The prevalence of obesity among clinical students in a Malaysian medical school

Boo N Y, Chia G J Q, Wong L C, Chew R M, Chong W, Loo R C N

ABSTRACT

Introduction: This study aimed to determine the prevalence of obesity among medical students and its relationship with their dietary intake and physical activities.

Methods: This observational study was carried out on 240 medical students during the clinical phase of their medical course in a private medical school. Their body weight and height were measured, and a standardised questionnaire was used to collect information on their physical activities and dietary intake.

Results: The median body weight of the participants was 59.0 kg (interquartile range: 51.3–66.8), the mean body height was 166.1 cm (standard deviation [SD] 8.5 cm), and the mean body mass index (BMI) was 21.8 kg/m2 (SD 3.4 kg/m^2). Based on the World Health Organization BMI cut-offs for the Asian population, 30.1 percent (n is equal to 72) of the students were overweight or obese, with a BMI that was equal to or greater than 23.0 kg/m^2. Logistic regression analysis showed that, after controlling for various potential confounders, the only significant risk factors associated with overweight/obesity among these students were: male gender (adjusted odds ratio [OR] 2.1; 95 percent confidence intervals [CI] of 1.1 and 4.1; p is equal to 0.03), Malay ethnic group (adjusted OR 2.4; 95 percent CI 1.0 and 5.7; p is equal to 0.04), Indian ethnic group (adjusted OR 3.6; 95 percent CI 1.5 and 8.9; p is equal to 0.005), and the number of soft drinks consumed per week (adjusted OR 1.3; 95 percent CI 1.0 and 1.5; p is equal to 0.02). Skipping breakfast, the frequency of physical exercise per week, the number of hours of sleep per day, and eating noodles or roti canai (a type of Malaysian pancake) for breakfast were not significant risk factors.

Conclusion: Obesity remains a common problem among medical students in their clinical years.

Department of Paediatrics, Clinical School, International Medical University, Jalan Rasah, Seremban 70300, Malaysia

Boo NY, MRCP, FRCP
Professor

Chia GJQ
Medical Student

Wong LC
Medical Student

Chew RM
Medical Student

Chong W
Medical Student

Loo RCN, SRN
Nursing Sister

Correspondence to:
Prof Nem-Yun Boo
Tel: (60) 6 767 7798
Fax: (60) 6 767 7709
Email: nemyun_boo@yahoo.com

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INTRODUCTION

Obesity and its related disorders are a growing epidemic in both developing and developed countries.[1-10] A variety of factors, including diet, genetic predisposition, physical activities, physiological and behavioural factors, are implicated as contributing factors to obesity.[1,2]

Health personnel are important promoters and role models for maintaining a healthy lifestyle for the general population. Studies on medical students and health personnel in many countries, however, suggest that obesity is a problem among these population groups.[11-16] For example, a study conducted in a Japanese university found a progressive and significant rise in obesity levels among medical students from 1979 to 1991.[12] In Greece, a study on 989 third-year medical students showed that around 40% of men and 23% of women had a body mass index (BMI) ≥ 25.0 kg/m^2. Furthermore, 33.4% of male and 21.7% of female students in this study had central obesity.[13] In a study carried out among healthcare workers employed in a large hospital in Sicily, Italy, 13.3% of males and 13.6% of females were found to be obese.[15]

In Malaysia, the prevalence of obesity among Malaysians aged 15 years and older was reported to be 11.7% in a national study. Obesity was found to be more prevalent among Malaysian females (13.8%) than males (9.6%). Its prevalence was highest among the Malays (13.6%) and Indians (13.5%), followed by the indigenous group of Sarawak (10.8%) and the Chinese (8.5%).[16] However, a review of the literature using online resources and databases (PubMed, Ovid and Proquest) showed that no studies have reported on the prevalence of obesity among Malaysian medical students or healthcare providers. The present study aimed to determine the prevalence of obesity among medical students and its relationship with their dietary intake and physical activities.

METHODS

This was an observational study carried out in the clinical

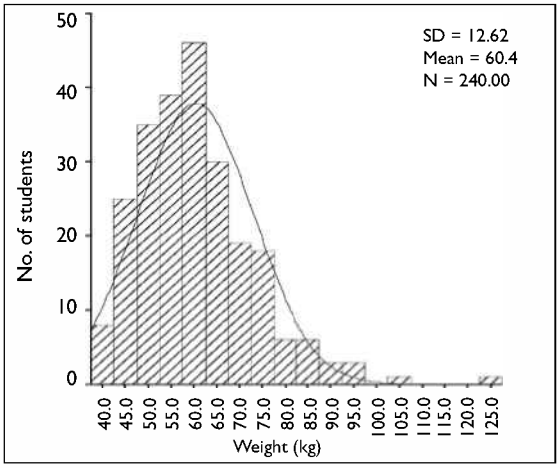

Fig. 1 Frequency distribution of medical students according to the body weight.

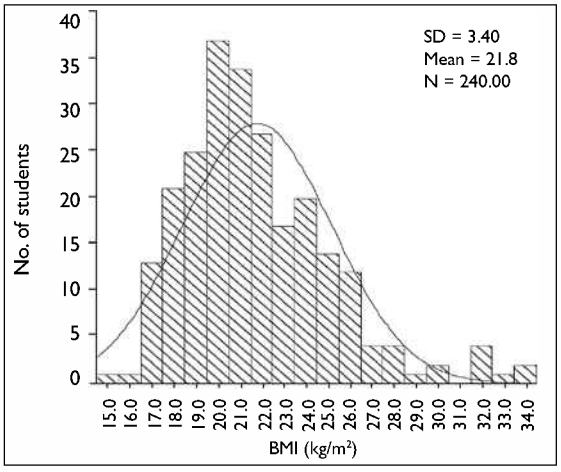

Fig. 3 Frequency distribution of medical students according to the body mass index (BMI).

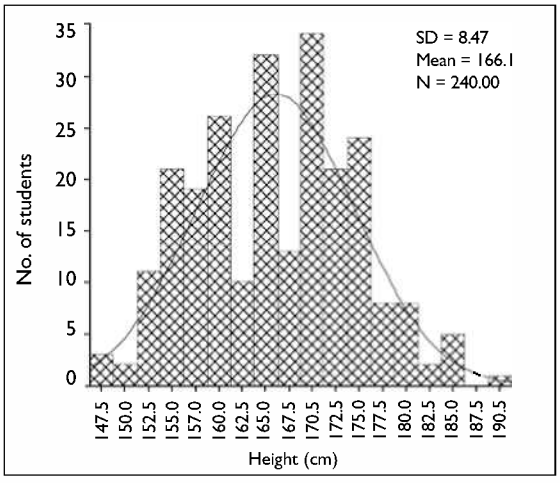

Fig. 2 Frequency distribution of medical students according to the body height.

school of the International Medical University, Malaysia, between July and September 2008. The inclusion criterion was all medical students in the clinical school. Verbal consent was obtained from each of the students before recruitment into the study.

A standardised self-administered questionnaire containing 15 questions was used to collect the following data from the students: their age, gender, ethnic group, current semester of study, perception of their own weight status, time spent on exercise, sleep and entertainment, and the number of meals and snacks eaten per day. Prior to starting the study, the questionnaire was tested on five students to determine its acceptability and ease of use by the study subjects as well as the usefulness of the data for analysis. During the study, the height and weight of each participant were measured using the same weighing scale and measuring rod (SECA Medical, Bradford, MA, USA). The weighing scale was calibrated at the beginning of every session of measurement. Participants were weighed in their light clothing without shoes (after the removal of their coats, handbags, mobile phones and other personal accessories). Their height was measured, to the nearest 0.5 cm. With the footwear removed, standing straight and looking forward, the participant's height was recorded at the point when the arm of the measuring rod was resting on the head. The BMI was calculated as the weight in kilograms divided by the height in square metres (kg/m^2). In this study, based on the World Health Organization (WHO) BMI cut-offs for the international classification of body weight, a BMI < 18.5 kg/m^2 was categorised as underweight, 18.5–24.9 kg/m^2 as the normal range, and ≥ 25.0 kg/m^2 as overweight, which was further classified as pre-obese (25.0–29.9 kg/m^2), obese Class I (30.0–35.9 kg/m^2), obese Class II (36.0–39.9 kg/m^2), and obese Class III ($\geq$ 40 kg/m^2).[17] Based on the WHO BMI cut-offs for the Asian population, a BMI < 18.5 kg/m^2 was categorised as underweight, 18·5–22·9 kg/m^2 as the normal range, and ≥ 23.0 kg/m^2 as overweight, which was further classified as pre-obese (23.0–27.4 kg/m^2), obese Class I (27.5–34.9 kg/m^2), obese Class II (35.0–39.9 kg/m^2), and obese Class III (≥ 40 kg/m^2).

At the time of this study, the medical course in this university consisted of ten semesters, and students began their clinical rotation from Semester 6 onwards. During this study, students in Semesters 6 and 7 were categorised as junior clinical students, and those in Semesters 8 and 9 were categorised as senior students. Semester 10 students had their clinical rotation in a campus sited in another town and were not included in this study.

The demographics, physical activities and eating habits of normal-weight and overweight students based on the Asian BMI cut-offs were compared. The chi-square test (or Fisher's exact test for an expected

Table I. Frequency distribution of students according to World Health Organization (WHO) body mass index (BMI) cut-offs for international classification of body weight and Asian population.

BMI (kg/m²)	WHO international classification, No.(%)			
	BMI category	Male (n = 122)	Female (n = 118)	Total (n = 240)
18·5–24.9	Normal	85 (69.7)	80 (67.8)	165 (68.8)
< 18.5	Underweight	8 (6.6)	28 (23.7)	36 (15.0)
25.0–29.9	Pre-obese	23 (18.9)	8 (6.8)	31 (12.9)
30.0–35.9	Obese Class I	6 (4.9)	2 (1.7)	8 (3.3)
BMI (kg/m²)	WHO body weight classification for Asian population, No.(%)			
	BMI category	Male (n = 122)	Female (n = 118)	Total (n = 240)
18·5–22·9	Normal	65 (53.3)	67 (56.8)	132 (55.0)
< 18.5	Underweight	8 (6.6)	28 (23.7)	36 (15.0)
23.0–27.4	Pre-obese	38 (31.1)	20 (16.9)	58 (24.2)
27.5–34.9	Obese Class I	11 (9.0)	3 (2.5)	14 (5.8)

Table II. Relationship between students' self perception of their body weight and their body weight category based on World Health Organization (WHO) body mass index (BMI) cut-offs for international classification of body weight and Asian populations.

Self perception of weight category	Weight category based on BMI cut-offs for international classification, No.(%)				
	Normal (n = 165)	Underweight (n = 36)	Pre-obese (n = 31)	Obese Class I (n = 8)	Total (n = 240)
Normal	115 (69.7)	15 (41.7)	4 (12.9)	0 (0.0)	134 (55.8)
Underweight	14 (8.5)	20 (55.6)	0 (0.0)	0 (0.0)	34 (14.2)
Overweight	26 (15.8)	1 (2.8)	26 (83.9)	3 (37.5)	56 (23.3)
Obese	3 (1.8)	0 (0.0)	1 (3.2)	5 (62.5)	9 (3.8)
Not sure	7 (4.2)	0 (0.0)	0 (0.0)	0 (0.0)	7 (2.9)
Self perception of weight category	Weight category based on Asian BMI cut-offs, No.(%)				
	Normal (n = 132)	Underweight (n = 36)	Pre-obese (n = 58)	Obese Class I (n = 14)	Total (n = 240)
Normal	100 (75.8)	15 (41.7)	18 (31.0)	1 (7.1)	134 (55.8)
Underweight	14 (10.6)	20 (55.6)	0 (0.0)	0 (0.0)	34 (14.2)
Overweight	11 (8.3)	1 (2.8)	36 (62.1)	8 (57.1)	56 (23.3)
Obese	2 (1.5)	0 (0.0)	2 (3.4)	5 (35.7)	9 (3.8)
Not sure	5 (3.8)	0 (0.0)	2 (3.4)	0 (0.0)	7 (2.9)

value of less than 5) was used for the analysis of the categorical variables, and the Student's *t*-test (or Mann-Whitney test for skewed distribution) was used for the continuous variables. Forward logistic regression analysis was carried out to determine the significant risk factors associated with overweight (pre-obesity and obesity) among the students by using the weight category as the dependent variable and the following as independent variables: gender, ethnic group, number of times engaging in physical exercises per week, number of hours of sleep per day, having breakfast, number of times having breakfast per week, having noodles for breakfast, having roti canai, a type of Malaysian pancake, for breakfast, and number of times having sweet drinks per week. A p-value of less than 0.05 was considered to be statistically significant.

A previous study has shown that the prevalence of overweight/obesity in the Malaysian population was about 25%.[16] In order to detect the prevalence of overweight/obesity of at least 15% among our students with a statistical power of 90% (one-sided) at 5% level of significance, a minimum sample size of 137 students had to be recruited.

RESULTS

During the study period, 78.2% (240 out of 307) of the students in the clinical school participated in this study. The remaining 67 students either refused to participate or were away for elective postings. The data obtained from the 240 participating students is presented here. The participants constituted 77.8% (63 out of 81) of Semester 6 students, 90.5% (76 out of 84) of Semester 7 students, 67.8% (40 out of 59) of Semester 8 students and 73.5% (61 out of 83) of Semester 9 students. There were 122 (50.8%) male and 118 (49.2%) female students. The majority (71.7%, n = 172) were Chinese, while 13.8%

Table III. Comparison of demographic data between normal-weight and overweight/obese students based on the World Health Organization BMI cut-offs for Asian Population.

Demographic data	Overweight/obese students (n = 72)	Normal weight students (n = 132)	95% CI of mean difference; OR(95% CI)	p-value
Mean body weight ± SD (kg)	73.4 ± 12.3	56.8 ± 6.9	13.5, 19.8	< 0.0001*
Mean body height ± SD (cm)	168.5 ± 7.7	165.4 ± 8.5	0.9, 5.5	0.008*
Median BMI (kg/m^2) (IQR)	25.0 (23.9, 26.5)	20.6 (19.6, 21.6)	-	< 0.0001*
Male (%)	49 (68.1)	65 (49.2)	1.7 (1.1, 2.5)	0.01*
Ethnic group (%)				
Chinese	41 } (58.3)	103 } (79.5)		
Others	1 }	2 }		
Malay	14 (19.4)	16 (12.1)	2.2 (1.0, 4.9)	0.04*
Indian	16 (22.2)	11 (8.3)	3.6 (1.6, 8.5)	0.002*
Semester (%)				
6 and 7	40 (55.6)	74 (56.1)		
8 and 9	32 (44.4)	58 (43.9)	0.6, 1.8	0.9

BMI: body mass index; CI: confidence interval; SD: standard deviation; IQR: interquartile range; OR: odds ratio
* denotes statistical significance.

(n = 33) were Malays, 12.9% (n = 31) were Indians and 1.7% (n = 4) were from other ethnic groups.

The median body weight was 59.0 kg (interquartile range: 51.3–66.8 kg; range: 39.0–124.0 kg) (Fig. 1). The mean body height was 166.1 cm ± 8.5 (Fig. 2) and the mean BMI was 21.8 kg/m^2 ± 3.4 (Fig. 3). Based on the WHO International classification of body weight, 68.8% of the subjects were of a normal body weight and 16.1% were overweight or obese (Table I). Based on the WHO Asian BMI cut-offs, 55.0% were of a normal weight, 30.0% were overweight and 15.0% were underweight. Among the overweight students, none were in the obesity Class II or III categories. When compared with the females, a significantly higher percentage of the males were overweight or obese ($p < 0.001$), irrespective of the classification used. A significantly higher percentage of the female students were underweight ($p < 0.001$).

Based on either the WHO International or Asian BMI cut-offs, only 69.2% of the students perceived their weight categories correctly (Table II). A higher proportion (17.6%) of the students who were classified in the normal-weight group based on the international cut-offs perceived themselves to be overweight or obese compared to those who were classified in the normal-weight group based on the Asian BMI cut-offs (Tables II). Only 75.0% of the students with a normal weight, based on the Asian BMI cut-offs, thought that their weight was within the normal category. The remaining students in the normal-weight group perceived themselves to be either underweight or overweight. More than 40% of the underweight students thought that their weight was within the normal category, while more than 30% of the students who were overweight thought that their weight was normal. Only 35.0% of the obese students thought that they were obese.

When compared with the demographic data of normal-weight students (Table III), overweight students were significantly heavier and taller. A significantly higher proportion of these participants were male, and from the Malay or Indian ethnic groups (Table III). There was no significant difference in the proportions of junior or senior students between the two groups. There was also no significant difference in the physical activities and the number of hours spent using the computer or watching television between the two groups. Although normal-weight students had longer hours of sleep than overweight/obese students, the difference was not statistically significant (Table IV).

Smoking was uncommon among the students, and there was no significant difference between the two groups (Table V). A significantly higher proportion of the overweight/obese students had no breakfast compared to the normal-weight students ($p = 0.04$). The overweight/obese students had significantly lesser number of breakfast in a week ($p = 0.01$), and consumed more soft drinks ($p = 0.01$) than the normal-weight students. Although a higher proportion of overweight students had noodles and/or roti canai for breakfast, the difference was not statistically significant. There was no significant difference in the proportion of students who had other types of breakfast, snacks, supper and fast food between the two groups of students ($p > 0.05$).

Forward logistic regression analysis showed that after controlling for various potential confounders, the only significant risk factors associated with overweight among the medical students were: male gender (adjusted odds ratio [OR] 2.1; 95% confidence interval [CI] 1.1, 4.1; $p = 0.03$), Malay ethnic group (adjusted OR 2.4; 95% CI 1.0, 5.7; $p = 0.04$), Indian ethnic group (adjusted

Table IV. Comparison of physical activities between overweight or obese students and normal weight students based on World Health Organization body mass index cut-offs for the Asian population.

Activity	Overweight or obese students (n = 72)	Normal-weight students (n = 132)	p-value
Engaged in physical exercise or sports (%)	52 (72.2)	91 (68.9)	0.6
Median no. of times engaging in physical exercise or sports/week (IQR)	2 (0, 3)	1 (0,2)	0.1
Median duration of physical exercise or sports/week, minutes (IQR)	30 (0, 60)	30 (0, 60)	0.5
Median no. of hours spent on the computer/day (IQR)	3 (2, 5)	2 (2, 4)	0.2
Median no. of hours spent watching television/week (IQR)	0 (0, 1)	1 (0, 2)	0.4
Believed physical exercise had effect on body weight (%)	61 (84.7)	111 (84. 1)	0.5
Median hours of sleep/day (IQR)	6 (6, 7)	7 (6, 7)	0.07

IQR: interquartile range

Table V. Comparison of smoking and eating habits between normal weight and overweight or obese students based on World Health Organization body mass index cut-offs for the Asian population.

Habit	Overweight or obese students (n = 72)	Normal-weight students (n = 132)	p-value
Smoking (%)	6 (8.4)	4 (3.1)	0.2
Median number of meals/day (IQR)	3 (3, 3)	3 (3, 3)	0.6
No breakfast (%)	35 (48.6)	45 (34.1)	0.04*
Median number of days having breakfast/week (IQR)	5 (3, 7)	7 (4,7)	0.01*
Fruits for breakfast (%)	6 (8.3)	8 (6.1)	0.6
Nut-based cereal for breakfast (%)	11 (15.3)	29 (22.0)	0.3
Bread for breakfast (%)	40 (55.6)	78 (59.1)	0.6
Noodles for breakfast (%)	17 (23.6)	17 (12.9)	0.049*
Roti canai for breakfast (%)	10 (13.9)	8 (6.1)	0.05
Sweet cakes for breakfast (%)	7 (9,7)	8 (6.1)	0.3
Consumed snacks (%)	51 (70.8)	103 (78.1)	0.4
Median no. of snacks/day (IQR)	2 (0, 5)	2 (1, 3)	0.5
Consumed soft drinks (%)	49 (68.1)	95 (72.0)	0.6
Median no. of soft drinks/week (IQR)	1.5 (0, 3.0)	1 (0, 1.8)	0.01*
Consumed supper (%)	35 (48.6)	64 (48.5)	1.0
Median no. of supper/week (IQR)	0 (0, 3.0)	0 (0, 2.75)	0.9
Consumed fast food (%)	65 (90.3)	121 (91.7)	0.7
Median no. of fast food/week (IQR)	1 (0.3, 1.0)	1 (0, 1.0)	0.4

IQR: interquartile range
* denotes statistical significance.

OR 3.6; 95% CI 1.5, 8.9; p = 0.005) and the number of soft drinks consumed per week (adjusted OR 1.3; 95% CI 1.0, 1.5; p = 0.02). Skipping breakfast, the number of times engaging in physical exercise per week, the number of hours of sleep per day, and eating noodles or roti canai for breakfast were not found to be significant risk factors.

DISCUSSION

In order to allow us to compare the prevalence of obesity with previous studies and to determine the extent of obesity problems in relation to the Asian body frame, the prevalence of obesity was calculated using both the International and Asian cut-offs. When compared with the reported prevalence (11.7%) among the Malaysian population,[16] where obesity was defined as a BMI ≥ 30 kg/m^2, the prevalence among the medical students in this study, at 3.3%, was relatively low. However, based on the Asian cut-off, the combined prevalence of overweight and obesity among our students, at 30.0%, was worrying. Similar to a national study,[16] this study found that Malays and Indians were more obese than the Chinese. Unlike the national data, however, a significantly higher proportion of the male students were found to be overweight in this study.

The results of this study found that only slightly more than half (55.0%) of the students were in the normal weight category, while the rest were either overweight/obese (30.1%) or underweight (15.0%). While being overweight was more prevalent among male students, being underweight was significantly more common among female students. By the time they reached the clinical phase of their training, medical students were supposed to have received reasonably adequate medical education on the prevention of and the adverse outcomes associated with overweight/obesity and underweight.

They are future doctors who are expected to treat patients as well as to serve as promoters and good role models for healthy lifestyles in their community. It is therefore important to identify the gaps in knowledge and practice in the curriculum of this medical school so as to address this issue.

Physical exercise did not seem to play a major discriminatory role between normal-weight students and the overweight/obese students in the present study. Unlike the low level of involvement in physical exercise reported in other universities,[18] a relatively high proportion (> 65.0%) of students in this medical school engaged in physical exercise. However, the frequency of physical exercise among the students (at one to two times a week) was less than the recommended minimum of three times a week. Given the less than recommended minimal frequency of physical exercise of the students, its impact on weight control among the students would be low.

As with the findings of previous studies, the univariate analysis of our data showed that skipping breakfast was significantly associated with being overweight.[19-21] Our data showed a similar inverse relationship between the frequency of breakfast consumption and obesity, as reported by other studies.[22] These studies have shown that people who skip breakfast tend to select more calorically dense foods later in the day and tend to overeat at subsequent meals.[23,24] In contrast, eating breakfast results in a greater reduction in unplanned, impulsive snacks and a larger reduction in calories and fats consumption that is associated with impulsive snacking.[25] Our results also showed that when compared with normal-weight students, a higher proportion of the overweight students consumed carbohydrate-rich noodles rather than a variety of different types of food for breakfast. However, the logistic regression analysis did not identify skipping breakfast or eating carbohydrate-rich noodles or fat-laden roti canai to be significant risk factors associated with overweight/obesity among these students, after controlling for various potential confounders. One possible explanation for this finding could be that the current study was not powered to study this factor.

The present study also showed that the consumption of soft drinks is a significant risk factor that is associated with overweight, as reported by other studies.[26] A can of soft drink contains high fructose corn syrup, which is equivalent to ten teaspoons of table sugar. Weight gain results for people who consumed these soft drinks, as they usually do not compensate for this consumption by reducing the intake of other food items.[26-28]

The main limitation of this study was the omission of a detailed dietary history on the types and quantities of food consumed by the students in their main meals. As a consequence, this study was unable to determine the impact of these meals on the weight of the students. Based on the findings of the present study, it is recommended that students in this university increase the frequency of their physical exercise to at least three times a week, avoid or reduce their consumption of soft drinks, and have breakfast regularly. There is also a need for this institution to consider improvements to its curriculum content and delivery regarding the subject of nutritional intake and its impact on body weight and health. Further studies should be carried out to determine why male gender and ethnicity are significant risk factors associated with overweight/obesity among Malaysian medical students.

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