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## Association of Age and Gender with the BMI of Obese Individuals in Lahore, Pakistan

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### Abstract

Obesity is a serious public health concern. It is expanding exponentially across the globe and is associated with chronic diseases, such as Type II diabetes and cardiovascular diseases. The aim of the current study was to find the association among age, gender, and Body Mass Index (BMI) of obese individuals residing in Lahore, Pakistan. This cross-sectional study was carried out in January 2021. Data was collected through an electronic questionnaire. A total of 868 individuals (84.3% female and 15.7% male) of ages between 18 to 60 years participated in the current study. Convenient sampling method was used. Anthropometrics including weight, height, and age were taken in kilograms (kg), centimeters (cm) and years, respectively. The standard equation to calculate BMI was used (weight in kg/height in m<sup>2</sup>). WHO BMI cut-points for Asians were used to assess the BMI status of the selected individuals. Statistical analysis was carried out through Microsoft Excel and SPSS. It was found that the prevalence of obesity was 17.2% (12% Type I obesity, while 2.6% Type II and Type III obesity), while 15.1% participants were found to be overweight, 22.7% were underweight, and 44.9% were determined to be normal. It was also determined that the prevalence of underweight, overweight, Type I, Type II, and Type III obesity is more common among women (20.6%, 12.3%, 9.2%, 2.3%, and 2%, respectively) than men (2.1%, 2.8%, 2.8%, 0.3%, and 0.7%, respectively) ( $p$ -value <0.05), indicating a positive association. The highest prevalence of underweight, overweight, Type I, Type II, and Type III obesity was observed in age group 19-21 years (11.1%, 7.3%, 7.4%, 1.5%, and 2.1%, respectively) ( $p$ -value <0.05). These results would help to develop public health programs and preventive measures to reduce the prevalence of the above risk factors for obesity and other non-communicable diseases.

## 1. Introduction

The purpose of the current study is to assess the relationship among BMI, age, and gender of obese individuals in Lahore, Pakistan. Obesity is the abnormal buildup of fat in the body which poses serious health risks [1]. Obesity has increased manifolds worldwide during the last few decades, especially in developed countries [2]. The prevalence of obesity has doubled since 1980. One-third of the world population can be categorized as obese or overweight, irrespective of their locality, gender, or ethnicity. Moreover, obesity is widely prevalent among all countries and nations [3]. It has become the leading concern in causing medical ailments, leaving behind under-nutrition and infections [4, 5]. It has also increased the risk of heart diseases, diabetes, hypertension, and cancer in the world population [6, 7]. The critical parameter used to define obesity is known as Body Mass Index (BMI), in which the body weight in kilograms is divided by height in m<sup>2</sup>. Keeping in view the Asian cut-off point, the person with the BMI of 25 kg/m<sup>2</sup> or above is categorized as obese [8].

Obesity is growing worldwide and it will predictably affect more than one billion people by 2030. Obesity has become a leading public health concern as it enhances insulin resistance and is linked with developing comorbidities, such as metabolic syndrome (Mets), cardiovascular diseases (CVDs), and Type II diabetes mellitus [9]. According to the World Health Organization (WHO), obesity bears a huge economic load on healthcare systems worldwide, with 1.9 billion adults being overweight. Obesity incurred in the middle age increases the risk of dementia in the old age [10, 11]. According to WHO, 60% of the disease burden around the world is due to obesity. MONICA project by WHO

shows that obesity at an increased rate is found especially in the western nations; however, as the Asian inhabitants are thought to have more central obesity, their cut-off values are reduced and these values show an increasing trend of obesity in the Asian nations too [12].

Obesity is caused by several factors; mostly, it is taken as the accumulation of fat in adipose tissues because of high energy intake or minimum physical activity [13, 14]. Taking a significant portion of energy intake after midday can also lead to obesity [15]. Food with a high sugar content is regarded as a more prominent factor in causing weight gain and a direct association was found between the intake of high sugar content and increasing cases of obesity [16, 17]. Human and animal trials showed that food which is high in fat content can induce hyperphagia (passive overconsumption), which leads to fat storage of 50-100g/day in human body [18, 19]. Fancy advertisements of packaged and processed foods and widespread addiction to overeating also play a significant role in obesity [20]. Specific hormone imbalances and body issues also lead to obesity. Furthermore, obesity is inherited genetically [21].

A number of studies have pointed out the association of obesity with gender, since obesity was found to be more common in women as compared to men. A six-level study conducted in Kashmir concluded that the value of BMI in women is more than men, which shows that women were more obese than men in the study population [22]. Another study conducted in Ghana also found women more obese (7.4%) than men (2.8%) [23]. Obesity is increasingly affecting individuals of all ages and there has been a noted increase in the prevalence of childhood obesity too. Another study was conducted to compare childhood obesity with adult obesity. The results

showed that overweight and obesity are more common in children than adults in Australia. In the United States, obesity has been increasing in both children and adults, although its trend was found to be increasing at a greater speed in adulthood than childhood in Indonesia [24].

In Pakistan, statistics show that about 4.8% of the population comes in the obese category, where school going children and women of child bearing age are at increased risk. A report stated that 28% of men and 36% of the women of Pakistan were obese in 2013 [34].

## 2. Methodology

This cross-sectional study was conducted in Lahore, Pakistan in January 2021. A total of 868 individuals participated in it. Research objectives were mentioned in the questionnaire for the knowledge of the participants. An electronic version of the questionnaire was shared among them through social media. Demographic data was self-reported by the participants, such as their age in years, height in centimeters (cm), and weight in kilograms (kg). BMI was calculated using the standard equation (weight in kg/height in m<sup>2</sup>) [25, 26]. World Health Organization (WHO) BMI cut-points including [underweight (<18.5 kg/m<sup>2</sup>), normal (18.5–22.9 kg/m<sup>2</sup>), overweight (23–24.9 kg/m<sup>2</sup>), Type I obesity (25–27.49 kg/m<sup>2</sup>), Type II obesity (27.5–29.9 kg/m<sup>2</sup>), and Type III obesity (≥30 kg/m<sup>2</sup>)] for Asians were used to examine the weight status [8]. The whole data was recorded in Microsoft Excel and SPSS (Statistical Package for the Social Sciences) version 22 was used to perform the statistical analysis.

## 3. Results

The sample consisted of participants with an average age of 20.26 years (2.15622).

Out of the total participants, 84.3% were men and 15.7% were women (Table 1). Data showed that 19.6% of participants were ≤18 years of age, 51% fell between 19-21 years of age, 23.3% were aged between 22-24 years, and 2.1% were ≥ 25 years of age (Table 1). The prevalence of overweight (BMI 23–24.9 kg/m<sup>2</sup>) individuals was 15.1%, while 22.7% were underweight (BMI <18.5 kg/m<sup>2</sup>). Among the overweight individuals, 12% were Type I obese (BMI 25–27.49 kg/m<sup>2</sup>), 2.6% were Type II (BMI 27.5–29.9 kg/m<sup>2</sup>) obese, and 2.6% were Type III obese (BMI ≥30 kg/m<sup>2</sup>), while 44.9% were normal (BMI 18.5–22.9 kg/m<sup>2</sup>) (Table 1).

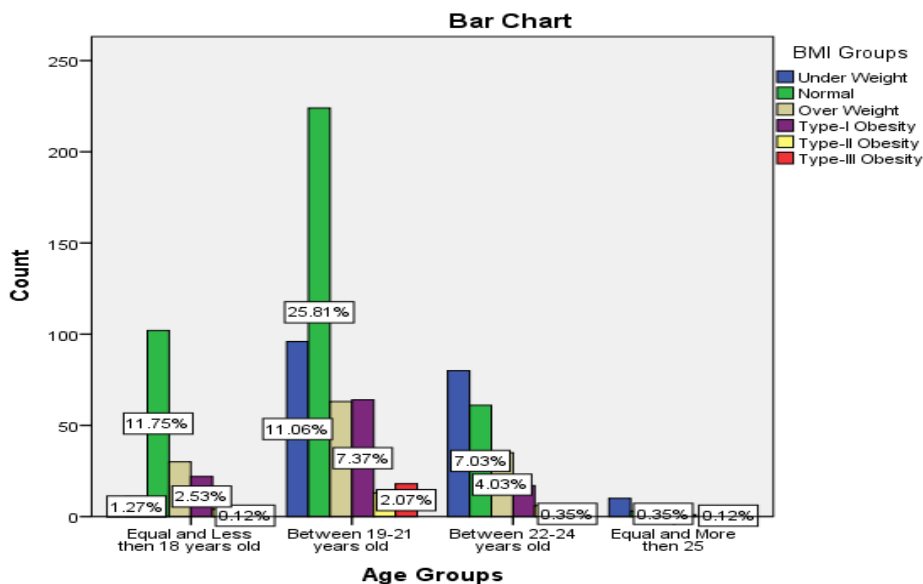
**Table 1.** Descriptive Analysis of Demographic Characteristics

Variables	Frequency	Percent
<b>Gender</b>		
Male	136	15.7
Female	732	84.3
Total	868	100.0
<b>Age Groups</b>		
≤18	170	19.6
19-21	478	55.1
22-24	202	23.3
≥25	18	2.1
Total	868	100.0
<b>BMI Groups</b>		
Underweight	197	22.7
Normal	390	44.9
Overweight	131	15.1
<b>Obesity</b>	<b>150</b>	<b>17.2</b>

Variables	Frequency	Percent
Type-I Obesity	104	12.0
Type-II Obesity	23	2.6
Type-III Obesity	23	2.6
Total	868	100.0

Overall, the prevalence of obesity was 17.2% (12% Type I obesity, 2.6% Type II obesity, and another 2.6% Type III obesity). The prevalence of underweight, overweight, Type I obesity, Type II obesity, and Type III obesity among female participants was 20.6%, 12.3%, 9.2%, 2.3%, and 2%, respectively, while 37.9% were normal weight (Table 2). Among the male participants, the prevalence of underweight, overweight, Type I obesity, Type II obesity, and Type III obesity was 2.1%, 2.8%, 2.8%, 0.3%, and 0.7%, respectively,

while 7% were normal weight (Table 2). The prevalence of underweight, overweight, Type I, Type II, and Type III obesity was greater in female participants (20.6%, 12.3%, 9.2%, 2.3%, and 2%, respectively) than male participants (2.1%, 2.8%, 2.8%, 0.3%, and 0.7%, respectively) ( $p$ -value <0.05) (Table 2). Among the age groups, for age group  $\leq 18$  years the prevalence of underweight, overweight, Type I, Type II and Type III obesity was 1.3%, 3.5%, 2.5%, 0.5%, and 0.1%, respectively; for age group 19-21 years it was 11.1%, 7.3%, 7.4%, 1.5%, and 2.1%, respectively; for age group 22-24 years it was 9.2%, 4%, 2%, 0.7%, and 0.3%, respectively; and for age group  $\geq 25$  years it was 1.2%, 0.3%, 0.1%, 0%, and 0.1%, respectively (Table 3, Fig II). These figures show that the highest prevalence of underweight, overweight, Type I, Type II, and Type III obesity was found in the age group 19-21 years ( $p$ -value <0.05) (Table 3).



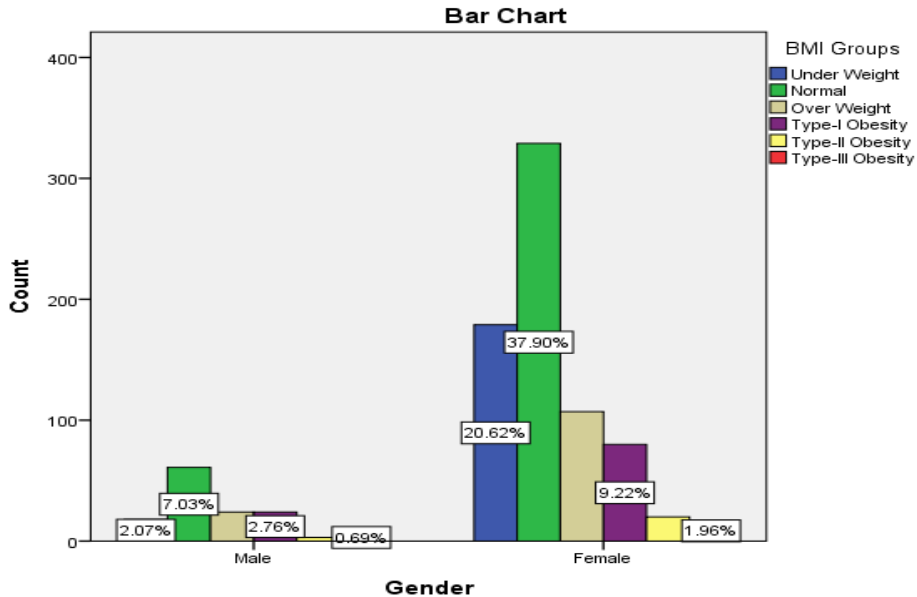
**Figure 1.** Association of Age with Weight Status

**Table 2.** Association between BMI and Gender

Gender		BMI					Chi-Square	P	
		Underweight	Normal	Overweight	Type I Obesity	Type II Obesity			Type III Obesity
<b>Male</b>	Count	18	61	24	24	3	6	13.387	0.020
	%	2.1	7.0	2.8	2.8	0.3	0.7		
<b>Female</b>	Count	179	329	107	80	20	17		
	%	20.6	37.9	12.3	9.2	2.3	2.0		
<b>Total</b>	Count	197	390	131	104	23	23		
	%	22.7	44.9	15.1	12.0	2.6	2.6		

**Table 3.** Association between BMI and Age

Age (Years)		BMI					Chi-Square	P	
		Underweight	Normal	Overweight	Type I Obesity	Type II Obesity			Type III Obesity
<b>≤18</b>	Count	11	22	30	22	4	1	90.59	0.00
	%	1.3	2.5	3.5	2.5	0.5	0.1		
<b>19-21</b>	Count	96	64	63	64	13	18		
	%	11.1	7.4	7.3	7.4	1.5	2.1		
<b>22-24</b>	Count	80	17	35	17	6	3		
	%	9.2	2.0	4.0	2.0	0.7	0.3		
<b>≥25</b>	Count	10	1	3	1	0	1		
	%	1.2	0.1	0.3	0.1	0.0	0.1		
<b>Total</b>	Count	197	390	104	104	23	23		
	%	22.7	44.9	15.1	12.0	2.6	2.6		



**Figure 2.** Association between BMI and Gender

#### 4. Discussion

Obesity has become a serious health hazard for the whole world. It carries many comorbidities with it. It leads to insulin resistance in the body [27, 28], which progressively becomes diabetes, causes heart diseases, cancer, and also affects the immune system adversely [29]. In women of child bearing age, it causes hormonal imbalance resulting in infertility. Obesity is caused by multiple factors; however, major causes include eating caloric-dense food more than nutrient-dense food, accompanied by low physical activity. This excessive energy causes the buildup of fats in the body that hinders daily life activities in many ways. In Pakistan, despite the fact that a significant proportion of people live below the poverty line [30], obesity has increased manifolds during the last two decades. Moreover, no particular measures have been taken to overcome its prevalence.

This study was intended to find out the prevalence of obesity in Lahore, Pakistan. The city is ranked as the 10<sup>th</sup> most populated city of the world [31]. It was observed that obesity was more prevalent in female participants as compared to male participants. Similarly, participants in age group 19-21 years were found to have the highest obesity prevalence. WHO BMI cut-points were used in this study. The BMI cut-point of the Asian populations is 2-kg/m<sup>2</sup> less than the non-Asian populations because their body fat and muscle composition are different [8].

In the current study, the prevalence of overweight participants was 5.1%, while 22.7% were underweight and 44.9% were normal weight. A similar study published in the journal Environmental Research and Public Health stated that 5.8% men and 5.2% women are obese [32]. According to another comprehensive review of studies conducted in Pakistan, 9% prevalence was

observed in male participants and 14% in female participants [33].

In comparative terms, the prevalence of Type I obesity was the highest (12%) and overall, 17.2% of the participants were obese. Numerous studies have observed obesity as the leading cause of Type II diabetes, cardiovascular diseases, and hypertension [6].

## 5. Conclusion

Obesity is no more a problem for a particular age group or gender, since it affects every ethnicity, gender, and age. Childhood obesity is also a leading concern. Obesity is increasing day by day in the Pakistani population. This study highlights that 17.2% of the population is obese, whereas a more significant percentage of the population falls in the overweight category. The overweight population is also at risk of obesity.

## 5.1 Implications

The current study only involved the population of Lahore and it can be the reason behind the varying percentages of obese individuals in different studies. Research should be planned on a larger scale to get a more accurate idea of obesity prevalence in the country. If there is no timely intervention, the prevalence of obesity will become more alarming. Obesity can lead to other comorbidities which affect the quality of an individual's life and add economic load to the health sector. The current investigation can act as a red flag for public health department to take timely action across the country. There is a dire need to introduce lifestyle modification plans, nutrition interventions, and preventive programs to reduce the prevalence of obesity in Pakistan.

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