

## Association of Depression with Body Mass Index among Ischemic Heart Disease Patients: A Cross-Sectional Study

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### ABSTRACT

**Background:** Globally, ischemic heart disease (IHD) is one of the main causes of death. It manifests clinically as myocardial infarction and ischemic cardiomyopathy. The current study shows that there is a strong association between depression and body mass index among ischemic heart disease patients. **Objectives:** To determine the association of depression with BMI among IHD patients. **Methodology:** An analytical cross-sectional study has been conducted among IHD patients admitted to selected hospitals, Khyber Teaching Hospital and Hayatabad Medical Complex, Peshawar, Pakistan, using convenient sampling techniques. **Results:** 196 participants were included in this study from tertiary hospitals in Peshawar. In the current study, the mean and standard deviation (SD) of age were (59.35±14.59). This study reveals that there is a strong association between depression and BMI among IHD patients. The depressions of participants were minimal depression (8.2%), mild depression (16.8%), moderate depression (24.5%), moderately severe depression (31.1%), and severe depression (19.4%). The association of depression with BMI (P value is.021). **Conclusion:** Depression is the major cause of ischemic heart disease. Because of the increase in platelet activation, endothelial dysfunction has been implicated as a potential pathophysiological pathway for ischemic heart disease.

**Keywords:** Depression, Body mass index (BMI), ischemic heart disease (IHD).

**I. INTRODUCTION:** According to the World Health Organization, cardiovascular diseases (CVD) cover a bundle of diseases, including ischemic heart diseases (IHD) and cerebrovascular diseases. IHD is caused by plaque formation inside the blood vessel walls, which constricts vessels and constricts blood supply to the heart (1). A major cause of death globally, ischemic heart disease

(IHD) is also known as coronary artery disease (CAD). Major depression (MD) is characterized by sadness or irritability combined with a variety of psychophysiological disturbances such as changes in weight, sleep issues, difficulty concentrating, and thoughts of death (1). According to the World Health Organization (WHO), ischemic heart disease (IHD) is one of the major and most frequent public health problems around the globe. IHD affects 126 million people, which will increase to 7.8% by 2030. Obesity is associated with a higher risk of mental disease; however, the relationship between mental illness and body mass index (BMI), which measures overall obesity, is not well-established (1). This study examined the relationship between depression and BMI in patients with IHD at Peshawar's tertiary care hospitals. A study conducted in Pakistan in 2017 indicates that 31% of patients died from IHD globally, and 19% of people died from IHD in Pakistan (2).

According to a WHO statistic report, a research study done in 2011 shows that most patients will develop multiple disorders in 2020 if IHD and depression are present together, and it will directly impact their life expectancy (3). Another study indicates that 15% of IHD patients developed depression (4, 5). Another study revealed that growing bodies show obesity. Obesity is associated with the risk of developing depression, which can lead to IHD. Obesity adversely affects cardiovascular structure and function in multiple ways. Obesity increases cardiac output and total blood volume, and it mainly results in a higher cardiac workload. According to meta-analyses of cross-sectional studies (6, 7), the concentrations of inflammatory markers, such as CRP, IL-6, TNF-alpha, and IL-1 $\beta$ , are enhanced in peripheral blood during an acute depressive episode. Overweight (adiposity) increases the risk of depression, which leads to IHD (8).

The study conducted in UK found that depression and, in high-income nations, IHD are the primary causes of disability; by 2030, this is predicted to change to a global phenomenon (9, 1). According to the World Health Organization, the relationship between depression, body mass index, and ischemic heart disease is complex and multidirectional (10). The association between depression and obesity may also be mediated by multiple variables like age, gender, and socioeconomic status. The positive link between depression and an increase body mass index is significant in males, thus depression and body mass index (BMI) have all negative impacts on different diseases (11). A snapshot study conducted in the US revealed that obesity and depression have strong associations with IHD patients and expanded the probability of long-term sickness

(12, 13). Comparing cardiac patients to people without the illness, the results showed that the former group had worse mental health in the areas of psychological stress (13). The two primary variables that were discovered to differ between the individuals without the disease and the cardiac patients were anxiety and depression; this conclusion corresponds with a prior study carried out in the United States (14).

Huffman reported that anxiety and depression might arise as psychological effects of cardiac diseases. Furthermore, the presence of negative emotional states such as anxiety and hopelessness was found to be strongly linked to an increased risk of experiencing cardiovascular disease and death (15, 16, 17). In a study from the United States in 2010, the researchers suggested that 16.1% of ischemic heart disease is one of the major causes of mortality and morbidity rates among both men and women. The overall population with IHD in Pakistan is less than 45 years of age (8%), and less than 40 years of age were diagnosed with IHD (18).

A study conducted in 2016 in Lahore (18) shows that the prevalence of IHD is 0 to 1.5% in rural areas and 0.7% to 3.7% in urban areas. Moreover, research evidence confirms that in women who have not yet reached menopause and are 55 years old or younger, having natural estrogens in their bodies tends to postpone the risk of ischemic heart disease (IHD) by a period of 10 to 20 years. According to the World Health Organization (WHO), depression ranked as the second major factor contributing to disability-adjusted life years among women in 2005 and the fifth leading cause of death among all people worldwide in 2013 (19, 1). The elevated risk linked to a higher BMI was present even after adjusting for hypertension, hypercholesterolemia, and diabetes. Another study concluded (20) that IHD is the leading cause of mortality in the developed world. If cardiac disease and depression are present together, the results for both are worse (20).

Furthermore, another study has shown that heart disease and depression are commonly related diseases, are considered to have a bidirectional relationship, and are associated with strong and mainly comparable physical functional impairment (21). The Framingham study suggested that a BMI of more than 26 shows the risk factors for IHD (21).

A study shows that depression is one of the most common mental health problems affecting adults and is a major public health problem in the US (22). Another study concluded that the association between cardiovascular disease and depression is complex and multidirectional. There is strong

evidence that proves depression is the independent cause of the incidence of IHD (11). Epidemiological research has indicated that obesity and poor cardiorespiratory fitness are the causes of CVD. Another suggestion is that a variety of diseases can lead to obesity, like IHD. Furthermore, studies suggest that obesity is strongly related to the cause of ischemic heart disease in both males and females.

## II. METHODOLOGY:

An analytical cross-sectional study was conducted on hospitalized patients with ischemic heart disease (IHD) at the Medical Teaching Institution (MTI) Khyber Teaching Hospital (MTI-KTH) and the MTI Hayatabad Medical Complex (MTI-HMC) in Peshawar, Pakistan. Hospitalized patients with IHD and those who are willing to participate in the study were considered and included in the study through convenient sampling. Exclusion criteria encompassed patients with mental illness, already on anti-depressants, terminally ill, and those who declined participation or did not consent. The 196 sample size was calculated through Openepi.com software with the following parameters: a margin of error of 05%, a confidence interval of 95%, and a prevalence of depression in ischemic heart disease patients.

Data was collected through the following patient health questionnaire (PHQ-9) (23): A self-administered questionnaire was adopted, modified, and used for depression measurement. It contains three sections: socio-demographic, depression score questionnaire, and body mass index (BMI). The first section of the Modified PHQ-9 questionnaire is socio-demographic data containing variables like age, marital status, gender, family status, education status, and employment status. The second section of the depression score questionnaire contains nine Likert scale questions. The depression was categorized into five categories: minimum depression (1-4), mild depression (5-9), moderate depression (10-14), moderately severe depression (15-19), and severe depression (20-27). The third section contains questions about body mass index (BMI), and the BMI scale was allocated into four groups: underweight: less than 18.5 kg, normal: 18.5–24.9 kg, overweight: 25–29.9 kg, and obese: more than 30 ( $BMI = \text{weight (kg)}/\text{height in m}^2$ ). The Cronbach's  $\alpha$  coefficient of PHQ-9 was 0.892. The researchers obtained permission from the authors to use the PHQ-9 tool.

We analyzed the collected data using SPSS version 22. Descriptive statistics were calculated to summarize demographics and key variables. The frequency, percentage, mean, and standard deviation of depression and body mass index were calculated and presented in the table and graph. Inferential statistics were applied (Chi-square) to determine the measure of association between depression and BMI in ischemic heart disease patients. For all associations and comparisons,  $P < 0.05$  was considered statistically significant.

### III. RESULTS:

**3.1 Age:** In this study, 196 participants were included. The mean and standard deviation of age were measured as  $(59.35 \pm 14.59)$ . The minimum age of participants was 18 years, and the maximum was 90 years.

*Table: - 1 Mean and Standard deviation of Age.*

Variable	Mean	SD
Age	59.35	14.592

### 3.2 Description of demographic variables:

In this study, frequency and percentage of men and women were (n = 103) (52.6%) (n = 93) (47.4%). Single (n = 13) (6.6%), married (n = 18) (92%), and widowed (n = 2) (1%) participated in the study. However, single family (n = 68) (34.7%) and joint family (n = 128). Furthermore, illiterate (n = 62) (31%), primary (n = 24) (12%), matriculated (n = 47) (24%), intermediate (n = 18) (9%), bachelor (n = 11) (5%), and (n = 34) (17%) candidates were masters in the current study. Furthermore, there were 122 employed people (62.2%), 64 unemployed people (33.7%), and ten retired people (5.1%).

*Table: - 2 Frequency and percentage of demographic variables:*

Variable		Frequency	Percentage
Gender	Male	103	52.6%
	Female	93	47.4%
Marital status	Married	181	92%
	Un-married	13	6.6%
	Widow	2	1%
Employment status	Employed	64	32.7%
	Un-employed	122	62.2%
	Retired	10	5.1%
Family status	Single family	68	34.7%
	Joint family	128	65%
Education Level	Illiterate	62	31%
	Primary	24	12%
	Matric	47	24%
	Intermediate	18	9%
	Master	34	17%
	Bachelor	11	5%

### 3.3 Frequency of Depression:

The depression was categorized in 5 categories. The scale for measuring depression ranges from minimum depression (1-4), mild depression (5-9), moderate depression (10-14), moderately severe depression (15-19), to severe depression (20-27). However, in this study, the percentage and

frequency of the minimum depression were (n = 16) (8.2%), mild depression (n = 33) (16.2%), moderate depression (n = 48) (24.5%), moderately severe (n = 61) (31.1%), and severe (n = 38) (19.4%).

*Table 3: - Frequency and percentage of Depression:*

Variable	Frequency	percentage
Minimum depression	16	8.2%
Mild depression	33	16.8%
Moderate depression	48	24.5%
Moderately severe depression	61	31.1%
Severe depression	38	19.4%

### 3.4 Frequency of Body mass index (BMI):

The 196 candidates were included in this study. The BMI scale was divided into four groups: underweight: less than 18.5 kg; normal: 18.5–24.9 kg; overweight: 25–29.9 kg; and obese: 30 and more. In this study, the frequency and percentage of the underweight (n = 19) (9.7%) were underweight, (n = 70) (35.7%) were normal, (n = 50) (25.5%) were overweight, and (n = 57) (29.1%) were obese people.

*Table 4: - Frequency and percentage of body mass index (BMI):*

Variable	Frequency	Percentage
Underweight	19	9.7%
Normal	70	35.7%
Overweight	50	25.5%
Obesity	57	29.1%

### 3.5 Association of depression and Body mass index (BMI):

The prevalence of moderately severe depression was significantly higher in obese ischemic heart disease patients as compared to non-obese. The findings of the current study show that depression has a strong association with BMI in ischemic heart disease patients. Pearson chi-square value 23.885a and df 2 on 2-tailed (p value 0.021).

*Table 5: - Chi square test*

	Values	df	Asymp, sig.(2-sided)
Pearson Chi Square	23.885	12	.021

Chi square test was applied for the association of depression with BMI among IHD patients. The results showed that the association is  $P = .021$ , thus depression has a strong association with BMI among ischemic heart disease patients.

#### IV. DISCUSSION

Depression is one of the subsequent causative factors for ischemic heart diseases. Obesity is the major cause of depression and ischemic heart disease. Depression can cause ischemic heart disease directly or indirectly; it alters the platelet level, which can be a factor in ischemic heart disease. Platelet problems seen in depressed people may make them more likely to have a relative clotting diathesis, which would explain why they are more likely to get ischemic heart disease (24).

The National Heart Foundation of Australia's expert working group reviewed the information and came to conflicting conclusions. They came to the conclusion that depression's etiology, prognosis, and cardiovascular disease are all independently correlated (25). On the contrary, (26) demonstrated a higher incidence of sudden cardiovascular mortality in people exhibiting phobic and panic feelings. Many studies indicate that patients with depression also have a higher risk of sudden cardiac death. (26, 27) In this study, 196 participants (Ischemic Heart Disease patients) were involved and showed a significant level of depression. The prevalence of depression is high, with minimal depression at 8.2%, mild depression at 16.8%, moderate depression at 24.5%, moderately severe depression at 31.1%, and severe depression at 19.4% in the Pakistan (Peshawar) population above the age 18 years. Because of increased social responsibilities after the age of 18 years.



In a Pakistani context, it was also found that cardiac patients had a greater prevalence of co-morbidity between depression and anxiety. The prevalence of depression among males was 58%, while among females it was 74%. In contrast, the prevalence of anxiety among males was 54%, while among females it was 65%.8 (4, 11). In our study, depression is directly related to ischemic heart disease. However, our study results show a high level of depression in ischemic heart disease patients, which can affect the level of disease. The role of obesity seems to be different in different populations, at different ages, and among males and females. Similarly, in our study, there was no specific age for obesity, and the risk of ischemic heart disease was greater in obese people. Epidemiological research in 2017 has indicated that obesity and poor cardiorespiratory fitness are the causes of cardiovascular disease (28, 29). In contrast, our study did not show any relationship between respiratory and cardiac disease, but if depression and obesity are present together, it can be the cause of mostly cardiovascular diseases, mainly ischemic heart disease (30, 31).

## V. CONCLUSION:

Chronic metabolic disorders like obesity are linked to cardiovascular disease (CVD) and higher rates of death and morbidity. Depression is the major cause of ischemic heart disease. Because of the increase in platelet activation, endothelial dysfunction has been implicated as a potential pathophysiological pathway for ischemic heart disease. Obesity can directly or indirectly cause ischemic heart disease. Directly cause ischemic heart diseases because of fat accumulation inside the blood vessels around the heart and all over the body, and indirectly, a higher body mass index was significantly related to lower appearance satisfaction. Moreover, a less positive body image was significantly associated with more depression symptoms, which can lead to ischemic heart disease. Patients with IHD need good adherence to care in a home setting where family caregivers have good knowledge regarding IHD care, which can play a very important role in the management of IHD. Poor health outcomes are also caused by lifestyle and behavioral factors such as smoking, alcohol consumption, an unhealthy diet, and physical inactivity. A future study should focus on implementing lifestyle interventions in individuals with depression with the goal of enhancing physical activity levels while simultaneously alleviating symptoms of depression.

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