals. Overweight and obesity may place children and adolescents at increased risk of significant health problems including Type II diabetes mellitus, as well as social and psychological problems.

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Child Obesity And Diabetes Screening

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