

## Estimation of body mass index in students of a public sector medical college in Pakistan

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### ABSTRACT

**Objectives:** To determine the BMI status of the students of Dow Medical College and to calculate frequency of different BMI categories.

**Methodology:** A cross-sectional questionnaire based study was carried out in Dow Medical College, Dow University of Health Sciences, Karachi. Body weight and height were measured and body mass index (BMI) values were calculated by dividing weight with (height)<sup>2</sup>. Overweight and obesity were defined using WHO international standard BMI cut-offs.

**Results:** The overall prevalence of underweight students was 29.9% out of which 9.6% fell under the category of severely underweight (BMI of < 16.5). In overweight category there were 8%. The frequency of students falling in Obese Class I, II & III was 2.7%, 0.6% & 0.0% respectively. It was found that more female students compared to male students were underweight. In the overweight and obese categories there was a preponderance of male students. A positive correlation was found between perception of obesity amongst parents and overweight obese students.

**Conclusion:** According to this study, underweight, especially in girls, should be considered a serious health problem among adolescent students which needs to be addressed. Obesity on the other hand does not seem to be a major issue amongst them.

**KEY WORDS:** Body Mass Index, Obesity, Under-weight, Medical Students.

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### INTRODUCTION

Body fat is an essential part of the body. Needless to say, fat performs quite a few functions in the body. It provides an important energy source, acts as a heat

insulator and shock absorber, is the source of estradiol in women and produces numerous hormones such as adiponectin, resistin and leptin. Too much or too little fat in the body poses problems. Obesity has been found to closely correlate with the level of body fat.<sup>1,2</sup> Body mass index (BMI) is commonly used to define obesity (also known as Quetelet Index), other methods used are waist circumference, CT, MRI, absorptiometry and life insurance tables.<sup>3-7</sup> BMI describes relative weight for height, is not gender specific and is significantly correlated with total body fat content. It is also the most widely accepted means of assessing obesity measured by dividing weight by height<sup>2</sup>. Among the many indices used to assess obesity, BMI has shown strongest correlation with continuous hypertension in both genders.<sup>8</sup>

Obesity and its associated morbidities are leading causes of cardiovascular disease, type II diabetes, hypertension, osteoarthritis, anesthesia risks,

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menstrual abnormalities as well as some types of cancers including those of colon and breast.<sup>8-10</sup> Underweight is classified as having a BMI <18.5. Among the adolescent population of Pakistan, underweight is more frequent than obesity, whereas the opposite is true for adults.<sup>5,6</sup>

The data regarding the BMI status of adolescent population of Pakistan is scanty, a study with small sample size has reported the frequency of overweight at 12.6% and there is a need to determine the BMI of this group of population with a large number subjects for accuracy.<sup>11</sup> The current study was designed to determine the BMI status of the students in Dow Medical College which is a public sector medical college with students belonging to divergent socio-economical background. This will also help generate the base line data for adolescent group for the country.

**METHODOLOGY**

This was a cross-sectional questionnaire based study and was conducted from 1<sup>st</sup> June till August 31<sup>st</sup> 2008, in Dow Medical College, Dow University of Health Sciences (DUHS), Karachi, Pakistan. The study population included all medical students of Dow Medical College. Questionnaire was handed over to the students in lecture halls while they entered the hall and their weight and height was recorded while they left the hall. This procedure was repeated for each class for three times on three different days to improve enrollments. Students were also contacted during the breaks, in common room and canteen to participate in study. Each student was enrolled only once. Ethical approvals for the study were obtained through the participating faculty from DUHS.

Body weight and height were measured to the nearest 0.1 kg and 0.5 cm using Standard calibrated scales and a non-stretch tape fixed to a flat vertical wall, respectively. To minimize errors in measurement, scales were checked for accuracy by weighing an object of known weight.

SPSS version 16.0 software (SPSS Inc., Chicago, IL, USA) was used for statistical analysis of data. In this study, parametric variables were analyzed using the Student's t-test. Differences in the prevalence rates of underweight, overweight and obesity between males and females were tested by chi square statistics. Difference in the prevalence rates of obesity between obese students and their parents were tested by ANOVA statistics. Linear regression was used to examine the correlation of BMI of participating students with their perception regarding obesity in their

parents. All values are presented as mean ± standard deviation. And a 'P' value less than 0.05 was considered statistically significant.

BMI was calculated by dividing weight in kilograms by height in meters squared.

$$BMI = \frac{weight (kg)}{height \times height (meters)}$$

Respondents were classified on the basis of current WHO BMI cut-off points:<sup>12</sup>

- \* <16.00 kg/m<sup>2</sup> (severe underweight)
- \* 16.00–16.99 kg/m<sup>2</sup> (moderate underweight)
- \* 17.00–18.49 kg/m<sup>2</sup> (mild underweight)
- \* 18.50–24.99 kg/m<sup>2</sup> (normal range)
- \* 25.00 kg/m<sup>2</sup> (overweight)
- \* 25.00–29.99 kg/m<sup>2</sup> (pre obese),
- \* 30.00 kg/m<sup>2</sup> (obesity)
- \* 30.00–34.99 kg/m<sup>2</sup> (obese class I),
- \* 35.00–39.99 kg/m<sup>2</sup> (obese class II),
- \* ≥40.00 kg/m<sup>2</sup> (obese class III)

**RESULTS**

Among the 850 medical students to whom the questionnaire was administered, 792 completely

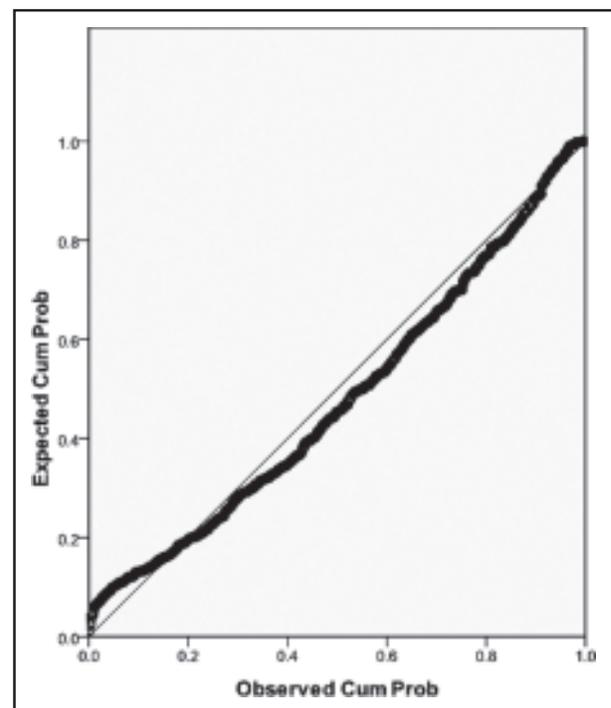


Figure-1: Regression plot of BMI of Students with Perceived Obesity in Parents

R	R Square	Adjusted R Square	Std. Error of the Estimate	Significance
0.234 <sup>a</sup>	0.055	0.053	3.67	< 0.001

Table-I: Segregation of BMI categories according to gender

		Gender * BMI Categories Cross tabulation						Total
		BMI Categories						
		Severely Underweight	Underweight	Normal	Overweight	Obese Class I	Obese Class II	
Gender Male	Count	19	31	132	28	12	0	222
	% within Gender	8.6%	14.0%	59.5%	12.6%	5.4%	0.0%	100.0%
Female	Count	57	130	334	35	9	5	570
	% within Gender	10.0%	22.8%	58.6%	6.1%	1.6%	0.9%	100.0%
Total	Count	76	161	466	63	21	5	792
	% within Gender	9.6%	20.3%	58.8%	8.0%	2.7%	0.6%	100.0%
<i>P value</i>		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

filled were included. Among them 222 (28%) were male students and 570 (72%) were female students. Mean height of students was 164.3 ±9.9 cm. The mean height of males was 174.7 ±7.8 cm while that of females was 160.2 ±7.3 cm. The difference was statistically significant ( $P < 0.01$ ; 95% CI 13.3 to 15.6). The mean weight of students was 56.2 ±11.9 kg. The mean weight of males was 66.3 ±12.0 kg and of females was 52.3 ±9.3 kg. The weight of males was significantly more than that of female students ( $P < 0.01$ ; 95% CI 12.4 to 15.6).

The mean BMI of the students was 20.8 ±3.8. BMI among males was 21.8 ±3.9 while that in females was 20.4 ±3.6. The difference was statistically significant ( $P < 0.01$ ; 95% CI 0.8 to 1.9). Distribution of students according to the BMI categories showed that 58.8% of students were among the normal BMI category of 18.5-25.0. The frequency of underweight students was 29.9% out of which 9.6% fell under the category of severely underweight with BMI of < 16.5. In overweight category there were 8%. The frequency of students falling in Obese Class I, II & III was 2.7%, 0.6% & 0.0% respectively.

The segregation of BMI categories according to gender showed that out of 570 female students 57 (10%) fell in severely underweight group while 19 (8.6%) out of total 222 male students fell into this category. The trend changes towards male preponderance in higher BMI categories, 12.6% males were overweight as compared to 6.1% females; similar

Table-II: Presence of obesity, hypertension &amp; diabetes among parents.

	Obesity		Hypertension		Diabetes	
	#	%	#	%	#	%
Father	69	8.7	198	25.0	134	16.9
Mother	174	22.0	128	16.0	76	9.6

results were seen in Obese Class-I in which there were 5.4% males and 1.6% females. The difference in frequency was analyzed by Chi-square test which was significant with  $p < 0.01$ . Details are given in Table-I

Perceived obesity in father was reported by 69 (8.7%) students while 174 (22.0%) said their mother was obese and 69 (8.7%) reported obesity in both parents (Table-II). Hypertension was reported in 198 (25%) and 128 (16.0%) among fathers and mothers respectively. Hypertension in both parents was reported in 31 (3.9%). Diabetes Mellitus among father, mother and both parents was reported in 134 (16.9%), 76 (9.6%) and 31 (3.9%) respectively.

The analysis of the students' BMI values with their perception of presence of obesity among their parents showed that children of obese parents had higher BMI. Results are given in Table-III. The linear regression analysis showed positive correlation with adjusted  $r^2$  value of 0.053 and  $P < 0.0001$ . The regression plot gave a positive correlation line also shown in Figure-1.

## DISCUSSION

Our study showed significant number of students in underweight category with about 30% of students falling in this category while obesity at about 3% was not found to be a significant problem. An earlier

Table-III: BMI of Students According to the Perception of Obesity among their Parents.

Obesity in Parents	Mean BMI of Students	N	SD
None	20.0	480	3.4
Father	21.6	69	3.5
Mother	21.7	174	4.0
Both	22.5	69	4.7

study from a private sector medical university showed similar underweight proportion of 29% but they took the cutoff for underweight of  $< 19 \text{ kg/m}^2$  and they also did not report the subgroup category analysis.<sup>11</sup> They reported the obesity at 12.6% by using the cutoff of  $> 26 \text{ kg/m}^2$ .<sup>11</sup> Our study also showed that majority of underweight students were females, this could be due to the current trend for slimmness rather than malnutrition. The overweight and obesity were more prevalent among the male students in our study and similar findings were also observed in Greek adolescents.<sup>13</sup>

The accuracy of self reporting regarding BMI categories has found to be of acceptable in a recent study.<sup>14</sup> In our study we took opinion of students regarding presence of obesity in their parents and found positive correlation of presence of obesity in parents with its presence in studied students.<sup>15</sup> The observed higher frequency of underweight in adolescent age has also been reported from many other countries.<sup>16-19</sup> This has many important medical implications as it has been reported that it could lead to psychological and physical disorders including infertility.<sup>20-23</sup>

The WHO expert consultation reports that the universal BMI criteria developed by WHO are not suitable for Asian populations, since such individuals have different associations between BMI, percentage of body fat, and health risks, from European populations. There is no recommendation, however, for new clear BMI cut-off points for all Asians.<sup>24</sup> The proportion of Asian people with a high risk of type 2 diabetes and cardiovascular disease is substantial at BMIs lower than the existing WHO cut-off point for overweight ( $e'25 \text{ kg/m}^2$ ). Available data do not indicate a clear BMI cut-off point for all Asians for overweight or obesity. The cut-off point for observed risk varies from  $22 \text{ kg/m}^2$  to  $25 \text{ kg/m}^2$  in different Asian populations. It is recommended that current WHO BMI cut-off points should be retained as international classifications.<sup>25</sup>

The findings in our study of significant proportion of underweight especially among the female students is alarming. Studies have shown that there is relation between somatic and psychological variables in such individuals and a suppressed serum leptin levels have been documented in them.<sup>26</sup> There is also difference in perception for under-weight status in subjects suffering from it.<sup>27-28</sup>

## CONCLUSION

The study highlights the fact that obesity is not a major problem among the medical students but

under-weight is coming up as a significant problem particularly among the female medical students. Keeping in view that now about 80% of medical students belong to female gender this is a significant finding and needs better education and awareness.

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