

v1: 23 December 2024

Research Article

# Interplay of Psychological Distress, Obesity, and Insomnia among Hypertensive Patients: A Cross-Sectional Study in Bangladesh

Peer-approved: 23 December 2024

© The Author(s) 2024. This is an Open Access article under the CC BY 4.0 license.

Qeios, Vol. 6 (2024)  
ISSN: 2632-3834

Salma Akter<sup>1</sup>, Afsana Rahman Aupsory<sup>1</sup>, MD. Faisal Ahmed<sup>1</sup>, Jonaed Mallik Abir<sup>1</sup>, Farjana Nur Naly<sup>1</sup>, Mariam Mardia<sup>1</sup>, Rim Dilower<sup>1</sup>, Touhidul Islam<sup>1</sup>

1. Department of Behavioral Science, Bangladesh Institute of Innovative Health Research, Bangladesh

**Background:** Hypertension is a critical global health challenge, closely interlinked with obesity, insomnia, and psychological distress. In Bangladesh, rising urbanization and lifestyle changes exacerbate these conditions, yet limited research has explored their combined impact, particularly among hypertensive patients. This study investigates the interconnections between psychological distress, obesity, and insomnia among hypertensive patients in Bangladesh, aiming to identify risk factors and inform interventions for holistic health management.

**Methods:** A cross-sectional study was conducted from September to December 2024, involving 739 hypertensive patients (400 males and 339 females) aged 18 and above. Data collection utilized a Personal Information Form, the Bengali Kessler Psychological Distress Scale (K6), and the Bangla Insomnia Severity Index (ISI). BMI was calculated from self-reported weight and height. Data were analyzed using SPSS, employing descriptive statistics, chi-square tests, and regression analyses to examine associations.

**Results:** The majority of participants (65.1%) experienced moderate psychological distress, with severe insomnia reported by 8.5%. Significant associations were found between psychological distress and socioeconomic status, education, and urban-rural residency ( $p < 0.05$ ). Obesity and insomnia were strong predictors of distress, creating a bidirectional relationship.

**Conclusion:** Psychological distress significantly influences obesity and insomnia in hypertensive patients, highlighting the need for integrated mental health and lifestyle interventions. Addressing socio-economic and demographic disparities is critical for effective hypertension management in Bangladesh.

Corresponding author: MD. Faisal Ahmed,  
[faisal.biihr@gmail.com](mailto:faisal.biihr@gmail.com)

## 1. Introduction

Hypertension is a significant global health issue affecting millions of people worldwide and is a major

risk factor for cardiovascular diseases such as heart attack and stroke. It often remains undiagnosed until severe cardiovascular damage occurs, earning it the label "silent killer"<sup>[1]</sup>. Hypertension may result from medical conditions such as chronic kidney disease, sleep apnea, or hormonal imbalances, and can also be induced by certain medications<sup>[2]</sup>. Obesity contributes to hypertension by increasing vascular resistance and heart rate, in addition to releasing chemicals that disrupt blood pressure regulation<sup>[3][4]</sup>. Even modest weight loss has been shown to significantly reduce blood pressure, highlighting the importance of weight management in preventing and treating hypertension. Obesity and insomnia can coexist in a vicious cycle. Insomnia, a sleep disorder characterized by difficulty falling or staying asleep, is closely linked to hypertension. Studies indicate that individuals with insomnia are at a greater risk of developing hypertension, suggesting a bidirectional relationship between these two conditions<sup>[5]</sup>. Obesity, insomnia, and hypertension are interconnected disorders with profound implications for health and well-being.

Psychological distress is an overwhelming emotional experience that reflects an individual's emotional struggles<sup>[6]</sup>. Psychological distress often manifests in the form of anxiety, depression, and a general sense of being emotionally imbalanced<sup>[6]</sup>. Common indicators of psychological distress include the following: anxiety, which makes individuals feel constantly uneasy or fearful<sup>[7]</sup>. People dealing with psychological distress worry about things that others might not even notice, leading to a racing heart, trouble concentrating, or restlessness. Depression is characterized by prolonged feelings of sadness. It is a deep sense of hopelessness. It affects sleep patterns, appetite, and overall motivation. Mood swings and irritability can be caused by this distress. The quick change in mood leads a person to experience emotional instability. Such mood swings can exacerbate psychological distress. Recognizing psychological distress early is essential for healthcare professionals to provide holistic care, addressing both physical and mental well-being<sup>[7]</sup>.

Psychological distress acts as a catalyst for the development or worsening of various chronic conditions<sup>[8]</sup>. These often lead to negative impacts on the body, making certain health issues more severe to manage. Psychological distress is closely related to increased blood pressure. Obesity can be caused by distress. Psychological stress often leads people to turn to food as a coping mechanism. Additionally,

distress can disrupt the balance of hormones that regulate appetite, such as increasing levels of ghrelin which stimulates hunger and decreasing levels of leptin which signals fullness, resulting in obesity. Psychological distress is a well-known contributor to sleep disturbances, including insomnia. Mentally or emotionally distressed people may have difficulty falling asleep or staying asleep through the night. In summary, as Liu, et al. described, psychological distress has tangible effects on physical health by contributing to the development and progression of conditions such as hypertension, obesity, and insomnia<sup>[8][9]</sup>.

From previous studies we found, nonspecific psychological distress and high scores for feeling "nervous" over the past 30 days were notable indicators of the development of hypertension in a Black population, regardless of alcohol consumption. Moreover, less psychological distress can lead to better self-care and increase the likelihood of optimal HTN control<sup>[2][10][11]</sup>. Moreover, from the previous studies we also reported a relationship between insomnia and psychological distress with insomnia being associated with 9.82 times more clinically significant depression and 17.35 times more clinically significant anxiety<sup>[12][13]</sup>. Anxiety and depression cause insomnia, which leads to increased anxiety and depression and the relationship is bidirectional<sup>[12][14][15]</sup>. Obesity significantly increases the risk of essential hypertension, diabetes, and other conditions that contribute to kidney disease<sup>[3][16]</sup>.

Hypertension affects about approximately 25% of adults in Bangladesh and is driven by dietary changes, stress, and sedentary lifestyles<sup>[17][18][16]</sup>. It is a key risk factor for cardiovascular diseases, which are major causes of morbidity and mortality<sup>[19]</sup>. On the other hand, obesity is increasing, with nearly 10% of adults classified as obese, largely due to increased caloric intake and decreased physical activity<sup>[3][20]</sup>. Approximately 25% of adults in Bangladesh experience insomnia, which is worsened by stress and anxiety<sup>[21]</sup>. Psychological distress, including stress, anxiety, and depression, exacerbates hypertension, obesity, and insomnia. Research shows that stress often leads to unhealthy behaviors, worsening these conditions<sup>[18]</sup>.

Most current research focuses on larger population groups or different geographical settings, leaving a gap in understanding the unique challenges faced by patients with hypertension in Bangladesh.

Environments in urban areas are related to specific pressures such as greater socioeconomic pressures, lifestyle changes, and decreased physical activity, which can contribute to a complex interplay between mental and physical health. This longitudinal study is necessary to monitor the progress of these conditions. Furthermore, successful techniques for handling mental distress were discovered to lessen the impact of obesity and sleeplessness on individuals with high blood pressure.

This study aims to unpack the tridirectional effects of the psychological distress-obesity-insomnia path. There are no prevalence studies on the psychological burden linked to cognitive, psycho-dysthymia and mood disorders in urban Bangladesh. The underlying pathophysiological consequences of the associations between psychological distress and hypertension, obesity, and insomnia have yet to be elucidated. The relevant research outcome is scant and restricted; samples come from minority groups. Social stressors due to socioeconomic demands, changing lifestyles, and physical inactivity—all the pathways connecting psych outcomes—are still not clearly understood. The study suggests ways to improve well-being by identifying major risk factors via the triad relationship.

## 2. Methods and Materials

### 2.1. Study design and Participants

This cross-sectional study, conducted between September 26, 2024, and December 5, 2024, examined the impact of psychological distress on obesity and insomnia among hypertensive patients. The study involved 739 participants (400 male, 339 female) aged 18 years and above, and convenience sampling techniques were used to select them. Adults aged 18 years and older with a diagnosis of hypertension who could complete a survey in Bengali were included. The exclusion criteria will include people under 18 years of age, individuals who are not diagnosed with hypertension, and those who will not be able to finish the online survey.

### 2.2. Data Collection Tools

A *Personal Information Form (PIF)* collected data on age, gender, socioeconomic status, educational background, income, residential area, occupational status, monthly income, and self-reported blood pressure. *Body mass index (BMI)* was calculated by using participants' self-reported weight and height,

based on the standard formula: weight (kg)/height (m<sup>2</sup>).

Psychological distress was measured by the *Kessler Psychological Distress Scale (K6)* by Kessler et al.<sup>[22]</sup>. The Bangla adaptation by Khan et al. was employed which has six questions that measure symptoms such as nervousness, hopelessness, restlessness and worthlessness within the last four weeks<sup>[23]</sup>. The results were measured on a five-point Likert scale from 0 (none of the time) to 4 (all of the time to yield a summary score of distress severity).

The *Insomnia Severity Index (ISI)*, originally developed by Bastien et al., was translated and validated into Bangla by Mamun et al.<sup>[24][25]</sup>. This seven-item scale evaluates the intensity of insomnia symptoms on a five-point Likert scale, with total scores ranging from 0 to 28. Scores were categorized as no insomnia (0–7), subthreshold insomnia (8–14), moderate insomnia (15–21), or severe insomnia (22–28).

### 2.3. Data Collection Procedure

The participants were selected through convenience sampling, social media, online-based platforms, and healthcare institution connectiveness. After rapport building, the participants were advised on the purpose and processes of the study, and were assured of anonymity and the option of withdrawal from the study at any time. The data were collected through the Google Form, which consists of the Personal Information Form, the Bangla version of Kessler Psychological Distress Scale (K6), and the Insomnia Severity Index (ISI). Ethical approval for the study was granted by the Institutional Review Board of the Bangladesh Institute of Innovative Health Research (IRB Protocol: BIIHR-2024-008), adhering to the Declaration of Helsinki<sup>[26]</sup>. The participants agreed to participate in the study voluntarily, and no personal data were revealed without the subjects' names or identifying information.

### 2.4. Statistical Analysis

Data analysis was conducted via SPSS (version 26.0) to explore the associations among psychological distress, obesity, insomnia, and hypertension. Descriptive statistics summarized participant demographics and health characteristics, including frequencies, percentages, means, and standard deviations. Chi-square tests were used to assess associations between psychological distress and categorical variables such as gender, socioeconomic

status, and residential area. Ordinal regression analysis identified predictors of psychological distress, BMI, and insomnia severity, with odds ratios and confidence intervals reported. Multiple linear regression was used to examine the effects of sociodemographic factors on BMI, insomnia severity, and psychological distress scores. Statistical significance was set at  $p < 0.05$ . All analyses were conducted with appropriate checks for normality and multicollinearity to ensure the robustness of the findings.

### 3. Results

This study examined the relationship between psychological distress and its potential impact on obesity and insomnia among patients diagnosed with hypertension. Understanding these interactions can provide valuable insights into the multidimensional challenges faced by hypertensive individuals and inform targeted interventions to address their physical and mental health needs.

#### 3.1. Participant Characteristics

The study involved participants with diverse demographic and socioeconomic backgrounds, as detailed in Table 1. The mean age was 45.19 years (SD = 16.13). The gender distribution included 54.1% male and 45.9% female participants. Socioeconomic status (SES) varied, with the majority classified as middle class (52.0%), followed by higher-middle class (19.4%) and lower-middle class (16.1%). Other SES categories included lower class (5.5%) and higher class (7.0%).

In terms of BMI classifications, 18.1% were underweight, 35.5% were of normal weight, 25.3% were overweight, and 21.1% were obese. The prevalence of psychological distress was moderate among 65.1% of the participants, whereas 26.9% experienced severe distress. Insomnia severity levels varied, with subthreshold insomnia reported in 46.1% of participants, moderate insomnia reported in 36.1%, and severe insomnia reported in 8.5% (TABLE 1).

Variable	N	%	Mean ± SD (Range)
Age (in years)	-	-	45.19 ± 16.13 (219)
<b>Gender</b>			
Male	400	54.1	-
Female	339	45.9	-
<b>Socioeconomic Status</b>			
Lower Class	41	5.5	-
Lower-Middle Class	119	16.1	-
Middle Class	384	52.0	-
Higher-Middle Class	143	19.4	-
Higher Class	52	7.0	-
Height (in cm)	-	-	165.58 ± 8.47 (51.82)
Weight (in kg)	-	-	66.45 ± 11.94 (72)
<b>Residential Division</b>			
Dhaka	228	30.9	-
Chittagong	156	21.1	-
Rajshahi	22	3.0	-
Sylhet	19	2.6	-
Khulna	284	38.4	-
Barishal	8	1.1	-
Rangpur	7	0.9	-
Mymensingh	15	2.0	-
<b>Residential Place</b>			
Rural	342	46.3	-
Sub-Urban	65	8.8	-
Urban	332	44.9	-
<b>Educational Qualification</b>			
No Formal Education	41	5.5	-
Primary	120	16.2	-
Secondary	153	20.7	-
Higher Secondary	131	17.7	-
Undergraduate	176	23.8	-
Graduate	118	16.0	-
<b>Occupation</b>			
Student	149	20.2	-
Unemployed	292	39.5	-

Variable	N	%	Mean ± SD (Range)
Govt. Employee	108	16.6	-
Private Employee	190	25.7	-
<b>Monthly Income</b>			
<20000 BDT	199	26.9	-
20000 - 30000 BDT	197	26.7	-
30000 - 50000 BDT	194	26.3	-
>50000 BDT	149	20.2	-
<b>Systolic Blood Pressure</b>	-	-	147.42 ± 16.07 (92)
<b>Diastolic Blood Pressure</b>	-	-	91.22 ± 10.05 (80)
<b>BMI</b>			
Underweight	134	18.1	-
Normal	262	35.5	-
Overweight	187	25.3	-
Obese	156	21.1	-
<b>Psychological Distress</b>			
Low	59	8.0	-
Moderate	481	65.1	-
Severe	199	26.9	-
<b>Insomnia Severity</b>			
Absence of Insomnia	68	9.2	-
Sub-threshold Insomnia	341	46.1	-
Moderate Insomnia	267	36.1	-
Severe Insomnia	63	8.5	-

**Table 1.** Participant Demographics and Health Characteristics (n=739).

### 3.2. Associations Between Psychological Distress and Demographic Variables

Table 2 presents the associations between psychological distress and various demographic variables. Gender, SES, residential division, and educational qualifications were significantly associated with psychological distress. Notably, males were more likely to experience severe psychological

distress (30.5%) than females were (22.7%) ( $\chi^2 = 9.820, p = .007$ ). Higher SES was inversely associated with severe distress ( $p < .001$ ), with individuals from higher-class backgrounds reporting lower levels of distress. Residential division and place of residence (urban vs. rural) were also significantly associated with psychological distress, with urban residents experiencing lower levels of distress ( $\chi^2 = 74.642, p < .001$ ) (TABLE 2).

Variable	Psychological Distress			
	Low; n (%)	Moderate; n (%)	Severe; n (%)	$\chi^2$ (p)
<b>Gender</b>				
Male	23 (5.75%)	255 (63.75%)	122 (30.5%)	9.820 (0.007)
Female	36 (10.62%)	226 (66.67%)	77 (22.71%)	
<b>Socioeconomic Status</b>				
Lower Class	1 (2.44%)	26 (63.41%)	14 (34.15%)	26.208 (<0.001)
Lower-Middle Class	6 (5.04%)	66 (55.46%)	47 (39.50%)	
Middle Class	26 (6.77%)	257 (66.93%)	101 (26.30%)	
Higher-Middle Class	19 (13.29%)	94 (65.73%)	30 (20.98%)	
Higher Class	7 (13.46%)	38 (73.08%)	7 (13.46%)	
<b>Residential Division</b>				
Dhaka	51 (22.37%)	167 (73.25%)	10 (4.39%)	246.106 (<0.001)
Chittagong	5 (3.21%)	120 (76.92%)	31 (19.87%)	
Rajshahi	0 (0.00%)	6 (27.27%)	16 (72.72%)	
Khulna	2 (0.70%)	159 (55.99%)	123 (43.31%)	
Sylhet	0 (0.00%)	1 (5.26%)	18 (94.74%)	
Barishal	1 (12.50%)	7 (87.5%)	0 (0.00%)	
Rangpur	0 (0.00%)	7 (100.00%)	0 (0.00%)	
Mymensingh	0 (0.00%)	14 (93.33%)	1 (6.67%)	
<b>Residential Place</b>				
Rural	9 (2.63%)	198 (57.89%)	135 (39.47%)	74.642 (<0.001)
Sub-Urban	4 (6.15%)	42 (64.62%)	19 (29.23%)	
Urban	46 (14.76%)	241 (72.59%)	45 (13.55%)	
<b>Educational Qualification</b>				
No Formal Education	0 (0.00%)	28 (68.29%)	13 (31.70%)	58.047 (<0.001)
Primary	2 (1.67%)	63 (52.50%)	55 (45.83%)	
Secondary	12 (7.83%)	93 (60.78%)	48 (31.37%)	
Higher Secondary	10 (7.63%)	82 (62.59%)	39 (29.77%)	
Undergraduate	25 (14.20%)	125 (71.02%)	26 (14.77%)	
Graduate	10 (8.47%)	90 (76.27%)	18 (15.25%)	
<b>Occupation</b>				
Student	18 (12.08%)	107 (71.81%)	24 (16.11%)	24.964 (<0.001)
Unemployed	21 (7.19%)	169 (57.88%)	102 (34.93%)	
Govt. Employee	11 (10.19%)	73 (67.59%)	24 (22.22%)	
Private Employee	9 (4.74%)	132 (69.47%)	49 (25.79%)	

Variable	Psychological Distress			
	Low; n (%)	Moderate; n (%)	Severe; n (%)	$\chi^2$ (p)
<b>Monthly Income</b>				
<20000 BDT	4 (2.01%)	113 (56.78%)	82 (41.21%)	43.114 (<0.001)
20000 - 30000 BDT	14 (7.11%)	130 (65.99%)	53 (26.90%)	
30000 - 50000 BDT	22 (11.34%)	137 (70.62%)	35 (18.04%)	
>50000 BDT	19 (12.75%)	101 (67.79%)	29 (19.46%)	
<b>BMI</b>				
Underweight	9 (6.72%)	80 (59.70%)	45 (33.58%)	10.412 (0.108)
Normal	14 (5.34%)	176 (67.18%)	72 (27.48%)	
Overweight	22 (11.76%)	120 (64.17%)	45 (24.06%)	
Obese	14 (8.97%)	105 (67.31%)	37 (23.72%)	
<b>Insomnia Severity</b>				
Absence of Insomnia	7 (10.29%)	52 (76.47%)	9 (13.24%)	25.510 (<0.001)
Sub-threshold Insomnia	38 (11.14%)	223 (65.40%)	80 (23.46%)	
Moderate Insomnia	13 (4.87%)	162 (60.67%)	92 (34.46%)	
Severe Insomnia	1 (1.59%)	44 (69.84%)	18 (28.57%)	

**Table 2.** Associations Between Psychological Distress and Demographic Variables.

### 3.3. Predictive Analysis of Psychological Distress and Health Variables

Table 3 presents odds ratios for predicting psychological distress on the basis of BMI and insomnia severity. Compared with obese individuals,

normal and underweight individuals had a slightly lower, though nonsignificant, likelihood of distress. With respect to insomnia severity, participants with no insomnia were more likely to report low levels of psychological distress (OR = 14.00,  $p = .021$ ), indicating a strong link between insomnia severity and psychological distress (TABLE 3).



Variable	Psychological Distress	Odds Ratio (OR)	95% CI for OR	p
<b>BMI<sup>a</sup></b>				
Underweight	Low	0.529	0.206-1.358	0.185
	Moderate	0.626	0.371-1.057	0.080
	Severe (Redundant)			
Normal	Low	0.514	0.222-1.191	0.120
	Moderate	0.861	0.541-1.370	0.529
	Severe (Redundant)			
Overweight	Low	1.292	0.581-2.872	0.530
	Moderate	0.940	0.566-1.561	0.810
	Severe (Redundant)			
<b>Insomnia Severity<sup>b</sup></b>				
Absence of Insomnia	Low	14.00	1.486-131.885	0.021
	Moderate	2.364	0.966-5.786	0.060
	Severe (Redundant)			
Sub-threshold Insomnia	Low	8.550	1.100-66.440	.040
	Moderate	1.140	0.623-2.088	0.670
	Severe (Redundant)			
Moderate Insomnia	Low	2.543	0.313-20.682	0.383
	Moderate	0.720	0.393-1.319	0.288
	Severe (Redundant)			

**Table 3.** Odds Ratios for Predicting Psychological Distress by BMI and Insomnia Severity.

<sup>a</sup> The reference category is: Obese

<sup>b</sup> The reference category is: Severe Insomnia

### 3.4. Influence of Sociodemographic Variables on BMI, Psychological Distress, and Insomnia Severity

Table 4 provides insights from a multiple linear regression, examining the effects of various

sociodemographic variables on BMI, psychological distress, and insomnia severity. Weight and height significantly predicted BMI ( $p < .001$ ), whereas residential division and psychological distress significantly predicted insomnia severity ( $p < .001$ ). Age was significantly associated with insomnia severity ( $p = .009$ ), suggesting that older individuals tend to experience more severe insomnia (TABLE 4).

Dependent Variable	Predictor Variable	B	Standard Error (SE)	Standardized Coefficient (Beta)	t	p
BMI	Age	-0.001	0.001	-0.015	-1.191	0.234
	Gender	0.032	0.028	0.016	1.148	0.251
	Height	-0.050	0.003	-0.419	-16.746	<0.001
	Weight	0.047	0.002	0.550	22.811	<0.001
	Residential Division	-0.001	0.010	-0.002	-0.115	0.909
	Residential Place	0.021	0.017	0.020	1.242	0.215
	Systolic Blood Pressure	0.001	0.001	0.014	1.204	0.229
	Diastolic Blood Pressure	0.001	0.001	0.009	0.774	0.439
	Psychological Distress	0.030	0.024	0.016	1.244	0.214
	Insomnia Severity	-0.010	0.17	-0.007	-0.586	0.558
Psychological Distress	Age	0.000	0.001	0.012	0.335	0.738
	Gender	-0.108	0.043	-0.097	-2.544	0.011
	Height	-0.002	0.005	-0.026	-0.311	0.756
	Weight	-0.006	0.004	-0.136	-1.539	0.124
	Residential Division	0.105	0.015	0.305	7.053	<0.001
	Residential Place	-0.055	0.026	-0.093	-2.111	0.035
	Systolic Blood Pressure	-0.002	0.001	-0.048	-1.432	0.152
	Diastolic Blood Pressure	-0.002	0.002	-0.028	-0.809	0.419
	BMI	0.071	0.057	0.129	1.244	0.214
	Insomnia Severity	0.110	0.025	0.152	4.297	<0.001
Insomnia Severity	Age	0.004	0.002	0.093	2.632	0.009
	Gender	0.195	0.061	0.125	3.189	0.001
	Height	-0.005	0.008	-0.050	-0.586	0.558
	Weight	-0.003	0.006	-0.051	-0.555	0.579
	Residential Division	-0.139	0.036	-0.292	-6.487	<0.001
	Residential Place	-0.244	0.008	-0.301	-6.745	<0.001
	Systolic Blood Pressure	0.000	0.002	-0.008	-0.215	0.830
	Diastolic Blood Pressure	-0.002	0.003	-0.027	-0.771	0.441
	BMI	-0.048	0.082	-0.063	-0.586	0.558
	Psychological Distress	0.226	0.053	0.163	4.297	<0.001

**Table 4.** *Multiple Linear Regression Analysis of Sociodemographic Factors on BMI, Psychological Distress, and Insomnia Severity.*

Table 5 shows the model summary for predicting BMI, psychological distress, and insomnia severity. The BMI model demonstrated a strong predictive capacity ( $R^2 = .896$ ), whereas the models for psychological distress and insomnia severity showed moderate predictive power ( $R^2 = .181$  and  $.121$ , respectively) (TABLE 5).

Dependent Variable	R <sup>2</sup>	Adjusted R <sup>2</sup>	F-Value	p
BMI	0.896	0.894	626.512	0.000
Psychological Distress	0.181	0.181	16.129	<0.001
Insomnia Severity	0.121	0.108	9.977	<0.001

**Table 5.** Model Summary for Predicting BMI, Psychological Distress, and Insomnia Severity.

### 3.5. Predictors of Psychological Distress, BMI, and Insomnia Severity

Table 6 presents ordinal regression results, indicating the associations between BMI and sociodemographic factors. Socioeconomic status and educational

qualifications were significant predictors of BMI. Compared with private employees, middle class participants were more likely to be obese (OR = 2.083,  $p = .016$ ), whereas students and unemployed individuals had significantly different BMI levels ( $p = .011$  and  $p < .001$ , respectively) (TABLE 6).

Dependent Variable	Predictor Variable	Estimate (B)	Standard Error (SE)	Wald $\chi^2$	Odds Ratio (Exp(B))	P
BMI	<b>Socioeconomic Status</b>					
	Lower Class	0.735	0.472	2.428	2.085	0.119
	Lower-Middle Class	0.536	0.366	2.140	1.709	0.144
	Middle Class	0.734	0.304	5.840	2.083	0.016
	Higher-Middle Class	0.462	0.311	2.216	1.587	0.137
	Higher Class (Redundant)	-	-	-	-	-
	<b>Educational Qualification</b>					
	No Formal Education	0.433	0.430	1.013	1.542	0.314
	Primary	0.172	0.328	0.274	1.188	0.601
	Secondary	0.068	0.289	0.056	1.070	0.813
	Higher Secondary	0.254	0.257	0.978	1.289	0.323
	Undergraduate	0.384	0.242	2.519	1.468	0.112
	Graduate (Redundant)	-	-	-	-	-
	<b>Occupation</b>					
	Student	0.568	0.224	6.459	1.765	0.011
	Unemployed	0.684	0.195	12.323	1.982	<0.001
	Govt. Employee	-0.410	0.254	2.599	0.664	0.107
	Private Employee (Redundant)	-	-	-	-	-
	<b>Monthly Income</b>					
	<20000 BDT	-0.354	0.273	1.680	0.702	0.195
	20000 - 30000 BDT	0.011	0.240	0.002	1.011	0.964
	30000 - 50000 BDT	0.291	0.211	1.897	1.338	0.168
	>50000 BDT (Redundant)	-	-	-	-	-
	<b>Psychological Distress</b>					
	Low	0.356	0.284	1.574	1.427	0.210
	Moderate	0.177	0.160	1.225	1.194	0.268
	Severe (Redundant)	-	-	-	-	-
	<b>Insomnia Severity</b>					
	Absence of Insomnia	0.262	0.337	0.602	1.300	0.438
	Sub-threshold Insomnia	0.158	0.269	0.345	1.171	0.557
	Moderate Insomnia	-0.232	0.261	0.787	0.793	0.375
	Severe Insomnia (Redundant)	-	-	-	-	-

**Table 6.** Ordinal Regression Analysis of Sociodemographic Factors Predicting BMI.

Table 7 focuses on the influence of sociodemographic factors on psychological distress. Primary education level was associated with greater odds of experiencing psychological distress (OR = 2.237,  $p = .036$ ). Monthly income was also significant, with those earning less than 20,000 BDT showing higher distress levels ( $p = .018$ ). Compared with private employees, occupation was significant, as students were less likely to experience psychological distress (OR = .442,  $p = .002$ ) (TABLE 7).

Dependent Variable	Predictor Variable	Estimate (B)	Standard Error (SE)	Wald $\chi^2$	Odds Ratio (Exp(B))	P
Psychological Distress	<b>Socioeconomic Status</b>					
	Lower Class	0.274	0.548	0.250	1.276	0.617
	Lower-Middle Class	0.543	0.434	1.567	1.721	0.211
	Middle Class	0.591	0.365	2.617	1.806	0.106
	Higher-Middle Class	0.218	0.374	0.338	1.246	0.561
	Higher Class (Redundant)	-	-	-	-	-
	<b>Educational Qualification</b>					
	No Formal Education	0.611	0.500	1.493	1.842	0.222
	Primary	0.805	0.383	4.418	2.237	0.036
	Secondary	0.118	0.343	0.118	1.125	0.731
	Higher Secondary	0.568	0.307	3.437	1.765	0.064
	Undergraduate	-0.122	0.293	0.174	0.885	0.677
	Graduate (Redundant)	-	-	-	-	-
	<b>Occupation</b>					
	Student	-0.816	0.268	9.239	0.442	0.002
	Unemployed	-0.274	0.229	1.426	0.760	0.232
	Govt. Employee	0.101	0.303	0.111	1.106	0.739
	Private Employee (Redundant)	-	-	-	-	-
	<b>Monthly Income</b>					
	<20000 BDT	0.755	0.320	5.560	2.128	0.018
	20000 - 30000 BDT	0.151	0.286	0.281	1.163	0.596
	30000 - 50000 BDT	-0.238	0.254	0.876	0.788	0.349
	>50000 BDT (Redundant)	-	-	-	-	-
	<b>BMI</b>					
	Underweight	0.386	0.257	2.253	1.471	0.133
	Normal	0.068	0.223	0.093	1.070	0.760
	Overweight	-0.025	0.235	0.012	0.975	0.914
	Obese (Redundant)	-	-	-	-	-
	<b>Insomnia Severity</b>					
	Absence of Insomnia	-0.626	0.397	2.480	0.535	0.115
	Sub-threshold Insomnia	-0.053	0.310	0.029	0.948	0.866
	Moderate Insomnia	0.181	0.300	0.364	1.198	0.546
	Severe Insomnia (Redundant)	-	-	-	-	-

**Table 7.** Ordinal Regression Analysis of Sociodemographic Factors Predicting Psychological Distress.

Table 8 shows the sociodemographic variables influencing insomnia severity. Lower education levels, specifically primary and secondary education, were associated with significantly greater insomnia severity ( $p < .001$ ). Unemployed individuals were more likely to experience severe insomnia than private employees were ( $OR = 2.678, p < .001$ ) (TABLE 8).



Dependent Variable	Predictor Variable	Estimate (B)	Standard Error (SE)	Wald $\chi^2$	Odds Ratio (Exp(B))	P
Insomnia Severity	<b>Socioeconomic Status</b>					
	Lower Class	0.117	0.503	0.054	1.124	0.816
	Lower - Middle Class	-0.021	0.392	0.003	0.979	0.957
	Middle Class	-0.192	0.326	0.347	0.825	0.556
	Higher - Middle Class	-0.115	0.334	0.119	0.891	0.730
	Higher Class (Redundant)	-	-	-	-	-
	<b>Educational Qualification</b>					
	No Formal Education	1.420	0.456	9.684	4.137	0.002
	Primary	1.700	0.351	23.407	5.474	<0.001
	Secondary	1.484	0.310	22.912	4.411	<0.001
	Higher Secondary	0.658	0.279	5.578	1.931	0.018
	Undergraduate	0.146	0.263	0.307	1.157	0.579
	Graduate (Redundant)	-	-	-	-	-
	<b>Occupation</b>					
	Student	0.176	0.242	0.532	1.192	0.466
	Unemployed	0.985	0.208	22.327	2.678	<0.001
	Govt. Employee	-0.481	0.272	3.138	0.618	0.076
	Private Employee (Redundant)	-	-	-	-	-
	<b>Monthly Income</b>					
	<20000 BDT	-0.316	0.293	0.532	0.729	0.466
	20000 - 30000 BDT	0.124	0.208	22.327	1.132	<0.001
	30000 - 50000 BDT	0.357	0.272	3.138	1.429	0.076
	>50000 BDT (Redundant)	-	-	-	-	-
	<b>BMI</b>					
	Underweight	0.263	0.236	1.242	1.301	0.265
	Normal	0.342	0.203	2.836	1.408	0.092
	Overweight	-0.010	0.214	0.002	0.990	0.964
	Obese (Redundant)	-	-	-	-	-
	<b>Psychological Distress</b>					
	Low	-0.694	0.306	5.181	0.499	0.023
	Moderate	-0.066	0.170	0.149	0.936	0.699
Severe (Redundant)	-	-	-	-	-	

**Table 8.** Ordinal Regression Analysis of Sociodemographic Factors Predicting Insomnia Severity.

Table 9 provides the overall model summaries, showing strong fit for predicting insomnia severity (Nagelkerke  $R^2 = .234$ ) and psychological distress (Nagelkerke  $R^2 = .143$ ). These results indicate a moderate association between the examined sociodemographic and health-related variables and the severity of insomnia and psychological distress in the sample (TABLE 9).

Dependent Variable	-2 Log Likelihood	Cox & Snell R <sup>2</sup>	Nagelkerke R <sup>2</sup>	$\chi^2$ (Overall Model)	P
BMI	1422.428	0.083	0.089	64.378	<0.001
Psychological Distress	898.621	0.116	0.143	91.330	<0.001
Insomnia Severity	1225.403	0.211	0.234	174.940	<0.001

**Table 9.** Model Summary of Regression Analysis for BMI, Psychological Distress, and Insomnia Severity.

## 4. Discussion

The findings revealed significant correlations between psychological distress, obesity, insomnia, and hypertension, which were influenced by socioeconomic and demographic factors. Compared with males, females reported lower levels of psychological distress suggesting the presence of gender-specific stressors. Nevertheless, in this study psychological distress was greater in women with low education and those who were mainly housewives; therefore, we can see a more complex relationship between gender and socioeconomic status. SES and psychological distress were inversely correlated with higher levels of SES associated with lower distress levels. Furthermore, participants living in urban areas reported lower scores for psychological distress than those living in rural areas did, which might point to inequalities in mental health care in addition to environmental pressures.

These findings align with those of Liu et al., who reported strong correlations between depression, sleep disturbances, and hypertension<sup>[27]</sup>. In the present study, Araghi et al. reported that lower education level, obesity and severe insomnia were positively correlated with each other<sup>[28]</sup>. Furthermore, Bose et al. described the effect of the HPA axis on cortisol irregularity and discussed the complex relationships among stress, obesity, and sleep disruption<sup>[29]</sup>. We did find a few differences compared with other studies from around the world. In contrast to prior studies revealing consistently elevated distress levels in females, our results suggest that this difference might be defined by education level and occupational status, thus varying across cultures and regions.

Additionally, the research highlights the strong links between socioeconomic and education levels, and

between psychological well-being and sleep patterns. There was a positive relationship between financial status and level of education on the one hand and between psychological distress and insomnia on the other hand. Again, employment status, which was characterized by high unemployment and high proportions of homemakers also experienced high levels of distress probably due to social and economic factors. These findings accord well with other studies of the association between unemployment and mental health issues in the general population. This disparity can cause distress and may be affected by targeted interactions, including community-based education.

The study revealed psychosocial and psychosocial pathways of symptoms of psychological distress with obesity and insomnia. HPA axis activity in response to stress interferes with the cortisol balance by promoting fat deposition and reducing sleep quantity and quality. Moreover, distress is associated with diet, high levels of sedentarism and sleep irregularities. These factors form a loop whereby elevated psychological distress intensifies obesity coupled with insomnia to worsen hypertension. By targeting these mechanisms through stress reduction, diet modification, exercise, and other aspects of patient care related to hypertension could lead to enormous improvements.

The results of this research have clinical and public health relevance. It is therefore important to introduce psychological screening as part of standard hypertension management across potential risk factors including low income from rural backgrounds. Stress management techniques, including training, sleep therapy, and behavioral counseling, can help address the intertwined challenges of distress, obesity, and insomnia. Certainly, mental health stigma is still rife in Bangladesh—a factor that frustrates people from seeking assistance when it is needed. Efforts for destigmatization will lead to early

treatment hence improving both mental health and chances of hypertension.

The use of a cross-sectional design limits the determination of causality, as well as the fact that actual BMI and insomnia data were collected via self-reports, which are under- or overestimations. The sample size ensured that the study achieved its aim but was convenience-based, which has a methodological weakness in terms of generalizability. However, the inclusion of more patients in the study also enhances the external generalizability of the results, which sheds light on the associations among psychological distress, obesity and insomnia in patients with hypertension.

Subsequent studies should employ longitudinal designs to establish whether psychological distress causes obesity and poor sleep or does the other way around, or both. Implementing targeted interventions such as mindfulness-based stress reduction (MBSR) programs or cognitive-behavioral therapy (CBT) tailored for hypertensive patients could effectively address the combined challenges of psychological distress, obesity, and insomnia. Future research should explore how stress management interventions impact diabetes outcomes, such as glycemic control, or examine the interplay between psychological distress and cardiovascular disease progression to uncover shared mechanisms and intervention opportunities.

## 5. Conclusion

This study highlights the critical interplay between psychological distress, obesity, and insomnia in hypertensive patients, underscoring the influence of socioeconomic and demographic factors. Furthermore, the results illustrate the reciprocation of these variables wherein psychological distress is not only a precursor of obesity and sleep disturbances but also a booster of hypertension. In particular, the study highlights how restricted access to and perceived appropriateness of mental health care can be explained by inequalities in poverty, limited education and living in rural areas, highlighting systemic inequalities in mental health care access. The incorporation of screening for psychological issues for hypertension patients and aspiration to adopt stress management and other behavior modifications serves the purpose to increasing the rate of effectiveness for such a disease. It is therefore clear that there is much that needs to be done in terms of eradicating stigma related to mental health in

Bangladesh and ensuring early intervention and improved efficiency in controlling hypertension. Future research should explore causal pathways and evaluate the effectiveness of targeted interventions to address these interconnected health challenges.

## Statements and Declarations

### *Funding*

Authors received no funding for this study.

### *Conflicts of Interest*

Authors declared no conflict of interest.

### *Author Contributions*

- **SA:** Methodology, Writing-Original Draft, Data Curation, Formal Analysis, Project Administration
- **ARA:** Methodology, Writing-Original Draft, Data Curation, Formal Analysis, Validation
- **MFA:** Conceptualization, Investigation, Methodology, Writing-Original Draft, Writing-Review & Editing
- **JMA:** Investigation, Methodology, Writing-Original Draft, Data Curation, Formal Analysis
- **FNN:** Investigation, Methodology, Writing-Original Draft, Data Curation, Formal Analysis
- **MM:** Investigation, Methodology, Writing-Original Draft, Data Curation, Formal Analysis
- **RD:** Investigation, Methodology, Writing-Original Draft, Data Curation, Formal Analysis
- **TI:** Investigation, Methodology, Writing-Original Draft, Data Curation, Formal Analysis

### *Declaration of Generative AI and AI-Assisted Technologies in the Writing*

During the preparation of this work, the authors used ChatGPT in order to assist with refining the writing process. After using this tool, the authors reviewed and edited the content as needed and takes full responsibility for the content of the published article.

### *Acknowledgements*

We would like to express our heartfelt gratitude to Sheikh Arafat Islam, Kszi Jannatun Nayeem, and Rahat Alam for their invaluable assistance in data collection. Their dedication and hard work were instrumental in ensuring the success of this study. We sincerely appreciate their commitment to this research and their contributions to its completion.

## References

1. <sup>△</sup>Arnett DK, Blumenthal RS, Albert MA, Buroker AB, Goldberger ZD, Hahn EJ, Himmelfarb CD, Khera A, Lloyd-Jones D, McEvoy JW, Michos ED, Miedema MD, Muñoz D, Smith SC, Virani SS, Williams KA, Yeboah J, Ziaeian B (2019) 2019 ACC/AHA Guideline on the Primary Prevention of Cardiovascular Disease: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *Circulation* 140. doi:10.1161/CIR.0000000000000678
2. <sup>△</sup>, <sup>△</sup>Mills KT, Stefanescu A, He J (2020) The global epidemiology of hypertension. *Nat Rev Nephrol* 16:223–237. doi:10.1038/s41581-019-0244-2
3. <sup>△</sup>, <sup>△</sup>, <sup>△</sup>Jiang S-Z, Lu W, Zong X-F, Ruan H-Y, Liu Y (2016) Obesity and hypertension. *Exp Ther Med* 12:2395–2399. doi:10.3892/etm.2016.3667
4. <sup>△</sup>Cleven L, Krell-Roesch J, Nigg CR, Woll A (2020a) The association between physical activity with incident obesity, coronary heart disease, diabetes and hypertension in adults: a systematic review of longitudinal studies published after 2012. *BMC Public Health* 20:726. doi:10.1186/s12889-020-08715-4
5. <sup>△</sup>Liu D, Yu C, Huang K, Thomas S, Yang W, Liu S, Kuang J (2022) The Association between Hypertension and Insomnia: A Bidirectional Meta-Analysis of Prospective Cohort Studies. *Int J Hypertens* 2022:1–11. doi:10.1155/2022/4476905
6. <sup>△</sup>, <sup>△</sup>Ridner SH (2004) Psychological distress: concept analysis. *J Adv Nurs* 45:536–545. doi:10.1046/j.1365-2648.2003.02938.x
7. <sup>△</sup>, <sup>△</sup>Böhnke JR, Croudace TJ (2015) Factors of psychological distress: clinical value, measurement substance, and methodological artefacts. *Soc Psychiatry Psychiatr Epidemiol* 50:515–524. doi:10.1007/s00127-015-1022-5
8. <sup>△</sup>, <sup>△</sup>Liu Y, Croft JB, Wheaton AG, Perry GS, Chapman DP, Strine TW, McKnight-Eily LR, Presley-Cantrell L (2013) Association between perceived insufficient sleep, frequent mental distress, obesity and chronic diseases among US adults, 2009 behavioral risk factor surveillance system. *BMC Public Health* 13:84. doi:10.1186/1471-2458-13-84
9. <sup>△</sup>Schutte AE, Ware LJ, Huisman HW, Fourie CMT, Greff M, Khumalo T, Wissing MP (2015) Psychological Distress and the Development of Hypertension Over 5 Years in Black South Africans. *J Clin Hypertens* 17:126–133. doi:10.1111/jch.12455
10. <sup>△</sup>Cleven L, Krell-Roesch J, Nigg CR, Woll A (2020b) The association between physical activity with incident obesity, coronary heart disease, diabetes and hypertension in adults: a systematic review of longitudinal studies published after 2012. *BMC Public Health* 20:726. doi:10.1186/s12889-020-08715-4
11. <sup>△</sup>Eghbali M, Akbari M, Seify K, Fakhrolmobasheri M, Heidarpour M, Roohafza H, Afzali M, Mostafavi-esfahani F, Karimian P, Sepehr A, Shafie D, Khosravi A (2022) Evaluation of Psychological Distress, Self-Care, and Medication Adherence in Association with Hypertension Control. *Int J Hypertens* 2022:1–7. doi:10.1155/2022/7802792
12. <sup>△</sup>, <sup>△</sup>Taylor DJ, Lichstein KL, Durrence HH, Reidel BW, Bush AJ (2005) Epidemiology of Insomnia, Depression, and Anxiety. *Sleep* 28:1457–1464. doi:10.1093/sleep/28.11.1457
13. <sup>△</sup>Sayed Ahmed HA, Abo El-Ela SG, Joudeh AI, Moawad SM, El Hayek S, Shah J, Eldahshan NA (2024) Prevalence and Correlates of Night Eating Syndrome, Insomnia, and Psychological Distress in Primary Care Patients with Obesity: A Cross-Sectional Study. *Obes Facts* 17:274–285. doi:10.1159/000538341
14. <sup>△</sup>Johnson EO, Roth T, Breslau N (2006) The association of insomnia with anxiety disorders and depression: Exploration of the direction of risk. *J Psychiatr Res* 40:700–708. doi:10.1016/j.jpsychires.2006.07.008
15. <sup>△</sup>Jansson-Fröjmark M, Lindblom K (2008) A bidirectional relationship between anxiety and depression, and insomnia? A prospective study in the general population. *J Psychosom Res* 64:443–449. doi:10.1016/j.jpsychores.2007.10.016
16. <sup>△</sup>, <sup>△</sup>Ahmed MdF (2024) Addressing Non-Communicable Diseases in Bangladesh: A Perspective on Lifestyle Changes and Public Health Strategies. *J Innov Health Res* 1:4–8. <https://doi.org/10.5281/ZENODO.14265606>
17. <sup>△</sup>Hossain MdB, Parvez M, Islam MR, Evans H, Mistry SK (2022) Assessment of non-communicable disease related lifestyle risk factors among adult population in Bangladesh. *J Biosoc Sci* 54:651–671. doi:10.1017/S0021932021000286
18. <sup>△</sup>, <sup>△</sup>Guo X, Gong S, Chen Y, Hou X, Sun T, Wen J, Wang Z, He J, Sun X, Wang S, Feng X, Tian X (2023) Lifestyle behaviors and stress are risk factors for overweight and obesity in healthcare workers: a cross-sectional survey. *BMC Public Health* 23:1791. doi:10.1186/s12889-023-16673-w
19. <sup>△</sup>Pacific WHORO for the W (2015) Bangladesh health system review. *Health Syst Transit* 5
20. <sup>△</sup>Hossain MS, Tabassum N, Bary MA, Shipa SJ, Sarkar MR (2024) Prevalence of Overweight and Obesity among Bangladeshi Young Adults and Evaluation of t

- he Associated Factors after COVID-19 Pandemic: a Cross-Sectional Study. *Bangladesh Pharm J* 27:182–192. doi:10.3329/bpj.v27i2.75187
21. <sup>^</sup>Mamun MA, Hossain MdS, Kamruzzaman Md, Khalil MdI, Sikder MdT, Manzar MdD, Griffiths MD (2020) Prevalence of Poor Sleep Quality and Its Determinants Among Bangladeshi Students: A Pilot Study. *Sleep Vigil* 4:185–193. doi:10.1007/s41782-020-00109-1
  22. <sup>^</sup>Kessler RC, Andrews G, Colpe LJ, Hiripi E, Mroczek DK, Normand S-LT, Walters EE, Zaslavsky AM (2002) Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychol Med* 32:959–976. doi:10.1017/S0033291702006074
  23. <sup>^</sup>Khan A, Uddin R, Alam N, Sultana S, Alam M-U, Ahmed R (2019) Psychometric properties of the Bangla version of the Kessler Psychological Distress Scale (K6). *Glob Psychiatry* 2:183–194. doi:10.2478/gp-2019-0016
  24. <sup>^</sup>Bastien C (2001) Validation of the Insomnia Severity Index as an outcome measure for insomnia research. *Sleep Med* 2:297–307. doi:10.1016/S1389-9457(00)00065-4
  25. <sup>^</sup>Mamun MA, Alimoradi Z, Gozal D, Manzar MD, Broström A, Lin C-Y, Huang R-Y, Pakpour AH (2021) Validating Insomnia Severity Index (ISI) in a Bangladeshi Population: Using Classical Test Theory and Rasch Analysis. *Int J Environ Res Public Health* 19:225. doi:10.3390/ijerph19010225
  26. <sup>^</sup>(2013) World Medical Association Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects. *JAMA* 310:2191. doi:10.1001/jama.2013.281053
  27. <sup>^</sup>Liu C, Ye Z, Chen L, Wang H, Wu B, Li D, Pan S, Qiu W, Ye H (2024) Interaction effects between sleep-related disorders and depression on hypertension among adults: a cross-sectional study. *BMC Psychiatry* 24:482. doi:10.1186/s12888-024-05931-9
  28. <sup>^</sup>Araghi MH, Jagielski A, Neira I, Brown A, Higgs S, Thomas GN, Taheri S (2013) The Complex Associations Among Sleep Quality, Anxiety-Depression, and Quality of Life in Patients with Extreme Obesity. *Sleep* 36:1859–1865. doi:10.5665/sleep.3216
  29. <sup>^</sup>Bose M, Oliván B, Laferrère B (2009) Stress and obesity: the role of the hypothalamic-pituitary-adrenal axis in metabolic disease. *Curr Opin Endocrinol Diabetes Obes* 16:340–346. doi:10.1097/MED.0b013e32832fa137

Supplementary data: available at <https://doi.org/10.32388/3VG3VJ.2>

## Declarations

**Funding:** No specific funding was received for this work.

**Potential competing interests:** No potential competing interests to declare.