LOW PREVALENCE OF OVERWEIGHT AND OBESITY AMONG MEDICAL STUDENTS AT A UNIVERSITY IN MALAYSIA

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Abstract. Obesity is a growing public health concern. Lifestyle modifications should be aggressively promoted in communities, with health care professionals expected to be role models of healthy living. A cross-sectional study using proportionate stratified sampling of prevalence of overweight and obesity and associated risk factors among randomly selected medical students ($n = 179$) attending a university in Malaysia revealed prevalence rate of overweight and obesity was 22% and 11%, respectively, based on cut-off points for the Asian population. These values are significantly lower compared to the national prevalence of the same age group conducted in the same year. Among the factors investigated using multivariate logistic regression indicated male gender significantly predicted the odds of being obese or overweight, while other factors, such as race, fiber consumption, sleeping hours, sedentary activity, stress, phase of study, fast food accessibility and late-night snacking were not associated with obesity. Larger scale studies should be carried out to investigate obesogenic tendencies of medical students and prospective studies to explore risk factors in the development of obesity among all medical students.

Keywords: obesity, overweight, prevalence, risk factor, medical student, Malaysia

INTRODUCTION

Obesity is a growing pandemic that has reached epidemic proportions worldwide (WHO, 2018). In Malaysia, one out of two adults are either obese or overweight (Aris *et al*, 2015). This country has the highest proportion of obesity in Southeast Asia (Ng *et al*, 2014) and, unless urgent actions are taken, obesity-related mortality will dramatically increase in the coming years.

Prevalence of overweight and obesity in Malaysia is 32.4% and 11.4 % among adult males, respectively, and 31.9% and 16.7% among adult females (Ng *et al*, 2014) Among boys, the country has the highest prevalence of obesity (8.8%), just below that of Georgia (10.7%) and among girls ranks 3rd below Georgia (12.1%) and Azerbaijan (7.9%) out of 33 countries in the entire Asian region. (Ng *et al*, 2014). Large scale studies of obesity in the country

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show a two-fold increase in overweight prevalence from 16.6% to 30% and a four-fold increase in obesity prevalence from 4.5% to 17.7% in the past two decades (Lin *et al*, 2008; Aris *et al*, 2015). These figures are even higher if Asian body mass index (BMI) ($\geq 27.5 kg/m^2$) cut-off point is used instead of the WHO classification ($\geq 30\ kg/m^2$) (WHO Expert Consultation, 2004). Asian populations have different associations between BMI and percent body fat and thereby different health risks as compared to European populations (WHO Expert Consultation, 2004). The latest National Health Morbidity Survey (2015) in Malaysia used two guidelines in the classifications of obesity, that according to the 2004 Malaysian Clinical Practice Guidelines classification (Zainudin *et al*, 2011) giving prevalence of overweight and obesity of 33.4% and 30.6%, respectively, and that according to World Health Organization cut-off points (WHO, 2018) of 30% and 17.7%, the former figure for obesity being almost comparable to that in developed countries, such as USA where 31.6% of men and 33.9% of women are obese (Ng *et al*, 2014).

Obesity is a major risk factor in development of leading causes of global deaths, such as diabetes, cardiovascular diseases and cancer (Hubert *et al*, 1983; De Pergola and Franco, 2013; Al-Goblan *et al*, 2014). Current public health intervention strategies are all directed to diet restrictions and physical activities (Buraphat *et al*, 2017; A Hamid and Sazlina, 2019). However, with industrialization and globalization, these lifestyle practices are becoming more difficult to carry out. Even healthcare professionals who are expected to be role models are no exceptions. A lack of training in obesity management during medical education is associated with fewer discussions of healthy lifestyle practices with obese patients (Forman-Hoffman *et al*, 2006). Only physicians with normal weight provide invoke confidence in obese patients under their care (Bleich *et al*, 2012). In order to combat this growing obesity epidemic, implementers would be more effective in counselling patients by being role models. However, only a small number of studies have been conducted into prevalence and risk factors of obesity among physicians. In Brunei Darussalam, Isa *et al* (2016) reported prevalence of overweight among physicians is similar to the national prevalence but prevalence of obesity is lower. In USA, 63% of 19,000 male physicians are either overweight or obese, the former prevalence similar to the national prevalence but the latter being lower, indicating this group is not immune to obesogenic tendencies (Buring and Gaziano, 2008).

Some studies showed a high prevalence of overweight and obesity among medical students. Among Malaysian medical students prevalence of overweight and obesity was considerably high (Boo *et al*, 2010; Gopalakrishnan *et al*, 2012), similar to surveys done among medical students in Greece, India and Pakistan (Bertsias *et al*, 2003; Purohit *et al*, 2015; Khan *et al*, 2016). Interestingly, there are consistent findings that male medical students are more likely to be obese than female medical students in all findings. However, no investigation was conducted on whether prevalence of obesity among medical students in Malaysia is significantly different from the national data at the same study period.

Hence, a survey was conducted to determine prevalence of obesity among medical students at a university in Selangor, Malaysia in comparison to the national prevalence estimate during the same year of study. The survey also

explored possible risk factors of obesity among this group of university students. Data gathered from the survey study will provide a baseline for future research.

MATERIALS AND METHODS

Study design and participants

This cross-sectional study was carried out among medical students (n = 331) at Taylor's university in Selangor, Malaysia from July to August 2015. Sample size was calculated using Krejcie and Morgan formula for prevalence studies of a known population, with the combined prevalence of overweight and obesity for both genders constituting 50% (Aris *et al*, 2015). Selection of the sample of 331 medical students was based on a proportionate stratified sampling method (Salkind, 2010).

A pilot test was carried out to test comprehensibility, relevancy and significance of the questionnaire by analyzing answers of the respondents. Fifteen students from other disciplines were also requested to comment if the instructions were clear, comprehensive and easy to understand. They were also asked if the confidentiality was appropriately maintained in the questionnaire. Suggestions were collected and integrated into the questionnaires.

Two types of study tools were employed, namely, self-administered questionnaire and anthropometric measurements. A standardized questionnaire assessed socio-demographic and other associated factors: ethnicity, gender, stress level, physical activities, sleeping hours and eating habits.

The study was conducted according to the Declaration of Helsinki. Prior verbal informed consent was obtained from all participants. The School of Medicine, Taylor's University supported the conduct of this study.

Determination of risk factors

Physical activity. Multiple choice questions on physical activity was based on the recommendations provided by the Ministry of Health Malaysia (2017) on losing weight and preventing weight gain or regain. Moderate to vigorous intensity physical activity for 30 minute/day is recommended to reduce health risk of chronic disease, 45-60 minute/day to prevent transition from overweight to obesity and 60-90 minute/day to prevent weight gain or regain.

Sedentary activity. Sedentary activity is defined as physical activity of <2 hour/day (Ministry of Health Malaysia, 2017).

Fiber intake. Fiber intake was assessed based on the daily recommended servings by the Ministry of Health. Students who took <5 servings were considered not meeting the requirement whereas those who took ≥5 servings of fiber in a day is considered reaching the recommended amount (Ministry of Health Malaysia, 2017).

Fast food accessibility. Fast food accessibility was adapted from the Wisconsin retail food environment index (WRFEI) (Laxy *et al*, 2015). Respondents' proximity to fast food outlets is determined as the ratio of mean distance to three closest supermarkets: mean distance to three closest convenience stores or fast food restaurants. Distance from home to supermarket is taken as a measurement of access to a potential supply 'healthy' food, while that to a fast food outlet as access to a place providing 'unhealthy' food.

Late night snacks. Assessment of late-night snacks was made using a close-ended question with "yes: or "no" answer.

Stress score. Assessment of stress score adapted the classic stress assess-

ment questions (Lee, 2012), comprising of 10 items perceived stress scale (PSS) questionnaire with a 5-point scale ranging from 0 (never) to 4 (very often). The first four questions were stated in a positive way and were scored by reversing responses (*eg*, 0=4, 1=3, 2=2 and 3= 1 and 4=0). In order to obtain a psychological stress score, scores from the 10 PSS questions were added up, higher scores indicating higher perceived stress.

Hours of sleep. Assessment of regular sleeping hours was based on a questionnaire containing the following choices: ≤6 hours of sleep, 7-9 hours of sleep and >9 hours of sleep. The American Academy of Sleep Medicine and Sleep Research Society recommends at least 7 hours of sleep in a day to promote optimal health (Watson *et al*, 2015). Sleep of <7 and >9 hours are not recommended.

Anthropometric measurements

Body weight was determined wearing light clothing without a lab-coat and footwear using an Omron HBF-375 Body Composition Monitor digital weighing scale (Omron, Petaling Jaya, Malaysia) to one decimal place of a kilogram and each weighing was conducted in triplicate. Height was measured without wearing shoes to the nearest 0.1 cm using a measuring tape fixed to a flat wall without any surface irregularities. Height was measured in centimeters and performed by research personnel trained on how to minimize random error and variability. Based on the Malaysian Clinical Practice Guidelines of Obesity (Ministry of Health Malaysia, 2017), which adopted the recommended cut-off values for the Asian population. (WHO Expert Consultation, 2004), BMI was classified into six categories; underweight (<18.50 kg/m^2), normal (18.50-22.99 kg/m^2), overweight (23.00-27.49 kg/m^2), obese I (27.50-34.99 kg/m^2), obese II (35.00-39.99), and obese III (>40 kg/m^2) (Zainudin *et al*, 2011). For this study, obese I, II and III is categorized as obese.

Statistical analysis

Data were analyzed using an IBM Statistical Package for Social Sciences version 23 (IBM, Armonk, NY). Frequency, mean and standard deviation (SD) were used to summarize the findings. Chi-square was employed to compare obesity prevalence of the sample group to the national prevalence and to determine if obesity prevalence differs according to different risk factors; and logistic regression to determine relationship of obesity and the different risk factors. Predictor variables were tested using univariate logistic regression analysis, and variables significant at 0.25 level were tested by multivariate analysis. Good model fit is based on a classification table, Nagelkarke R^2, Cox and Snell R^2, and Hosmer-Lemeshow test, with an alpha level of 0.05.

Table 1
Proportionate Stratified Sampling of medical students at Taylor's University, Selangor, Malaysia (2015).

Study batch	Study population	Proportionate stratified sample
	No. (%)	No. (%)
Batch 1	17 (5)	9 (5)
Batch 2	58 (18)	31 (18)
Batch 3	41 (12)	22 (12)
Batch 4	48 (15)	26 (15)
Batch 5	44 (13)	24 (13)
Batch 6	46 (14)	25 (14)
Batch 7	50 (15)	27 (15)
Batch 8	27 (8)	15 (8)
Total	331 (100)	179 (100)

RESULTS

Comparison of prevalence of overweight and obesity between medical students and general population

Out of 331 medical students, 179 from all batches were randomly chosen and invited to participate in this study via telephone calls (Table 1). The response rate was 93% (166/179). Characteristics of medical students participated in the study are presented in Table 2. Classified by BMI, prevalence of overweight and obesity among the participants was 22% and 11%, respectively (Table 3). The prevalence of overweight and obesity among the medical students is significantly lower compared to the national prevalence (Aris *et al*, 2015) based on guidelines of both Malaysia Clinical Practice Guidelines (33.4%, $\chi^2 = 10.329$, $p = 0.001$) and 30.6%, $\chi^2 = 30.511$, $p < 0.001$, respectively) and World Health Organization (30%, $\chi^2 = 27.213$, $p < 0.001$ and 17.7%, $\chi^2 = 11.098$, $p<0.001$, respectively) (Aris *et al*, 2015); and to the national prevalence for the same age group (20-24 years of age) of 24.3%, $\chi^2 = 5.826$, $p = 0.016$ and 20.8%, $\chi^2 = 9.999$, $p = 0.002$, respectively (Ministry of Health Malaysia, 2017).

Table 2
Characteristics of medical students at Taylor's University, Selangor, Malaysia (2015).

Characteristic	(*N*=166) Number (%)
Race	
Malay	84 (51)
Chinese	56 (34)
Indian	16 (9)
Others	10 (6)
Gender	
Male	56 (34)
Female	110 (66)
Phase of study	
Pre-clinical	87 (52)
Clinical	79 (48)
Physical activity/day	
<30 minutes	82 (49)
≥30-44 minutes	59 (35)
45-60 minutes	17 (11)
61-90 minutes	8 (5)
Late night snacks	
Yes	68 (41)
No	98 (59)
Sleeping period	
≤6 hours	90 (54)
7-9 hours	71 (43)
>9 hours	5 (3)
Weight, kg (mean ± SD)	58.3 ± 4.9
Height, m (mean ± SD)	1.63 ± 5.35
BMI, kg/m^2 (mean ± SD)	22.0 ± 1.1
Stress score (mean ± SD)	19 ± 3
Servings of fiber/day (mean ± SD)	2.0 ± 2.7
Access to fast food index (mean ± SD)	15.7 ± 0.1

Evaluation of risk factors for obesity among medical students

When predictor variables were tested using univariate analysis, significant differences between obese and non-obese groups only in gender ($\chi^2 = 20.063$, $p<0.001$ and in physical activity ($\chi^2 = 8.245$, $p = 0.041$) (Table 4). Variables significant at 0.25 level were then subjected to multivariate analysis, which revealed only

Table 3
BMI classification of medical students at Taylor's University, Selangor, Malaysia (2015).

Classication*	BMI (kg/m^2)	(*N*=166) No. (%)
Underweight	<18.5	33 (20)
Normal	18.5-22.9	79 (47)
Overweight	≥23.0	36 (22)
Obese	≥27.5	18 (11)

*Zainudin *et al* (2011).

Table 4
Obesity risk factors among medical students at Taylor's University, Selangor, Malaysia (2015).

Variable	Number (N=166)	Not overweight/obese[a] Number (%)	Overweight/obese[b] Number (%)	t/X^{2c}
Race				1.578
Malay	84	57 (68)	27 (32)	
Chinese	56	40 (71)	16 (29)	
Indian	16	9 (56)	7 (44)	
Others	10	6 (60)	4 (40)	
Gender				20.063*
Male	56	25 (45)	31 (55)	
Female	110	87 (79)	23 (21)	
Phase of study				0.583
Pre-clinical	87	61 (70)	26 (30)	
Clinical	79	51 (65)	28 (35)	
Physical activities				8.245**
Less than 30 minutes	82	63 (77)	19 (23)	
At least 30 minutes	59	36 (61)	23 (39)	
45-60 minutes	17	10 (59)	7 (41)	
60-90 minutes	8	3 (37.5)	5 (62.5)	
Late night snack				-0.022
Yes	68	47 (69)	21 (31)	
No	98	65 (66)	33 (34)	
Sleeping period				0.573
≤6 hours	90	63 (70)	27 (30)	
>7 hours	76	49 (64.5)	27 (35.5)	
Sedentary activity, hours/day				2.423
≤2	31	21 (68)	10 (32)	
3-4	68	45 (66)	23 (34)	
5-6	26	15 (58)	11 (42)	
>6 hours	41	31 (76)	10 (24)	
Stress scores, mean ± SD		19 ± 6	18 ± 4	0.845
Servings of fiber/day, mean ± SD		2 ± 1	2 ± 1	-0.306
Access to fast food index, mean ± SD		3 ± 3	3 ± 3	0.603

[a]Body mass index (BMI) <23.0 kg/m^2. [b]BMI ≥23.0 kg/m^2. [c]t score/chi-square
*p-value <0.001. **p-value <0.05.

gender was an independent predictor of obesity, males being 4.3 times at risk than females (Table 5).

DISCUSSION

The predominant risk factor for obesity is male gender, consistent with other prevalence studies conducted on medical students within the country (Boo *et al*, 2010; Gopalakrishnan *et al*, 2012;) and in Greece, India and Pakistan (Bertsias *et al*, 2003; Purohit *et al*, 2015; Khan *et al*, 2016).

Table 5
Logistic regression analysis of risk factors for overweight/obesity among medical students at Taylor's University, Selangor, Malaysia (2015).

Variable	Not overweight/ obesea (N = 166) OR (95% CI)	p-value*	Overweight/obeseb (N = 166) OR (95% CI)	p-value*
Gender		<0.001		<0.001
Male	4.69 (2,33-9.44)		4.281 (2.066-8.871)	
Female	1.00			
Race		0.669		
Malay	0.711 (0.185-2.728)			
Chinese	0.600 (0.149-2.413)			
Indian	1.167 (0.234-5.808)			
Others	1.000			
Physical activity per day		0.051		0.241
<30 minutes	0.181 (0.040-0.828)	0.028	0.390 (0.078-1.942)	0.250
30 minutes	0.383 (0.084-1.760)	0.218	0.799 (0.159-4.019)	0.785
45-60 minutes	0.420 (0.075-2.361)	0.325	0.787 (0.127-4.872)	0.797
≥60 minutes	1.000			
Phase of study		0.446		
Pre-clinical	0.776 (0.405-1.488)			
Clinical	1.000			
Sedentary activity per day		0.431		
≤2 hours	1.421 (0.518-3.896)	0.495		
3-4 hours	1.586 (0.659-3.819)	0.304		
5-6 hours	2.436 (0.841-7.057)	0.101		
≥6 hours	1.000			
Late night snack		0.968		
Yes	0.986 (0.510-1.910)			
No	1.000			
Sleeping habit		0.564		
≥6 hours	1.714 (0.183-16.058)	0.637		
7-9 hours	2.311 (0.245-21.793)	0.463		
>9 hours	1.000			
Stress score	0.974 (0.915-1.036)	0.397		
Fiber intake	1.048 (0.776-1.416)	0.758		
Access to fast food index	0.962 (0.847-1.092)	0.547		

[a]Body mass index (BMI) <23.0 kg/m^2. [b]BMI ≥23.0 kg/m^2. *Significant at <0.05. Nagelkerke R^2= 0.187; Cox & Snell R^2= 0.134; Hosmer and Lemeshow $\chi^2(3) = 1.740$, $p = 0.628$; threshold value = 67.5%; CI, confidence interval; OR, odds ratio.

This was in contrast to the prevalence in the general where females of the same age are more likely to be more obese (Aris Ht *et al*, 2015).

The association among medical students of obesity with male gender not

related to any temporal factor as both BMI values and gender were determined at the same time. The data were from a cross sectional study limited to one university and variables were not collected over time. High-quality nutritional education should be included in medical curriculum, aptly stated by Dr Katherine: "What is lacking in medical education lacks in the medical plate." (Barnett and Blair, 2014). There must be a radical change in medical education. Students, interns and residents should be given a balanced lifestyle, with time for adequate sleep, and exercise, and access to a proper diet (Barnett and Blair, 2014). Further investigations involving more than one university are needed to confirm the findings and, in particular, prospective studies to identify obesogenic tendencies of female and male medical students as they progress in their medical training.

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