

## Frequency, Distribution and Determinants of Obesity

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### ABSTRACT

**Objective:** Obesity is the state of the body where weight of the individual is high as compared to his/her weight. It is taken with reference to body mass index according to WHO. In this study we are going to determine the frequency, distribution and determinants of obesity in a selected area.

**Study Design:** A cross sectional study

**Place and Duration:** Gomal Medical College, D.I.Khan, Pakistan. 16/08/2020 to 20/05/2020

**Material and Results:** Out of 206 subjects, 18 (8.73%, 90% CI 5.47-11.93%) were obese, while 188 (91.3%, 90% CI 88.07-94.53%) were non obese. There is no association between obesity and sex, obesity and age groups and obesity and occupation in our population.

**Conclusion:** The frequency of obesity was significantly less in our population than the other national and international studies. The proportion of obese men in our study is more than expected values from literature and the reverse is true for women. The proportion of obese persons in age group 19-39 years in our study is more than the expected values from literature and the reverse is true for the age group of 40-59 years. The proportion of obese office workers in our study is same as in other studies and the same is true for obese physical workers. There is no association between obesity and sex, obesity and age groups and obesity and occupation in our population.

**Keywords:** Obesity, Obese, Healthy.

### INTRODUCTION

Obesity is defined as state of the body where the weight of an individual is high as compared to his/her height.<sup>2</sup> Obesity is defined from the body mass index of a person which can be calculated as dividing the weight of the person taken in kilograms by the person height taken in meter square. A person with a BMI above 25 kg/m<sup>2</sup> is considered overweight, and above 30 kg/m<sup>2</sup> is considered obese.<sup>2</sup> It is established that obesity develops when the energy expenditure is low compared to food intake which leads to chronic imbalance state food intake. However it is believed that other factors such as family history, genetics, behavior, life style, eating behavior and some medicine can lead to this condition.<sup>2</sup>

Obesity especially if left un-noticed can lead to serious complications and many chronic diseases such as cardiovascular diseases, diabetes mellitus, GI diseases and in presence of other risk factors such as high cholesterol levels, alcohol intake, smoking and high blood pressure levels increases the chances of developing serious complications. Obesity can also cause menstrual abnormalities, sleep disorders, joint disorders and many other medical as well as social problems. It is believed that obesity can lead to decrease life expectancy and one can live 6-7 years shorter than a normal individuality. For now it is well known that eating behavior including diet and sedentary life style contributes a lot to the development of obesity. Obesity was formally recognized as an epidemic by WHO in 1997. In 2008 300 million adults were recognized as obese persons by WHO in which women were more than men. Obesity is in association with age as it increases when one ages and high numbers of obese persons can be found in age group 50-60. Obesity is recognized now as a worldwide problem and it is affecting both the high and low income countries compared to previous times where it was believed that obesity is a problem of developed countries only. Just like other countries Pakistan is also facing the problems of obesity and it is considered now a chronic health issue which is affecting the lives of these peoples in various health and socio-economic fields. Major contributing factors to obesity in Pakistan are unhealthy food, rich in oil and sedentary life style. Pakistan ranked 165 in terms of its overweight population with 22% of individuals over the age of 15 crossing the threshold of obesity.<sup>2</sup>

### MATERIALS AND METHODS

**Design, Duration and Setting:** This cross sectional study was conducted from 16/08/2020 to 20/05/2020 at Gomal Medical College, D.I.Khan, Pakistan.

**Approval & Consent:** This proposal was submitted for approval to the Departmental Research & Ethics Committee of the Department of Community Medicine and got approved. The verbal consent of the participants was taken.

**Sample Size, Sampling Technique and Randomization:** The population of the study was comprised of all the population of Gomal Medical College, D.I.Khan, Pakistan as in April 2020 of 854 elements, including three strata of 479 students, 106 teaching staff and 269 management staff respectively. Stratified random probability technique was employed. A proportionate sample size of 206 including 115 students, 26 teaching staff and 65 management staff was calculated by online Raosoft® sample size calculator<sup>3</sup> with a margin of error 6.2% confidence level of 95%, population size of 854 and response distribution of 50%. A sampling frame of 220 subjects was formed including 124 students, 27 teaching staff and 69 management staff to cover absenteeism and refusals. Random numbers were generated for each strata through an online random numbers generator<sup>4</sup>.

**Equipment and Procedure of Conduct:** Data was collected through observation by using weight machine and meter tap. The subjects were requested to attend the Department of Community Medicine for weight and height measurements. Weight in kilograms (rounded to nearest kg) and height in meters (with two decimals) was measured. BMI was calculated as weight in kg divided by height in meter square. Presence of obesity was calculated on the basis WHO criteria as obese with BMI > 30 and non-obese as BMI ≤ 30.

**Data Collection Plan:** Data was collected for the following four variables.

- Demographic variables
- Sex with two attributes of;
  - Men
  - Women
- Age groups with two attributes of;
  - 19-39 years
  - 39-60 years
- Occupation with two attributes of;

- Office (Indoor) workers
- Physical (Outdoor) workers
- Research Variables
- Presence of obesity with two attributes of;
  - Obese (BMI > 30)
  - Non obese (BMI ≤ 30)

**Data Analysis:** Descriptively each of the four variables was analyzed by count and percentage. Estimation of parameters for proportion for population was given as confidence interval at confidence level of 90% for each variable. Frequency of obesity (H<sub>01</sub>) and distribution of the presence of obesity by sex, age groups and occupation (H<sub>01</sub>-H<sub>04</sub>) was analyzed separately by chi square goodness-of-fit test.<sup>5,6</sup> The observed counts of the sample was compared to the counts of the population .To see for association, presence of obesity was considered independent variable and sex, age groups and occupation (H<sub>05</sub>-H<sub>07</sub>) were dependent variable each separately. Chi-square test of association<sup>5,6</sup> was used here. chi-square statistic, degree of freedom and significance level was given at alpha 0.05 for all the seven tests.

**RESULTS**

**Univariate Descriptive Analysis and Estimation of Parameters:**

Out of 206 subjects 153 (74.31%) were men and 53 (25.7%) were woman, 181 (87.9%) were 19-39 years, 25 (12.1%) were 40-60. 163 (79.1%) were office workers, while 43 (20.9%) were physical worker. Out of 206 subjects, 18 (8.73%, 90% CI 5.47-11.93%) were obese, while 188 (91.3%, 90% CI 88.07-94.53%) were non obese.

**Testing of Hypothesis:** The observed frequency of obesity in the sample was compared with the expected frequency from the study by Ogden CL<sup>7</sup> and colleagues from United States by chi-square goodness-of-fit test at alpha 0.05 as in Table 1.

Table 1: Comparison of observed (sample) to the expected (population) frequency of obesity

Obesity	O	E	O-E	(O-E) <sup>2</sup>	(O-E) <sup>2</sup> /E	X <sup>2</sup>	d.f.	P-value
Obese	18	72	-54	2916	40.50	62.26	1	<0.00001
Non obese	188	134	54	2916	21.76			

O = Observed counts, E = Expected Counts, X<sup>2</sup> = Chi-square value, d.f. = degree of freedom  
H<sub>01</sub> proved to be false.

The distribution of obesity frequency by sex in the sample was compared with the expected distribution of obesity by sex in the population by chi square goodness-of-fit test at alpha 0.05. The expected counts are taken from the study by Hales CM and his colleagues from United States.<sup>8</sup> Table 2

Table 2: Comparison of observed (sample) to the expected (population) distribution of obesity by sex

Sex	O	E	O-E	(O-E) <sup>2</sup>	(O-E) <sup>2</sup> /E	X <sup>2</sup>	d.f.	P-value
Men	16	8.64	7.36	54.17	6.27	12.057	1	0.0005
Women	2	9.36	-7.36	54.17	5.79		2	

O = Observed counts, E = Expected Counts, X<sup>2</sup> = Chi-square value, d.f. = degree of freedom  
H<sub>02</sub> was rejected showing that the observed distribution of obesity by sex in sample is different from population. In simple words the frequency of obesity in men in our sample is more than expected for population and the reverse is true for women.

The distribution of obesity by age groups in the sample was compared with the expected distribution of obesity by sex in the population by chi-square goodness-of-fit test at alpha 0.05. The expected counts are taken from the study by Hales CM and his colleagues from United States.<sup>8</sup> Table 3

Table 3: Comparison of (sample) to the expected (population) distribution of obesity by age groups

Age groups	O	E	O-E	(O-E) <sup>2</sup>	(O-E) <sup>2</sup> /E	X <sup>2</sup>	d.f.	P-value
19-39 years	13	8	5.00	25.00	3.12	5.62	1	0.0177
40-60 years	5	10	-5.00	25.00	2.50			1

O = Observed counts, E = Expected Counts, X<sup>2</sup> = Chi-square value, d.f. = degree of freedom  
H<sub>03</sub> proved to be false, rejected showing that the observed distribution of obesity by age groups in sample is different from population.

The distribution of obesity by occupation in the sample was compared with the expected distribution of obesity by occupation in the population by chi-square goodness-of-fit test at alpha 0.05. The expected counts are taken from the study by Adil M<sup>9</sup> and colleagues from Bannu, Pakistan.<sup>9</sup> Table 4

Table 4: Comparison of observed (sample) to the expected (population) distribution of obesity by occupation

Occupation	O	E	O-E	(O-E) <sup>2</sup>	(O-E) <sup>2</sup> /E	X <sup>2</sup>	d.f.	P-value
Office Workers	14	15.48	-1.48	2.19	0.14	1.01	1	0.3147
Physical Workers	4	2.52	1.48	2.19	0.87			

O = Observed counts, E = Expected Counts, X<sup>2</sup> = Chi-square value, d.f. = degree of freedom  
H<sub>04</sub> accepted showing that the observed distribution of obesity by occupation in sample is same as in population.

To see for association, presence of obesity was an independent variable and sex was a dependent variable. Chi-square test of association was used here at alpha 0.05. Table 5

Table 5: Association between the presence of obesity and sex in the population

Sex	Presence of Obesity		Rows Total	X <sup>2</sup>	d.f.	P-value
	Obese	Non obese				
	O (E) [x <sup>2</sup> ]	O (E) [x <sup>2</sup> ]				
Men	16 (13.37) [0.52]	137 (139.63) [0.05]	153	2.2053	2	0.137537
Women	2 (4.63) [1.49]	51 (48.37) [0.14]	53			
Columns Total	18	188	206			

O = Observed counts, E = Expected Counts, X<sup>2</sup> = Chi-square value, d.f. = degree of freedom  
H<sub>05</sub> proved to be true, hence accepted showing that there is no association between obesity and sex in our population.

The association between the presence of obesity and age groups in the population was checked by chi-square test at association at alpha 0.05. Table 6

Table 6: Association between the presence of obesity and age groups in the population

Age Groups	Presence of Obesity		Rows Total	X <sup>2</sup>	d.f.	P-value
	Obese	Non Obese				
	O (E) [x <sup>2</sup> ]	O (E) [x <sup>2</sup> ]				
18-25	7 (10.75) [1.31]	116 (112.25) [0.13]	123	4.4657	2	.107223
26-40	7 (5.33) [0.52]	54 (55.67) [0.05]	61			
41-60	4 (1.92) [2.25]	18 (20.08) [0.22]	22			
Columns Total	18	188	206			

O = Observed counts, E = Expected Counts, X<sup>2</sup> = Chi-square value, d.f. = degree of freedom  
H<sub>06</sub> proved to be true, hence accepted showing that there is no association between obesity and sage groups in our population.

The association between the presence of obesity and occupation in the population was checked by chi-square test of association alpha 0.05. Table 7

Table 7: Association between the presence of obesity and occupation in the population

Occupation	Presence of Obesity		Rows Total	X <sup>2</sup>	d.f.	P-value
	Obese	Non Obese				
	O (E) [x <sup>2</sup> ]	O (E) [x <sup>2</sup> ]				
Office workers	14 (14.24) [0]	149 (148.76) [0]	153	0.0217	2	0.88285 3
Physical workers	4 (3.76) [0.02]	39 (39.24) [0]	53			
Columns Total	18	188	206			

O = Observed counts, E = Expected Counts, X<sup>2</sup> = Chi-square value, d.f. = degree of freedom

H<sub>7</sub> proved to be true, hence accepted showing that there is no association between obesity and occupation in our population.

## DISCUSSIONS

The observed frequency of obesity in our sample was 18/ 244 (8.73%). It was compared with the expected frequency of 3201/9120 (35.09%) from the study by Ogden CL<sup>7</sup> and colleagues from United States for years 2011-2012 as in Table 1. It proved that the prevalence of obesity in our population is four times less than the prevalence of obesity in US. The prevalence of obesity in U.S. adults was 39.8% which is almost 5 times greater than our prevalence of 8.73%.<sup>8</sup> The prevalence of obesity in Pakistan is 9% in adults which is similar to our finding of 8.7%.<sup>8</sup> A study done in Lahore, Pakistan and published in March-April 2016, showed the prevalence of obesity in medical students to be 51/244 (20.9%), 2.5 times higher than our percentage of obesity.<sup>9</sup> The prevalence of obesity in health employees of Bannu Medical College and its affiliated teaching hospitals was 20% in 2011.<sup>10</sup>

In our sample the distribution of obesity was more in men as compared to woman which is in contrast to the expectations and the reverse is true for women as in Table 2. Our value was 10.5% for men and 3.2% for women versus 38.0% for men and 41.5% for women in U.S. study, which is almost four times greater for men than ours and almost 13 times greater for women than our value.<sup>8</sup> There were 18/86 (20.93%) obese men and 4/86 (4.65%) obese women in study from Bannu by Adil M and colleagues in 2011 versus our findings of 10.5% for men and 3.2% for women respectively, these are comparable.

The distribution of obesity by age groups in sample is different from population in our study. National Center for Health Statistics reported the prevalence of obesity in adults in US as 35.7% in age group 20-39 years and 42.8% in age group 40-59 yrs for 2015-16. The frequency of obesity in our age group of 19-40 years was 7.2% which is five times less than their prevalence for age group of 20-39 years, while the frequency of obesity in our age group of 41-60 years was 20.0% which is almost half of their prevalence for age group of 40-59 years.<sup>8</sup>

The distribution of obesity by occupation in sample is same as in population in our study. The data for comparison was taken from a study conducted in 2011 in Bannu Medical College and its affiliated teaching hospitals in Bannu, Pakistan. Here we squeezed

three groups of teachers, administrative staff and paramedical staff into office workers and support staff into physical workers in the study of Bannu.<sup>10</sup>

H<sub>05</sub> accepted showing that there is no association between obesity and sex in our population.

H<sub>06</sub> proved to be true, hence accepted showing that there is no association between obesity and age groups in our population. No relevant articles were available for comparison in local, national, regional and global literature.

There is no association between obesity and occupation in our population, while a study from USA by Choi B and colleagues showed that low physical activity workers are at high risk for being obese which is contrary to our results.<sup>11</sup>

## CONCLUSIONS

- The frequency of obesity was significantly less in our population than the other national and international studies.
- The proportion of obese men in our study is more than expected values from literature and the reverse is true for women.
- The proportion of obese persons in age group 19-39 years in our study is more than the expected values from literature and the reverse is true for the age group of 40-59 years.
- The proportion of obese office workers in our study is same as in other studies and the same is true for obese physical workers.
- There is no association between obesity and sex, obesity and age groups and obesity and occupation in our population.

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