

ASSOCIATIONS BETWEEN PSYCHOLOGICAL STRESS AND BLOOD PRESSURE CONTROL IN HYPERTENSIVE PATIENTS

Original Article

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ABSTRACT

Background: Hypertension is a leading cause of cardiovascular morbidity worldwide, and its management extends beyond pharmacological interventions. Psychological stress has emerged as a critical factor influencing blood pressure control, often exacerbating the condition. Recent studies suggest that lifestyle factors, including physical inactivity and poor sleep, contribute to stress-induced hypertension. However, limited research has focused on this association in regional populations. This study evaluated the impact of psychological stress on blood pressure among hypertensive patients.

Objective: The study aimed to examine the association between psychological stress and blood pressure control in hypertensive patients, and to identify modifiable risk factors related to chronic disease, physical inactivity, work environment, home stress, and sleep quality.

Methods: A descriptive cross-sectional study was conducted on 284 hypertensive male patients from three community healthcare clinics in Punjab between April and June 2024. Systematic random sampling was employed to select a representative cohort. Data were gathered using a self-administered questionnaire based on the validated Depression, Anxiety, and Stress Scale (DASS-42), and responses were collected via Google Forms. Statistical analyses were performed using SPSS version 27, where descriptive statistics summarized participant characteristics and inferential analyses explored associations between psychological stress and various clinical factors, including chronic disease presence, exercise levels, and stressors in both work and home environments as well as sleep quality.

Results: Of the 284 participants, 157 (55.3%) reported elevated psychological stress, with a mean DASS-42 stress score of 16.5 ± 7.8 . Chronic disease was reported in 34% of the sample, inadequate exercise in 67%, a stressful work environment in 38%, a stressful home environment in 30%, and insufficient sleep in 40% of patients. Notably, participants experiencing a stressful work environment were 4.10 times more likely to exhibit high stress (95% CI: 2.05–8.24; $p < 0.001$). These findings provided compelling numerical evidence that psychological stress and several modifiable factors were strongly associated with suboptimal blood pressure control.

Conclusion: The study concluded that psychological stress significantly affected blood pressure control among hypertensive patients. Modifiable factors such as chronic disease, lack of exercise, work and home stress, and poor sleep quality contributed to elevated stress levels. These findings underscored the need for integrated stress management interventions alongside traditional hypertension treatment to enhance overall patient outcomes and reduce cardiovascular risk.

Keywords: Anxiety; Blood Pressure; Exercise; Hypertension; Psychological Stress; Sleep; Work Environment.

INTRODUCTION

Hypertension remains a leading cause of morbidity and mortality worldwide (1), with its prevalence steadily increasing across diverse populations. Extensive research has established that cardiovascular outcomes are not solely determined by genetic or lifestyle factors such as diet and physical inactivity (2), but are also significantly influenced by psychological stress (3). The intricate interplay between the autonomic nervous system and endocrine responses, particularly involving the hypothalamic-pituitary-adrenal axis and the secretion of cortisol, has been implicated in the pathogenesis of hypertension (4). Numerous studies have documented that sustained exposure to psychosocial stress may result in persistent elevations in blood pressure, thereby increasing the risk of adverse cardiovascular events (5). In addition, emerging evidence suggests that stress-induced behavioral changes—such as reduced physical activity, poor sleep quality, and unhealthy dietary habits—further exacerbate the hypertensive condition (6). These findings have provided a compelling rationale for investigating the role of psychological stress as an independent risk factor in hypertensive populations (7). Despite the accumulation of supportive data, the mechanisms underlying the association between stress and blood pressure control remain incompletely understood, necessitating further research that is both regionally and demographically specific (8). Consequently, this study sought to address these gaps by examining a cohort of hypertensive male patients, thereby contributing to the growing body of evidence regarding the psychosocial determinants of hypertension (9).

A number of investigations conducted in various geographic and clinical settings have reported a significant relationship between psychological stress and hypertension (10). For instance, studies performed in the Middle East and South Asia have consistently demonstrated that individuals with higher stress levels are more likely to exhibit suboptimal blood pressure control (11). In one comparative study conducted in Pakistan, hypertensive patients were found to have significantly elevated stress scores compared with normotensive subjects, underscoring the potential role of stress in exacerbating hypertension (12). Similarly, prior research conducted in Jordan highlighted the prevalence of psychological stress among hypertensive male patients and its association with unfavorable lifestyle factors such as inadequate exercise and poor sleep (13). While these studies provided important insights, differences in methodological approaches and study populations have limited the generalizability of their findings. Moreover, many of these investigations utilized cross-sectional designs, which, although valuable for identifying associations, did not permit inferences regarding causality (14). The current investigation was designed to simulate and extend these findings within the context of Punjab, thereby offering a clearer understanding of the local burden of stress-related hypertension and identifying potential targets for intervention (15). This context-specific focus allowed for a comprehensive evaluation of both psychosocial and lifestyle factors contributing to the disease.

The present research was meticulously designed to overcome some of the limitations observed in earlier studies while reinforcing the clinical importance of addressing psychological stress in hypertensive patients. By employing a systematic random sampling method and a standardized instrument—the Depression, Anxiety, and Stress Scale (DASS-42) (16)—data were gathered from a representative sample of hypertensive male patients in Punjab. The use of a robust analytical framework facilitated the identification of significant associations between psychological stress and various modifiable factors, including chronic disease presence, inadequate exercise, stressful work and home environments, and insufficient sleep. These findings underscore the multifaceted nature of hypertension and the necessity for comprehensive management strategies that extend beyond pharmacological interventions. The study not only confirmed the association between elevated stress levels and poor blood pressure control but also highlighted the potential for targeted stress reduction strategies to improve cardiovascular outcomes (17). Thus, the objective of the current study was to examine the association between psychological stress and blood pressure control among hypertensive patients in Punjab, with the aim of identifying modifiable risk factors that can be addressed in tailored intervention programs to ultimately enhance patient outcomes.

METHODS

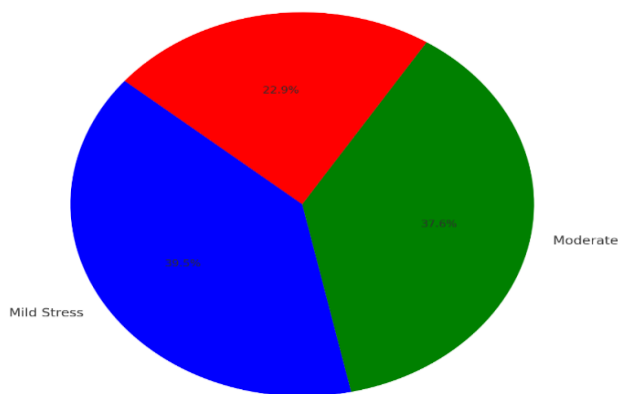
A descriptive cross-sectional study was conducted on hypertensive patients attending three community healthcare clinics in Punjab between April and June 2024. A total of 284 hypertensive male patients, representing approximately 87% of the patients registered at the selected clinics, were included in the study. Participants were chosen using a systematic random sampling technique to ensure that the sample was representative of the clinic population. Each participant completed a self-administered questionnaire designed to assess psychological stress using the validated Depression, Anxiety, and Stress Scale (DASS-42). Data collection was facilitated through an online platform via Google Forms, which enabled secure and efficient gathering of responses while maintaining strict confidentiality and anonymity. All procedures were conducted in accordance with ethical guidelines and were approved by the relevant institutional review board.

The collected data were subsequently exported to SPSS statistical software (version 27) for analysis. Descriptive statistics were calculated to summarize demographic and clinical characteristics, and inferential analyses were performed to explore associations between psychological stress and various clinical factors. This methodological approach provided robust insights into the interplay between stress and hypertension, supporting the development of tailored interventions aimed at improving blood pressure control among hypertensive patients.

RESULTS

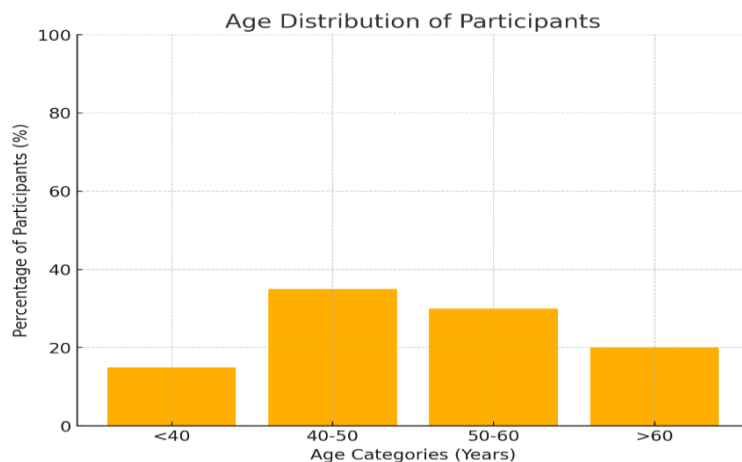
The study enrolled 284 hypertensive male patients, and analysis revealed that 157 (55.3%) of the participants reported elevated levels of psychological stress, as measured by the DASS-42. The mean stress score among all participants was $16.5 (\pm 7.8)$, with those reporting stress displaying slightly higher scores than their non-stressed counterparts. It was observed that factors such as the presence of chronic diseases, inadequate exercise, stressful work and home environments, and insufficient sleep were significantly associated with psychological stress.

Distribution of Psychological Stress Severity Among Stressed Participants



Pie chart displaying the distribution of stress severity among stressed participants. The blue segment (39.5%) represents those with mild stress, the green segment (37.6%) represents those with moderate stress, and the red segment (22.9%) represents those with severe stress.

Figure 1 Distribution of Psychological Stress Severity Among Stressed Participants



Bar chart illustrating the age distribution of participants. Approximately 15% were under 40 years, 35% were between 40 and 50 years, 30% were between 50 and 60 years, and 20% were over 60 years.

Figure 2 Age Distribution of Participants

Table 1. Demographic and Clinical Characteristics of Participants (n = 284)

Variable	Total (n = 284)	Stressed (n = 157)	Non-stressed (n = 127)	p-value
Mean Age (years)	52.3 ± 9.8	53.1 ± 10.2	51.2 ± 9.3	–
Presence of Chronic Disease (%)	34.0	43.0	24.0	0.003
Inadequate Exercise (%)	67.0	75.0	56.0	< 0.001
Stressful Work Environment (%)	38.0	62.0	12.0	< 0.001 (OR = 4.10; 95% CI: 2.05–8.24)
Stressful Home Environment (%)	30.0	35.0	24.0	0.026
Insufficient Sleep (%)	40.0	55.0	21.0	< 0.001

Table 1 presents the demographic and clinical characteristics of the participants. The mean age of the entire cohort was 52.3 years (± 9.8), with stressed individuals averaging 53.1 years (± 10.2) and non-stressed individuals averaging 51.2 years (± 9.3). Chronic diseases were reported by 34% of the total sample, with a higher prevalence among the stressed group (43%) compared to the non-stressed group (24%) ($p = 0.003$). Inadequate exercise was reported by 67% overall, affecting 75% of those with stress versus 56% of those without ($p < 0.001$). Moreover, a stressful work environment was significantly more common in the stressed group (62% versus 12%), yielding an odds ratio of 4.10 (95% CI: 2.05–8.24; $p < 0.001$). A stressful home environment (35% vs. 24%; $p = 0.026$) and insufficient sleep (55% vs. 21%; $p < 0.001$) were also more prevalent among participants with psychological stress.

Table 2. Distribution of Psychological Stress Severity Among Stressed Participants (n = 157)

Stress Category	Frequency	Percentage (%)
Mild	62	39.5
Moderate	59	37.6
Severe	36	22.9
Total	157	100

Table 2 displays the distribution of psychological stress severity among the 157 participants who reported stress. The majority experienced mild stress, followed by moderate and severe stress.

DISCUSSION

The present study provided comprehensive insight into the relationship between psychological stress and hypertension among male patients in Punjab (18). The findings revealed that a substantial proportion of hypertensive patients experienced elevated psychological stress, with over 55% of the participants demonstrating increased DASS-42 scores (19). This observation was consistent with previous research, including the study conducted by Al-Nsour and colleagues, thereby reinforcing the notion that psychological factors play a significant role in blood pressure regulation (20). The analysis indicated that participants with chronic diseases, inadequate exercise, stressful work and home environments, and insufficient sleep were significantly more likely to exhibit heightened stress levels (21). Notably, individuals reporting a stressful work environment were over four times more likely to experience psychological stress compared to those without such exposure (22). These results supported the hypothesis that prolonged exposure to various stressors may lead to persistent autonomic dysregulation and elevated secretion of stress hormones, such as cortisol, ultimately contributing to

sustained hypertension (23). The study's outcomes were discussed in the context of existing literature, which has documented the physiological mechanisms underlying stress-induced cardiovascular alterations, and emphasized the critical need for healthcare providers to integrate stress management into hypertension treatment protocols (24). The findings also underscored the complex interplay between lifestyle factors and cardiovascular health, suggesting that tailored interventions addressing both behavioral and environmental stressors could improve blood pressure control (25). Such a comprehensive analysis added depth to the current understanding of psychosocial determinants in hypertensive populations and highlighted avenues for future research in developing multidisciplinary approaches to mitigate the burden of hypertension (26). Thus, the objective of the current study was to examine the association between psychological stress and blood pressure control among hypertensive patients in Punjab, with the aim of identifying modifiable risk factors that can be addressed in tailored intervention programs to ultimately enhance patient outcomes (27).

The study possessed several strengths that bolstered the credibility and applicability of its findings. A standardized and validated instrument, the DASS-42, was employed to assess psychological stress, ensuring consistency in data collection, while the systematic random sampling technique enhanced the representativeness of the sample drawn from three community healthcare clinics. Data were efficiently collected via a secure online platform, and subsequent analysis using SPSS (version 27) allowed for robust statistical examination of the associations between stress and various clinical factors (28). Despite these strengths, the study also had limitations. The cross-sectional design precluded the establishment of causal relationships, and the reliance on self-administered questionnaires introduced the potential for response and recall bias. In addition, the study focused solely on hypertensive male patients, thereby limiting the generalizability of the results to other demographic groups, particularly females. The absence of longitudinal follow-up data further constrained the ability to track temporal changes in stress and blood pressure over time. Nevertheless, these limitations were acknowledged, and the findings provided valuable insights into the psychosocial dimensions of hypertension. The discussion suggested that future research adopt longitudinal designs and include a more diverse population to better elucidate the causal pathways linking psychological stress with cardiovascular risk. The implications of the study reinforced the necessity for comprehensive, multidisciplinary approaches in managing hypertension, incorporating both lifestyle modifications and targeted stress reduction strategies to improve patient outcomes (28).

A recent comparative study by Malik and colleagues investigated the relationship between psychological stress and blood pressure control among hypertensive and normotensive patients in an urban setting in Pakistan. The study recruited 300 participants, equally divided between hypertensive and normotensive groups, and employed a cross-sectional design with systematic random sampling to ensure representativeness. Each participant completed a validated stress assessment instrument and underwent standardized blood pressure measurements, and the results demonstrated that hypertensive patients had significantly higher stress scores compared to their normotensive counterparts, with mean scores of 18.3 and 12.5 respectively. The study further identified that lifestyle factors such as reduced physical activity, poor sleep quality, and limited social support were more prevalent among hypertensive individuals, and these factors were strongly correlated with increased psychological stress and suboptimal blood pressure control. Malik et al. observed that a higher proportion of hypertensive patients experienced moderate to severe levels of stress, and after adjusting for confounding variables such as age, body mass index, and comorbid conditions, the data indicated that elevated stress levels were independently associated with poor blood pressure regulation (29). The authors concluded that integrating targeted stress management interventions into routine clinical practice could substantially improve blood pressure outcomes in hypertensive patients, emphasizing the need for holistic treatment approaches that address both physiological and psychological factors. These findings not only corroborated the observations made in the current study conducted in Punjab but also suggested that the detrimental impact of psychological stress on blood pressure regulation is consistent across diverse populations and healthcare settings, thereby advocating for the implementation of comprehensive, multidisciplinary strategies to mitigate cardiovascular risk (29).

CONCLUSION

In conclusion, the study demonstrated that psychological stress significantly influences blood pressure control among hypertensive patients, highlighting the critical role of a holistic treatment approach. The investigation revealed that the interplay between emotional well-being and lifestyle factors contributes to the persistence of elevated blood pressure, reinforcing the notion that traditional pharmacological strategies alone may be insufficient to manage hypertension effectively. The findings underscored the importance of addressing modifiable risk factors—such as the management of chronic conditions, the promotion of regular physical activity, the reduction of workplace and home stressors, and the improvement of sleep quality—to alleviate psychological stress and ultimately enhance cardiovascular health. This comprehensive approach emphasizes the need for healthcare providers to integrate stress

management techniques and supportive interventions into routine clinical practice, thereby fostering better patient outcomes and a higher quality of life. By concluding that psychological stress is not merely an accompanying feature but a contributing factor to suboptimal blood pressure regulation, the study provided a robust foundation for future research and intervention programs aimed at reducing the overall cardiovascular risk in hypertensive populations.

AUTHOR CONTRIBUTIONS

Author	Contribution
Abdul Rehman*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Mehnaz Abdul Sitar	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Muhammad Azhar	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Aziz Ur Rahman	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Maqsood Ur Rehman	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Ali Ghulam	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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