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Association Between Anxiety and Hypertension in Working-Age Adults: A Cross-Sectional Study

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Abstract

Background: Anxiety is a prevalent psychological condition that activates neuroendocrine stress pathways and may contribute to blood pressure dysregulation. Hypertension remains a major global public health concern and is frequently undiagnosed among working-age adults, who are commonly exposed to substantial psychosocial stressors.

Objective: To examine the association between anxiety levels and hypertension among working-age adults in Kartasura District, Sukoharjo Regency, Indonesia.

Methods: This community-based cross-sectional study included 219 adults aged 22–59 years, recruited using consecutive non-random sampling. Anxiety levels were assessed using the Zung Self-Rating Anxiety Scale, while blood pressure was measured with a calibrated digital sphygmomanometer. Hypertension was categorized according to national clinical guidelines. Data were analyzed using Kendall's tau-b correlation test with a significance level of 0.05.

Results: Most participants reported mild to moderate anxiety, and more than 40% were classified as hypertensive. A statistically significant and strong positive correlation was observed between anxiety level and hypertension severity ($r = 0.626$; 95% CI 0.55–0.70; $p < 0.001$), indicating that higher anxiety scores were consistently associated with higher blood pressure categories.

Conclusion: Anxiety levels are strongly associated with hypertension among working-age adults. These findings highlight the importance of integrating psychological assessment and stress management into hypertension prevention and control strategies, particularly within primary care and physiotherapy-based services.

Keywords
Anxiety; Hypertension; Blood Pressure; Psychological Stress; Cross-Sectional Studies

Introduction

Hypertension remains one of the most critical global public health challenges and continues to be a leading contributor to cardiovascular morbidity and premature mortality worldwide. The World Health Organization estimates that more than 1.28 billion adults are living with hypertension, with a disproportionate burden in low- and middle-income countries.(1) Despite advances in screening and pharmacological management, hypertension is frequently asymptomatic and inadequately controlled, particularly among working-age adults.(2) This condition increases long-term cardiovascular risk and contributes substantially to preventable disease burden during economically productive years.

Traditionally, hypertension has been attributed primarily to biological and lifestyle-related determinants, including genetic predisposition, aging, obesity, physical inactivity, unhealthy dietary patterns, and tobacco use.(3) However, accumulating evidence suggests that these factors alone do not fully explain the observed variation in blood pressure regulation across populations. In recent years, psychological factors have gained increasing recognition as important contributors to blood pressure dysregulation, warranting greater attention within both clinical practice and public health research.(4)

Anxiety is one of the most prevalent psychological conditions worldwide and is characterized by persistent worry, emotional tension, and heightened physiological arousal.(5) From a pathophysiological perspective, anxiety activates the sympathetic nervous system and the hypothalamic–pituitary–adrenal axis, leading to increased secretion of catecholamines and cortisol.(6) These neuroendocrine responses elevate heart rate, promote peripheral vasoconstriction, and increase systemic vascular resistance, thereby contributing to elevated blood pressure. When anxiety persists over time, repeated activation of these mechanisms may result in sustained blood pressure elevation, endothelial dysfunction, and structural vascular changes that facilitate the development and progression of hypertension.(7,8)

Several epidemiological and clinical studies have reported associations between anxiety and hypertension, particularly among older adults and individuals with established cardiovascular disease. Evidence indicates that individuals with higher anxiety levels tend to exhibit poorer blood pressure control, reduced treatment adherence, and diminished quality of life.(9) However, the majority of existing research has focused on elderly populations, while adults of working age have received comparatively limited attention. This represents a critical gap, given that psychological stressors are highly prevalent during the working years.

Adults of working age are frequently exposed to multiple psychosocial stressors, including occupational demands, job insecurity, financial pressure, and family responsibilities. These stressors may increase vulnerability to anxiety and contribute to stress-related physiological changes affecting cardiovascular regulation.(10) Epidemiological data from Indonesia indicate a rising prevalence of hypertension among adults of productive age, suggesting that hypertension is no longer confined to older populations.(11) Nevertheless, psychological determinants such as anxiety are rarely incorporated into routine hypertension assessment and management strategies for this age group, particularly in community and primary care settings.

To date, empirical evidence examining the relationship between anxiety levels and hypertension among working-age adults in community-based populations remains limited, especially in low- and middle-income countries such as Indonesia. Many previous studies have combined wide age ranges or focused on clinical samples, thereby limiting the generalizability of their findings to community-dwelling adults of productive age. Consequently, there is a clear need for population-based observational studies that explicitly evaluate anxiety as a correlating factor of hypertension within this demographic group.

Therefore, the present study aimed to examine the association between anxiety levels and hypertension among working-age adults residing in Kartasura District, Sukoharjo Regency, Indonesia. By focusing on a community-based population, this study seeks to contribute evidence that supports a more holistic approach to hypertension management, integrating both physiological and psychological dimensions. Based on existing theoretical frameworks and empirical findings, it was hypothesized that higher anxiety levels would be positively and significantly associated with higher blood pressure categories among working-age adults.

Methods

This study employed an observational analytic design with a cross-sectional approach to examine the association between anxiety levels and hypertension at a single point in time. The cross-sectional design was selected to efficiently assess the relationship between psychological and physiological variables within a community-based population. Although this design is appropriate for identifying associations, it does not allow causal inference regarding the directionality of the observed relationship. The study was conducted in Kartasura District, Sukoharjo Regency, Central Java, Indonesia. Data collection was carried out from March to May 2024 and included participant recruitment, questionnaire administration, blood pressure measurement, and data processing.

The target population consisted of community-dwelling adults of working age (22–59 years) who were permanent residents of Kartasura District. Although the initial population frame was derived from community health records that included individuals previously diagnosed with hypertension, the final study sample comprised both normotensive and hypertensive participants. Blood pressure status was determined through direct measurement during data collection rather than based on prior medical diagnosis. This approach explains the presence of multiple blood pressure categories in the study results and ensures that the sample reflects a broader community-based population. The minimum required sample size was calculated using the Slovin formula with a margin of error of 6.9%, resulting in a minimum sample size of 200 participants. A total of 219 individuals met the eligibility criteria and were included in the final analysis.

Participants were recruited using a consecutive non-random sampling technique. Eligible individuals encountered during the data collection period were invited to participate until the target sample size was achieved. This sampling approach was selected due to logistical constraints inherent in community-based field research. However, the use of non-random sampling may increase the risk of selection bias and limit the generalizability of the findings.

Eligible participants were adults aged 22–59 years who were permanent residents of Kartasura District and were able to read and understand the study questionnaire. All participants were required to provide written informed consent prior to participation. Individuals were excluded if they had a clinical diagnosis of insomnia, diabetes mellitus, chronic kidney disease, or cardiovascular diseases other than hypertension. Pregnant women were also excluded to minimize potential physiological confounding related to pregnancy-associated blood pressure changes.

The variables examined in this study included anxiety level as the independent variable and blood pressure status as the dependent variable. Blood pressure status was categorized according to established clinical thresholds for hypertension severity. Anxiety level was operationally defined as a psychological response characterized by excessive worry, emotional tension, and heightened physiological arousal. It was measured using the Zung Self-Rating Anxiety Scale, a standardized self-administered questionnaire, and treated as an ordinal variable. Hypertension was defined as systolic blood pressure of 140 mmHg or higher and/or diastolic blood pressure of 90 mmHg or higher. Blood pressure was measured directly using a calibrated digital sphygmomanometer and analyzed as a numeric variable.

Anxiety levels were assessed using the Zung Self-Rating Anxiety Scale, a standardized self-report instrument consisting of 20 items that evaluate both psychological and somatic symptoms of anxiety. Each item is rated on a four-point Likert scale, with total scores categorized into mild, moderate, severe, and panic levels of anxiety. Previous validation studies have reported acceptable internal consistency for the Zung Self-Rating Anxiety Scale, with Cronbach's alpha values exceeding 0.70. Validation data for the Indonesian-language version of the instrument and corresponding reliability coefficients should be explicitly cited. Blood pressure was measured using a calibrated digital sphygmomanometer to obtain systolic and diastolic values expressed in millimeters of mercury.

Blood pressure measurements were conducted in accordance with standard clinical guidelines. Participants were instructed to rest for at least five minutes in a seated position before measurement. Measurements were taken on the upper arm with participants seated comfortably, feet flat on the floor, and the arm supported at heart level. At least one blood pressure reading was obtained for each participant. Repeated measurements were not performed, which may have introduced measurement variability and is acknowledged as a methodological limitation.

Data were collected through door-to-door visits conducted by trained researchers. Eligible participants received a comprehensive explanation of the study objectives and procedures and provided written informed consent prior to participation. Participants then completed the anxiety questionnaire independently, followed by blood pressure measurement performed by the research team using standardized procedures.

Data analysis was performed using statistical software. Univariate analysis was conducted to describe participant characteristics and variable distributions, including age, sex, anxiety level, and blood pressure category. Bivariate analysis was conducted to assess the association between anxiety levels and hypertension severity. As both variables were ordinal and did not meet normality assumptions, Kendall's tau-b correlation test was selected as the most appropriate statistical method. Statistical significance was set at an alpha level of 0.05. Confidence intervals were not included in the initial correlation analysis, representing a limitation in the precision of effect size estimation.

Potential sources of bias include selection bias resulting from the use of non-random sampling and information bias related to self-reported anxiety measures. In addition, no multivariable analysis was performed to adjust for potential confounders such as body mass index, smoking status, physical activity level, dietary intake, or antihypertensive medication use. These factors were not assessed and may have influenced the observed association.

The study was conducted in accordance with ethical principles for health research involving human participants. All participants received a detailed explanation of the study objectives and procedures and provided written informed consent prior to participation. Participant confidentiality and data anonymity were strictly maintained throughout the study period.

Results

Participant Flow

During the recruitment process, a total of 235 individuals were assessed for eligibility. Of these, 16 individuals were excluded due to failure to meet the inclusion criteria (n = 10) or refusal to participate (n = 6). Consequently, 219 participants were included in the final analysis. The flow of participant recruitment, exclusion, and inclusion is presented in Figure 1.

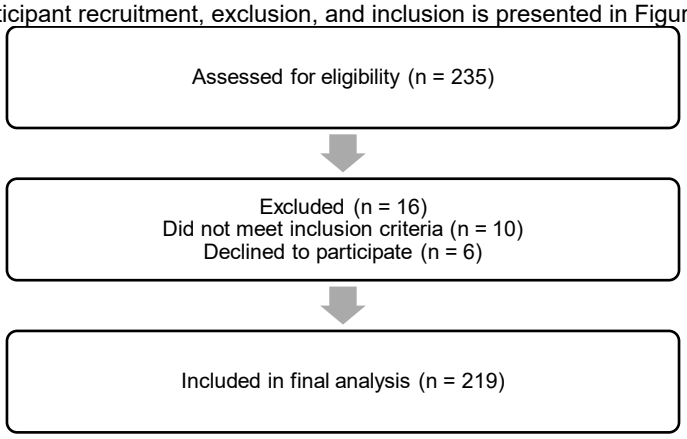

Figure 1. Flow diagram of participant recruitment and inclusion

Participant Characteristics

A total of 219 participants were included in the final analysis. All participants were within the predefined working-age range (22–59 years) and completed both the anxiety assessment and blood pressure measurement. No participants were excluded after enrollment due to missing or incomplete data.

Baseline characteristics of the participants are presented in Table 1. The mean age of the study population was 34.67 years (SD 11.74), indicating a predominance of young to middle-aged adults. The mean Zung Self-Rating Anxiety Scale score was 48.02 (SD 17.67), reflecting overall moderate anxiety levels among participants. Mean systolic blood pressure was 134.37 mmHg (SD 19.76), which falls within the prehypertensive range, while mean diastolic blood pressure was 79.95 mmHg (SD 11.18), remaining within normal limits.

Table 1. Baseline Characteristics of Participants (n = 219)

Variable	Minimum	Maximum	Mean	SD
Age (years)	20	59	34.67	11.74
ZSAS score	20	80	48.02	17.67
Systolic blood pressure (mmHg)	90	196	134.37	19.76
Diastolic blood pressure (mmHg)	45	113	79.95	11.18

ZSAS = Zung Self-Rating Anxiety Scale; SD = standard deviation.

Distribution of Anxiety Levels

The distribution of anxiety levels among participants is shown in Table 2. Most participants experienced mild to moderate anxiety, accounting for 68.0% of the study population. Severe anxiety was observed in approximately one-quarter of participants, while panic-level anxiety was reported by a small proportion.

Table 2. Distribution of Anxiety Levels Among Participants

Anxiety level	n	%
Mild	85	38.8
Moderate	64	29.2
Severe	56	25.6
Panic	14	6.4
Total	219	100

Distribution of Blood Pressure Categories

Blood pressure categories among participants are summarized in Table 3. Normal blood pressure was observed in 37.0% of participants, whereas 21.9% were classified as having high-normal blood pressure. Overall, 41.2% of participants were categorized as hypertensive, with stage 1 hypertension being the most prevalent category.

Table 3. Distribution of Blood Pressure Categories

Blood pressure category	n	%
Normal	81	37.0
High-normal	48	21.9
Hypertension stage 1	63	28.8
Hypertension stage 2	19	8.7
Hypertension stage 3	8	3.7
Total	219	100

Sex and Age Group Distribution

Participant distribution by sex and age group is presented in Table 4. The sex distribution was relatively balanced, with females accounting for 52.1% of the sample. Participants aged 20–33 years constituted the largest age group.

Table 4. Distribution of Participants by Sex and Age Group

Variable	Category	n	%
Sex	Male	105	47.9
	Female	114	52.1
	Total	219	100
Age group (years)	20–33	120	54.8
	34–46	49	22.4
	47–59	50	22.8
	Total	219	100

Association Between Anxiety Level and Hypertension

The association between anxiety level and blood pressure category was examined using Kendall's tau-b correlation analysis. The results are presented in Table 5**.** A statistically significant and strong positive correlation was identified between anxiety level and hypertension severity (r = 0.626; 95% CI 0.55–0.70; p < 0.001).

Table 5. Association Between Anxiety Level and Hypertension

Variables	Kendall's tau-b (r)	95% CI	p-value
Anxiety level vs. hypertension category	0.626	0.55–0.70	< 0.001

Discussion

This study examined the association between anxiety levels and hypertension among working-age adults in a community setting and demonstrated a statistically significant and strong positive relationship between the two variables. Higher anxiety levels were consistently associated with higher blood pressure categories, indicating that psychological distress may play an important role in blood pressure dysregulation among adults of productive age.

From a physiological perspective, the observed association is biologically plausible. Anxiety is known to activate the sympathetic nervous system and the hypothalamic–pituitary–adrenal axis, resulting in increased secretion of catecholamines and cortisol. These neuroendocrine responses elevate heart rate, increase peripheral vascular resistance, and promote sodium retention, all of which contribute to elevated blood pressure.(9,12) When anxiety is persistent, repeated activation of these mechanisms may lead to endothelial dysfunction and structural vascular changes that facilitate the development and progression of hypertension. The strength of the correlation observed in this study supports the relevance of these mechanisms in a community-dwelling working-age population.(7,13)

The findings of this study are consistent with previous national and international studies reporting significant associations between anxiety and hypertension. Prior research has predominantly focused on older adults or patients with established cardiovascular disease, often demonstrating poorer blood pressure control and reduced quality of life among individuals with elevated anxiety levels.(9,14) The present study extends this evidence by showing that the anxiety–hypertension relationship is also evident among working-age adults, a population that has received comparatively less attention in the literature. This is particularly important given the increasing prevalence of hypertension in younger and middle-aged adults reported in recent epidemiological data.(12,15)

Working-age adults are frequently exposed to a wide range of psychosocial stressors, including occupational demands, job insecurity, financial pressure, and family responsibilities. These stressors may increase vulnerability to anxiety and contribute to chronic stress-related physiological responses that affect cardiovascular regulation.(16) The relatively high prevalence of both anxiety and hypertension observed in this study suggests that psychological factors may be especially relevant in this age group and should not be overlooked in hypertension prevention and management strategies.

From a clinical and public health perspective, the findings highlight the importance of adopting a more holistic approach to hypertension management. Conventional strategies often emphasize pharmacological treatment and lifestyle modification, while psychological factors receive limited attention.(17) Integrating anxiety screening into routine hypertension assessment may help identify individuals at higher risk of poor blood pressure control. Early identification and management of anxiety could potentially improve treatment adherence, enhance self-management behaviors, and contribute to better cardiovascular outcomes.(18)

The results are also highly relevant to physiotherapy and primary care practice. Physiotherapists are well positioned to deliver non-pharmacological interventions that address both physical and psychological components of hypertension. Interventions such as structured aerobic exercise, breathing exercises, relaxation techniques, and stress management programs have been shown to improve autonomic balance, reduce anxiety symptoms, and support blood pressure regulation. Incorporating these approaches into physiotherapy-based hypertension programs may enhance the effectiveness of existing management strategies, particularly for working-age adults.(19,20)

Several limitations of this study should be considered when interpreting the findings. First, the cross-sectional design precludes causal inference, and the directionality of the relationship between anxiety and hypertension cannot be determined. It remains unclear whether anxiety contributes to the development of hypertension, whether elevated blood pressure increases anxiety levels, or whether both are influenced by unmeasured factors. Second, anxiety was assessed using a self-report questionnaire, which may be subject to reporting bias or social desirability effects. Third, blood pressure was measured at a single time point, which may not fully capture day-to-day variability or white-coat effects.

Selection bias may also be present due to the use of non-random consecutive sampling, potentially limiting the generalizability of the findings. In addition, several potential confounders—including body mass index, smoking status, physical activity level, dietary intake, and antihypertensive medication use—were not assessed or controlled for in the analysis. The absence of multivariable adjustment may have influenced the observed strength of the association.

Despite these limitations, this study has several strengths. It focused specifically on a working-age community population, addressed an underexplored research gap, and employed standardized instruments for anxiety assessment and blood pressure measurement. The inclusion of confidence intervals for the correlation estimate further strengthens the interpretability of the findings.

Future research should employ longitudinal or interventional study designs to clarify the causal pathways linking anxiety and hypertension. Prospective cohort studies could help determine temporal relationships, while randomized controlled trials are needed to evaluate the effectiveness of anxiety-targeted interventions—including physiotherapy-led stress reduction programs—on blood pressure outcomes. Such research would provide stronger evidence to inform integrated, multidisciplinary approaches to hypertension management.

Conclusion

This study demonstrated a statistically significant and strong positive association between anxiety levels and hypertension among working-age adults in a community-based setting. Higher anxiety levels were consistently associated with higher blood pressure categories, underscoring the relevance of psychological factors in cardiovascular health during economically productive years. These findings contribute to growing evidence that hypertension is not solely determined by biological and lifestyle factors but is also closely linked to psychological well-being.

From a clinical and public health perspective, the results highlight the need to incorporate psychological assessment into routine hypertension prevention and management strategies, particularly for working-age populations who are frequently exposed to occupational and social stressors. Early identification of anxiety may facilitate more comprehensive risk stratification and enable timely, targeted interventions that address both mental and physical health components of hypertension.

The findings are particularly relevant to physiotherapy and primary care services, where non-pharmacological interventions play an essential role in cardiovascular risk management. Physiotherapy-based approaches, including structured aerobic exercise, breathing exercises, relaxation techniques, and stress management programs, may serve as effective complementary strategies to reduce anxiety and support blood pressure control. Integrating these interventions into routine care may enhance treatment adherence, improve self-management behaviors, and contribute to better long-term cardiovascular outcomes.

Despite the strength of the observed association, causal relationships cannot be inferred due to the cross-sectional design of the study. Future research should therefore prioritize longitudinal and interventional designs to clarify temporal relationships between anxiety and hypertension. Randomized controlled trials evaluating anxiety-targeted non-pharmacological interventions, including physiotherapy-led stress reduction programs, are particularly warranted. Such studies would strengthen the evidence base for holistic, multidisciplinary approaches to hypertension management and support the integration of psychological care into cardiovascular health services.

Author Contribution

Conceptualization: Puspita Salwa Septa Wina, Wahyu Tri Sudaryanto
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Writing—review & editing: Wahyu Tri Sudaryanto
Supervision: Wahyu Tri Sudaryanto
All authors have read and approved the final version of the manuscript.

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Conflict of Interest Statement

The authors declare no conflict of interest.

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Ethics Statement

This study was conducted in accordance with the ethical principles of health research involving human participants. Ethical approval was obtained from the Faculty of Health Sciences, Universitas Muhammadiyah Surakarta, under the supervision of the academic ethics committee. Written informed consent was obtained from all participants prior to participation, and participant confidentiality and data anonymity were strictly maintained throughout the study.

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