

Prevalence of Overweight among Secondary School Students in Klang District, Selangor

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ABSTRACT

Overweight and obesity place children and adolescents at increased risk of significant health problems, both during their early life and adult life. A cross-sectional study was carried out to determine the prevalence of overweight among secondary school students aged 13-17 years in the Klang district and to determine the association between overweight and age, sex, ethnicity, religion and blood pressure. Random cluster proportionate to size sampling technique was used to select the respondents. Weight was recorded using TANITA model HD-309 and height was measured using SECA Body meter Model 208. A mercury sphygmomanometer was used to measure blood pressure manually. Statistical analysis was carried out using SPSS version 13. Out of the 3,333 respondents, 11.4% were found to be at risk of overweight and 8.2% were overweight. The prevalence of overweight was significantly higher in the males (10.6%) as compared to females (6.0%). Prevalence of overweight was highest in Malays (10.7%) followed by the Indians (7.1%) and the Chinese (5.9%). Prevalence of 'risk of overweight' was highest in the Indians (13.7%) followed by Chinese (12.0%) and Malays (9.8%). There was a moderate direct significant relationship between overweight and systolic blood pressure ($r=0.5$, $r^2=0.25$, $p<0.001$) and also diastolic blood pressure ($r=0.42$, $r^2=0.18$, $p<0.001$). The relationship between BMI and overweight was very weak ($r=0.11$, $r^2=0.01$ and $df=3331$, $p<0.001$). In conclusion the prevalence of overweight among the secondary school students is high and there is a need for a comprehensive integrated population-based intervention program.

INTRODUCTION

The need for estimates of overweight and obesity in children to assess preventive measures, monitor secular trends, and identify high-risk groups has been emphasised in recent years (Reilly & Dorosty,

1999). An estimated 17.6 million children worldwide are overweight (WHO, 2003). The prevalence of obese children aged 6 to 11 years old has more than doubled since the 1960s (WHO, 2003). In a review of various available data in the region, Darnton-Hill *et al.* (1995) drew attention to the

decline in the proportion of undernourished children on the one hand and the increasing evidence that children are getting heavier on average and in higher proportions.

In Malaysia, obesity has increased from 1% in 1990 to 6% in 1997 among 13 to 17 year-olds (Ismail & Vickneswary, 1999). A survey by Ismail & Tan (1998) has also demonstrated the increase of obesity with increasing age: 6.6% among 7 year-olds, rising to 13.8% among 10 year-olds (Ismail & Tan, 1998). Obesity among these 7 to 10 year-olds was higher among boys than girls (12.5% compared to 5.0%). Ethnic differences were also observed, especially among boys, with 16.8% of Malays being obese compared to approximately 11.0% of Chinese and Indians (Ismail & Tan, 1998).

Another study among school children (6,239 respondents) aged between 7 and 16 years old in Kuala Lumpur by Kasmini *et al.* (1997) found that prevalence of obesity and overweight were 3.5% and 6.0% respectively. Males were found to be more obese than females. Most children were found to be overweight and obese around the puberty period (between 11 and 14 years old) (Kasmini *et al.*, 1997). However, ethnic differences in this study were not similar to the study by Ismail and Tan (1998). There were more overweight children among the Indians followed by the Chinese and Malays in this study. Indian males were more obese, Chinese males were more overweight, Chinese females more obese and Indian females more overweight (Kasmini *et al.*, 1997).

The objective of this study is to determine the prevalence of overweight among secondary school students in the Klang district and to determine the association of overweight with age, gender, ethnicity, religion and blood pressure.

MATERIALS AND METHODS

Study location, study design and sampling method

A cross-sectional study was conducted in Klang District in the state of Selangor in the months of April and May 2005. The study was approved by the Ethical Committee of the Faculty of Medicine and Health Science and permission was obtained from the Ministry of Education, Malaysia. The sampling frame consisted of a list of all the 35 secondary schools in Klang District. Twelve schools were selected using random cluster sampling technique proportionate to size.

Data collection

A standardised format questionnaire was used to collect the data on age, sex, ethnicity, religion, weight and height. The interviewer obtained verbal consent from the subjects before administering the interview. Information given was immediately transcribed to the questionnaire.

Anthropometric measurements

Weight was recorded using the digital bathroom scale TANITA model HD-312 Weighing Machine on which the students were made to stand. This digital bathroom scale has scale marked in kilogram and measures weight to the nearest 0.2 kilogram. Two measurements were taken for both weight and height and the average of the two values were used in the analysis. After each respondent, the weighing machine was reset to zero. It was checked frequently by the use of a known weight. The students were requested to stand barefoot on the middle of the weighing machine, with the head looking straight in front, arms by the side and with only basic clothing. When the reading of the weighing machine was stable, the weight was recorded.

Height was measured by using SECA Body meter Model 208 (made in Hamburg). The accuracy of this device is up to 0.05 centimeter. Height was measured by suspending the SECA Body-meter, 2 meters high from the floor against a straight wall, parallel to either door-frame or pillar. The student was then requested to stand barefoot under the center of the measuring tongue of the body meter without cap or songkok and then to lean against the wall with the back and head looking straight ahead so that an imaginary plane that would connect the eyes and ears were parallel to the floor. The student's heels were made to rest together against the wall or pillar, and the hands were loosely by the sides. The measuring tongue was lowered towards the head until it gently touched the head. Height measurement that appeared in the read-off area was then recorded.

Body mass index (BMI) was calculated as weight in kilograms divided by the square of height in meters. The respondents were categorised according to age and gender specific BMI for adolescents. Underweight was defined as BMI-for-Age < 5th percentile (WHO, 1995). Although there is currently no clear definition of obesity among adolescents, the most widely accepted definition is that a body mass index (BMI; in kg/m²) between the 85th and 95th percentile indicates a risk of overweight and that a BMI greater than the 95th percentile indicates overweight (Goran, 2001). In this study this definition suggested by Goran (2001) was used to differentiate those at risk of overweight and those overweight (Table 1).

Blood pressure measurements

A mercury sphygmomanometer was used to measure blood pressure (BP) manually. Two measurements were obtained for all respondents in sitting position. The mean of the two systolic and diastolic measurements was used as the BP reading.

Statistical analysis

Data was analysed using Statistical Package of Social Sciences (SPSS) Version 13.0. Age was computed from the information of date of birth and date of interview. Chi-square test was used to determine the relationship between two nominal variables or between one nominal and another dichotomous. The t-test was used to compare the means of two continuous variables. The level of significance used for the above data was $p < 0.05$.

RESULTS

Response rate

The 12 schools selected in this study were located in the urban areas of Klang. Out of 3,367 students aged 13-17 years in the 12 selected schools, 3,333 were examined, giving a response rate of 99%. Non-respondents were those who were absent from class, unable to provide adequate information and refused to measure their height and weight.

Table 1. Interpretation of BMI-for-age

≥ 95th percentiles	Overweight
85th to < 95th percentiles	At risk of overweight
5th to < 85th percentiles	Normal
< 5th percentiles	Underweight

Characteristics of respondents by age, sex, ethnicity and religion

Table 2 shows the characteristics of 3,333 respondents by age, sex, ethnicity and religion. Out of the 3,333 respondents, 52.8% of the respondents were females. The overall mean age of the 3,333 respondents was 14.9 (95%CI =14.9, 15.0) years and a median of 15 years. The age ranged from 13 to 17 years. The mean age for male respondents was 14.9 years (95%CI =14.8, 14.9) as compared to 15 years (95%CI =14.9, 15.1) for the female respondents. Majority of respondents were Malays

(41.5%) and Chinese (41.4%) followed by Indians (16.4%) and others (0.7%). 41.8% were Muslims, followed by Buddhists (35.9%), Hindus (14.2%), Christians (5.8%) and others (1.5%). There were 0.8% respondents who reported they had no religion.

Prevalence of overweight by age, gender, ethnicity and religion

Body Mass Index

The overall mean body mass index for the 3,333 respondents was 20.7 kg/m² (95%CI=20.5 - 20.8) and ranged from 11.0

Table 2. Characteristics of respondents (n=3,333)

	<i>Frequency</i>	<i>Percent (%)</i>
Sex		
Male	1573	47.2
Female	1760	52.8
Total	3333	100.0
Age		
13	738	22.1
14	676	20.3
15	658	19.7
16	615	18.5
17	646	19.4
Total	3333	100.0
Ethnicity		
Malay	1384	41.5
Chinese	1380	41.4
Indian	547	16.4
Others	22	0.7
Total	3333	100.0
Religion		
Islam	1392	41.8
Buddhist	1196	35.9
Hindu	474	14.2
Christian	192	5.8
Others	51	1.5
No Religion	28	0.8
Total	3333	100.0

kg/m² to 45.1 kg/m². The median was 19.5 kg/m². The overall mean body mass index for the 1,573 male respondents was 20.8 kg/m² (95%CI=20.6 - 21.0) and ranged from 11.8 kg/m² to 43.6 kg/m². The median was 19.6 kg/m². For the 1,760 females, the overall mean BMI was 20.5 kg/m² (95%CI=20.3 - 20.8) and ranged from 11.0 kg/m² to 45.1 kg/m². The median was 19.5 kg/m². The results showed that there was no overall significant difference in the mean BMI between the males and females ($t=1.6$, $df=3331$, $p=0.1$).

Table 3 shows the prevalence of overweight by age, gender, ethnicity and religion. The results show that out of the 3,333 respondents, 380 (11.4%) were at risk of overweight and 272 (8.2%) were overweight.

Overweight and sex

The prevalence of overweight was significantly higher in the males (10.6%) as compared to 6% in the females ($P^2 = 24$, $df=1$, $p<0.001$). The proportion of those at 'risk of overweight' was also significantly

Table 3. Prevalence of overweight by age, gender, ethnicity and religion

Age/Sex/ Race/Religion	n	Under	Normal	At risk of	Overweight
		Height		Overweight	Overweight
n (%)					
Age					
13	738	84 (11.4)	482 (65.3)	98 (13.3)	74 (10.0)
14	676	72 (10.7)	466 (68.9)	87 (12.9)	51 (7.5)
15	658	53 (8.1)	472 (71.7)	83 (12.6)	50 (7.6)
16	615	57 (9.3)	452 (73.5)	50 (8.1)	56 (9.1)
17	646	66 (10.2)	477 (73.8)	62 (9.6)	41 (6.3)
Gender					
Male	1573	222 (8.7)	975 (62.0)	209 (13.3)	167 (10.6)
Female	1760	110 (6.3)	1374 (78.1)	171 (9.7)	105 (6.0)
Ethnicity					
Malay	1384	120 (8.7)	980 (70.8)	136 (9.8)	148 (10.7)
Chinese	1380	116 (8.4)	1017 (73.7)	165 (12.0)	82 (5.9)
Indian	547	94 (17.2)	339 (62.0)	75 (13.7)	39 (7.1)
Others	22	2 (9.1)	13 (59.1)	4 (18.2)	3 (13.6)
Religion					
Islam	1392	121 (8.7)	983 (70.6)	140 (10.1)	148 (10.6)
Buddhist	1196	96 (8.0)	887 (74.2)	136 (11.4)	77 (6.4)
Hindu	474	89 (18.8)	292 (61.6)	64 (13.5)	29 (6.1)
Christian	192	19 (9.9)	128 (66.7)	30 (15.6)	15 (7.8)
Others	51	3 (5.9)	38 (74.5)	7 (13.7)	3 (5.9)
No Religion	28	4 (14.3)	21 (75.0)	3 (10.7)	0 (0)
Total	3333	332 (10.0)	2349 (70.5)	380 (11.4)	272 (8.2)

higher in the males (13.3%) as compared to 9.7% in the females ($p < 0.001$).

Overweight and ethnicity

There was significant association between overweight and ethnicity among the respondents in this study. The results show that the prevalence of overweight was highest in Malays (10.7%) followed by the Indians (7.1%) and the Chinese (5.9%). The difference in the prevalence of overweight among the Malays and Chinese, and the Malays and Indians was statistically significant ($p < 0.05$). However, the difference in the prevalence of overweight among the Chinese and Indians was not statistically significant ($P^2 = 0.9$, $df=1$, $p=0.33$).

Overweight and religion

The results also show that there was a significant association between the prevalence of overweight and religion ($p < 0.01$), where overweight was highest among the Muslims (10.6%), followed by Christians (7.8%) and Buddhists (6.4%).

Overweight and age

The prevalence of overweight was highest in the pubertal age, 10.0% at 13 years old and significantly decreased with advancing age to 6.3% at 17 years old ($p < 0.001$). The results showed that there is a very weak direct significant relationship between overweight and age ($r=0.105$, $r^2=0.011$, $df=3331$, $p < 0.001$).

BMI and blood pressure

The results show that there is a moderate direct significant relationship between overweight and systolic blood pressure ($r=0.5$, $r^2=0.25$, $p < 0.001$), and also between overweight and diastolic blood pressure ($r=0.42$, $r^2=0.18$, $p < 0.001$).

DISCUSSION

In this study, the overall prevalence of overweight among secondary school students aged 13-17 was 8.2%. The figure is much lower than the prevalence of overweight in a study reported by Troiano & Flegal (1998) in the United States (11.0%). In addition to the 8.2% of respondents classified as overweight, an additional 11.4% had a BMI between the 85th and 95th percentiles of the reference population, which put them in an area of concern because they may be at risk of becoming overweight. This study showed that 10.6% of male adolescents (aged 13 - 17 years) examined were overweight and 13.3% were at 'risk of overweight', giving an overall prevalence of 23.9%. For the female adolescents, overall prevalence was 15.7% (6.0% overweight and 9.7% at 'risk of overweight'). Zalilah *et al.* (2006) also reported an overall higher prevalence in males (19.5%) as compared to the females (16.7%) in Malaysian adolescents aged 11 to 15 years. The prevalence of overweight among primary school children reported by Rampal, Teh & Tan (2004) was 15.2% and was higher in males as compared to the females in Sepang District in 2004.

A study done by Popkin and Udry (1998) also concluded that males had higher prevalence of overweight compared to females. Kasmini *et al.* (1997) also showed that males had higher prevalence of overweight compared to females.

Overweight was also significantly associated with ethnicity. The findings of this study show that the Malay students have the highest prevalence of overweight (10.7%), followed by Indians (7.1%) and Chinese (5.9%). However, Kasmini *et al.* showed that the prevalence of overweight was highest in Indians, followed by the Chinese and Malays (Kasmini *et al.*, 1997).

There was also a significant association between overweight and religion ($p < 0.05$), where Muslims had the highest prevalence of overweight (10.6%),

followed by Christians (7.8%) and Buddhists (6.4%). There is currently no published material on religion and overweight among adolescents in Malaysia.

This study found a moderate direct significant relationship between overweight with both systolic and diastolic blood pressure. High blood pressure, dyslipidaemia, and abnormalities in left ventricular mass and/or function, abnormalities in endothelial function and hyperinsulinaemia and/or insulin resistance are the major cardiovascular risk factors associated with childhood obesity (Reilly *et al.*, 2003).

In conclusion, overweight and obesity among adolescents present new challenges for those concerned with public health in Malaysia. Overweight and obesity place children and adolescents at increased risk of significant health problems including hypertension, type II diabetes mellitus, and dyslipidaemia as well as social and psychological problems. Health care workers need to understand the regulation of body weight and causes of childhood obesity in order to meet this new challenge.

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