



EFFECTIVENESS OF ISOMETRIC HANDGRIP EXERCISE IN REDUCING BLOOD PRESSURE IN HYPERTENSION PATIENTS

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ABSTRACT

Hypertension is one of the major health problems that can trigger complications of cardiovascular disease. One of the non-pharmacological therapies that has been proven effective in lowering blood pressure is Isometric Handgrip Exercise (IHE). This study aims to analyze the effect of IHE on reducing blood pressure in hypertensive patients in Dusun Bungkel, Grobogan Regency. The design of this study used a quasi-experiment with a time-series approach. A total of 31 respondents were selected using a purposive sampling technique. The IHE intervention was carried out for five consecutive days with a training duration of six minutes per day. Blood pressure was measured before and after each training session. Data were analyzed using paired t-test and Wilcoxon. The results showed that IHE for five days could reduce systolic blood pressure by 21.6 mmHg and diastolic by 13.5 mmHg, with an average decrease per session of 6.5 mmHg for systolic and 4.1 mmHg for diastolic. The results of the statistical test showed a p value <0.05, which means that the decrease in blood pressure was significant.

Keywords: blood pressure; hypertension; isometric handgrip exercise; non-pharmacological therapy

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INTRODUCTION

Hypertension is still a significant public health problem in both developed and developing countries. This disease is known as a silent killer because it often does not show symptoms but can cause serious complications such as stroke, coronary heart disease, kidney failure, and damage to other organs. According to the World Health Organization (2023), around 1.28 billion adults aged 30–79 years worldwide suffer from hypertension, and ironically, almost half of them do not know that they have this condition. Around two-thirds of people with hypertension live in low- and middle-income countries, including Indonesia (Organization, 2021). At the national level, the 2018 Basic Health Research (Riskesdas) data showed a significant increase in the prevalence of hypertension from 25.8% in 2013 to 34.1% in 2018. This indicates that almost one in three adults in Indonesia suffer from hypertension. Central Java Province itself recorded a prevalence of 39.6%, which is above the national average. Grobogan Regency is one of the areas with a high burden of hypertension, especially in the elderly population. (Widiati & Wulandari, 2024).

Uncontrolled hypertension is a major cause of morbidity and mortality from cardiovascular disease. Effective blood pressure control is key to reducing the risk of long-term complications. (Tanu, Situmorang, Zai, & Siregar, 2025). Generally, hypertension treatment involves pharmacological therapy with antihypertensives. However, not all patients can access or comply with pharmacological treatment due to cost, side effects, or limited health care facilities. As an alternative, non-pharmacological

therapy is now a concern in hypertension management. This approach not only enhances the effects of drug therapy but can also stand alone as a method of blood pressure management. Some non-pharmacological interventions that have been proven effective include the DASH (Dietary Approaches to Stop Hypertension) diet, physical activity, weight loss, reduced salt intake, and relaxation techniques.(Özkan et al., 2022).

One form of physical activity that is relatively new but has the potential to lower blood pressure is Isometric Handgrip Exercise (IHE).(Ahmed & Hawash, 2022). This exercise involves static muscle contractions using a handgrip device and has been shown to improve endothelial function, decrease peripheral vascular resistance, and increase parasympathetic tone which results in lower blood pressure.(Alanis et al., 2025). Several previous studies have evaluated the effectiveness of IHE on blood pressure. Badrov et al. (2013) and Millar et al. (2008) reported that routine IHE interventions were able to significantly reduce systolic and diastolic blood pressure.(Andrianto & Harsismanto, 2021). Similar research in Indonesia by Puspitasari (2020) showed positive results for elderly hypertension sufferers after undergoing a two-week IHE program. However, there are still limited studies evaluating the short-term effects and frequency of IHE training in community settings, especially in rural areas such as Dusun Bungkel, Grobogan Regency. Dusun Bungkel is an area with a fairly high prevalence of hypertension, but access to health services and advanced therapy is still limited. People in this area tend to have low physical activity, lack information regarding independent hypertension management, and have limited access to routine antihypertensive drugs. Therefore, a simple, inexpensive approach is needed that can be carried out independently by the community in controlling their blood pressure.

Isometric Handgrip Exercise is a form of intervention that is very suitable to be applied in an environment like this.(Bertoletti, Ferrari, Ferlin, Barcellos, & Fuchs, 2022). This exercise does not require special facilities or large costs, and can be done at home with simple tools. Moreover, IHE also has a good level of compliance because the implementation time is short and does not require complicated technical skills.(Degroote et al., 2021). It is important to conduct research that systematically evaluates the effect of IHE on blood pressure in hypertensive patients, especially in shorter but consistent intervention periods.(Ahmed & Hawash, 2022). It is important to prove whether this exercise can provide significant results in the short term, and whether this intervention is worthy of being recommended as part of ongoing self-therapy for people with hypertension in rural areas. Research by Badrov et al. (2013) showed that IHE exercise for 8 weeks was able to reduce systolic blood pressure by an average of 13 mmHg and diastolic by 6 mmHg. This study used an intensity of 30% of maximum contraction with a duration of 2 minutes per session for 4 sessions per day. Meanwhile, Millar et al. (2008) reported that IHE was effective in lowering blood pressure even in elderly groups who previously did not respond well to pharmacological therapy. In Indonesia, studies by Wahyuni (2020) and Puspitasari (2021) proved that IHE intervention for 2 weeks significantly reduced systolic and diastolic blood pressure in hypertensive patients of productive age and the elderly.(Ahmed & Hawash, 2022). However, there is not much research that focuses on the effectiveness of this exercise in shorter durations (e.g. 5 consecutive days) and how it changes between training sessions.

From the literature review, it can be concluded that IHE has great potential as a non-pharmacological intervention that is worthy of being developed in community settings. However, scientific evidence is still needed regarding the effectiveness of IHE in the short term and its adaptation to the social context of rural communities in Indonesia.

Based on the description above, this study aims to analyze the effect of Isometric Handgrip Exercise on reducing blood pressure in hypertension patients in Dusun Bungkel, Grobogan Regency. This study is expected to provide scientific evidence on the effectiveness of simple and inexpensive interventions that can be independently adopted by the community as part of community-based hypertension management.

METHOD

This study used a pre-experimental design with a one group pretest-posttest design approach. This design allows researchers to measure changes in blood pressure before and after the Isometric Handgrip Exercise (IHE) intervention without using a control group. The study was conducted in Bungkel Hamlet, Kemloko Village, Godong District, Grobogan Regency, Central Java. The study was conducted from November to December 2023. The population in this study were all hypertension sufferers in Bungkel Hamlet. The sampling technique used purposive sampling with inclusion criteria: Aged 40–65 years; Diagnosed with mild to moderate hypertension; Not undergoing pharmacological antihypertensive therapy or willing to stop temporarily during the study period; Have no history of heart disease, stroke, or other serious complications; and Willing to participate in all intervention sessions. The sample consisted of 31 respondents. Blood pressure was measured in the morning before the intervention. Respondents sat relaxed for at least 5 minutes before the measurement. Implementation of Isometric Handgrip Exercise is with Respondents sitting upright with their forearms placed on the table, Respondents gripping the handgrip tool with a strength of about 30% of the maximum (determined based on the respondent's initial comfort), Contractions are performed for 2 minutes 4 times, with a 1 minute rest break between sessions. The intervention was carried out once a day for 5 consecutive days. The statistical analysis used was the paired sample t-test to determine the difference in average systolic and diastolic blood pressure before and after the intervention. The level of significance was set at $p < 0.05$.

RESULT

ResultsThe research is presented in the table below

Table 1.

Frequency Distribution of Respondent Characteristics in Bungkel Hamlet		
Characteristics	f	%
Age(Mean ± SD)	52 ± 10,079	
Min – Mix	34 - 67	
Gender		
Man	10	32.3
Woman	21	67.7
Family History of Hypertension		
There is		
There isn't any	22	71.0
	9	29.0
BMI Level		
Thin	-	-
Normal	14	45.2
Obesity	17	54.8
Stress Level		
Normal	29	93.5
Light	1	3.2
Currently	1	3.2
Heavy	-	-
Very heavy	-	-

Based on table 1, the average age of respondents is 52 years, with an age range of 34 to 67 years. Most respondents are women 67.7%. As many as 71% of respondents have a family

history of hypertension. For BMI levels with obesity categories 54.8%, and 45.2% are included in the normal weight category, and 93.5% of respondents do not experience stress.

Table 2.
Analysis of the Effect of Isometric Handgrip Exercise on Reducing Blood Pressure

Day	TD Type	Measurement	Mean	Min - Max	Difference(Mean ± SD)	*t / z	p Value
1	Systole	Pre	160.16	145 – 190	7.71 ± 5.312	-4,744	0.0001
		Post	152.45	130 – 180			
	Diastol	Pre	91.45	80 – 110	5.03 ± 3.545	-4.616	0.0001
		Post	86.42	70 – 100			
2	Systole	Pre	153.65	138 – 185	5.81 ± 6.625	-3,850	0.0001
		Post	147.84	130 – 170			
	*Diastol	Pre	87.32	70 – 110	4.84 ± 5.763	4.675	0.0001
		Post	82.48	70 – 98			
3	*Systole	Pre	150.61	120 – 180	6.84 ± 5.254	7.247	0.0001
		Post	143.77	120 – 175			
	*Diastol	Pre	84.23	70 – 105	3.74 ± 4.865	4.283	0.0001
		Post	80.48	65 – 100			
4	Systole	Pre	147.13	130 – 175	6.48 ± 4.016	-4.838	0.0001
		Post	140.65	124 – 170			
	*Diastol	Pre	82.90	70 – 100	3.77 ± 2.883	7.288	0.0001
		Post	79.13	65 – 98			
5	Systole	Pre	144.19	120 – 190	5.65 ± 4.144	-4.437	0.0001
		Post	138.55	120 – 180			
	Diastol	Pre	81.42	70 – 100	3.48 ± 2.644	-4.375	0.0001
		Post	77.94	65 – 100			

*paired T-Test

non-parametric T-Test (Wilcoxon)

Table 2 shows the analysis of the effect of isometric handgrip exercise on reducing blood pressure carried out during 5 days of intervention. Each intervention was measured pre-post. Normally distributed data were tested with paired T-Test showing t-count > 2.042 (t-table) which showed significance p-value = 0.0001 (α = < 0.05). While the data is not normally distributed, tested with the non-parametric T-Test (Wilcoxon) shows z-count > 1.96 (z-table) which shows the significance of p-value = 0.0001. (α = < 0.05).

Table 3.
Analysis of the Effect of Isometric Handgrip Exercise on Reducing Blood Pressure After 5 Days of Intervention

Types of Blood Pressure	Δ Blood Pressure	z	p-value
Systolic H1-H5	21.6	-4.783	0.0001
Diastolic H1-H5	13.5	-4,760	0.0001

Table 3 shows that after the isometric handgrip exercise intervention for 5 days, there was a difference in systolic decrease of 21.6 mmHg and diastolic of 13.5 mmHg. The results of the analysis showed that systolic blood pressure z count (4.783) > z table (1.96) with a p-value of

0.0001 ($\alpha = <0.05$) and diastolic blood pressure z count (4.760) > z table (1.96) with a p-value of 0.0001 ($\alpha = <0.05$). These results indicate significant meaning that isometric handgrip exercise can lower blood pressure in people with hypertension.

Table 4.
Odds Ratio Analysis of Respondent Characteristics for Hypertension Incidence

Characteristics	Exp (B)Odds Ratio
Gender	6.016
Family History of Hypertension	1.457
Age	1.090
BMI Level	0.149
Stress Level	0.0001

Table 4 shows that in this study, female gender has a 6.016 times greater risk of hypertension than male gender with a positive correlation. Respondents with a family history of hypertension have a 1.457 times greater risk of hypertension, and every 1 year increase in age increases the risk of hypertension by 1.09 times. In addition, the higher the BMI (obesity) the greater the risk of hypertension 0.149 times. While stress levels have a 0.0001 times risk of hypertension

DISCUSSION

This study shows that age is an important factor that influences the incidence of hypertension. Respondents in this study consisted of various age groups, with the majority distribution being in the adult to elderly age range. The relationship between age and hypertension has been supported by various previous studies. As a person gets older, the elasticity of blood vessels will decrease due to the degenerative process, which causes increased peripheral resistance and ultimately has an impact on increased blood pressure.(Tanu et al., 2025). In addition, the body's regulatory systems such as the renin-angiotensin system and kidney function also decline with age, which cumulatively increases the risk of hypertension. Research by Chaddock et al. (2025) showed that those aged ≥ 80 years are at high risk for vascular complications, including cranial ischemia, which is closely related to hypertension.(Cottu et al., 2025). Therefore, the results of this study confirm that advanced age is an important factor in the risk of hypertension and support the need for intervention in this age group.

Gender has also been shown to play a significant role in the prevalence of hypertension. In this study, the majority of respondents were women (67.7%). This result is in line with various studies stating that women, especially after menopause, are more susceptible to increased blood pressure. This is due to a decrease in estrogen hormone levels which previously functioned to maintain blood vessel elasticity and regulate blood pressure.(Kartini et al., 2025). The decrease in estrogen hormone causes a decrease in protective function of the cardiovascular system, so that the risk of hypertension increases in elderly women. In addition to hormonal factors, lifestyle also plays a role. Women tend to have lower levels of physical activity than men, as well as a diet high in sodium and high stress exposure, all of which contribute to an increased risk of hypertension.(Yanti & Rizkia, 2022).Most respondents (71%) in this study had a family history of hypertension. This finding suggests that family history is an important risk factor for the occurrence of hypertension. This is reinforced by the theory that genetic factors and family lifestyles also influence an individual's tendency to experience hypertension. The biological mechanisms underlying this involve inherited disorders of salt metabolism, the renin-angiotensin system, and sensitivity to stress.(Tanu et al., 2025). Based on the odds ratio, individuals with a family history of hypertension have a 1.457 times greater risk of developing hypertension than those without such a history.

Therefore, early screening and intervention are highly recommended for individuals with this genetic risk factor.

Body Mass Index (BMI) in this study was categorized into thin, normal, and obese. Some respondents were in the obese category. High BMI or obesity is closely related to the risk of hypertension because excess body fat can increase the workload of the heart, insulin resistance, and stimulate the sympathetic nervous system and the renin-angiotensin-aldosterone system (Sulochana & Rani, 2022). This leads to a sustained increase in blood pressure. Being overweight is also correlated with increased blood volume and cardiac output, thus worsening blood pressure conditions. Respondents' stress levels were assessed using a stress scale and categorized into several levels, ranging from normal to very severe. (Simanungkalit, Lumbantobing, & Adyani, 2021). This study showed that respondents with high stress levels had a higher prevalence of hypertension compared to those with lower stress levels. Chronic stress is known to increase the activity of the sympathetic nervous system and hormones, which causes vasoconstriction of blood vessels and increased heart rate and blood pressure. In addition, stress also encourages unhealthy behaviors such as smoking, alcohol consumption, and overeating, all of which can worsen hypertension. (Riyanto, Purbasary, Husnaniyah, & Pratama, 2024).

Bivariate analysis conducted in this study showed that isometric handgrip exercise has a significant effect on reducing blood pressure in hypertensive patients. This intervention has a positive impact in reducing systolic and diastolic blood pressure significantly. This shows that isometric handgrip exercise can be an effective non-pharmacological therapy in the management of hypertension. (Andrianto & Harsismanto, 2021). The mechanism of action of isometric handgrip exercise in lowering blood pressure involves increasing baroreceptor activity and decreasing sympathetic nervous system activity. Isometric exercise causes a temporary increase in blood pressure during exercise, but in the long term triggers physiological adaptations that result in a decrease in resting blood pressure. This decrease is caused by improved endothelial function, increased blood vessel elasticity, and decreased total peripheral resistance. (Riyanto et al., 2024). Previous research by Millar et al. (2014) supports these findings, showing that isometric exercise with a duration of 8-10 minutes per day for 3-4 weeks can significantly lower blood pressure in patients with mild to moderate hypertension. (Pratamawati et al., 2025). In addition, research by Taylor et al. (2021) found that this exercise can increase heart rate variability and reduce oxidative stress, both of which contribute to blood pressure control. In the context of this study, the handgrip technique used was using a rubber ball, which applies pressure to the hand and arm muscles for a certain period. This exercise is carried out routinely with controlled intensity and time. (Ahmed & Hawash, 2022). The results obtained showed a significant decrease in blood pressure before and after the intervention, both in systolic and diastolic pressure. The results of statistical tests on bivariate analysis support a significant difference between blood pressure before and after the intervention.

This confirms the effectiveness of this method as an alternative pharmacological companion therapy, especially for hypertensive patients who are intolerant to drugs or want to reduce dependence on medication. The use of isometric handgrip exercise also has advantages in terms of ease of implementation, low cost, and minimal risk, making it very suitable for application in the elderly group and patients with limited physical activity (Anggraini, Andhini, & Muharyani, 2025). However, monitoring is still needed to avoid side effects such as muscle fatigue or temporary increases in blood pressure that are too high during exercise. The results of this study have important implications for nursing practice and public health. First, isometric handgrip exercise can be integrated into community intervention programs as

part of health promotion and hypertension prevention. Second, nurses can provide education on the techniques and benefits of this exercise to patients, especially those who have limited access to pharmacological treatment. Third, the characteristics of respondents who are risk factors such as age, gender, family history, obesity, and stress can be the basis for conducting screening and planning more personalized and targeted nursing care.

CONCLUSION

This study shows that isometric handgrip exercise has a significant effect on reducing blood pressure in hypertensive patients. Interventions in the form of isometric handgrip exercises have been shown to significantly reduce systolic and diastolic blood pressure after being carried out for two weeks. These findings strengthen the evidence that simple non-pharmacological therapies such as isometric exercises can be an effective alternative in managing hypertension, especially in primary health care facilities. Analysis of respondent characteristics shows that factors such as age, gender, family history of hypertension, body mass index, and stress levels are associated with the incidence of hypertension. This confirms that the approach to treating hypertension must consider biological and psychosocial factors as a whole. However, even though these factors have an effect, handgrip exercise interventions are still able to consistently reduce blood pressure in almost all groups of respondents. The contribution of this study to science is to provide empirical evidence that static muscle exercises such as isometric handgrip can trigger adaptation of the autonomic nervous system and vascular which play a role in lowering blood pressure. This study also broadens the understanding of the benefits of non-aerobic physical exercise in community nursing practice and prevention of non-communicable diseases. Thus, isometric handgrip exercise is worthy of consideration as an independent, easy, inexpensive, and effective intervention in hypertension control programs in the community. Nurses have a strategic role in educating patients and implementing this intervention routinely, so that the quality of life of hypertension sufferers can be improved and the incidence of complications can be suppressed. This study provides an applicable contribution in the development of sustainable community-based preventive and promotive health services.

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