

## Gender Differences of Body Mass Index in Adults of Pakistan: A Case Study of Multan City

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**Abstract:** Obesity is an epidemic health problem worldwide that can result in many serious and sometimes, fatal diseases. It is very important to study such prevalence in developing countries, like Pakistan where people cannot afford the medical tolls, additionally, added to their non-meeting budgets, due to problems of obesity. The present study addresses the same issue by taking into account of 2000 adults from Multan city as case study of Pakistan. Although many of similar studies have also been carried out in the region but the present study evaluates the obesity prevalence according to recommendations of World Health Organization that in Asia Pacific Region, a person is considered to be overweight if BMI  $\geq 23$  rather BMI  $\geq 25$  and to be obese if BMI  $\geq 25$  rather than if BMI  $\geq 30$ . According to this new definition, we report that more than 46% people are overweight (18.95%) and obese (27.85%). The percentage of normal people is just 28.65 while 24.55% are underweight. We report the mean MBI to be  $22.87 \pm 0.086$  (S.E), males have 13 kg more weight as compared to that of females have and males are more than 5 inches taller as compared to females, on the average. It is noted that mean BMI of males ( $23.51 \pm 0.11$ ) and mean BMI of females ( $22.05 \pm 0.133$ ) are different significantly. We find that 55.12% among males and 36.15% among females are either overweight or obese. The percentile plot of the data also displays the similar picture. We further report that married people are three times obese as compared to unmarried ones.

**Key words:** Obesity, BMI of females, BMI of males

### INTRODUCTION

Obesity is used to describe body weight that is much greater than what is considered healthy. It is considered a worldwide challenge to public health. As it has been related to numerous health risks, both physical and psychological therefore, its prevalence has led the World Health Organization (WHO) to declare it a "global epidemic" (WHO, 1998). On the behalf of International Diabetes Federation (2004), Jawad (2005) reports that more than 1.1 billion people in the world are estimated to be overweight and 320 million are calculated to be obese. More than 2.5 million deaths each year are attributed to obesity, a figure expected to double by 2030. Many of recent studies show that obesity should be taken scarily as it can result in many serious, and potentially deadly, health problems. These problems include hypertension, Type II diabetes mellitus, coronary diseases, infertility, kidney diseases and a higher risk for certain forms of cancer, such as those that affect the colon, prostate, endometrium and possibly breasts (Bray *et al.*, 1998; Marion and Jacobson, 2000; Ferris, 2007).

In developed countries, obesity is an intensifying public health problem. For example, Mokdad *et al.* (2002) report that 19.8% of U.S. adults in 2000 (20.2% for males and 19.4% for females) are obese and its prevalence rate is

rising alarmingly. Zohoori *et al.* (1998) show that the obesity rate among men aged 18-60 has increased considerably from 1992-1996 in Russia. Peytremann-Bridevaux (2007) reports the increase in prevalence of obesity in different European countries. Similarly, as a notion of obesity to be world wide health issue, El-Hazmi and Warsy (1997) estimate that 13.05% of Saudi males and 20.26% females also being obese.

Such irksome conditions of obesity prevalence are not much different in Pakistan. Bharmal (2000), focusing in Pakistan, reports that obesity in childhood and adolescent is increasing in developing countries. On the basis of National Health Survey of Pakistan (1998,) Pappas *et al.* (2001) report on the health status of the Pakistani population that the overweight prevalence rates for adults aged 25-64 years are 13.2% for men and 22.6% for women. Nanan (2002) also gives the similar comments about Pakistani population w.r.t. obesity. Afridi and Khan (2004) also reported similar details.

There are many ways to determine if a person is obese, but a person's Body Mass Index (BMI), defined as the ratio of weight (kg) to squared height ( $m^2$ ), has been popularly used as a measure of overweight and obesity. According to WHO's standards, a person is overweight if BMI  $\geq 25$  and is obese if BMI  $\geq 30$ .

According to Kan and Tsai (1993), the possession of knowledge on obesity's health risks prevents an individual from being overweight. So by the analysis of BMI, we can, implicitly, assume it to contribute to lessen the said hazards of obesity for public. The growth of obesity usually, results in high medical expenditures and is elevated risk of mortality and morbidity likely to accompany it. Obesity accounts for 2-6% of total health care costs in several developed countries (Khan *et al.*, 2008). Thus, there is a need to study such prevalence in developing country like Pakistan where people cannot afford to spend more on medical tolls due to their financial conditions. But most of the developing, transitional and newly industrialized countries are still not alert from the above-mentioned hazards of obesity. Pakistan is one amongst such countries.

In available literature, many studies can be found about the prevalence of obesity in Pakistan. But majority of them follow the same BMI cut-offs as defined by WHO, internationally and have already defined above. Such cut-offs are used by many of the researchers, in their studies, namely, Kiyani *et al.* (2002), Rehman *et al.* (2003), Shah *et al.* (2004), Khurram *et al.* (2006) and Khan *et al.* (2008) among many others, addition to them already mentioned above. But Nanan (2002), in a study, concludes, "In South Asia, including Pakistan, social and environmental changes are occurring rapidly, with increasing urbanization, changing lifestyles, higher energy density of diets and reduced physical activity. The coexistence of underweight in early life with obesity in adults may presage both a higher prevalence and incidence for Noncommunicable Diseases (NCDs) such as hypertension and diabetes". Thus, she favours the provisional recommendations for Asia Pacific Region published in February 2000 by the WHO Regional Office for the Western Pacific. These recommendations state to use of BMI  $\geq 23$  for overweight and BMI  $\geq 25$  for obesity, for the countries of Asia Pacific Region. So according to Nanan (2002), these new definitions may provide a more accurate determination of the health of Pakistanis, especially in those with more than one risk factor for NCDs. Recently, a large study in Chinese population has been published, with same reference (Leung *et al.*, 2008). Such details can also be found by Jaleel (2009).

The main objective of the present study is two-fold; first to study the obesity prevalence in adults in Pakistan by taking Multan city as a case study, according to new bounds of BMI and the second to study the differences in BMI among male and female adults. The reason for the study to be focused on adults is that according to Guo *et al.* (1994), the risk of being overweight in adulthood is greater with higher degrees of being overweight in childhood (Bovet *et al.*, 2004; Padula, 2008).

## MATERIALS AND METHODS

A cross-sectional data comprising 2000 adult (aged 14 years or more) individuals, both males and females were taken from Multan city from January 1, 2007 to December 31, 2008. The sample was taken by convenient sampling, from Bahauddin Zakariya University, Multan, different colleges and different public places, including parks and markets etc. For the present study, we take data on the variables, gender (1 = male and 2 female), marital status (0 = unmarried and 1= married), age (in years, rounded to next year), weight (in kg) and height (in inches).

BMI of the individuals are calculated as weight in kilograms divided by height in meters squared, using measurements obtained from medical examinations employing standardized procedures and equipments:

$$\text{BMI} = \frac{\text{Weight in kg}}{(\text{Height in meters})^2}$$

According to the recommendations of WHO (2000) for Asia Pacific Region, a person will be underweight (if BMI  $\leq 19$ ), normal (if  $20 \leq \text{BMI} < 23$ ), overweight (if BMI  $23 \leq \text{BMI} < 25$ ) and obese (BMI  $\geq 25$ ).

## RESULTS AND DISCUSSION

In our data set of 2000 individuals, 1123 are males (56.2%) and 877 are females (43.8%). Moreover, among these 2000 respondents, 1501(75.05%) are unmarried and 499 are married (24.95%). The mean age of the respondents is  $24.35 \pm 0.16$  (SE) years. These figures are  $25.92 \pm 0.23$  and  $22.33 \pm 0.18$  for males and females, respectively.

The summary of weight (in kg) and height (in inches) are given in Table 1 along with mean comparisons of males and females, using t-test. The table shows that mean weight of males is significantly greater than that of females and similar findings for mean height. We note that males have about 13 kg more weight, on the average, as those of females have. Similarly, males are about 5 inches taller, on the average, as compared to females.

We compute BMI as mentioned above. We report the mean MBI to be  $22.87 \pm 0.086$  (SE) that reflects that the respondents are normal in regard of obesity, on the average. But the mode value of 23.46 shows that majority of the respondents are overweight, according to new WHO's standards for the regions in which Pakistan lies. Furthermore, the value of median shows that more than 50% of the respondents have BMI greater than 22.72. It is a clear notion that people have notable tendency to become overweight and stepping towards obese. It can be noticed that mean, median and mode of BMI are almost equal and the same can be depicted by Fig. 1 that shows the symmetric histogram of BMI.

Table 1: Summary of weight (kg) and height (inches)

Variable	Gender	N	Mean	SE	t-statistic	d.f	p-value
Weight	Male	1123	68.11	0.318	27.92	1998	0.00
	Female	877	55.23	0.327			
	Total	2000	62.46	0.269			
Height	Male	1123	67.06	0.090	36.42	1998	0.00
	Female	877	62.37	0.088			
	Total	2000	65.01	0.082			

Table 2: Obesity status (Comparison among males and females)

Gender	Obesity status				Total
	Underweight	Normal	Overweight	Obese	
Male	199 (17.72)	305 (27.16)	240 (21.37)	379 (33.75)	1123
Female	292 (33.30)	268 (30.56)	139 (15.85)	178 (20.30)	877
Total	491 (24.55)	573 (28.65)	379 (18.95)	557 (27.85)	2000

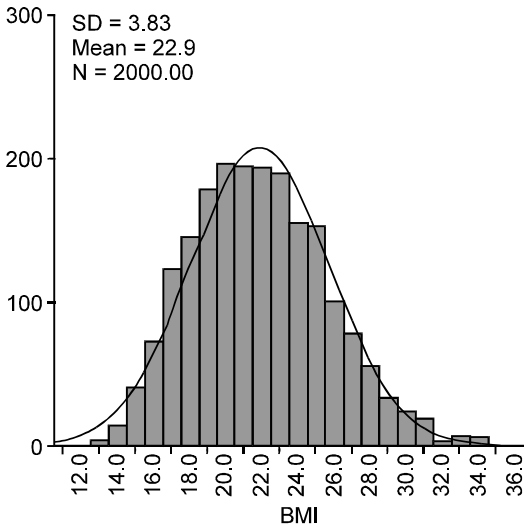


Fig. 1: BMI histogram

Table 2 presents the frequencies and percentages (shown in parentheses) of the underweight, normal, overweight and obese persons dividing in 1123 males and 877 females and also the same measures for the overall sample of 2000. From the table, we note that more than 46% people are overweight and obese. Percentage of normal people is just 28.65 while 24.55% are underweight. When we want to note the gender differences so far, we see that percentage of female underweight is double than that of males while 55.12% among males and 36.15% among females are either overweight or obese. We also compute Chi-square test for the association between gender and obesity status showing the similar findings that obesity status is highly associated with gender (Chi-square statistic = 87.266, d.f = 3 and p-value = 0.00). So, generally, in Multan city, males have higher tendency to become obese as compared to females. The same is also true when we compare mean BMI of males ( $23.51 \pm 0.11$ ) and mean

BMI of females ( $22.05 \pm 0.133$ ), we note that mean BMI of males is significantly (p-value = 0.00) larger than that of females. These estimated means of BMI for males and females are quite closer as reported by Shah *et al.* (2004) in their study and according to them the mean BMI was 22.4 (95% CI; 21.9, 22.9) for men and 22.6 (95% CI; 21.9, 23.2) for women. But they further use the previously available definitions of BMI as discussed earlier.

Table 3 gives a comparison between married and single adults. It presents the frequencies and percentages (shown in parentheses) of the underweight, normal, overweight and obese persons dividing in 1501 unmarried and 499 married people. We note that married people are about three times obese as when compared with unmarried ones. The percentage of married people who are successful in controlling their weights is almost half to that for unmarried ones. The one chief reason for these figures is that married people are indulged in many activities regarding economical, their children, social commitments etc. so they are not able to take good care of their health. The percentage of unmarried underweight is about five times as compared to that of married people. When we compare the mean weights of married and unmarried people, it is found that mean weight married people is about 10 kg more than that of unmarried people (p-value = 0.00).

Fig. 2 portrays a percentile plot where 10<sup>th</sup>, 20<sup>th</sup>, ... , 90<sup>th</sup> percentiles have been drawn against the BMI for males and females in order to indicate gender differences and for the whole sample as well. According to new WHO standards, we take BMI cut-offs at 19, 23 and 25. The same interpretation can be derived as Table 3 does. The overweight of males starts above 40<sup>th</sup> percentile while the same starts above 60<sup>th</sup> percentile for females. The obesity for males exits between 60<sup>th</sup> and 70<sup>th</sup> percentile while the same begins near 80<sup>th</sup> percentile for females. The plot also shoes that about one-quarter number of females are underweight.

Table 3: Obesity status (Comparison among married and unmarried people)

Marital status	Obesity status				Total
	Underweight	Normal	Overweight	Obese	
Unmarried	457 (30.45)	492 (32.78)	267 (17.79)	285 (18.99)	1501
Married	34 (6.81)	81 (16.23)	112 (22.44)	272 (54.51)	499
Total	491	952	479	78	2000

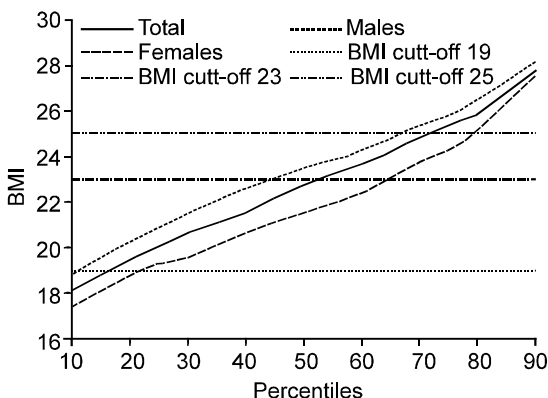


Fig. 2: Percentile plot

**Conclusion:** The present study about BMI of 2000 adults including 1123 males (56.2%) and 877 females (43.8%) conducted in Multan city, concludes that males have about 13 kg more weight, on the average, as that of females have. According to new recommendation of WHO regarding obesity definition in Asia Pacific Region, a considerable number (more than 46%) of the respondents is found to be overweight and obese. It is reported that the percentage of female underweight percentage of female underweight is double than that of males and males are about 20% more overweight and obese as compared to females. When we compare obesity of married people as compared to unmarried ones, we report that married people are about three times obese as compared to unmarried ones. These figures show an alarming situation that needs serious attention for policy makers and the people of health concern.

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