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The effect of mindfulness interventions on blood pressure and stress in hypertensive patients: A Literature Review

El efecto de las intervenciones de mindfulness sobre la presión arterial y el estrés en pacientes hipertensos: una revisión de la literatura

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SUMMARY

Introduction*: Hypertensive patients have received appropriate treatment, but some still show uncontrolled blood pressure. One way to control blood pressure is to adopt a healthy lifestyle and manage stress, with or without drug therapy. This study aimed to review the literature on the effectiveness of mindfulness interventions on hypertensive patients' blood pressure and stress, providing a focused and comprehensive understanding of the topic.* **Methods***: A comprehensive literature review of randomized control trials reporting the effectiveness of mindfulness programs on blood pressure and stress in hypertensive patients served as the method. Relevant articles published from January 2019 to December 2023 are in English and open access. We conducted article searches in four databases: Scopus, ScienceDirect, ProQuest, and CINAHL, ensuring a thorough and exhaustive search.* **Results:** *There were 14 articles reviewed. The number of participants was 906. Five studies used mindfulness-based stress reduction (MBSR). One study used the MBSR intervention program and samavittri pranayama (Sama Vritti is Sanskrit for equal breathing, is a pranayama technique). Most articles found that the mindfulness intervention significantly reduced the average systolic and diastolic blood pressure in the intervention group compared to the initial value. The systolic blood pressure of the control group significantly decreased (p = 0.001). Four studies were conducted in the clinic to measure blood pressure. Two studies used clinical and ambulatory measurements. Three studies used ambulatory blood pressure measurements. Eight articles show the effectiveness of mindfulness in reducing stress. The study showed significant differences between the experimental and control groups in the mean scores of positive stresses (p = 0.001) and negative stress (p = 0.001).* **Conclusion:** *The thoroughness of our research process and the validity of the findings underscore the significant role of mindfulness in reducing stress levels and blood pressure, including systolic and diastolic measurements, in individuals with hypertension.*

Keywords: *Blood pressure, hypertension, mindfulness, stress.*

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RESUMEN

Introducción: *Los pacientes hipertensos han recibido el tratamiento adecuado, pero algunos aún presentan presión arterial no controlada. Una forma de controlar la presión arterial es adoptar un estilo de vida saludable y manejar el estrés, con o sin terapia farmacológica. El objetivo de este estudio fue revisar la literatura sobre la efectividad de las intervenciones de mindfulness en la presión arterial y el estrés de los pacientes hipertensos.* **Métodos:** *Una revisión de la literatura de ensayos controlados aleatorios que informan sobre la efectividad de los programas de mindfulness en la presión arterial y el estrés en pacientes hipertensos sirvió como método. Los artículos relevantes publicados desde enero de 2019 hasta diciembre de 2023 están en inglés y son de acceso abierto. Se realizaron búsquedas de artículos en cuatro bases de datos: Scopus, Science Direct, Proquest y CINAHL* **Resultados:** *Los resultados arrojaron un total de 14 artículos que fueron revisados. Hubo un total de 906 participantes. Cinco estudios utilizaron la reducción de estrés basada en la atención plena. (MBSR). Un estudio incluyó el programa terapéutico MBSR con la respiración cuadrada o samavritti pranayama. La mayoría de las publicaciones indicaron que la intervención de mindfulness tuvo un impacto considerable en la reducción tanto de la presión arterial sistólica como diastólico promedio en el grupo de intervención, en comparación con la medición inicial. La presión arterial sistólica del grupo de control mostró una caída considerable (p = 0,001). Se llevaron a cabo cuatro investigaciones clínicas para evaluar la presión arterial. Dos investigaciones utilizaron tanto medidas clínicas como ambulatorias. Tres estudios utilizaron lecturas de presión arterial ambulatoria. Hay un total de ocho artículos que proporcionan evidencia de la eficacia del mindfulness en la reducción del estrés. La investigación reveló disparidades sustanciales entre los grupos experimental y de control en las calificaciones promedio de estrés positivo (p = 0,001) y estrés negativo (p = 0,001).* **Conclusión:** *En pacientes con hipertensión, se ha demostrado que el mindfulness es beneficioso para reducir los niveles de estrés y la presión arterial, tanto sistólica como diastólica.*

Palabras clave: *Mindfulness, estrés, hipertensión, presión arterial.*

INTRODUCTION

Hypertension is a major risk factor for cardiovascular disease, the deadliest non-communicable disease. Hypertension is the leading cause of cardiovascular disease and premature death worldwide, impacting around 1.2 billion individuals globally (1,2). According to the World Health Organization (WHO) (2011), the global prevalence of hypertension is estimated to be one billion individuals. The incidence of hypertension is expected to rise significantly, with a projected 29 % of individuals globally experiencing hypertension by 2025. Hypertension is responsible for around 8 million fatalities annually (2). According to the Indonesian Ministry of Health, the prevalence of hypertension among Indonesians is 1 in 3, and this rate is consistently rising annually (3). The data from the Regional Health Research (Riskesdas) conducted in 2018 indicate a rise in hypertension from 25.8 % in 2013 to 34.1 % in 2018. In 2018, the prevalence of hypertension in Indonesia was 34.1 %, with the highest prevalence in South Kalimantan at 44.3 % and the lowest in Papua Province at 22.2 % (4).

Hypertension is commonly known as the silent killer due to the absence of symptoms in individuals with high blood pressure. Most patients report feeling healthy and not experiencing any symptoms of illness. This condition significantly elevates the likelihood of developing heart disease, stroke, kidney failure, and other fatal conditions, resulting in substantial healthcare expenses (4). The primary determinants contributing to reducing blood pressure are environmental influences and behavioral choices (6). One method of managing high blood pressure in hypertensive patients is by the adoption of a healthy lifestyle and the implementation of disease control measures, with or without the use of medication (4).

This leads to heightened emotional and behavioral alterations and interferes with cognitive and biological processes. Contemporary modifications in lifestyle contribute to a multitude of mental health issues. The WHO reports that around 250 million individuals are impacted by mental illness (7). Stress is a prevalent occurrence in human life, including among individuals with hypertension. Any internal or external factor that disturbs the homeostasis balance will trigger a stress response and subsequent adaptation. According to the Roy Adaptation Model (RAM),

which are (a) stimuli, (b) coping processes, and (c) adaptive responses used to guide interdisciplinary education, knowledge development, practice, and research, a stimulus will regulate the body's coping processes through regulators and cognators. The cognator subsystem is related more to attention, memory, learning, problem-solving, decision-making, excitement, and defense status. The four modes of adaptation defined in Roy Adaptation Model are physiologic, self-concept, role function and interdependence modes (8). Nurses can play a role in initiating and supporting efforts that address the health and social needs of the community, particularly among groups such as hypertension patients who face stress. They can do this by offering mindfulness therapies. Despite receiving sufficient medication, multiple research findings indicate that hypertension patients continue to exhibit suboptimal blood pressure levels. Less than 25 % and 10 % of hypertension individuals in industrialized and developing nations, respectively, can attain blood pressure management. Hence, there is a requirement for further therapies to decrease blood pressure and alleviate stress.

Prior studies have thoroughly examined the efficacy of mindfulness therapies in reducing stress and blood pressure (9-21). These studies have documented a reduction in blood pressure and stress levels among participants in the mindfulness intervention group compared to those in the control group. This literature review aims to present data on the efficacy of mindfulness therapies in lowering blood pressure and stress levels.

METHODS

Search Strategy and Selection Criteria

The search was conducted on pertinent publications published between January 2019 and December 2023, utilizing English, open access, full-text resources from four databases: Scopus, ScienceDirect, ProQuest, and CINAHL. The search was conducted using the PICO framework, which involved the following components: Population (individuals afflicted with hypertension), Intervention (attention and prayer or dhikr or spirituality), Comparison alone between the intervention and control groups, and Outcome (blood pressure and stress). Searches employed the Boolean operators "AND" and "OR" in conjunction with the terms "mindfulness," "Stress," "Blood pressure," and "Hypertension."

Selection of Studies

The literature review was performed and documented following the PRISMA and Rayyan flowchart criteria. The initial step was utilizing Rayyan to identify duplicate entries and conducting an abstract selection process to ensure alignment with the specified inclusion and exclusion criteria. Subsequently, the articles were conducted.

Eligibility Criteria

1) Patients with high blood pressure who are 18 years or older, regardless of whether they receive therapy.
2) Interventions: Mindfulness interventions such as Mindfulness-Based Stress Reduction (MBSR) or similar approaches.
3) Comparator: The intervention group received mindfulness, while the control group received treatment as normal.
4) Results: The findings indicate the measurement of blood pressure and the value of pound currency.
5) The research design includes a randomized clinical trial, cross-sectional survey, prospective clinical trial, associative analytic, quasi-experimental, cluster randomized controlled trial, experimental study, two-group single-site clinical trial design, retrospective study, cross-sectional design, descriptive study, and a two-site randomized clinical trial.
6) The English language.
7) Timeframe of Publication: January 1, 2019, to December 1, 2023.
8) Article category: Open access and full text.

Exclusion Criteria

Hypertensive individuals who are currently breastfeeding, pregnant, or have already undergone mindfulness therapy

RESULTS

The remaining 38 publications were evaluated for eligibility based on their entire text using the title, abstract, publication type, and language. Ultimately, 12 papers were included in the systematic observation.

The author found a total of 1,326 publications by utilizing four different databases. Specifically, Scopus yielded 128 articles, CINAHL provided 308 articles, ScienceDirect contributed 284 articles, and ProQuest yielded 606 articles. After eliminating duplicate articles in eight sources and excluding articles that did not meet the PICO criteria, 367 articles were included in the screening procedure. The article writing process involved utilizing the Rayyan tool to filter articles based on their title and abstracts. This resulted in a total of 251 articles, with the remaining 116 articles specifically focusing on mindfulness. An eligibility selection was conducted based on the publication type and language, followed by an assessment of suitability using the full text. Subsequently, 29 articles were obtained for further selection, with 14 articles meeting the inclusion criteria and 15 being excluded due to insufficient study quality.

Additional search results can be observed by referring to the flow diagram in Figure 1, which represents the literature search process.

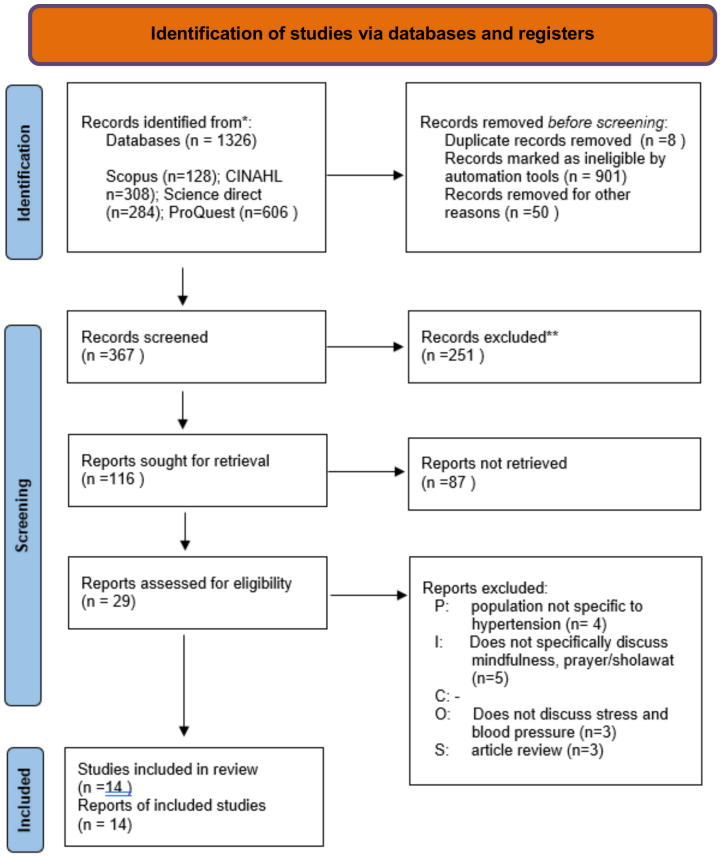

Figure 1 PRISMA flowchart
The final outcomes consist of 14 publications that align with the research

Table 1

Characteristics of Reviewed Studies

No	Title, Author, Year of publication	Method	Results
1	Effects of Mindfulness-Based Stress Reduction on Blood Pressure, Mental Health, and Quality of Life in Hypertensive Adult Women: Randomized Clinical Pilot Study (5)	Design: Randomized clinical trial Subjects: The study included 80 women with hypertension selected from the Imam Ali Healthcare Center in Iran. These participants were divided into two groups: an intervention group consisting of 40 women and a control group consisting of another 40 women. Variable Independent: mindfulness-based stress reduction (MBSR) Dependent: blood pressure, stress, depression, anxiety, and quality of life Instrument: Depression, Anxiety, and Stress Scale-21 (DASS-21) and 36-Item Short Form Survey questionnaire (SF-36) Analysis: Independent t-test, paired t-test, and MANCOVA test	Following the implementation of the mindfulness intervention, the intervention group's average systolic and diastolic blood pressure decreased significantly compared to the baseline measurement. The control group had a systolic blood pressure of 140.18 ± 14.27 mmHg compared to 142.15 ± 10.23 mmHg and a diastolic blood pressure of 84.62 ± 9.22 mmHg compared to 88.51 ± 8.54 mmHg (P = 0.001). The intervention group saw a noteworthy improvement in quality of life and decreased stress, anxiety, and depression levels (P<0.05).
2	The Effect of Adapted Mindfulness Training on Participants With High Offices Blood Pressure: MB-BP Study: Randomized Clinical Trial (6)	Design: Randomized clinical trial (RCT) Subject: The study included 201 individuals diagnosed with hypertension. 101 were assigned to the intervention group, and 100 were assigned to the control group. Variables: Independent: Mindfulness training Dependent: Blood pressure and stress Instrument: 10 Felt items Stress Scale; Five-Faceted Mindfulness Questionnaire. Analysis t-test results	The study revealed a noteworthy decrease in systolic blood pressure in the mindfulness group (n=100) compared to the control group. The main result was the difference in unmonitored clinic systolic blood pressure after 6 months. The study demonstrated a decrease in systolic blood pressure of 5.9 mm Hg (95% CI, –9.1 to –2.8 mm Hg) compared to the control group's decrease of 4.5 mm Hg at 6 months (95% CI, –9.0 to –0.1 mm Hg) from the initial measurement. The DASH (Dietary Approaches to Stop Hypertension) diet score was 0.32 (95% CI, –0.04 to 0.67), while the mindfulness score was 7.3 (95%).
3	Mindfulness-Based Exercise to Reduce Blood Pressure and Stress Priest (7)	Design: Cross section Subjects: A total of 11 priests, ranging in age from 27 to 95 years old, Variable Dependent: Blood pressure, stress Independent:	Evidence of the efficacy of mindfulness-based therapies has been shown through decreased stress levels and lowered blood pressure after applying mindfulness practices. The average systolic blood pressure

Continued in pag. S271…

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No	Title, Author, Year of publication	Method	Results
		Mindfulness-Based Practice Instrument: Perceived Stress Scale (PSS), blood pressure observation sheet Analysis: t test; repeated measures analysis of variance (RM-ANOVA)	e (SBP) of 121.06 mm Hg and diastolic blood pressure (DBP) of 76.72 mm Hg are within the target blood pressure range below 150/80 mm Hg. Practicing mindfulness has the potential to reduce blood pressure levels.
4	Mindfulness-Based Meditation Sessions May Result in Reduction of Cardiovascular Risk in Hypertension Patients: A Pilot Study (9)	Design: Clinical trials prospective, Subjects: 60 individuals Variable Independent: Single Mindfulness-Based Meditation Dependent Variable: Blood Pressure Instrument The International Physical Activity Questionnaire (IPAQ-6) is a standardized survey used to assess levels of physical activity The one-way analysis of variance (ANOVA) is used to analyze ABPM data, whereas the two-way ANOVA is used to analyze blood pressure	As determined by statistical analysis, hemodynamic measures between the treatment group and the control group did not significantly change. However, the morning systolic BP exhibited a statistically significant decrease following the practice of meditation. The systolic blood pressure (SBP) during the morning surge was found to be significantly lower after the meditation session ($t=3.497, P<0.05$). Furthermore, a significant trend was observed in the mean blood pressure (MBP) readings between sessions after meditation, with a t-value of -2.648 and $p< 0.05$. The findings of our investigation revealed a reduction in morning systolic blood pressure. There was a noticeable decrease in median blood pressure (MBP) measurements throughout the day ($p = 0.057$). Nevertheless, the MBSR intervention did not result in any significant alteration in clinical blood pressure. Thus, a single application of MBSR has the potential to be a significant strategy in reducing cardiovascular risk in sedentary hypertensive women.
5	Benefits of Mindfulness Meditation in Lowering Blood Pressure and Stress in Arterial Hypertension Sufferers (10)	Design: Randomized controlled trial Subjects: 24 individuals with normal high blood pressure and 18 individuals with grade I hypertension. Variable Meditation technique: mindfulness meditation blood pressure, anxiety, stress and depression Instruments:	Initially, the intervention group had slightly higher blood pressure levels that were not statistically significant, while the second group had similar values when assessed by ambulatory blood pressure monitoring (ABPM). By week 8, the intervention group had significantly lower ambulatory blood pressure monitoring scores the three

Continued in pag. S272„

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No	Title, Author, Year of publication	Method	Results
		The Perceived Stress Scale, Depression, Anxiety and Stress Scale (DASS-21), and Five-Sided Mindfulness Questionnaire (FFMQ) are all measures used to assess levels of stress, depression, anxiety, and mindfulness Analysis: Comparative descriptive	the control group. The intervention group had average blood pressure readings of 124/77 mmHg, whereas the control group had 126/80 mmHg ($p < 0.05$). Additionally, the intervention group had average readings of 108/65 mmHg, whereas the control group had 114/69 mmHg ($p < 0.05$). The overnight systolic blood pressure was associated with lower clinically observed systolic pressure levels (130 mmHg vs 133 mmHg; $p = 0.02$). During the eighth week, the mindfulness group exhibited reduced diastolic blood pressure levels measured by clinical assessments.
6	Effectiveness of Mindfulness-Based Group Therapy on Stress Perception, Cognitive Emotional Regulation, and Self-Care Behavior in Hypertension Sufferers (11)	Design: The study utilized a quasi-experimental design that included a pre-test, post-test, follow-up, and control group Subjects: All individuals diagnosed with hypertension were referred to health centers on Kish Island, Iran, between March and June 2010. The research sample had 32 candidates selected based on meeting the requirements using the purposive selection method. Subsequently, the participants were randomized to experimental and control groups in a random manner Variables: Stress Mindfulness-Based Group Therapy, Stress Perception, Cognitive Emotional Regulation, and Self-Care Behavior Instrument: Perceived Stress Scale Analysis: Utilizing the repeated measures analysis of variance function in SPSS version 22. The test's significance threshold is 0.05	The results showed significant differences between the experimental and control groups in the mean scores of positive stresses ($p=0.001$), negative stress ($p=0.001$), positive emotions ($p=0.001$), negative emotions ($p=0.001$), treatment regimen ($p=0.003$), diet ($p=0.011$), and disease management ($p=0.026$) at post-test and follow-up. However, there was no significant difference between the food label mean scores ($p=0.195$).
7	Dhikr and Prayer Guidance Regarding Peace of Mind and Controlling Blood Pressure (12)	Design: quasi-experimental with a pretest-post-posttest approach Subject: 24 older individuals with hypertension Variables:	The study's findings indicated that the p-value was 0.036, less than the significance level of 0.05. This suggests that the intervention of dhikr and prayer direction did not have a meaningful impact on the mental calm

Continued in pag. S273…

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No	Title, Author, Year of publication	Method	Results
		Independent: Instructions for Dhikr and Prayer to Attain Inner Tranquility. Individuals who rely on someone else for financial support or care Dependent: Regulation of Blood Pressure Instrument: observation form Analysis: Wilcoxon Signed-Rank Test and T-test	tof older individuals with hypertension in the intervention group. The examination of blood pressure before and after in the intervention group yielded a p-value of 0.0001 <0.05, indicating a significant impact of the intervention group variable (systole) on blood pressure.
8	Effects of the Mindfulness-Based Blood Pressure Reduction (MB-BP) program on depression and neural structural connectivity (13)	Design: Randomized clinical trials (RCT) Subjects: The study included 36 individuals, with 14 groups assigned to the MBBP intervention and 22 groups assigned to the control condition. The inclusion criteria for the entire randomized controlled trial (RCT) were limited to those with hypertension. High blood pressure is defined as having a systolic blood pressure (SBP) of 120 mm Hg or higher or a diastolic blood pressure (DBP) of 80 mm Hg or higher. To participate in the study, individuals must be able to communicate effectively in English, including speaking, reading, and writing. The study included adults who were 18 years of age or older, regardless of their gender or racial/ethnic background Variables: Independent: Mindfulness-Based Blood Pressure Reduction Program (MB-BP) Dependent: Reduction in arterial blood pressure Instrument: Guidelines set out by the American Heart Association Analysis: Repeated measures ANOVA (RM ANOVA), standard linear regression	DTI data analysis identified notable group disparities in various white matter brain pathways associated with the limbic system and/or blood pressure. Measures of interoception and depression were substantially linked to specific alterations in brain structural connectivity. The study concludes that MB-BP causes alterations in the structural connections inside the brain, which may facilitate positive improvements in depression and the ability to perceive internal bodily sensations in persons with hypertension.
9	Comparing the effectiveness of mindfulness-based stress reduction therapy and Islamic spirituality therapy on the quality	Design: Empirical investigation employs an experimental approach, utilizing a pretest-post-test design with a control	After the intervention, the MBSR and spiritual therapy group substantially improved their overall quality of life score (p<0.001). However, the control

Continued in pag. S274…

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No	Title, Author, Year of publication	Method	Results
	of life of hypertensive heart patients (14)	group. Subject: A total of 75 participants were chosen and allocated into two experimental groups and one control group by a random selection process, ensuring that each group comprised 25 individuals. Variable Independent: MBSR spiritual therapy with an Islamic perspective. Dependent: Quality of life Instrument: The McNew quality of life questionnaire and John Kabbat's MBSR Protocol are two assessment tools used to measure different aspects of well-being Analysis: ANOVA and paired t-test	group's overall quality of life score did not change after the intervention ($p = 0.10$). There was a notable disparity among the three groups in terms of the overall quality of life score. Specifically, the average difference in the quality-of-life score between the spiritual therapy group before and after the intervention was larger than the other groups. The statistical significance of the result is extremely high, with a p-value less than 0.001.
10	Effects of mindfulness on lifestyle behavior and blood pressure: A randomized controlled trial (15)	Design: A single-site clinical trial with two arms was designed. Subjects: A total of 52 female subjects were included in the study. There are 20 participants in the study. HPP, with a sample size of 16. The inclusion criteria encompassed individuals with hypertension, regardless of whether they were taking prescribed antihypertensive medication. The exclusion criteria encompassed current pregnancy or nursing, substance misuse, and chemotherapy. Additional exclusions encompassed people engaged in meditation or yoga, adhering to a weight loss regimen or other behavioral intervention, or unable to fully commit to the study's duration. Furthermore, individuals with untreated mental issues and an inability to speak or read English were also excluded Variables: Independent: Caution Dependent: Lifestyle behaviors that reduce blood pressure Instrument:	The greater decrease in blood pressure observed in the MAP group provides further evidence that the mindful meditation technique is a safe and effective method for reducing blood pressure in persons with hypertension. A notable correlation was seen between systolic blood pressure (SBP, $p = 0.005$) and diastolic blood pressure (DBP, $p = 0.003$) in relation to the time difference between mean arterial pressure (MAP) and high pulse pressure (HPP). The average reduction in systolic blood pressure (SBP) from the beginning of the study to week 13 was 19 mm Hg (from 138 ± 15 mmHg to 119 ± 6 mm Hg) for the MAP group, while it was 7 mmHg (from 134 ± 18 mm Hg to 127 ± 22 mm Hg) for the HPP group. Comparatively, the MAP group had significantly larger reductions in DBP compared to the HPP group, with a fall of 12 mm Hg (from 89 mm Hg ± 11 to 77 ± 7 mm Hg) and a decrease of 1 mm Hg (from 81 ± 16 mm Hg to 80 ± 18 mm Hg), respectively. The mean systolic blood pressure (SBP) was consistently lower that

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No	Title, Author, Year of publication	Method	Results
		Rapid Eating and Activity Assessment for Patients (REAP) is a tool for quickly evaluating and measuring a patient's eating habits and physical activity levels. The Exercise Behavior Questionnaire (EB) comprises six items, while the Brief Treatment Questionnaire 1 (BMQ) is also included. Analysis: T-test	week in the MAP group compared to the HPP group, even though two participants in the MAP group had discontinued their antihypertensive medication. A similar pattern was noticed in DBP, although the disparities between the two groups were less pronounced. The MAP group generally exhibited a more pronounced downward trend in blood pressure (BP) than the HPP group, particularly in systolic blood pressure (SBP).
11	Attention to stress and anxiety management in nursing students in clinical simulation: A quasi-experimental study (16)	Design: Quasi-experimental research with a non-equivalent control group design Subject: There is a total of 42 nursing students, including 21 students in the experimental group (EG) and 21 students in the control group (CG) Variables: Dependent: Blood pressure, heart rate, stress Independent: Attention Instrument: VAS refers to the self-administered stress analog scale, while STAI stands for the State-Trait Anxiety Inventory The FFMQ, which stands for Five-Faced Mindfulness Questionnaire, is a questionnaire used to assess mindfulness. Analysis: Descriptive statistics and inferential statistics Mann-Whitney and Wilcoxon tests	During the prebriefing phase, the physiological measures showed improvement. However, these indicators remained considerably lower in the experimental group, with a diastolic blood pressure p-value of 0.032 and a heart rate p-value of 0.048. The management of stress levels ($p = 0.029$) and anxiety ($p = 0.016$) were improved. Both groups in the debriefing session exhibited statistically significant decreases in multiple physiological indicators and reductions in stress and anxiety. There were no apparent alterations in attention. A statistically significant difference in stress was seen only during the preadministration phase ($p = 0.029$), with a medium effect size ($r = 0.33$). At the beginning of the study, no statistically significant differences were seen between the groups in terms of global scores or domain scores.
12	The Influence of Mindfulness Level on Drug Adherence in Hypertension sufferers (17)	Design: This is a cross-sectional, descriptive study. Subjects: 68 individuals diagnosed with hypertension Variables: Independent:	There were no notable disparities across groups in terms of medication adherence when analyzed according to gender, education level, employment situation, and marital status.

Continued in pag. S276…

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No	Title, Author, Year of publication	Method	Results
		Attention Dependent: Adherence to drug regimen Instrument. The user refers to the Socio-demographic data form, the Mindful Attention Awareness scale (MAAS), and the Modified Morisky Adherence scale (MMAS). Analysis: Chi-square, Student t-test, Mann-Whitney U test, and multivariate logistic regression are statistical methods	Among those with a familial predisposition to hypertension, there was a notable increase in the frequency of low medication adherence in comparison to those who exhibited moderate to high levels of medication compliance. There was no statistically significant disparity in medication adherence scores based on the duration of hypertension. Participants with moderate to high medication adherence demonstrated significantly higher Mean MAAS scores. There was no statistically significant variation in medication adherence scores based on the duration of hypertension (p=0.665). The average MAAS scores were considerably greater among individuals who demonstrated moderate to high levels of drug adherence (p=0.004).
13	The effectiveness of mindfulness-based stress reduction and sama vritti pranayama on reducing blood pressure, improving sleep quality, and reducing stress levels in elderly people with hypertension (18)	Design: Cross-sectional model Subject: Thirty individuals are afflicted with hypertension. Variables: Dependent: Sleep quality, blood pressure, stress level Independent: Programs for Mindfulness-Based Stress Reduction (MBSR) and sama vittri pranayama. Intervention: The Indonesian version of the Pittsburgh Sleep Quality Index (PSQI) and the Mindfulness scale (Kentucky Inventory of Mindfulness Skills (KIMS) scale) are available Analysis: Student's T-test and Chi-square test	In summary, these results demonstrate that the integration of Mindfulness-Based Stress Reduction (MBSR) with sama vritti pranayama effectively lowers blood pressure in older individuals diagnosed with hypertension. The average systolic blood pressure in the intervention group exhibited a significant difference ($p < 0.001$). The mean systolic blood pressure was 155.00 mmHg before and 130.00 mmHg after. The control group had an average systolic blood pressure of 164.00 mmHg before the intervention, which decreased to 157.00 mmHg after the intervention. The intervention group exhibited a statistically significant difference in

Continued in pag. S277…

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No	Title, Author, Year of publication	Method	Results
			mean diastolic blood pressure ($p < 0.001$). The average diastolic blood pressure was 102.5 mmHg before and 90.00 mmHg after. The control group had an average diastolic blood pressure of 107.00 mmHg before the intervention, which decreased to 96.00 mmHg afterward. There was a significant disparity in stress levels among elderly individuals with hypertension between the intervention group and the control group ($p=0.000$). The intervention group had a smaller decrease in stress levels (7.5-2.2) compared to the control group (10.5-2.4). The mediation program primarily alleviates emotional and physiological difficulties in elderly individuals with hypertension. More precisely, this study discovered that utilizing MBSR meditation and sama vritti pranayama over 8 weeks effectively decreased hypertension, lowered anxiety ratings, and enhanced sleep quality in older individuals.
14	Does Dispositional Mindfulness Predict Cardiovascular Reactivity to Emotional Stress in Prehypertension? Latent Growth Curve Analysis of the Serenity Study (19)	Design: A randomized clinical trial conducted at two separate sites Subject: The study included 153 participants with an average age of 50 Variables: Independent: Full attention with slow breathing. Dependent: The values of blood pressure (BP) and heart rate (HR) Instrument: The self-report questionnaires used in this study include the Five-Facet Mindfulness Questionnaire (FFMQ) and the Experience Questionnaire (EQ) Analysis: The main model and LGCM were evaluated for their adequacy. The	Thus, it may be necessary to implement mindfulness-based therapies to explore the positive effects of mindfulness on stress physiology, which is believed to be a biological mechanism that can lower cardiovascular risk and enhance overall health. The average peak reaction at time points two for raw SPB reactivity was 134.95 mmHg (standard error = 0.90). The average linear change showed a rise of 1.95 mmHg per minute (standard error = 0.35; $p< 0.001$), while the average quadratic change indicated a decrease of -1.67 mmHg (standard error = 0.24; $p< 0.001$). The combined latent growth parameters indicated a considerable

Continued in pag. S278…

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No	Title, Author, Year of publication	Method	Results
		influence of predictors of trait conscientiousness in each latent growth curve model was adjusted using familial alpha adjustment (p = 0.05 split)	increase in systolic blood pressure (SBP) during the initial three minutes of the anger recall task. Subsequently, the rate of increase slowed down and reached a plateau during the final three minutes of the stressor. The average peak intercept for raw DBP reactivity was 83.01 mmHg (SE =0.69) at the second time point. There was an average linear change of 1.85 per minute (SE = 0.31; p < 0.001), and the average squared change was -1.08 (SE = 0.21; p < 0.001). These findings suggest that the reactivity curves for DBP during stressors were similar. The average peak intercept for raw HR reactivity at the second time point was 73.87 bpm (standard error = 0.91). There was an average linear increase of 1.72 bpm (standard error = 0.14; p < 0.001) and a mean quadratic decrease of -0.75 (standard error = 0.06; p < 0.001), suggesting that HR also increased in a quadratic manner during the stressor.

Study Characteristics

The randomized control trial (RCT) research design had four publications, while the cluster randomized design had one article (20). Four quasi-experimental articles (11,12,14,16) and three used a cross-sectional design (17,17,21). One paper has a prospective clinical trial design, specifically (9). The user's text mentions one publication that describes a two-group, one-site clinical experiment conducted by An et al. (15) and another paper that describes a two-site randomized clinical trial referenced as one article two-site randomized clinical trial.

A total of five randomized controlled trials (RCTs) were conducted in the United States (7,13,15,19,22). Two studies were carried out in Spain (16,23). Additionally, two articles were conducted in Iran (5,14). Furthermore, two articles were conducted in Indonesia (12,18). One article was located in Brazil (9) and one article was conducted in Turkey (19).

Eleven studies recruited participants from clinics and communities. All trials included patient demographic information and baseline blood pressure measurements, evenly distributed between the treatment and control groups. All research subjects were of mixed gender, except the studies conducted by Babak et al. (5) which

consisted entirely of female individuals. The participants' ages ranged from 45.8 to 60.3 years (9).

One study included 13 clergy members, while another included 18 students studying homicide (7,16). Two investigations included geriatric individuals diagnosed with hypertension (12,18). The overall research sample comprised 906, with varied sample sizes ranging from 11 to 201, including 30, 60, 75, and 80.

Participant Characteristics

The total number of participants across all papers was 906 individuals. Individuals who are 18 years of age or older and have hypertension are defined as having a systolic blood pressure of 180 mmHg or higher and/or a diastolic blood pressure of 80 mmHg or higher, with or without treatment for hypertension. The average age in the intervention group was 48.67 ± 1.42 years, while in the control group was 49.32 ± 2.31 years ($p = 0.343$) (5) (age 45.8 ± 4.15 years) (9).

Characteristics of the Intervention

Five research studies employed mindfulness therapies, specifically Mindfulness-Based Stress Reduction (MBSR), following the theoretical framework developed by John Kabbat's MBSR Protocol (14). A mindfulness intervention was administered two hours weekly for eight weeks (7,23). Additionally, a follow-up visit was conducted after 20 weeks (5,6,10,11,13,19). Participants were provided with preliminary instruction, including a collective introduction session, followed by eight consecutive weekly group sessions of 2.5 hours each, with a total of 7.5 hours per group session daily. The suggested home mindfulness practice consists of a minimum of 45 minutes daily for six days each week. Psychiatric doctors were responsible for training, while psychologists are responsible for conducting research Babak et al. (5). A study conducted in Indonesia utilized the Mindfulness-Based Stress Reduction (MBSR) and sama vittri pranayama intervention regimens (18). The study uses mindfulness to expand awareness within a confined environment for 30 minutes. The Mindbody session includes a concise introduction to meditation and proper posture (5 minutes), a body scan utilizing the body scan treatment technique (15 minutes), instruction on breathing techniques (5 minutes), and a brief discussion on the experience (5 minutes) (9).

A study from An et al. (15) used the MAP (Mindfulness Awareness Program) approach developed by the Mindfulness Awareness Research Center (MARC) of the University of California Los Angeles (UCLA). Certified instructors teach MAP classes. All MAP participants receive a practice guidebook and an audio recording of instructions for implementing 5–20-minute mindfulness sessions to listen to at home. MAP instructors encourage daily mindfulness practice, starting with five minutes and increasing to 20 minutes by week 5 (23). The exercise was carried out daily, starting with five minutes and increasing to 20 minutes in week 5 (15).

Four studies used the Five Facet Mindfulness Questionnaire (FFMQ) measuring tool (6,10,16,19). One study used the Kentucky Inventory of Mindfulness Skills (KIMS) scale (18). The Mindful Attention Awareness Scale (MAAS) was used by Vara-García et al. (25) and the Modified Morisky Compliance Scale (MMAS) (17).

Blood Pressure Measuring Instrument

All studies provide the impact of mindfulness on systolic and diastolic blood pressure. There are two methods for assessing blood pressure: clinical blood pressure and ambulatory blood pressure. Four studies carried out blood pressure measurements in clinics (5,10,12-14). Two studies used clinical and ambulatory measurements (9,10). Three studies used ambulatory blood pressure measurements (6,14,15,18,19).

Six studies assessed blood pressure using Omron automated blood pressure monitors (6,10,13,15,19). Others have no reports. Before providing intervention, participants received training on measuring blood pressure and monitoring at home. Participants measured their blood pressure after taking a five-

minute break after completing the mindfulness exercise, recorded in a book that was collected every week during the six-week training session and six weeks later online at follow-up (15).

Systolic and Diastolic Blood Pressure

Fourteen articles showed reduced blood pressure in the group that received the mindfulness intervention. Research (6) showed a clinically significant reduction in systolic blood pressure in the mindfulness group (n=101) compared to the control group (n=100). Changes in unmonitored clinic systolic blood pressure at six months showed a decrease in systolic blood pressure of 5.9 mm Hg (95 % CI, –9.1 to –2.8 mmHg) from baseline greater than the control group's 4.5 mm Hg at six months (95 % CI, –9.0 to –0.1 mm Hg).

In the study conducted by Ponte Márquez et al. (10) in the eighth week, the intervention group exhibited significantly lower scores in ambulatory blood pressure monitoring than the control group. The intervention group had 124/77 mmHg blood pressure readings, while the control group had 126/80 mmHg ($p < 0.05$). The intervention group had 108/65 mmHg readings, whereas the control group had 114/69 mmHg ($p < 0.05$). Clinical measurements of nocturnal systolic blood pressure similarly showed reduced values for systolic pressure (130 mmHg vs. 133 mmHg; $p = 0.02$). There was a decrease in clinically determined diastolic blood pressure values among eight mindfulness groups.

The study conducted by Babak et al. (5) exclusively included female participants. It revealed a substantial decrease in both systolic and diastolic blood pressure among the intervention group as compared to the initial measurements. The control group had a systolic blood pressure of 140.18 ± 14.27 mmHg compared to 142.15 ± 10.23 mmHg and a diastolic blood pressure of 84.62 ± 9.22 mmHg compared to 88.51 ± 8.54 mmHg ($p = 0.001$).

Stress Measurement

There are seven articles out of 14 that examine the impact of mindfulness on stress (10,11,17–19,21,26). Stress measuring device used Perceived Stress Scale (PSS) (10,11,18,20,21,24). One article used a visual analog scale (VAS) to measure stress levels (16). Three articles used the Depression, Anxiety and Stress Scales (DASS-21) (5,10). Eight articles show the effectiveness of mindfulness in reducing stress (5,6,7,10,11,16,18,19). Research shows significant differences between experimental and control groups in mean scores of positive stress ($p=0.001$), negative stress ($p=0.001$) (7,11).

There were differences in the stress levels of elderly hypertensive patients between the intervention group compared to the control group. The stress level measured using the perception stress scale (SPSS) score in the intervention group was initially 11.3-3.1 after the intervention decreased to 7.5 -22 ($p=0.001$). In the control group, the initial score was 11.2-2.7; afterward, it was 10.5-2.4 ($p=0.175$) (18).

DISCUSSION

Hypertension is the leading preventable risk factor for cardiovascular disease, such as heart disease and stroke, which are the leading causes of death. Prevention is by modifying risk factors that can be changed. Hypertension prevention interventions based on arterial management guidelines from the European Renal Association (ERA) and the International Society of Hypertension (ESH) include: 1) changes relevant lifestyle, weight loss, excess sodium intake, increased potassium intake from food, increased physical activity and exercise, reduce alcohol intake, stop smoking, diet, improve stress management (26). Implementing a heart-healthy lifestyle is a very important approach to preventing or preventing the emergence of hypertensive heart disease, reducing increases in blood pressure values and reducing increases in cardiovascular risk (26). Hypertension is closely related to lifestyle, mental health and quality of life. If not controlled properly it can cause various problems, including losses, decreased productivity, and ultimately poor health. The quality of life of hypertensive patients is also influenced by stress. Stress increases emotional and behavioral changes and disrupts cognition and biological mechanisms (5).

The WHO states that mental illness affects around 250 million people (5). Increased risk of hypertension and cardiovascular events have been associated with stress and anxiety. When patients' emotional distress subsides, their blood pressure may spike briefly before returning to normal. Increased risk is also associated with exposure to highly traumatic life experiences. The European Renal Association (ERA) and the International Society of Hypertension (ESH) 2023 stated that the expected blood pressure target in hypertensive patients is a systolic pressure of 140 mmHg or a diastolic pressure of 90 mmHg (26). The literature review results show mindfulness-based stress release (MBSR) therapy effectively reduces stress, mood changes, and systolic and diastolic blood pressure (SBP and DBP).

The An et al. research Center (MARC) at UCLA defines mindfulness as "the process of actively and openly moment-by-moment observation of one's physical, mental, and emotional experiences" (15). Mindfulness is very easy, cheap and effective as an intervention to maintain blood pressure and reduce stress (7,27). Environmental and behavioral factors are the greatest risk of increasing blood pressure. Therefore, the main intervention is to modify lifestyle and reduce stress among both through mindfulness (28). Mindbody treatment approaches include mantra, mindfulness, spiritual, guided imagery, progressive relaxation, yoga, tai chi, and qi gong (28). Individuals with hypertension most often used spiritual meditation (10.6 %), yoga (5.7 %), mindfulness meditation (3.2 %), progressive relaxation (3.1 %), mantra meditation (2.4 %), guided imagery (1.9 %), tai chi (1.5 %), and qi gong (0.4 %) (28). The results of the literature review prove that the mindfulness intervention carried out for 45 minutes every day for eight weeks was able to reduce systolic blood pressure and diastolic blood pressure and stress according to WHO targets, namely systolic blood pressure ≤ 130 mmHg and diastolic blood pressure ≤ 80 mmHg. Monitoring and measuring blood pressure at home is carried out three times daily in the morning, afternoon and evening.

CONCLUSION

Interventions to reduce blood pressure and stress are very necessary for hypertensive patients to prevent complications. Mindfulness is an easy and cheap way to reduce blood pressure and stress for hypertension patients.

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