Original Article

# Prevalence of Abnormal Body Mass Index Among Students of a Private Sector Medical College in Pakistan

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## ABSTRACT

**Objectives:** To determine the status of BMI among the students of Frontier Medical College, Abbottabad and to find out the frequency of different BMI groups.

**Design of Study:** Cross-sectional questionnaire based study.

**Place and Duration of Study:** This study was conducted from 01.11.2010 till 10.03.2011 in Frontier Medical College, Abbottabad.

**Materials and Methods:** A cross- sectional questionnaire based study was conducted in Frontier Medical College Abbottabad. Body weight and height of 400 students were measured and then their body mass index (BMI) was calculated. Keeping in view the WHO cut-offs, Under weight, Overweight and Obesity were defined.

**Results:** 9.75 % of students fell in the underweight category. About 63.25 % were in normal range. 21 % were Overweight while no less than 6 % formed the various categories of obesity

**Conclusion:** A significantly high proportion of students (36.75 %) were either over weight, obese or underweight. This is an alarmingly high percentage keeping in view the fact that all of them were 18-22 years of age. The students must be advised to take more care of their health status

**Key Words**: Body mass index, Obesity, Underweight, Overweight

## INTRODUCTION

Body Mass Index (BMI) is the ratio between the body weight and the height of a person and is calculated as,

BMI = Weight in Kg/Height $m^2$

Abnormality of this index, therefore, may be due to an unduly increased or decreased body weight with respect to the height. While the formula, previously called the *Quetelet Index* dates back to the 19th century, the new term "body mass index" for the ratio and its popularity date to a paper published in the July edition of 1972 in the Journal of Chronic Diseases by Ancel Keys. The interest in measuring body fat began due to obesity becoming a discernible issue in prosperous Western societies. BMI was explicitly cited by Keys as being appropriate for population studies, and inappropriate for individual diagnosis. Nevertheless, due to its simplicity, it came to be widely used for individual diagnosis, despite its inappropriateness[1,2]

BMI provided a simple numeric measure of a person's "fatness" or "thinness", allowing health professionals to discuss over and under-weight problems more objectively with their patients. However, BMI has become controversial because many people, including physicians, have come to rely on its apparent numerical authority for medical diagnosis, but that was never the BMI's purpose; it is meant to be used as a simple means of classifying sedentary (physically inactive) individuals with an average body composition.[3]

In clinical terms, a BMI between 25 and 29.9 $Kg/m^2$ is called overweight, and a BMI greater than 30 $Kg/m^2$ is called obese. BMI is not a direct estimate of adiposity and does not take into account the fact that some individuals have a high BMI due to a large muscle mass. When greater quantities of energy (in the form of food) enter the body than are expended, the body weight increases, and most of the excess energy is stored as fat. Therefore, excessive adiposity (obesity) is caused by energy intake in excess of energy output.[4]

The medical establishment has generally acknowledged some shortcomings of BMI. Because the BMI formula depends only upon weight and height, its assumptions about the distribution between lean mass and adipose tissue are not always exact. BMI sometimes overestimates adiposity on those with more lean body mass (e.g., athletes) while greatly under-estimating excess adiposity on those with less lean body mass. A study in June, 2008 by Romero-Corral et al examined 13,601 subjects from the United States ( Third National Health and Nutrition Examination Survey [NHANES III] ) and found that BMI-defined obesity was present in 21% of men and 31% of women. Using

body fat percentage (BF%), however, BF%-defined obesity was found in 50% of men and 62% of women. Thus BMI showed poor sensitivity.[5]

The reason the BMI is used for screening the health of the general population is due to the strong correlation between being overweight or obese and having health problems, chronic disease and premature death. People who are overweight or obese have an increased risk for Hypertension, Type 2 diabetes, Coronary heart disease, Stroke, Osteoarthritis, some cancers, Sleep apnea and respiratory problems. Over the past few decades, there has been a dramatic increase in the prevalence of obesity in many countries. The World Health Organization (WHO) estimates that more than 1 billion adults worldwide are overweight; of these, at least 300 million are obese [6]. Adipose tissue has been increasingly recognized as an active endocrine organ, capable of releasing a large number of cytokines and bioactive mediators that play important roles in the pathogenesis of many obesity-related diseases [7].

Relationship between an abnormal BMI and increased mortality has been studied by a large number of researchers in recent past. [8,9,10,11]

Body weight and height relationship and its association with physical activities are considered to be indicators of a life style and health status [12].A national representative survey indicates that, according to the Asian-Pacific BMI cut-off values, as much as 25% population of Pakistan is overweight and about 10% is obese [13]

The prevalence of underweight, overweight and obesity among young adults and college students has previously been documented.[14,15]

Such studies in Pakistan have largely been confined to a specific area situated in the southern part of the country.[16,17] Our present study was carried out in Frontier Medical College Abbottabad, which is situated in northern mountains. Aim of the study was not only to find out the BMI abnormalities of adolescent students but also to note if there is any gross difference in the results obtained from these geographically farthest apart medical institutions.

# MATERIALS AND METHODS

This study was conducted from 01.11.2010 till 10.03.2011 in Frontier Medical College, Abbottabad, Pakistan. It was a cross-sectional questionnaire based study. The study population included four hundred medical students of Frontier Medical College, Abbottabad. Every student was personally inquired about all the items of the data and body weight and height were measured. BMI was calculated by dividing weight in kilograms by height in meters square.

Following are the BMI cut-off points recommended by WHO,

<16.00 kg/m2 (severe underweight)
16.00- 16.99 kg/m2 (moderate underweight)
17.00-18.49 kg/m2 (mild underweight)
18.50-24.99 kg/m2 (normal range)
25.00-29.99 kg/m2 (pre obese)
30.00-34.99 kg/m2 (obese class I)
35.00-39.99 kg/m2 (obese class II)
≥ 40.00 kg/m2 (obese class III)

However, for practical purposes, the participants of our study were classified into the following four groups as well,

<16.00 kg/m2 -18.49 kg/m2 (underweight)
18.50-24.99 kg/m2 (normal range)
25.00-29.99 kg/m2 (overweight)
30.00-34.99 kg/m2 - ≥ 40.00 kg/m2 (obese )

# RESULTS

The questionnaire was provided to 400 students. All of them responded adequately and so were included in the study. Two hundred and Forty (60%) of them were males and remaining one hundred and sixty (40%) were females.

Mean height of students was 168.52 ±62cm. For males it was 172.91± 4.6cm and for females160.37 ± 6.2 cm. The difference was statistically significant (P <0.01)

Mean weight of students was 66.98 ± 10.6kg. That for male students was 71.77±11.2 kg

While for female students it was58.11±8.9kg. The difference was statistically significant (P <0.01)

Mean BMI of students was 22.80±3.2. Again, for males the mean BMI was 23.63±3.5

and for females 21.27±2.9.

According to the results obtained, 39 out of 400 students (9.75%) were underweight, 253 students (63.25%) were normal, 84 students (21%) were overweight or pre-obese, while 24 students (6%) were obese (Table-1).

Putting these results together, the total percentage of students with an abnormal BMI was as high as 36.75%. In males at it stood at38.08% while in females at 34.28% (Table-2). The precise details of the possible 8 groups according to WHO cut-off points were also tabulated (Table-3)

# DISCUSSION

It is clear from our study results that the medical students, be it males or females, are not careful about maintaining their body weight. Being overweight simply means to be in a preobese state, which if not properly taken care of, eventually culminates into obesity and this obesity is strongly associated with hypertension, ischemic heart disease, diabetes type-II, osteoarthritis and various types of cancers. A study published by JAMA in 2005 showed that "overweight" people had a similar relative risk of mortality to "normal" weight people as defined by BMI, while "underweight" and "obese" people had a higher death rate [18].

**Table No.1: Percentage wise BMI distribution of students**

| Gender | Underweight < 16.00-18.49 kg/m2 | Normal 18.50-24.99 kg/m2 | Over weight 25.00-29.99 kg/m2 | Obese 30.00-≥40.00 kg/m2 | Total |
|---|---|---|---|---|---|
| Males(260) | 4.22%(11) | 61.92%(161) | 24.61%(64) | 9.25%(24) | 100% |
| Females(140) | 20%(28) | 65.72%(92) | 14.28%(20) | 0%(0) | 100% |
| Both(400) | 9.75 %(39) | 63.25%(253) | 21%(84) | 6%(24) | 100% |

**Table No.2: Percentage of Healthy and Unhealthy students**

| Gender | Healthy | | Unhealthy | |
|---|---|---|---|---|
| | Number | Percentage | Number | Percentage |
| Males | 161 | 61.92% | 99 | 38.08% |
| Females | 92 | 65.72% | 48 | 34.28% |
| Total | 253 | 63.25% | 147 | 36.75% |

**Table -3: BMI categories according to WHO cut-off points**

| Gender | Underweight | | | Normal 18.50-24.99 kg/m2 | Over weight 25.00-29.99 kg/m2 | Obese | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | Severe < 16.00 kg/m2 | Moderate 16.00-16.99 kg/m2 | Mild 17.00-18.49 kg/m2 | | | I 30-34.99 kg/m2 | II 35-39.99 kg/m2 | III ≥40.00 kg/m2 | |
| Males | 0 | 3 | 8 | 161 | 64 | 21 | 3 | 0 | 260 |
| Females | 0 | 11 | 17 | 92 | 20 | 0 | 0 | 0 | 140 |
| | 0 | 14 | 25 | 253 | 84 | 21 | 3 | 0 | 400 |

Our study result showed that there are as much as 23% of students who form the overweight category. These are in synchronicity with a number of such studies carried out earlier, including one by Oguntibeju et al [19], giving the percentage of overweight students at 20%, and another one by Jaffar et al [13]calculating it at 25%.

Our study results, however, are highly contradictory to the two earlier studies conducted in Karachi: one in a medical university[16] giving the underweight category 29% whereas overweight category only 8% proportion. Another public sector Medical college[17] calculating it to the same level i.e. 29% and 12.6% respectively.

Now, this is very significant. According to these results, in the most southern medical institutions of the country, there is pronounced dominance of underweight students (29%) while those falling in Preobese and obese category are mere 10% or so. In our study carried out up north in mountains of Abbottabad this ratio is almost reversed i.e. only 10% are underweight while as much as 23% are definitely over weight (Pre obese and obese put together). It may be because of the general health status of the people living in these two locations; bulk of the students involved in these studies belongs to these cities and the surrounding areas. It is suggested that more research work in this regard be undertaken in other institutions, especially those located in the central regions of Pakistan.

Since most of the studies have been conducted in populations of European origin, relationship between BMI and the overall risk of death among Asians, who account for more than 60% of the world population, remains unclear. The definitions of overweight (BMI ≥25.0) and obesity (BMI ≥30.0) are based essentially on criteria derived from studies that involved populations of European origin. The validity of these criteria in Asian populations has yet to be determined. Studies have shown that for a given BMI, Asians generally have a higher percentage of body fat than do Europeans. On the basis of these observations, it has been proposed that the BMI cutoff points for overweight and obesity should be lower for Asian populations than they are for European populations (suggested cutoff points for Asians, ≥23.0 for overweight and ≥27.5 for obesity),although a 2004 consensus statement from the WHO concluded that the available data were not sufficient to support Asian-specific cutoff points to define overweight and obesity[20].The optimal weight range associated with a minimal risk of death in Asian populations remains controversial [21].Revision of the cut-off points for Asians, if however, may be considered for the people belonging to South East Asia, in whom the body frame is generally smaller than that of the rest of Asians

## CONCLUSION

We believe that preobesity, eventually leading to frank obesity, with all its sequels, is the real threat to the long term health status of these students. Regular exercise, careful selection of nature and amount of food, and keeping an eye on the weight measuring scales is all that is required.

## REFERENCES


1. Beyond BMI. Why doctors won't stop using an outdated measure for obesity, by Jeremy Singer-Vine, Slate.com, July 20, 2009
2. Keys, Ancel, Fidanza F, Karvonen MJ, Kimura N, Taylor HL. Indices of relative weight and obesity J Chronic Dis 1972;125(6):329–43.
3. Physical Status: The Use and Interpretation of Anthropometry". WHO Technical Report Series 854: 9.
4. Guyton AC, Hall JE. Dietary balance: Regulation of Feeding, Obesity and starvation, Vitamins and Minerals. In: Textbook of Medical Physiology, 11th ed. Philadelphia: WB Saunders & company; 2006.p.872.
5. Romero-Corral A, Somers VK, Sierra-Johnson J, Thomas RJ, Collazo-Clavell ML, Korinek J, et al. Accuracy of body mass index in diagnosing obesity in the adult general population. Int J of Obesit 2008;32 (6): 959–66.
6. Abelson P, Kennedy D. The obesity epidemic. Science 2004;304:1413-1413
7. Van Gaal LF, Mertens IL, De Block CE. Mechanisms linking obesity with cardiovascular disease. Nature 2006;444:875-880.
8. Whitlock G, Lewington S, Sherliker P, et al. Body-mass index and cause-specific mortality in 900 000 adults: collaborative analyses of 57 prospective studies. Lancet 2009;373:1083-1096
9. Flegal KM, Graubard BI, Williamson DF, Gail MH. Excess deaths associated with underweight, overweight, and obesity. JAMA 2005;293:1861-1867.
10. Gu D, He J, Duan X, et al. Body weight and mortality among men and women in China.JAMA 2006;295:776-783
11. Jee SH, Sull JW, Park J, et al. Body-mass index and mortality in Korean men and women.N Engl J Med 2006;355:779-787
12. Steyn NP, Senekal M, Brits S, Alberts M, Mashego T, Nel JH. Weight and Health of black female students. SA Med J 2000;90(2): 146-152.
13. Jafar TH, Chaturvedi N, Papps G. Prevalence of overweight and obesity and their association with hypertension and Diabetes Mellitus in an Indo-Asian population. CMAJ 2006;175:1071-7.
14. Hendricks KM, Herbold NH. Diet, activity and other health related behaviours in college- age women. Nutr Rev 1998; 56(3): 65-75.
15. Sax LJ. Health trends among college freshmen. Health Trends 1997;45: 252-262.
16. Aziz J, Siddiqui NA, Siddiqui IA, Omair A. Relation of body mass index with lipid profile and blood pressure in young healthy students at Ziauddin Medical University. J Ayub Med Coll Abbottabad 2003;160:898-904.
17. Minhas HT, Anis D, Jawaid A, Naeem H, Naz M, Zuberi BF. Estimation of body mass index in students of a public sector medical college in Pakistan. Pak J Med Sci 2010;26(4):918-922
18. Flegal KM, Graubard BI, Williamson DF, Gail MH. Excess Deaths Associated With Underweight, Overweight, and besity JAMA 2005;293(15): 186-7
19. Oguntibeju OO, Orisatoki RO, Truter EJ. The relationship between body mass index and physical activities among medical students in Saint Lucia. Pak J Med Sci 2010; 26(4):827-831
20. WHO Expert Consultation. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. Lancet 2004;363:157-163[Erratum, Lancet 2004;363:902.
21. Zheng MD, Dale F, McLerran MS, Rolland B. M.L.I.S Association between Body-Mass Index and Risk of Death in More Than 1 Million Asians. N Engl J Med.2011;364:719-729


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