An Investigation into Obesity Rates and Health Risks Among Adults in Peshawar (Pakistan)

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https://doi.org/10.62345/jads.2024.13.3.142

Abstract

This study underscores the critical public health importance of addressing obesity, particularly in urban areas like Peshawar city. The significant associations between obesity and a range of severe health conditions—such as depression, hypertension, joint pain, diabetes, kidney disease, and heart disease—highlight the urgent need for targeted interventions. The findings emphasize the amplified risk for obese individuals, with odds ratios revealing the extent of vulnerability to both physical and psychological health issues. Furthermore, the gender-specific differences in weight and height, along with the prevalent social issues like sleep disturbances, teasing, and discrimination, suggest that obesity's impact extends beyond medical complications to affect overall quality of life. The study's insights are essential for informing healthcare strategies, promoting public awareness, and guiding policy development aimed at reducing obesity rates and mitigating its far-reaching consequences.

Keywords: Hypertension, Diabetes, Depression, Kidney Disease, Heart Diseases.

Introduction

The objective of this study is crucial in addressing one of the most pressing global health issues of our time: the rapid rise in obesity. By focusing on obesity, particularly in the context of both developed and developing countries, the study highlights the need for a comprehensive understanding of its causes, consequences, and possible interventions. Given that obesity significantly increases the risk of non-communicable diseases like cardiovascular diseases, diabetes, and cancer, this study aims to provide vital insights that can inform public health strategies.

Understanding the interplay of genetic, environmental, and lifestyle factors in driving obesity is essential for developing effective prevention and treatment methods. The study's focus on Body Mass Index (BMI) as a measure of obesity also underscores its relevance in identifying at-risk populations, which is key for targeted interventions. As obesity rates continue to rise—affecting 39% of the global adult population, with a notable 62% of obese individuals now residing in developing countries—this research is critical for helping policymakers, healthcare professionals,

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Compliance with ethical standards: There are no conflicts of interest (financial or non-financial). This study did not receive any funding.

and communities tackle obesity’s far-reaching impacts on health, quality of life, and healthcare systems.

$$\text{BMI} = \frac{\text{Wt (Kg)}}{\text{Ht (Meter square)}}$$

Wt (kg) = Weight in kilogram,
Ht = Height in meters square

A normal BMI score is one that falls between 18.5 and 24.9. This indicates that a person is within the normal weight range for his or her height. A BMI chart is used to categorize a person as underweight, normal, overweight, or obese.

Table 1: BMI

Body Mass Index (BMI)	**Weight Status**
Below 18.5	Underweight
18.5 – 24.9	Normal
25.0 – 29.9	Overweight
30.0 plus	Obese

BMI is a tool used by healthcare professionals to screen for overweight and obesity. It helps assess an individual's risk for health issues such as heart disease, type 2 diabetes, high blood pressure, and joint diseases associated with excess weight.

Obesity Prevalence in Adults

Global obesity prevalence varies widely, with significant differences observed across and within countries. Between 1998 and 2008, more men than women were obese globally, though this varied by region. For example, obesity rates ranged from less than 2% in Bangladesh to over 80% in Tonga. In countries like New Zealand and Fiji, obesity rates differ significantly between ethnic groups, with higher prevalence among Pacific Islanders compared to Europeans and Indigenous Fijians compared to Fijians of Indian descent. The global rise in obesity, often referred to as "globesity," is a major public health issue, particularly in developing countries where obesity rates have tripled in the past 20 years. In Pakistan, obesity is on the rise, with 25.5% of women and 18.8% of men overweight, and 3.6% of women and 1% of men obese, according to WHO estimates. Urban areas show even higher rates of overweight and obesity. Pakistan's diet, rich in energy-dense foods, saturated fats, and sugars, contributes to the growing obesity problem, exacerbated by the popularity of processed foods, fast food, and sugary drinks, especially among the younger population. Rapid urbanization and modernization are further shifting dietary patterns towards high-fat diets.

Literature Review

Obesity is a global health concern, with a rapid increase in prevalence observed over the past few decades. According to the World Health Organization (WHO, 2016), over 1.9 billion adults were classified as overweight, and 650 million of them were obese. This rise in obesity has been associated with a significant increase in non-communicable diseases (NCDs) such as cardiovascular diseases, Type 2 diabetes, and certain types of cancer, which contribute to higher morbidity and mortality rates (Ng et al., 2014). Obesity has become a particular concern in developing countries, where it coexists with undernutrition, reflecting a complex double burden of disease (Popkin et al., 2012).

In Pakistan, the prevalence of obesity has been steadily increasing. According to a study by Jafar et al. (2013), about 25% of adults in Pakistan are classified as overweight or obese. The rise in obesity can be attributed to a combination of factors, including sedentary lifestyles, unhealthy dietary habits, urbanization, and genetic predispositions (Mishra et al., 2015). Peshawar, like many urban areas in Pakistan, has witnessed a shift in lifestyle patterns, with increasing reliance on processed foods and decreased physical activity, contributing to the obesity epidemic.

The relationship between obesity and health risks is well-documented in scientific literature. Obesity is associated with increased risks of hypertension, diabetes, dyslipidemia, and cardiovascular diseases (Haslam & James, 2005). Research by Guh et al. (2009) emphasizes that obese individuals are more likely to experience multiple comorbid conditions, further complicating disease management and leading to reduced quality of life. Moreover, studies have highlighted the psychosocial effects of obesity, including stigma, teasing, and discrimination, which negatively affect mental health and social well-being (Puhl & Heuer, 2010).

A study conducted by Alam et al. (2019) on the prevalence of obesity in Khyber Pakhtunkhwa, including Peshawar, reported that obesity rates in the region are significantly higher among women and urban dwellers. The study emphasized the importance of public health interventions to address obesity, particularly through awareness campaigns promoting healthier diets and physical activity.

Simmonds et al. (2016), conducted a systematic review later combined with meta-analysis to examine whether BMI and similar measures used to calculate childhood obesity could also predict adult obesity. Their review supported the conclusion that teenage obesity is a notable public health crisis because, it often continues into adulthood. Accordingly, acting to reduce teen obesity can also reduce adult obesity.

De squire et al. (2020), Presented a survey that evaluated potential relationships between obesity and COVID-19 as traced through increased hospitalization rates, poor diagnosis and recovery outcomes, and high death rates. This survey identified and validated associations between high BMI (that is, significantly higher than 30 kg/msup2) and poor COVID-19 outcomes. The researchers also discerned a high severity of clinical COVID-19 and a considerable prevalence of ICU and general hospitalizations in patients with high BMI led to worse outcomes.

Ananth Kumar et al. (2020) conducted a survey on patient responses to consultations about excess weight, examining how physician weight and the perceived health impact of obesity influenced these responses. The study found that patients were more likely to respond honestly to trusted clinicians who approached weight loss discussions non-judgmentally, and that weight loss efforts were more successful when clinicians emphasized the benefits in a supportive manner.

Felso et al. (2017) conducted a systematic literature review (SLR) exploring the link between sleep duration and childhood obesity, investigating potential physiological mechanisms. Their study found that shorter sleep duration is associated with weight gain in children, though the exact mechanisms are unclear. They also identified additional factors like a sedentary lifestyle, unhealthy diet, and insulin resistance as contributors to poor sleep and subsequent weight gain. The role of other potential mediators, such as ghrelin, screen time, and leptin levels, remains uncertain. The study highlights that much of the literature on obesity focuses on factors influencing adult obesity, with machine learning techniques increasingly being used in health applications, including disease recognition. However, only limited research has focused on associations between ML approaches and obesity. Moreover, understanding the potential association of obesity and its chronic diseases with severe outcomes is vital but still often neglected in previous studies.

Erem (2015) analyzed the significant rise in obesity among the adult Turkish population over 20 years. The prevalence increased from 18.8% in 1990 (28.5% among women and 9% among men) to 36% in 2010 (44% among women and 27% among men). The study identified key risk factors for adult obesity, including age, gender, hypertension, hyperlipidemia, smoking cessation, alcohol consumption, high income, low education, physical inactivity, occupation, marital status, and family medical history. Erem emphasized the urgent need for public health measures, such as education on balanced diets and promoting physical activity, to combat obesity.

Tada and Miura (2018) conducted a systematic review to explore the link between mastication (chewing) and obesity in adults. They analyzed 18 studies published between 2007 and 2016. The review found that 12 out of 16 cross-sectional studies showed an association between poor mastication and obesity. Additionally, one cohort study revealed that obese individuals had higher tooth loss, and one randomized controlled trial (RCT) demonstrated that an 8-week gum-chewing intervention significantly reduced waist circumference.

Fernández-Navarro et al. (2016) used machine learning (ML) to study the interactions between serum free fatty acids and fecal microbiota in relation to obesity. Their analysis, employing decision tree structures (DTS), identified serum eicosatetraenoic acid and gender as the most significant factors, with 100% and 80% significance, respectively. They also applied ML to identify new biomarkers for tracking knee osteoarthritis in overweight and obese women, using a heuristic called ranked guided iterative feature elimination (RGIFE). The ML models achieved high performance (AUC > 0.7) with relatively few variables.

Dunstan et al. (2020) used three machine learning algorithms—support vector machines (SVM), random forests (RF), and extreme gradient boosting—to predict obesity on a national level. Their study found that the consumption of flours and baked goods, dairy-product cheeses, and sugar-sweetened carbonated drinks were the most accurate predictors of obesity prevalence.

Cheng et al. (2020), revealed that significant predictors of adult obesity.

Al Kibria (2019) analyzed data from the 2016 Nepal Demographic and Health Survey to examine the prevalence and determinants of underweight, overweight, and obesity among adults in Nepal. Using both WHO and Asian-specific BMI cutoffs, the study found a median BMI of 21.5 kg/m². Underweight prevalence was 16.7%, overweight ranged from 18.2% to 26.4%, and obesity ranged from 4.3% to 11.0%, depending on the cutoff used. The study revealed that extreme body weight categories were influenced by factors such as age, sex, education, wealth, location, and ecological zone. Higher education and wealth were associated with increased overweight and obesity but decreased underweight.

Wrzosek et al. (2018) studied 469 bariatric surgery candidates to explore the relationship between the age at obesity onset and health outcomes. They found that individuals who became obese before age 20 had higher body fat mass and a greater risk of severe obesity (BMI > 40) compared to those who became obese at age 20 or older. Interestingly, despite longer obesity duration and higher BMI, early-onset obesity was associated with lower rates of hypertension and Type 2 diabetes. The study highlights the impact of obesity onset age on health parameters in bariatric surgery candidates.

Al-Sharafi et al. (2021) studied the risk of prediabetes and diabetes among 612 adults with a BMI ≥25 kg/m². The study found that 70.1% of participants had a family history of diabetes. Multivariate analysis showed that class III obesity significantly increased the risk of prediabetes (AOR 3.10) and diabetes (AOR 3.35). Participants with diabetic siblings also had increased risks for prediabetes (AOR 1.72) and diabetes (AOR 2.24). Additionally, khat chewing was associated with higher risks for prediabetes (AOR 1.61) and diabetes (AOR 2.09). Consanguinity combined with having diabetic siblings was linked to a higher risk of diabetes ($p = 0.031$).

Methodology

Our study, "Obesity and Its Implications Among Adults of Peshawar City," addresses the critical public health issue of obesity. This research, a key concern in health sciences, explores prevention, treatment, and quality of life for individuals with obesity. It includes original research using traditional methods, systematic literature reviews (SLRs), and novel approaches like machine learning (ML). This section outlines the research design and the statistical methods employed in the study. We employed a cross-sectional research design conducted across various clinics affiliated with a tertiary care hospital in Peshawar, Pakistan, aiming to include diverse socioeconomic and ethnic backgrounds. We utilized a non-probability convenience sampling method, gathering data from 215 adults aged 18 and above who visited primary health care units, allowing us to quickly and cost-effectively capture a wide range of perspectives. Convenience sampling, although practical and straightforward, does not ensure a representative sample of the broader population, as participants are selected based on their availability. To visually represent our data, we used a pie chart, which illustrates how a whole is divided into segments, each representing a part of the total, useful for showing proportions in a simple format. Additionally, we employed multiple bar charts to compare two or more characteristics for a common variable. These charts display grouped bars with varying lengths and colors, facilitating easy comparison of multiple data sets.

Chi-Square Test

The Chi-Square distribution, first obtained by F.R. Helmert in 1876 and later popularized by Karl Pearson, is crucial in statistical inference. It compares observed values, gathered through direct observations, with expected values based on hypotheses. The distribution, which uses degrees of freedom (d.f.) as its sole parameter, applies to tests of goodness of fit, independence, and homogeneity. Degrees of freedom depend on the number of observations minus the number of parameters estimated. The Chi-Square test uses a contingency table to compare observed and expected frequencies across categories.

$$\chi^2 = \sum_i^r \sum_j^e \left(\frac{(Oij - eij)}{eij}\right)^2$$

Where O_{ji} is the observed frequency of the j^{th} cell and
E_{ij} is the expected frequency of the ij^{th} cell.
We reject the null hypothesis, if and only if when the calculated p-value is less than the level of significance with (r – 1) degree of freedom, otherwise accept the null hypothesis for the same level of significance. The null and alternative hypothesis is:
H_o: There is no association between the two variables.
H_1: There is an association between the two variables

Odds Ratio

An odds ratio is simply the ratio of two odds. It is a way to compare the probability of an event in two groups whether it is the same or not. If not, then which one is more or less likely to happen? The 2 x 2 contingency, tables are shown below.

Table 2: Odds ratio

	No of success	Number of failures	
Group 1	A	B	a+ b
Group 2	C	D	C+ d
	a+ c	b+ d	a+b+c+d

The Mann-Whitney U Test

The Mann-Whitney U test is a non-parametric alternative to the student's two sample t test which requires random sampling from normal population with equal variances. The test is based on ranks and is used to determine whether or not two independent samples of size n_1 and n_2 come from populations having identical distributions. The null hypothesis to be tested is that the two populations are identical. To carry out the test, we arrange all $n_1 + n_2$ observations of the combined samples in order of increasing magnitude and assign the ranks 1,2, …., $n_1 + n_2$ to them. In case of ties, we assign the average of the tied ranks. We add the ranks assigned to the observations in sample 1 and denote this sum by R_1. Similarly, we calculate the sum of ranks of sample 2 and denote it by R_2. We then find, for both samples, the values of U, (the statistic used in this test) as below;

$$U_1 = n_1 n_2 + \frac{n_1(n_1+1)}{2} - R_1 \quad \textbf{and} \quad U_2 = n_1 n_2 + \frac{n_2(n_2+1)}{2} - R_2$$

We choose the smaller of the two values found for U_1 and U_2 as the value of the U statistic for the Mann-Whitney U test i.e. U= min [U1, U2].

We reject our null hypothesis if the calculated value of U is ≤ the smaller value or is ≥ the larger tabulated value.

Kolmogorov-Smirnov Test

The Kolmogorov–Smirnov test is a nonparametric test used to determine if two distributions differ or if a sample's distribution deviates from a hypothesized one. Unlike the Mann–Whitney and Wilcoxon tests, which focus on differences between means or medians, the Kolmogorov-Smirnov test assesses the entire distribution function. It can also be employed as a goodness-of-fit test for a single sample against a known distribution.

Statistical Analysis

A study was conducted in Peshawar city to identify factors influencing obesity and its implications among adults. Obesity, a common health issue, is linked to chronic diseases like cardiovascular diseases, Type 2 Diabetes, and various cancers. The study aimed to create awareness among adults about these risks, promoting weight loss through physical activity and diet control. A sample of 215 adults (201 men and 14 women) was analyzed using SPSS. Of these, 163 were obese, with many experiencing multiple health problems such as hypertension, heart disease, diabetes, and depression.

Table 3: Marital Status of Obese Individuals

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unmarried	70	42.9	42.9	42.9
	Married	93	57.1	57.1	100.0
	Total	163	100.0	100.0	

The table displays the marital status distribution of a sample consisting of 163 individuals. Among the respondents, 70 are unmarried, representing 42.9% of the sample. This percentage indicates that nearly 43% of the participants are single. Conversely, 93 individuals, or 57.1% of the sample, are married. This figure shows that the majority of the participants are married. Combining these two categories accounts for the entire sample, with 100% of the responses falling into either the unmarried or married categories. Thus, the sample includes no missing data regarding marital status.

Table 4: Distribution of Heart Disease by Gender

		Heart Disease		Total
		Yes	No	
Gender	Male	27	123	150
	Female	6	7	13
Total		33	130	163

The table titled "Distribution of Heart Disease by Gender" reveals how heart disease is distributed between males and females in a sample of 163 individuals. Among the males, 27 out of 150 have heart disease, while 123 do not. This indicates a higher prevalence of heart disease among males in this sample. In contrast, among the 13 females, only 6 have heart disease, with the remaining 7 females being free from the condition. Overall, there are 33 individuals with heart disease and 130 without. This distribution highlights a higher incidence of heart disease among males compared to females in this particular sample.

Table 5: Gender * Diabetes Crosstabulation

		Diabetes		Total
		Yes	No	
Gender	Male	40	110	150
	Female	3	10	13
Total		43	120	163

The table titled "distribution of diabetes by gender" provides insights into the prevalence of diabetes among males and females in a sample of 163 individuals. Among the 150 males, 40 have diabetes, while 110 do not, indicating a notable incidence of diabetes within this group. In contrast, among the 13 females, only 3 have diabetes, with the remaining 10 being free from the condition. Overall, 43 individuals in the sample have diabetes, whereas 120 do not. This distribution highlights a higher prevalence of diabetes among males compared to females in the sample, with the majority of both genders not having the condition.

Table 6: Gender * Depression Crosstabulation

		Depression		Total
		Yes	No	
Gender	Male	61	89	150
	Female	8	5	13
Total		69	94	163

The table titled "distribution of depression by gender" shows the prevalence of depression among males and females in a sample of 163 individuals. Among the 150 males, 61 are reported to have depression, while 89 do not, indicating a significant incidence of depression within this group. In contrast, among the 13 females, only 8 have depression, and 5 do not. Overall, there are 69 individuals with depression and 94 without it. This distribution underscores that depression is more common among males compared to females in this sample, although the majority of both genders do not suffer from depression.

Table 7: Gender * Joint Pain Crosstabulation

		Joint Pain		Total
		Yes	No	
Gender	Male	55	95	150
	Female	6	7	13
Total		61	102	163

The table titled "distribution of joint pain by gender" provides insights into the prevalence of joint pain among males and females in a sample of 163 individuals. Among the 150 males, 55 report experiencing joint pain, while 95 do not, indicating a notable occurrence of joint pain in this group. In contrast, among the 13 females, only 6 report having joint pain, with 7 not experiencing it.

Table 8: Odds Ratio of Diabetes VS Obesity

	Value	95% Confidence Interval	
		Lower	Upper
Odds Ratio for Obesity (yes / No)	2.747	1.096	6.889
For cohort Diabetes = Yes	2.286	1.032	5.063
For cohort Diabetes = No	.832	.728	.952
N of Valid Cases	215		

Overall, 61 individuals in the sample have joint pain, and 102 do not. This distribution demonstrates that joint pain is more prevalent among males compared to females in this sample, although the majority of both genders are unaffected by the condition.

The table displays the odds ratios for obesity in relation to diabetes status, along with their 95% confidence intervals. The overall odds ratio for obesity is 2.747, suggesting that individuals with obesity are approximately 2.747 times more likely to have diabetes compared to those without obesity. The confidence interval (1.096 to 6.889) indicates that we are 95% confident this ratio is within this range, and since it does not include 1, the association is statistically significant. For individuals with diabetes, the odds of having obesity are 2.286 times higher compared to those without diabetes, with a confidence interval of 1.032 to 5.063, also indicating statistical significance. Conversely, for individuals without diabetes, the odds of having obesity are 0.832 times lower compared to those with diabetes, with a confidence interval of 0.728 to 0.952. This suggests that while obesity is linked to a higher likelihood of diabetes, the relationship is more pronounced in individuals with diabetes.

Table 9: **Chi-Square Test Results of Diabetes and Obesity**

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1side)
Pearson Chi-Square	4.935	1	.026		
Continuity Correction	4.128	1	.042		
Likelihood Ratio	5.501	1	.019		
Fisher's Exact Test				.036	.017
Linear-by-Linear Association	4.912	1	.027		
N of Valid Cases	215				

The table presents the results of various statistical tests used to examine the relationship between two categorical variables. The Pearson Chi-Square test yields a value of 4.935 with a p-value of 0.026, indicating a significant association between the variables. The Continuity Correction test, with a value of 4.128 and a p-value of 0.042, also suggests a significant relationship, adjusting for continuity in 2x2 tables. The Likelihood Ratio test shows a value of 5.501 and a p-value of 0.019, further supporting the presence of a significant association. Fisher's Exact Test provides a 2-sided p-value of 0.036 and a 1-sided p-value of 0.017, confirming significant results, especially useful for smaller sample sizes. Additionally, the Linear-by-Linear Association test, with a value of 4.912 and a p-value of 0.027, indicates a significant linear trend. Overall, with 215 valid cases included in the analysis, all tests consistently show a statistically significant relationship between the variables.

Table 10: Chi-Square Test Result of Kidney Disease and Obesity Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1sided)
Pearson Chi-Square	3.033[a]	1	.022		
Continuity Correction	2.068	1	.150		
Likelihood Ratio	3.887	1	.049		
Fisher's Exact Test				.126	.065
Linear-by-Linear Association	3.019	1	.082		
N of Valid Cases	215				

The table displays the results of various statistical tests examining the relationship between two categorical variables. The Pearson chi-square test shows a value of 3.033 with a p-value of 0.022, indicating a statistically significant association between the variables. In contrast, the continuity correction test, with a value of 2.068 and a p-value of 0.150, suggests that the association is not significant when adjusted for small sample sizes. The Likelihood ratio test shows a value of 3.887 and a p-value of 0.049, confirming a significant association. Fisher's exact test provides a 2-sided p-value of 0.126 and a 1-sided p-value of 0.065, both indicating that the association is not statistically significant, particularly with the 2-sided p-value above 0.05. The Linear-by-Linear Association test has a value of 3.019 and a p-value of 0.082, suggesting that the linear trend is not significant. Overall, while the Pearson chi-square and likelihood ratio tests suggest a significant association, the other tests do not, indicating mixed results regarding the relationship between the variables.

Table 11: Odds Ratio of Obesity Vs Joint Pain Risk Estimate

	Value	95% Confidence Interval	
		Lower	Upper
Odds Ratio for Obesity (yes / No)	2.229	1.066	4.659
For cohort Joint Pain = Yes	1.769	1.009	3.100
For cohort Joint Pain = No	.794	.660	.954
N of Valid Cases	215		

The table provides odds ratios for obesity related to joint pain status, along with their 95%confidence intervals. The odds ratio for obesity indicates that individuals with obesity are approximately 2.229 times more likely to experience joint pain compared to those without obesity, with a confidence interval of 1.066 to 4.659. This interval suggests a statistically significant association, as it does not include the value of 1. For individuals who have joint pain, the odds of having obesity are 1.769 times higher, with a confidence interval ranging from 1.009 to 3.100, also reflecting a significant relationship. Conversely, for those without joint pain, the odds of having obesity are 0.794 times lower compared to those with joint pain, with a confidence interval of 0.660 to 0.954, indicating a significant association. Overall, these results demonstrate that obesity is significantly linked to joint pain, with higher odds for those with obesity and joint pain, and lower odds for those without joint pain.

Table 12: Chi-Square Test Results of Joint Pain and Obesity Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.685[a]	1	.030		
Continuity Correction	3.983	1	.046		
Likelihood Ratio	4.957	1	.026		
Fisher's Exact Test				.042	.021
Linear-by-Linear Association	4.663	1	.031		
N of Valid Cases	215				

The table displays the results of several statistical tests used to evaluate the association between two categorical variables. The Pearson Chi-Square test shows a value of 4.685 with a p-value of 0.030, indicating a statistically significant association between the variables. The Continuity Correction test, which adjusts for small sample sizes, yields a value of 3.983 and a p-value of 0.046, also confirming a significant relationship. The Likelihood Ratio test, with a value of 4.957 and a p-value of 0.026, supports the presence of a significant association. Fisher's Exact Test provides a 2-sided p-value of 0.042 and a 1-sided p-value of 0.021, both confirming the significance of the relationship, particularly useful for smaller sample sizes. Additionally, the Linear-by-Linear Association test shows a value of 4.663 with a p-value of 0.031, indicating a significant linear trend in the association. Overall, these results collectively demonstrate a robust and statistically significant relationship between the two variables.

Table 13: Chi-Square Test Result of Teasing Vs Obesity

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.935[a]	1	.026		
Continuity Correction	4.128	1	.042		
Likelihood Ratio	5.501	1	.019		
Fisher's Exact Test				.036	.017
Linear-by-Linear Association	4.912	1	.027		
N of Valid Cases	215				

The value of chi square is 4.935 with P-value 0.026 which is significant at 5% level of significance. Hence there is association between obesity and teasing. The estimated odds ratio for Low self-esteem is 5.185 with 95% confidence interval (1.191, 22.569). This odds ratio suggests that those individuals who are obese are 5.185 times more likely to have Low self-esteem than those individuals who are not obese.

Table 14: Chi-Square Test Results of Low Self-Esteem Vs Obesity Chi-Square Tests

	Value	Df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	5.836	1	.016		
Continuity Correction	4.778	1	.029		
Likelihood Ratio	7.281	1	.007		
Fisher's Exact Test				.019	.009
Linear-by-Linear Association	5.809	1	.016		
N of Valid Cases	215				

The value of chi square is 5.836 with P-value 0.016 which is significant at 5% level of significance. Hence there is association between obesity and Low self-esteem. The estimated odds ratio for Heart-disease is 6.346 with 95% confidence interval (1.468, 27.438). This odds ratio suggests that those individuals who are obese are 6.346 times more likely to have heart diseases than those individuals who are not obese.

Table 15: Chi-Square Test Results of Heart Diseases Vs Obesity

	Value	Df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	7.035	1	.008		
Continuity Correction	5.656	1	.017		
Likelihood Ratio	11.716	1	.001		
Fisher's Exact Test				.005	.003
Linear-by-Linear Association	7.002	1	.008		
N of Valid Cases	215				

The table presents results from various statistical tests used to evaluate the relationship between two categorical variables. The Pearson Chi-Square test shows a value of 7.035 with a p-value of 0.008, indicating a statistically significant association between the variables. The continuity correction, with a value of 5.656 and a p-value of 0.017, also confirms this significant association after adjusting for continuity in 2x2 tables. The Likelihood Ratio test, with a value of 11.716 and a p-value of 0.001, indicates a strong and highly significant association. Fisher's Exact Test provides a 2-sided p-value of 0.005 and a 1-sided p-value of 0.003, both confirming a significant relationship, particularly useful for smaller sample sizes. Additionally, the Linear-by-Linear Association test, with a value of 7.002 and a p-value of 0.008, indicates a significant linear trend in the association. Overall, these results collectively demonstrate a robust and statistically significant association between the variables.

Table 16: Odds Ratio of Hypertension Vs Obesity Risk Estimate

	Value	95% Confidence Interval	
		Lower	Upper
Odds Ratio for Obesity (yes / No)	2.229	1.066	4.659
For Cohort Hypertension = Yes	1.769	1.009	3.100
For Cohort Hypertension = No	.794	.660	.954
N of Valid Cases	215		

The table provides insights into the relationship between obesity and hypertension through various odds ratios and their 95% confidence intervals. The odds ratio for obesity indicates that individuals with obesity are about 2.229 times more likely to have hypertension compared to those without obesity, with a confidence interval ranging from 1.066 to 4.659, which confirms a statistically significant association. For individuals with hypertension, the odds of having obesity are 1.769 times higher, with a confidence interval between 1.009 and 3.100, highlighting a significant link. In contrast, for those without hypertension, the odds of having obesity are 0.794 times lower, with a confidence interval from 0.660 to 0.954, also showing a significant association. Overall, with 215 valid cases in the analysis, these results indicate that obesity is significantly associated with an increased likelihood of hypertension, especially among those who already have hypertension, while it is less associated with obesity in individuals without hypertension.

Conclusion

This study aimed to explore the health implications of obesity among adults in Peshawar City, with a focus on understanding its associations with various physical and psychological conditions. A total of 215 adults (201 males and 14 females) were included in the analysis, out of which 163 individuals were classified as obese (BMI > 30). The findings revealed a strong link between obesity and several serious health issues, significantly increasing the risk of conditions like depression, diabetes, kidney diseases, heart diseases, and joint pain. Specifically, obese individuals were 2.447 times more likely to suffer from depression, 2.747 times more likely to have diabetes, 5.169 times more likely to develop kidney diseases, 6.346 times more likely to experience heart diseases, and 2.229 times more likely to face joint pain compared to their non-obese counterparts. In addition to these physical health risks, the study also highlighted psychological and social challenges faced by obese individuals, including low self-esteem, teasing, and social stigma. These findings underscore the wide-reaching impact of obesity, both physically and emotionally.

The study employed rigorous statistical analysis, using methods such as the Mann-Whitney test and the Kolmogorov-Smirnov test, to evaluate differences between groups. These tests revealed significant variations in weight and height between genders, as well as across different marital statuses, suggesting that obesity patterns may differ based on these demographic factors. This comprehensive analysis provides valuable insights into the multi-faceted consequences of obesity in the region, emphasizing the need for targeted public health interventions to address the growing epidemic.

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