

Effectiveness of Isometric Handgrip and Exercise in Breath to Reduce Hypertension Symptoms in Hypertension Patients

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Abstract

INTRODUCTION: *Hypertension is a cause of cardiovascular disease morbidity and mortality. Hypertension sometimes does not cause specific symptoms, but patients will feel nonspecific symptoms such as headaches, tingling, and stiff neck feeling. Efforts can be made independently to reduce these symptoms by doing isometric handgrip and slow deep breathing. Both of these exercises will reduce sympathetic nerve activity resulting in vasodilation and will reduce symptoms of hypertension. The purpose of this study was to investigate the effectiveness of Isometric handgrip and slow deep breathing exercises towards the changes in hypertension symptoms on hypertensive patients in Dukuhwaluh Village.*

METHOD: *This research was a Quasi Experiment with Two Groups, Pretest Posttest Design. Samples were taken using a purposive sampling technique, the isometric handgrip group (n = 20) and a slow deep breathing group (n = 20). The exercise was carried out in both groups for six days, measurement of hypertension symptoms using a questionnaire.*

RESULT: *The results of data analysis using Wilcoxon revealed that both exercises influenced the changes in hypertension symptoms, (isometric handgrip group with p = 0.001 and in the slow deep breathing group with p = 0.003). Based on the Mann Whitney test, the findings obtained showed that p = 0.02, the difference in the decrease in the 2.2 handgrip isometric and the difference in slow deep breathing were 1.6.*

CONCLUSION: *The isometric handgrip and slow deep breathing affect the reduction in hypertension symptoms. Isometric handgrip exercise is considered more effective than slow deep breathing exercises.*

Keywords: *isometric handgrip exercise, slow deep breathing exercise, symptoms of hypertension*

cardiovascular disease in 2015, representing 31% of all causes of death in the world. Deaths from coronary heart disease were detected at 7.4 million, and due to stroke reached 6.7 million. Nearly 1 billion adults are detected as having hypertension and is estimated to increase to 1.56 billion by 2025. About a third of the adult population in the Southeast Asia region is detected to have high blood pressure [2].

The incidence of hypertension in 2018 in Indonesia based on doctor's diagnosis reached 8.4% and there was a significant increase from 2013 to 2018 at the age of more than 18 years reaching 8.3%. Central Java is ranked fourth for the prevalence of hypertension, after South Kalimantan, West Java and East Kalimantan [3]. The cases of hypertension in the Banyumas region in 2017 were 55.79%. Puskesmas I Kembaran is one of the areas reported by Banyumas Health Office to be the region with the second-highest incidence of hypertension, with 2287 cases [4].

Early symptoms of the disease are sometimes unknown to hypertensive patients. Patients usually experience nonspecific symptoms such as headaches, fatigue, tingling, stiff neck. This condition is found when patients seek medical help [5]. Hypertension can be a serious threat if you do not get proper treatment and care management. When there is an increase in high blood pressure, sympathetic nervous system activity, heart rate and contractility of the heart muscle will increase. This condition if it continues to occur makes the heart muscle thicken (hypertrophy) and causes the heart pump function to be disrupted, further consequences will occur damage to blood vessels of the brain, eyes (retinopathy), and kidney failure [6].

Conditions that result from uncontrolled high blood pressure can be treated with treatment management. Management of hypertension treatment is done in two ways, pharmacologically and nonpharmacologically [7]. The first non-pharmacological treatment recommended by The

Introduction

Hypertension is characterized by an increase in high blood pressure and a cause of cardiovascular disease morbidity and mortality. Reported from several developed countries and seven developing countries, hypertension is the cause of premature death [1]. 17.7 million people died of

Heart Association is isometric exercise as an effective strategy for treating and preventing hypertension [8]. Isometric handgrip exercise is one of the isometric physiological exercises to elicit cardiovascular responses [9]. Isometric handgrip training is a simple, effective, inexpensive and non-pharmacological exercise in reducing blood pressure [10]. Regular isometric handgrip exercises, can increase vascular flow, increase muscle ability, maintain aerobic metabolism, thus generating a smaller sympathetic response, which will cause changes in blood pressure. Changes in blood pressure and symptoms of hypertension are influenced by the presence of chemoreceptor reflexes during isometric exercise. Chemoreceptor reflexes make sympathetic nerve activity decrease and weakening of sympathetic nerve response to sympathetic nerve activity [11].

Besides isometric handgrip exercise, there is another therapy, i.e. slow deep breathing exercise. Slow deep breathing exercise is one of the exercises that use relaxation. When the body relaxes, muscle extension, decreased nerve impulses to the brain, decreased brain activity and other bodily functions occur. This makes the body more relaxed marked by a decrease in pulse rate, and a decrease in blood pressure. Slow deep breathing exercises can reduce sympathetic nerve activity by increasing the inhibition of central rhythm so that the hormone epinephrine is released and captured by alpha receptors which can affect the smooth muscle of blood vessels. Vascular smooth muscle will experience vasodilation which can reduce peripheral resistance [12].

Research on the effectiveness of isometric handgrip exercise and slow deep breathing exercise on changes in blood pressure has been done by [13]. An the results of these two actions can significantly reduce blood pressure in hypertensive patients. The study has not yet been described in which interventions are more effective and their effects on reducing symptoms of hypertension. Based on interviews with Posbindu cadres in Dukuhwaluh Village, information was obtained that some Posbindu participants had a history of high blood pressure, and did not take regular maintenance so that blood pressure was not controlled. Interviews were conducted on 10 people with hypertension, 6 people said that they had been suffering from hypertension for more than 2 years and only took medication regularly from doctors, while 3 other people said that not taking medication because they felt hypertension they experienced did not interfere with daily physical activity and assume blood pressure will return to normal within a few days and 1 person said he never took medicine again because he felt after taking medicine the body felt weak like there was no energy. Based on several explanations of the results of the study and the conditions mentioned above, the author conducted research entitled "Effectiveness of Isometric Handgrip Exercise and Exercise in Breath to Reduce

Hypertension Symptoms in Hypertension Patients at Dukuhwaluh Village". The objective of this study was to analyze the effect of isometric handgrip exercise and slow deep breathing exercise on the symptoms of hypertension, and to analyze both interventions for changes in hypertension symptoms.

METHOD

The type of this research was Quasi-Experimental with Two Group Pretest Postest Design. The researcher took 40 respondents who were divided into two intervention groups, namely the isometric handgrip exercise group (n = 20) and slow deep breathing exercise (n = 20). The purposive sampling technique was employed by researchers, with criteria for patients who had systolic and diastolic blood pressure ≥ 140 mmHg / ≥ 90 mmHg, were able to hold a handgrip, were aged $\geq 18-60$ years, were cooperative and could follow instructions. Respondents who had arthritis, musculoskeletal injuries to the extremities and respondents who had carpal tunnel syndrome or hand pain, respondents who had DM, kidney failure were not included in the study.

Data were collected in June 2019. Respondents who had agreed to take part in the research process, filled out and signed informed consent and filled out the questionnaire provided. The questionnaire was used to measure the symptoms of hypertension. The intervention on the isometric handgrip group was carried out for 6 days where symptom measurements were performed at the beginning and after the intervention on the sixth day. The exercise was done by the respondent sitting relaxed, asked to do isometric contractions (holding the handgrip) with one hand for 45 seconds, then opened the grip and rested for 15 seconds. This action was carried out alternately with the other hand. The total amount of duration was 4 minutes. In the slow deep breathing group, the intervention was carried out for 6 days where the measurement of hypertension symptoms was carried out at the beginning and after the intervention on the 6th day. Respondents were able to do slow deep breathing 5x / minute with 1-minute rest for 15 minutes.

Researchers used the Wilcoxon and Man Whitney tests. The Wilcoxon test was used to see the effect or change in symptoms before and after intervention was given. Mann Whitney test was employed to determine group differences.

Ethical approval was given by the Ethics Committee of Banyumas Hospital with No.006 / KEPK-RSUDBMS / VI / 2019 and written approval was obtained from all individual participants included in this study as multi-leveled equations, graphics, and tables are not prescribed, although the various table text styles are provided. The formatter will need to create these components, incorporating the applicable criteria that follow.

RESULTS AND DISCUSSION

Table 1 Data Characteristics of Hypertension Symptoms before Intervention

Perceived Symptoms	<i>Isometric Handgrip Group</i>				<i>Slow Deep Breathing Group</i>			
	No Symptom (%)	Mild Symptom (%)	Moderate Symptom (%)	Severe Symptom (%)	No Symptom (%)	Mild Symptom (%)	Moderate Symptom (%)	Severe Symptom (%)
Dizziness	14 (70)	4 (20)	2 (10)	0 (0)	10 (50)	1 (5)	8 (40)	1 (5)
Stiff Neck	12 (60)	7 (35)	1 (5)	0 (0)	11 (55)	4 (20)	5 (25)	0 (0)
Stiff Shoulder	17 (85)	3 (15)	0 (0)	0 (0)	15 (75)	2 (10)	3 (15)	0 (0)
Tingling	14 (70)	3 (15)	2 (10)	1 (5)	11 (55)	3 (15)	6 (30)	0 (0)
Fatigue	15 (75)	3 (15)	2 (10)	0 (0)	15 (75)	1 (5)	4 (20)	0 (0)
Back Pain	11 (55)	8 (40)	1 (5)	0 (0)	12 (60)	2 (10)	6 (30)	0 (0)

The symptoms of hypertension that were perceived by respondents in the two groups prior to the intervention were moderate dizziness (n = 10), mild neck stiffness (n = 11), mild shoulder stiffness

symptom (n = 5), moderate tingling symptom (n = 8), moderate fatigue symptom (n = 6), mild back pain (n = 10).

Table 2 Data Characteristics of Hypertension Symptoms after Intervention

Perceived Symptoms	<i>Isometric Handgrip Group</i>				<i>Slow Deep Breathing Group</i>			
	No Symptom (%)	Mild Symptom (%)	Moderate Symptom (%)	Severe Symptom (%)	No Symptom (%)	Mild Symptom (%)	Moderate Symptom (%)	Severe Symptom (%)
Dizziness	15 (75)	4 (20)	1 (5)	0 (0)	11 (55)	8 (40)	1 (5)	0 (0)
Stiff Neck	12 (60)	7 (35)	1 (5)	0 (0)	12 (60)	7 (35)	1 (5)	0 (0)
Stiff Shoulder	17 (85)	3 (15)	0 (0)	0 (0)	15 (75)	4 (20)	1 (5)	0 (0)
Tingling	16 (80)	2 (10)	0 (0)	2 (10)	12 (60)	6 (30)	2 (10)	0 (0)
Fatigue	19 (95)	1 (5)	0 (0)	0 (0)	16 (80)	4 (20)	0 (0)	0 (0)
Back Pain	17 (85)	3 (15)	0 (0)	0 (0)	10 (50)	7 (35)	3 (15)	0 (0)

The symptoms of hypertension that were perceived by respondents in the two groups after the intervention were light dizziness (n = 12), mild neck stiffness (n = 14), mild shoulder stiffness (n = 7),

mild tingling symptom (n = 8), mild fatigue symptoms (n = 5), mild back pain symptom (n = 10).

Table 3 The Difference in the Hypertension Symptom before and after the Intervention

Intervention	Hypertension Symptom	Mean+SD	Z test	p-value	Difference
<i>Isometric Handgrip</i>	Before	3,70±2,25	-3,433	0,001	-2,2±-1,11
	After	1,50±1,14			
<i>Slow Deep Breathing</i>	Before	4,20±3,28	-3,009	0,003	-1,6±-1,68
	After	2,60±1,60			

Table 3 showed the mean score of hypertension symptoms before being given isometric handgrip exercise by 3.70 decreased to 1.50 and the Wilcoxon test result revealed a p-value of 0.001 <α. It could be concluded that there was an effect of

isometric handgrip exercise on the symptoms of hypertension.

The mean score of hypertension symptoms before being given slow deep breathing exercise was 4.20 down to 2.60 and the Wilcoxon test result showed a p-value of 0.003 <α. Based on the score of

the test results, it could be concluded that there was an effect of slow deep breathing exercises on the

symptoms of hypertension.

Table 4 The Difference of the Hypertension Symptom after the Intervention of Isometric Handgrip and Slow Deep Breathing

Treatment	P-value	Z	Difference
<i>Isometric Handgrip</i>	0.02	-2.294	2.2
<i>Slow Deep Breathing</i>			1.6

Based on table 4, it could be seen that the mean score of hypertension symptoms in isometric handgrip exercise was 16.38 (with a mean difference of 2.2) and in the slow deep breathing exercise group 24.62 (with a mean difference of 1.6). Based on statistical analysis using the Mann Whitney test p-value of 0.02, which meant that there was a difference in the influence of isometric handgrip exercise and slow deep breathing exercise on hypertension symptoms in hypertensive patients.

The results revealed that hypertensive patients who performed isometric handgrip exercise for 6 consecutive days showed a decrease in hypertension symptoms (p-value 0.001). Respondents reported moderate dizziness symptoms, mild neck stiffness symptoms, mild shoulder stiffness symptoms, moderate tingling symptoms, moderate fatigue symptoms, mild back pain symptoms as the symptoms of hypertension that were felt. Reported symptoms of hypertension were the same as previous studies. Common symptoms associated with hypertension are headache, dizziness, fatigue, earache, and bleeding from the nose [14]. Patients with hypertension will experience headaches due to vasospasm reflexes of several head arteries including arteries that supply blood to the brain. Theoretically, vasospasm that occurs will cause ischemia in a part of the brain resulting in headaches [15].

Endothelial dysfunction in hypertensive patients causes a reduced production of nitric oxide, which can cause vasoconstriction. With isometric, there is an increase in blood vessel flow (an increase in friction acting on the endothelium of the arteries) and it will stimulate the production of nitric oxide in the endothelium which will cause vasodilation [16]. The isometric handgrip can also cause an increase in plasma adrenomedullin (ADM), which is a powerful vasorelaxant involved in blood pressure control, to counteract the effects of vasoconstrictors. Plasma adrenomedullin (ADM) functions to increase the amount of nitric oxide which is used to dilate blood vessels [17].

An important component of isometric handgrip training is an increase in blood flow to meet the increased metabolic demand of contracting muscles and bones. Blood flow can increase more than 20-50 times during contractions [18]. This will cause blood vessels to undergo vasodilation. The effect of

vasodilation and decreased sympathetic excitement can reduce intracranial pressure so that oxygen flow becomes smoother. Smoother oxygen flow causes dizziness symptom that is felt to be reduced or disappeared at once. Hypertensive patients who have neck stiffness, back pain and shoulder stiffness can be caused by the same factor, namely the lack of oxygen supply in the muscle tissue in the target area (neck, waist, and shoulder) due to hardening of the arteries and sympathetic stimulation resulting in local vasoconstriction of blood vessels [16]. Because the blood vessels undergo vasodilation, this will cause blood flow to organs (nape of the neck, waist and shoulders) to be smooth again, so that pain and stiffness in these organs become reduced.

The results also proved that hypertensive patients who were given slow deep breathing exercises for 6 consecutive days showed a significant decrease in hypertension symptoms (p-value 0.003). Slow deep breathing exercise reduces sympathetic nerve activity by increasing the inhibition of central rhythm which will result in decreased sympathetic expenditure. This decrease results in a reduction in the release of epinephrine which is captured by alpha receptors thus affecting the smooth muscle of blood vessels. Vascular smooth muscle undergoes vasodilation which decreases peripheral resistance [19].

The effect of vasodilation and decreased sympathetic stimulation can increase oxygen flow more smoothly. Smoother oxygen flow allows for the breakdown of lactic acid through oxidative decarboxylation in muscle tissue [15]. Decomposition of lactic acid and the effects of relaxation on muscle tissue in the nape of the neck, shoulders, and waist can reduce the symptoms of hypertension felt by hypertensive patients. Maneuvering slow deep breathing exercise will increase the sensitivity of arterial barriers, this has an impact on several factors, including reducing sympathetic nerve impulses and making peripheral blood vessels vasodilatation [20].

Slow deep breathing exercises will also have a relaxing effect. Relaxation effects in the body will cause two things, i.e. increased awareness and sensitivity to self-sensing and hypothalamic response to secreting the body's analgesic hormones namely endorphins and melatonin, which can make patients calmer [21]. Peripheral pain neurons send

signals to the synapses and synapses occur between peripheral neurons and neurons that go to the brain where substance P should deliver impulses. Endorphin and melatonin can inhibit the substance of P. Blocking substance P by endorphin and melatonin can reduce the sensation of pain that is felt in the symptoms of hypertension. Previous research also stated that the effects of deep breathing can reduce the symptoms of headache in hypertensive patients [22]. Effective relaxation techniques can reduce heart rate, blood pressure, reduce tension headache, reduce muscle tension, improve well-being and reduce the pressure of symptoms in individuals who experience various situations [23].

The mechanism of slow deep breathing exercise in reducing headache is related to the fulfillment of oxygen demand in the brain through an increased supply of oxygen and by reducing the oxygen demand of the brain. Slow deep breathing exercise is an action that can indirectly reduce lactic acid by increasing oxygen supply and decreasing the oxygen demand of the brain, so that it is expected that a balance of brain oxygen will occur. Slow deep breathing is a conscious action to regulate deep and slow breathing. Deep and slow breathing can stimulate the response of the autonomic nerve through the release of endorphin neurotransmitters that affect decreasing the sympathetic nervous response and increasing parasympathetic nerves. Parasympathetic response decreases more body activity or relaxation so that it can reduce metabolic activity [16]. Parasympathetic nerve stimulation and inhibition of sympathetic nerve stimulation in slow deep breathing also have an impact on cerebral vasodilation which allows more brain oxygen supply so that brain tissue perfusion is expected to be more adequate [24].

Hypertensive patients who have tingling complaints in the extremities can be caused by a lack of adequate blood flow to supply the upper and lower extremities. This inadequacy of blood flow then causes the muscles in the hands and feet to lack oxygen and food. The inadequacy of the supply of oxygen and food in the muscles can further result in the disruption of the delivery of neuromuscular impulses [15]. This disorder results in tingling felt by hypertensive patients. The effect of slow deep breathing will cause vasodilation of blood vessels, will cause a decrease in symptoms of hypertension in respondents.

The results of statistical tests using Mann-Whitney in this study indicated that there were differences in the effect of isometric handgrip and slow deep breathing on hypertension symptoms ($p = 0.002$), with the mean difference in the isometric group 2.2 and slow deep breathing 1.6. From table 1, it showed that the symptoms of hypertension felt by the study respondents differed between the isometric handgrip group and the slow deep breathing group. In theory, the appearance of hypertension symptoms is influenced by culture, the

meaning of pain, attention, anxiety, fatigue, previous experience, coping and family social support. Most patients with hypertension usually do not have specific symptoms that indicate an increase in blood pressure and are only identified by blood pressure testing [5]. States that the symptoms of primary hypertension include dizziness, stiff neck, tingling, nausea, fatigue, back pain and shortness of breath [25].

The influence of isometric handgrip and slow deep breathing in reducing the symptoms of hypertension of patients is related to the pathophysiology of symptoms that appear in each individual. Hypertension patients who have dizzy complaints can be caused by increased intracranial pressure due to the hardening of the walls of blood vessels in the brain due to age. This condition is compounded by the presence of hypertension triggers such as obesity, lack of exercise, stress and a high salt diet. Hardening of blood vessel walls and precipitating factors causes the supply of oxygen to the brain to be inadequate and symptoms of dizziness are felt [5].

Based on the mean difference, the isometric handgrip produced a higher mean difference than slow deep breathing. Isometric handgrip exercise can reduce cardiac output, decrease sympathetic nervous system activity, decrease peripheral vascular resistance and increase bar reflex sensitivity [26]. Isometric handgrip exercise is a gripping activity where contractions occur in the forearms and hands so that it will cause changes in hand muscle tension [27].

Based on previous research that changes in the effect of sympathetic nerves on total vascular resistance might act as an adequate stimulus to produce a decrease in blood pressure after isometric exercise [28]. Changes in blood pressure after the administration of isometric handgrip exercise occur because during doing isometric handgrip exercise, the need for oxygen in the tissues increases and controls the heart to pump blood to meet oxygen demand. This causes an increase in blood supply to active muscles to meet the need for oxygen.

Previous research states that with 12-week isometric handgrip exercise will reduce blood pressure and arterial stiffness and improve endothelial function in hypertensive patients [29] so that symptoms of hypertension that are felt by patients will decrease. While in slow deep breathing, there is no increase in energy requirements in the respiratory muscles (minimal energy expenditure), so there is no peripheral adaptation when compared with aerobic exercise. Aerobic exercise reduces blood pressure increases in response to muscle contractions [30] which may be partly due to metabolic adaptations in trained muscles [31] but it is also possible that there is a regulation of decreased metaboreflex sensitivity in either peripheral receptors or from the central autonomic response to afferent stimulation. Slow

deep breathing combined with isometric handgrip, in addition to reducing blood pressure at rest also reduces the pressor response to handgrip exercise [32].

CONCLUSIONS

The isometric handgrip and slow deep breathing affect the reduction in symptoms of hypertension. Isometric handgrip exercise is considered more effective than slow deep breathing exercises.

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