Sains Medika: Jurnal Kedokteran dan Kesehatan

journal homepage: http://jurnal.unissula.ac.id/index.php/sainsmedika/

RESEARCH ARTICLE

Effectiveness of combined low-impact aerobic exercise and hatha yoga on blood pressure and pulse rate in patients with hypertension

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ARTICLE INFO

Keywords:
Hatha yoga,
Hypertension,
Low impact aerobic

ABSTRACT

Nonpharmacological therapies are increasingly used to complement pharmacological treatment for hypertension by improving blood pressure and pulse rate. This study examined the effectiveness of combining low-impact aerobic exercise with Hatha yoga on blood pressure and pulse rate in patients with hypertension. A quasi-experimental pre–post test control-group design was used with 78 hypertensive patients recruited by purposive sampling and equally assigned to intervention and control groups (n = 39 each). The intervention group performed combined low-impact aerobic exercise and Hatha yoga twice weekly for four weeks. Each 70-minute session comprised 40 minutes of exercise, 10 minutes of rest, and 20 minutes of cool-down. Blood pressure and pulse rate were measured before and after the intervention. Data were analysed using paired t-tests. Thirty-seven participants in each group completed the study. The intervention produced significant reductions in systolic and diastolic blood pressure and pulse rate ($p < 0.001$). In the intervention group, mean systolic blood pressure decreased from 147.78 ± 6.01 to 131.08 ± 6.58 mmHg, diastolic blood pressure from 95.08 ± 2.28 to 80.81 ± 6.03 mmHg, and pulse rate from 87.62 ± 5.57 to 79.49 ± 5.30 bpm. Combining low-impact aerobic exercise with Hatha yoga effectively reduces blood pressure and pulse rate in patients with hypertension and may serve as a supportive therapy alongside pharmacological treatment.

1. Introduction

Hypertension, a "silent killer," often remains asymptomatic until it causes severe complications such as cardiovascular disease, cerebrovascular events, renal failure, or sudden death (Mpuuga & Eshete, 2022). Management of hypertension continues to rely heavily on pharmacological therapy, which may produce long-term side effects (Burnier & Egan, 2019). A national survey in Indonesia reported treatment success rates of only 30–40%, primarily due to noncompliance, physical inactivity, unhealthy lifestyles, poor stress management, and inadequate rest (Andari *et al.,* 2020; Andri, 2021). Nonpharmacological interventions should therefore complement drug therapy because they have fewer adverse effects and foster patient self-management (Li *et al.,* 2022; Villafuerte *et al.,* 2020). Exercise is one such intervention, but it remains underutilised among people with hypertension.

The prevalence of hypertension is increasing worldwide; the World Health Organisation (WHO) estimates that by 2025, 1.5 billion people will be affected,

https://doi.org/10.30659/sainsmed.v16i2.39271
Received 26 August 2024; Received in revised form 31 August 2024; Accepted 13 December 2025

and that hypertension and its complications account for an estimated 10.44 million deaths annually (Kemenkes RI, 2019). In Indonesia, the prevalence of hypertension is 34.1%, with notable increases among younger age groups: 4.5% in those aged 18–24 years, 5.4% in 25–34 years, and 6.8% in 35–44 years (Mulia & Prajitno, 2020). Central Kalimantan Province reports a higher-than-national prevalence of 34.5% (Dinas Kesehatan Provinsi Kalimantan, 2018). Among hypertensive patients, 95% do not engage in routine physical activity or exercise to support treatment; common barriers include lack of knowledge, perceived laziness, and the belief that exercise is unnecessary if medication is taken.

Low adherence to therapy can lead to disease exacerbation and fatal complications (Poulter *et al.,* 2020). Regular physical exercise is an important nonpharmacological strategy to prevent hypertension-related complications (Mahmood *et al.,* 2019). Exercise for hypertensive patients should be nonstrenuous, performed regularly, and evidence-based for blood pressure reduction (Islam *et al.,* 2023). Prior studies consistently report that exercise lowers blood pressure. Low-impact aerobic exercise is especially recommended because it provides cardiovascular benefit without undue strain on the heart and vasculature, which is critical for patients who cannot tolerate moderate or high-intensity activity. For example, one study found that low-impact aerobic exercise performed for three consecutive days reduced systolic blood pressure by 11.53 mmHg and diastolic pressure by 9.58 mmHg, while another study of twice-weekly sessions over three weeks reported reductions in both blood pressure and pulse (Hanisaningrum, 2020). In addition, Hatha yoga has been shown to significantly lower blood pressure in hypertensive individuals (Tamba *et al.,* 2021). Compared with more vigorous yoga styles, Hatha yoga emphasises slow movements, controlled breathing, and relaxation, which reduce sympathetic activity and stress—key contributors to hypertension. Studies indicate that practising Hatha yoga for 30–45 minutes, three to four times weekly, can lower systolic blood pressure by approximately 4–8 mmHg (Khandekar *et al.,* 2021), making it a suitable, safe adjunct to exercise for hypertensive patients.

Pharmacological treatment remains the primary approach for managing hypertension; however, long-term use of antihypertensive drugs can produce adverse effects (Lee *et al.,* 2019). Therefore, nonpharmacological therapies are recommended as complementary interventions to support blood-pressure control rather than to replace medication (Khandekar *et al.,* 2021). Physical exercise is an effective adjunct that helps regulate cardiovascular function and reduce blood pressure (Susanti *et al.,* 2022). In this study, the intervention combined low-impact aerobics and Hatha yoga, implemented in accordance with established exercise guidelines. This combination was selected because it promotes comfort and relaxation, which may contribute to reductions in blood pressure and pulse rate, consistent with Roy's Adaptation Model (Harris, 2021). To minimise confounding, participants were screened and instructed to maintain consistent diets, avoid caffeine, alcohol, and smoking, and refrain from other structured exercise during the study period. Baseline characteristics, including body mass index (BMI), stress level, and sleep duration, were monitored to ensure group comparability. Nevertheless, some factors beyond the researchers' control—such as individual psychological stressors or environmental influences—may have affected outcomes. The objective of this study was to evaluate the effectiveness of combined low-impact aerobics and Hatha yoga in reducing blood pressure and pulse rate in individuals with hypertension.

2. Materials and Methods

2.1 Research design

This quantitative study used a quasi-experimental pre–post test control-group design conducted from May to July 2022 in a village in Central Kalimantan Province, Indonesia. Participants were allocated to an intervention group (low-impact aerobics and Hatha yoga combined with usual medical therapy) or a control group (usual medical therapy only, supervised by local healthcare providers).

2.2 Participants

Inclusion criteria were female, diagnosed with stage 1 primary hypertension and taking a single antihypertensive medication, aged 20–50 years, able to communicate effectively, able to sit and stand without assistance, not pregnant, without complications, and abstaining from alcohol, cigarettes, and coffee during the study period. Dropout criteria were absence from the intervention for more than three consecutive sessions, voluntary withdrawal, or illness/worsening condition. Based on the sample size calculation, 39 participants were recruited per group using purposive sampling.

2.3. Instruments and data collection

The combined intervention was delivered twice weekly for four weeks. Each session lasted 70 minutes and comprised a 5–10-minute warm-up, 40 minutes of core exercise, 10 minutes of rest, and a 10–15-minute cool-down. The protocol was developed through focus group discussions and expert consultations, then compiled into standardised training modules and

standard operating procedures. Trained facilitators provided direct instruction and supervised every session; participants did not practice independently at home.

Blood pressure was measured with a calibrated mercury sphygmomanometer, and pulse was measured with a validated digital oximeter. Three readings were taken at each observation, and the mean value was used for analysis. All measurements were performed by the same research team using identical validated instruments to ensure consistency.

Participants were randomly assigned to groups using a simple lottery method. Groups were gathered in a single room for intervention delivery after obtaining written informed consent. Pre-intervention blood pressure and pulse were measured for all participants, and post-intervention measurements were taken approximately 10 minutes after the final session.

2.4. Data analysis

The collected data were summarised using frequency distributions for demographic characteristics and study variables. Normality was assessed with the Kolmogorov–Smirnov test; because data were normally distributed ($p > 0.05$), paired t-tests were used to evaluate within-group pre–and post–differences. Analyses were performed using SPSS version 21.

2.5. Ethical clearance

The study received ethical approval from the Health Research Ethics Commission, Faculty of Nursing, Universitas Airlangga (ethical certificate no. 2269-KEPK). Ethical principles of informed consent, respect for persons, beneficence, and nonmaleficence were observed throughout the study.

3. Results

The final number of respondents was 37 in each group (Table 1). During the study, two participants in the intervention group dropped out due to relocation to another district. In the control group, no issues occurred during the pretest; however, some participants were absent during the post-test and were therefore classified as dropouts. The intervention group participants were predominantly 31–40 years old (70.3%), with the most common educational level being junior high school (32.4%). Most were married (86.5%), and the largest occupational category was housewives (37.8%). Nearly half (48.6%) had been diagnosed with hypertension for 1–4 years, and 73.0% reported routine medication use. In the control group, 64.9% were aged 31–40 years, and

Table 1. Distribution of Research Respondents Characteristics (n=74)

Characteristics	Category	Intervention Group		Control Group		*p*-value
		n	%	n	%	
Age	20-30 years	4	10.8	3	8,1	0,319
	31-40 years	26	70.3	24	64.9	
	41-50 years	7	18.9	10	27.0	
Educational Background	Bachelor	4	10.8	3	8.1	0.288
	Diploma	4	10.8	3	8.1	
	Senior High School	7	18.9	8	21.6	
	Junior High School	12	32.4	12	32.4	
	Elementary School	10	27.0	11	29.7	
Occupation	Civil servant	1	2.7	8	21.6	0.568
	Farmer	8	21.6	4	10.8	
	Entrepreneur	7	18.9	6	16.2	
	Private	7	18.9	5	13.5	
	Housewife	14	37.8	14	37.8	
Marital Status	Marry	32	86.5	31	83.8	0.080
	Widow	5	13.5	6	16.2	
Duration in Diagnosed	1-4 years	18	48.6	19	51.4	0.520
	5-9 years	14	37.8	13	35.1	
	10 years and over	5	13.5	5	13.5	
Medication Routine	Yes	27	73.0	25	67.6	0.946
	No	10	27.0	12	32.4	

Table 2. Descriptive analysis of research variables (n=74)

Variable	Pretest			Posttest		
	Median	Min	Max	Median	Min	Max
Systolic BP						
Intervention Group	147.78	140	155	131.08	120	140
Control Group	146.73	140	159	146.73	140	158
BP Diastolic						
Intervention Group	95.08	90	99	80.81	70	90
Control Group	93.73	90	99	93.41	90	99
Pulse						
Intervention Group	87.62	80	98	79.49	70	88
Control Group	86.49	80	95	86.89	82	95

Table 3. Effect Test of Research Variables (n=74)

Variable	Intervention Group			Control Group		
	Std	Effect size	*p*	Std	Effect size	*p*
Pre and Post Test Systolic BP	10.87	1.54	0.000	2.39	0.23	0.177
Diastolic BP Pre and Post Test	5.57	2.56	0.000	3.88	0.08	0.614
Pre and Posttest Pulse Rate	7.67	1.06	0.000	2.5	0.16	0.330

32.4% had a junior high school education. Most were married (83.8%), 37.8% were housewives, 51.4% had been diagnosed with hypertension for 1–4 years, and 67.6% reported routine medication use. Homogeneity testing showed no significant differences between groups ($p > 0.05$), indicating comparable baseline characteristics

Blood pressure and pulse changes were greater in the intervention group than in the control group (Table 2). In the intervention group, mean systolic blood pressure decreased from 147.78 to 131.08 mmHg, mean diastolic blood pressure decreased from 95.08 to 80.81 mmHg, and mean pulse rate decreased from 87.62 to 79.49 bpm. The control group showed no notable change.

Paired t-test analysis showed that the combined low-impact aerobics and Hatha yoga intervention produced significant reductions in systolic and diastolic blood pressure and in pulse rate in the intervention group ($p < 0.001$ for all). No significant changes were observed in the control group ($p > 0.05$). Cohen's d effect sizes for the intervention group were very large: systolic BP d = 1.54, diastolic BP d = 2.56, and pulse d = 1.06, indicating a strong practical impact of the intervention (Table 3).

4. Discussion

The combination of low-impact aerobic exercise and Hatha yoga produced significant reductions in blood pressure and pulse rate in hypertensive patients, while no meaningful changes were observed in the control group. Low-impact aerobics involves gentle movements that promote muscle relaxation after exercise and typically consists of simple foot, hand, and shoulder movements (e.g., marching in place, walking back and forth, clapping). This modality is appropriate for people with cardiovascular disease and hypertension because it delivers cardiovascular benefits with low physiological strain (Yasa *et al.,* 2017). When combined with Hatha yoga, which emphasises slow movement, controlled breathing, and mental relaxation, the intervention may increase endorphin release and stimulate parasympathetic activity, reducing vascular tone and cardiac workload and thereby lowering blood pressure (Dimeo *et al.,* 2012).

Previous studies support the beneficial effects of combined aerobic and yoga-based programs. For example, combined low-impact aerobic exercise and yoga reduced body fat in obese individuals (Irawan & Anggarani, 2019), and regular practice of aerobic activities plus yoga increases fat metabolism and can substantially reduce adiposity (Yuniartika *et al.,* 2021). Improved cardiovascular efficiency and vascular function following low-impact aerobic training reduce peripheral resistance and contribute to lower blood pressure and pulse rate (Rohmah *et al.,* 2019). Accordingly, such combined programs have been recommended as nonpharmacological adjuncts for hypertension management (Wen & Wang, 2017).

The observed reductions in pulse rate likely reflect improved autonomic balance. Pulse rate reflects cardiac output and indicates how forcefully the heart pumps blood; physical activity and relaxation practices enhance vagal tone and reduce sympathetic drive,

thereby lowering heart rate and cardiac workload (Wen & Wang, 2017). Hatha yoga's focus on breath and mental relaxation can further decrease stress-mediated sympathetic activation and promote endorphin-mediated relaxation, which together help normalise pulse and blood pressure (Rohmah *et al.,* 2019).

Physiologically, systolic ejection generates pressure waves that propagate through the arterial tree; elevated blood pressure increases arterial stiffness and cardiac workload, which can augment sympathetic activity and raise pulse rate (De *et al.,* 2019; Dysart & Harden, 2023; Susanti *et al.,* 2022). The present intervention—by promoting muscle relaxation and reducing vascular resistance—likely reduced the pressure burden on the heart and consequently the pulse rate (Verma *et al.,* 2024).

This study has limitations. It was conducted during pandemic-related restrictions, which required additional coordination with local health services and smaller, staggered group sessions to comply with health protocols; this may have introduced variability in intervention dose and intensity across participants. Although participants were instructed to maintain consistent diet and lifestyle behaviours and avoid confounding substances and additional exercise, factors beyond the researcher's control—such as daily stress, emotional state, BMI, and environmental influences—may have affected outcomes. These potential confounders warrant caution in interpreting the findings.

5. Conclusions

The combined low-impact aerobic exercise and Hatha yoga intervention effectively reduced systolic and diastolic blood pressure and pulse rate in hypertensive patients. The intervention group showed significant improvements, whereas the control group demonstrated no meaningful changes. This combined approach may serve as a safe and practical nonpharmacological adjunct to pharmacotherapy for blood pressure and heart-rate management.

Acknowledgment

The authors express sincere gratitude to all who contributed to this research, particularly the participants, local authorities, and health service centers at the study site. Their support and cooperation were invaluable to the successful completion of this study.

Conflict of interest

The authors declare no conflicts of interest. The study was conducted independently without financial, personal, or institutional relationships that could have influenced the results or interpretation. All phases of the research, from data collection to analysis and manuscript preparation, were performed objectively for academic and scientific purposes.

References

Andari, F. N., Vioneery, D., Panzilion, P., Nurhayati, N., & Padila, P. (2020). Penurunan tekanan darah pada lansia dengan senam ergonomis. *Journal of Telenursing (JOTING),* 2(1): 81–90. https://doi.org/10.31539/joting.v2i1.859

Andri, J., Padila, P., Sartika, A. Andrianto, M.B, & Harsismanto, J. (2021). Changes in blood pressure in patients with hypertension. *Jounal of Nursing and Health,* 1(2): 54–64. https://doi.org/10.31539/josing.v1i2.2326

Burnier, M., & Egan, B. M. (2019). Adherence in hypertension: a review of prevalence, risk factors, impact, and management. *Circulation Research*, 124(7): 1124–1140. https://doi.org/10.1161/circresaha.118.313220

De, A., Mondal, S., & Deepeshwar, S. (2019). Single bout of yoga practices (Asana) effect on low frequency (LF) of heart rate variability–A pilot study. *International Journal of Medicine and Public Health,* 9(4): 160-163. http://www.ijmedph.org/v9/i4

Dimeo, F., Pagonas, N., Seibert, F., Arndt, R., Zidek, W., & Westhoff, T. H. (2012). Aerobic exercise reduces blood pressure in resistant hypertension. *Hypertension,* 60(3): 653-658. https://doi.org/https://doi.org/10.1161/hypertensionaha.112.197780

Dinas Kesehatan Provinsi Kalimantan. (2018). Data *Hipertensi*. Dinkes kalteng.

Dysart, A., & Harden, S. M. (2023). Effects of temperature and tempo: evaluating how much time in a typical community-based yoga class is moderate-intensity aerobic activity. *International Journal of Environmental Research and Public Health,* 20(3): 1-11. https://doi.org/10.3390/ijerph20032349

Hanisaningrum, H. (2020). *Pengaruh senam aerobik low impact terhadap perubahan tekanan darah pada lansia penderita hipertensi di Posyandu Lansia Jati Asih Kecamatan Geger Kabupaten Madiun.* Stikes Bhakti Husada Mulia Madiun.

Harris, R. (2021). *Sister Callista Roy: Adaptation model.* Nursing Theorists and Their Work E-Book, 247.

Irawan, R. J., & Anggarani, M. A. (2019). The effectiveness of 8 weeks low impact aerobics and yoga combination program on body fat percentage among obese female. *KEMAS:*

Jurnal Kesehatan Masyarakat, 14(3), 426–431. https://journal.unnes.ac.id/nju/kemas/article/view/13780/9216

Islam, F. M. A., Islam, M. A., Hosen, M. A., Lambert, E. A., Maddison, R., Lambert, G. W., & Thompson, B. R. (2023). Associations of physical activity levels, and attitudes towards physical activity with blood pressure among adults with high blood pressure in Bangladesh. *Plos One,* 18(2): 1-15. https://doi.org/10.1371/journal.pone.0280879

Kemenkes RI. (2019). *Hasil Riskesdas 2018.* Badan Penelitian dan Pengembangan Kesehatan, Kementrian Kesehatan.

Khandekar, J. S., Vasavi, V. L., Singh, V. P., Samuel, S. R., Sudhan, S. G., & Khandelwal, B. (2021). Effect of yoga on blood pressure in prehypertension: a systematic review and meta-analysis. *The Scientific World Journal,* 2021: 1-10. https://doi.org/10.1155/2021/4039364

Lee, H.-Y., Shin, J., Kim, G.-H., Park, S., Ihm, S.-H., Kim, H. C., Kim, K., Kim, J. H., Lee, J. H., & Park, J.-M. (2019). 2018 Korean Society of Hypertension Guidelines for the management of hypertension: Part II-diagnosis and treatment of hypertension. *Clinical Hypertension,* 25(20): 1–24. https://doi.org/10.1186/s40885-019-0124-x

Li, Y., Cao, Y., Ding, M., Li, G., Han, X., Zhou, S., Wuyang, H., Luo, X., Zhang, J., & Jiang, J. (2022). Non-pharmacological interventions for older patients with hypertension: A systematic review and network meta-analysis. *Geriatric Nursing,* 47: 71–80. https://doi.org/10.1016/j.gerinurse.2022.06.015

Mahmood, S., Shah, K. U., Khan, T. M., Nawaz, S., Rashid, H., Baqar, S. W. A., & Kamran, S. (2019). Non-pharmacological management of hypertension: In the light of current research. *Irish Journal of Medical Science* (1971-), 188: 437–452. https://doi.org/10.1007/s11845-018-1889-8

Mpuuga, D., & Eshete, Z. S. (2022). Uncovered silent killers: The prevalence of non-communicable diseases and health insurance coverage in Uganda. *African Journal of Economic Review*, 10(1): 95–116. https://doi.org/10.22004/ag.econ.320562

Mulia, E. P. B., & Prajitno, S. (2020). Neglected cases of hypertension in rural Indonesia: A cross-sectional study of prevalence and risk factors on adult population. *IOP Conference Series: Earth and Environmental Science,* 441(1):1-11. https://iopscience.iop.org/article/10.1088/1755-1315/441/1/012167

Poulter, N. R., Borghi, C., Parati, G., Pathak, A., Toli, D., Williams, B., & Schmieder, R. E. (2020). Medication adherence in hypertension. *Journal of Hypertension,* 38(4): 579–587. https://doi.org/10.1097/hjh.0000000000002294

Rohmah, R. A., Puspita, T., & Rahmasari, I. (2019). Effect of aerobic (low-impact) exercise on blood pressure in hypertension patients. *1st International Conference of Health, Science & Technology (ICOHETECH)* 2019, 22-24. https://doi.org/10.47701/icohetech.v1i1.751

Susanti, S., Ramadhani, N. N., & Puspitasari, P. (2022). Efforts to stabilise blood pressure in hypertensive patients with management of hypertension therapy gymnastics training. *Journal of Health Community Service,* 2(2): 71-75. https://doi.org/10.33086/jhcs.v2i2.2963

Tamba, D., Dharmajaya, R., & Sitohang, N. A. (2021). The effect of hatha yoga therapy on the blood pressure of primary hypertension patients of productive age. *Jurnal Keperawatan Soedirman,* 16(1). https://doi.org/10.20884/1.jks.2021.16.1.1543

Verma, S., Hatwal, J., & Batta, A. (2024). Impact of yoga beyond physical training on the cardiovascular system: An updated review. *The Journal of Tehran Heart Center,* 19(2): 79–88. https://doi.org/10.18502/jthc.v19i2.16195

Villafuerte, F. U., Cànaves, J. L., Montalvo, P. L., Sancho, M. L. M., Oliver, B. O., Flores, P. B., Mantolan, A. E., Bordoy, J. P., Ruiz, T. R., & Hernández, A. R. (2020). Effectiveness of a multifactorial intervention, consisting of self-management of antihypertensive medication, self-measurement of blood pressure, hypocaloric and low-sodium diet, and physical exercise, in patients with uncontrolled hypertension taking 2 or more antihypertensive drugs: *The Medichy study. Medicine,* 99(17): 1-7. http://dx.doi.org/10.1097/MD.0000000000019769

Wen, H., & Wang, L. (2017). Reducing the effect of aerobic exercise on the blood pressure of essential hypertensive patients. *Medicine (United States),* 96(11): 1-6. https://doi.org/10.1097/MD.0000000000006150

Yasa, I. D. G. D., Azis, A., & Widastra, I. M. (2017). Penerapan Hatha Yoga dapat menurunkan tekanan darah pada lansia dengan hipertensi. *Community of Publishing in Nursing,* 5, 19–25.

Yuniartika, W., Sudaryanto, A., Muhlisin, A., Hudiyawati, D., & Pribadi, D. R. A. (2021). Effects of yoga therapy and walking therapy in reducing blood sugar levels on diabetes mellitus patients in the community. *Open Access Macedonian Journal of Medical Sciences,* 9(E): 906–912. https://doi.org/10.3889/oamjms.2021.7104