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Ergonomics Exercises on blood pressure control among hypertensive patients

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Abstract

Background: Hypertension affects more than 31% of the adult population globally, data released by Cardiovascular Diseases (CDVs) hypertension is one of the largest contributors to cardiovascular disease. Untreated hypertension can increase the risk of heart disease, kidney failure, and stroke. The spread of hypertension will continue to grow strongly and it is predicted that in 2025 as many as 29% or around 1.15 billion individuals will suffer from hypertension. Deaths due to hypertension and its complications are estimated to reach 9.4 million people each year.
Purpose: To determine the effect of ergonomics exercises on blood pressure control among hypertensive patients.
Method: This study used a quasi-experimental pre-post test with group control design on the education of providing ergonomic exercise for controlling blood pressure in hypertensive patients or called *Ce'Esi* (prevent hypertension), divided into two groups, namely the intervention group and the control group. This study was conducted on all hypertensive patients who were treated at health centers in three cities in Indonesia, namely Cianjur Health Center, Permata Sukarame Health Center Bandar Lampung, and Tamanlanrea Health Center Makassar, which was carried out in March-July 2024. Data analysis used univariate and bivariate statistical tests Paired t-test and Independent t-test**.**
Results: There were significant differences in the intervention group, namely health status scores, knowledge, compliance, and diastolic pressure (p-value 0.000), while systolic pressure (p-value 0.003). in the control group, no significant differences were found in all variables. This shows that hypertension management education interventions and ergonomics exercises can improve the health status of hypertensive patients, knowledge, compliance, and lower diastolic blood pressure.
Conclusion: Health education and ergonomics exercise using videos in preventing hypertension can improve knowledge, compliance, health status, and lower blood pressure in hypertension sufferers.

Keywords: Blood Pressure; Ergonomics Exercise; Hypertension.

INTRODUCTION

Hypertension affects more than 31% of the adult population globally, data released by Cardiovascular Diseases (CDVs) hypertension is one of the largest contributors to cardiovascular disease (World Health Organization, 2023). Untreated hypertension can increase the risk of heart disease, kidney failure, and stroke (Mills, Stefanescu, & He, 2020). The spread of hypertension will continue to grow strongly and it is predicted that by 2025 as many as 29% or around 1.15 billion individuals will suffer from hypertension

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(Efliani, Ramadia, & Hikmah, 2022). Deaths due to and its complications are estimated to reach 9.4 million people each year (Ministry of Health of the Republic of Indonesia, 2020).

In Indonesia, hypertension is still a disease that is a major challenge in the health sector. This problem is proven by the frequent finding of hypertension cases in various primary health services. According to Basic Health Research data, hypertension had a prevalence rate of 25.8% in 2013 and when compared to cases in 2018 increased by 8.3% to 34.1% (Ministry of Health of the Republic of Indonesia, 2018). Based on prevalence data in several regions in Indonesia, it can be concluded that hypertension is a fairly serious problem. Several regions that experienced a significant increase were West Java, Lampung, and Makassar.

Hypertension prevalence data in West Java in 2019 is estimated at around 41.6%, while the previous year's Basic Health Research estimate was around 39.6%. This figure increased from the previous year by around 29% (West Java Health Office, 2020). The 2018 Lampung Province Basic Health Research data recorded that 20.838 people had hypertension (Ministry of Health of the Republic of Indonesia, 2019). Hypertension is ranked third in the top ten non-communicable diseases in 2022 in Lampung Province (Lampung Provincial Health Office, 2023). Based on data from the South Sulawesi Provincial Health Office, according to Regency/City data, the highest prevalence of hypertension is in Makassar City with 290.247 cases, then Bone Regency is the second highest with 158.516 cases, and the third highest is Gowa Regency with 157.221 cases, and the lowest prevalence is in Barru Regency with 1.500 cases (South Sulawesi Provincial Health Office, 2020). Hypertension also ranks second out of the ten highest diseases.

Hypertension can not only cause high mortality rates, but can also affect a person's quality of life. One way to improve quality of life is to monitor blood pressure regularly. Monitoring blood pressure in hypertensive patients is very important to ensure that blood pressure remains constant and within the normal range. This can usually be done if the patient truly implements a healthy lifestyle, starting from exercising regularly, losing weight, and maintaining physical fitness (Diaz & Shimbo, 2013; Van Horn, Peaceman, Kwasny, Vincent, Fought, Josefson, & Gernhofer, 2018).

A sustainable strategy to maintain health and constant blood pressure is exercise because it can stimulate the heart to provide valuable improvements for those who do it. This is a preventive measure whose purpose is to increase how much oxygen interaction is processed in the body in a certain period of time. The purpose of hypertension exercise is to dilate blood vessels, reduce blood vessel blockages, reduce hormones that cause blood pressure to increase, and reduce high cholesterol. Regular physical exercise reduces blood pressure and is highly recommended by the hypertension guidelines of the American Heart Association (AHA), the American College of Sports Medicine (ACSM), and the European Society of Cardiology (ESC) (Keller, Hartung, del Castillo Carillo, Treiber, Stock, Schröder, & Friedmann-Bette, 2022). Regular exercise can also lower systolic blood pressure by 3-5 mmHg and diastolic blood pressure by 2-3 mmHg. In people with hypertension, this effect will be more pronounced (Dimeo, Pagonas, Seibert, Arndt, Zidek, & Westhoff, 2012).

A meta-analysis study showed a mean reduction in systolic blood pressure of 7 mmHg and diastolic blood pressure of 5 mmHg. Aerobic exercise, dynamic resistance training, and isometric resistance training can reduce blood pressure in people with hypertension, normal high blood pressure, and individuals with normal blood pressure (Cornelissen & Fagard, 2005). Other studies have also shown that physical exercise can be an important part of the therapeutic approach in treating resistant hypertension. A regular physical exercise program can reduce blood pressure in individuals with resistant hypertension. In this randomized controlled trial, significant reductions in systolic and diastolic blood pressure were achieved in patients with resistant hypertension (Dimeo et al., 2012).

The benefits of hypertension training are that it can increase heart and lung endurance and burn excess fat in the body because it is a developmental exercise to strengthen and shape muscles and several other body parts, such as the middle of the

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body, thighs, hips, stomach and so on. Second, it increases flexibility, balance, coordination, agility, endurance, and the capacity to participate in sports or additional activities (Sumartini, Zulkifli, & Adhitya, 2019). In addition, regular physical exercise also improves physical performance as assessed through maximum oxygen uptake and lactate curves. However, there were no significant changes in arterial compliance and cardiac index (Dimeo, et al., 2012).

One of the hypertension exercises that can be done by hypertension sufferers is ergonomic exercise to control blood pressure. This exercise is one of the light exercises and can be done while relaxing without movements that require a lot of energy and can relax blood vessels, widen blood vessels, increase muscle strength and heart function, relax and reduce stress and prevent hypertension. A series of ergonomic exercises consisting of warming up, core body movements, and cooling down (Ayu, Dewi, Utami, Anggraeni, & Nuryani, 2023). Through this exercise activity, it is hoped that blood pressure in hypertension sufferers can be controlled, so that it can prevent more severe complications.

Many researchers have conducted research related to antihypertensive exercise, but combining education and antihypertensive exercise is a development of non-pharmacological therapy that has not been widely carried out. Therefore, the author is interested in conducting research by developing a model and education of hypertension prevention exercise as a non-pharmacological therapy for sufferers, so that it can improve health levels through stabilization or reduction of blood pressure that is close to normal.

RESEARCH METHOD

This study used a quasi-experimental pre-post test with group control design on the education of providing ergonomic exercise for controlling blood pressure in hypertensive patients or called *Ce'Esi* (prevent hypertension), divided into two groups, namely the intervention group and the control group. This study was conducted on all hypertensive patients who were treated at health centers in three cities in Indonesia, namely Cianjur Health Center, Permata Sukarame Health Center Bandar Lampung, and Tamanlanrea Health Center Makassar which was carried out in March-July 2024. The dependent variable in this study was blood pressure, while the independent variable was ergonomic exercise

The sampling technique used non-probability sampling with a purposive sampling technique. The sample size was 120 with 60 participants divided into the intervention group and 60 participants in the control group. The inclusion criteria for this study were hypertensive patients and routinely taking medication aged 40-59 years, willing to take ergonomic exercise from the beginning to the end of the study, suffering from primary hypertension for at least one month ago; do not have comorbidities or other complications, do not have physical disabilities, and do not participate in other exercises or sports. Exclusion criteria were hypertensive patients with complications, secondary hypertension and severe complications, and uncooperative patients.

After the pre-test, the intervention group received education in the form of health counseling and ergonomic exercises using videos, while the control group was only given leaflets containing information about hypertension and ergonomic exercises. After the intervention was completed, both groups were given a post-test. This study was conducted for 2 weeks with three meetings a week, a duration of 45 minutes which was carried out directly. Exercises were carried out in the morning in an open field, if indoors there must be adequate ventilation. The series of ergonomic exercise movements consisted of; warming up with joint range of motion, balance exercises, muscle exercises, games, and cooling down with deep breathing. Each stage of exercise was carried out for 10 minutes consisting of 1-2 movements. Each movement is recommended to be done while standing, if unable to do so, it is allowed to be done by holding onto a chair or sitting. The instruments used were an audio mixer, speaker, LCD, and laptop.

Data collection on patient characteristics, such as age, gender, education, and duration of hypertension, used questionnaires, observation sheets, and interviews. In addition, interviews and questionnaires were also used to determine patient compliance and health status. Blood pressure was

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measured with an acoustic stethoscope and aneroid sphygmomanometer.

Data analysis used univariate and bivariate statistical tests Paired t-test and Independent t-test to determine compliance and health status of hypertension sufferers before and after the intervention, as well as the differences between the intervention group and the control group. The researcher received an official letter from STIKes Permata Nusantara and the research area. After that, in February, an ethical test was carried out by Jenderal Ahmad Yani University on February 22, 2024 with the number: 042/ KEPK/ FITKes-Unjani/II/2024.

RESEARCH RESULTS

Table 1. Distribution Characteristics of Participants (N=120)

Variables	Intervention (n=60)	Control (n=60)
Age (Mean±SD)(Range)(Year)	(57±8.98)(47-73)	(56.5±7.38)(38-78)
Disease Duration (Mean±SD)(Range)(Year)	(5±8.78)(1-37)	(4±5.57)(1-35)
Gender (n/%)		
Male	10/16.7	19/31.7
Female	50/83.3	41/68.3
Education (n/%)		
Elementary School	29/48.4	17/28.3
Junior High School	12/20.0	33/55.0
High School	17/28.3	9/15.0
University	2/3.3	1/1.7

Based on Table 1. It is known (Mean age ± SD) the age of the intervention group participants (57 ± 8.98) ranged from 47-73 years, while the control group (56.5 ± 7.38) was in the age range of 38-78 years. The average duration of hypertension in each group was 5 and 4 years. The majority of participants in both the intervention and control groups were women, namely 50 people (83.3%) and 41 (68.3%) respectively. In the intervention group, the majority of participants only completed elementary school education, namely 29 (48.5%), while in the control group up to junior high school, namely 33 (55.0%).

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Table 2. Health Status, Knowledge, Compliance, and Blood Pressure Pre-Post Test (N=120)

Variables	Mean±SD	Difference	95%CI	Q	P-value
Health Status					
Intervention					
Pre/Post-test	43.43±9.10/49.60±9.10	-6.166	-8.517 (-5.249)	-5.249	0.000
Control					
Pre/Post-test	42.37±9.324/44.73±9.324	-2.366	-4.775 (0.042)	-1.966	0.064
Knowledge					
Intervention					
Pre/Post-test	10.10±3.23/12.55±3.23	-2.450	-3.285 (-1.614)	-5.869	0.000
Control					
Pre/Post-test	8.27±5.22/9.43±5.22	-1.166	-2.514 (0.181)	-1.732	0.089
Compliance					
Intervention					
Pre/Post-test	4.68±4.80/9.90±4.80	-5.216	-6.457(3.976)	-8.416	0.000
Control					
Pre/Post-test	5.17±2.67/5.10±2.67	0.066	-0.623 (0.757)	0.193	0.848
Systolic					
Intervention					
Pre/Post-test	145.92±10.42/141.76±10.42	4.166	1.474 (6.858)	3.697	0.003
Control					
Pre/Post-test	136.07±13.87/133.73±13.87	2.333	-1.249 (5.916)	1.303	0.198
Diastolic					
Intervention					
Pre/Post-test	92.75±6.78/89.25±6.78	3.50	1.747(5.252)	3.997	0.000
Control					
Pre/Post-test	77.18±8.99/77.78±8.99	-0.600	-2.921(1.721)	-0.517	0.607

The results of the analysis in Table 2. show a significant difference in the intervention group, namely the health status score, knowledge, compliance, and diastolic blood pressure (p-value 0.000), while in systolic blood pressure (p-value 0.003). In the control group, no significant differences were found in all variables. This shows that the hypertension management education intervention and ergonomic exercise are able to improve the health status of hypertensive patients, knowledge, compliance, and reduce diastolic blood pressure.

DISCUSSION

The results showed that the age of participants in the intervention and control groups was almost the same, namely an average of 57 years with a range of 47-73 years in the intervention group, while in the control group it was 56.5 years with a range of 38-78 years. In line with previous findings that most participants in the control and intervention groups were between 60-74 years old (Gao, Chen, Tian, Lin, Lu, & Weng, 2013). Hypertension is closely related to age, the risk of developing hypertension increases with age because blood vessels become less elastic due to natural changes in the heart, blood vessels, and hormones. Large arteries become less elastic, so they become stiff and blood has to pass through narrow blood vessels more often, which ultimately causes blood pressure to increase (Park, Kario, & Wang, 2015; Yin, Yin, Li, Silva-Nash, Tan, Pan, & Yan, 2022).

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Various risk factors, such as age, gender, family history, obesity, high salt levels, and poor lifestyle habits, smoking and drinking alcohol can cause high blood pressure. People who have these risk factors should be more vigilant and start prevention early. Controlling blood pressure regularly is the easiest preventive measure to prevent factors that can cause hypertension.

Participants in the intervention and control groups were mostly female. Previous studies have also shown that most participants have female characteristics. Although hypertension in young women is relatively low, it does not mean that they will be protected from hypertension forever as they age. When women enter menopause, women begin to lose the hormone estrogen so that the prevalence of hypertension in emale aged 45-55 years increases. The hormone estrogen helps women who have not experienced menopause to increase high-density lipoprotein (HDL) levels. High HDL levels help prevent atherosclerosis. In addition, women are more likely to experience an increase in body mass index than men, making them more susceptible to hypertension. Monthly cycle syndrome or what is known as premenopause is a postmenopausal condition that causes the distribution of body fat to accumulate more easily due to hormonal changes (Surti, Candrawati, & Warsono, 2017). The results of basic health research show that women in Indonesia have a greater risk of developing hypertension than men (Ministry of Health of the Republic of Indonesia, 2018).

Education level is one of the factors that influence a person's perception of their ability to accept new technology and concepts. The results showed that most of the intervention group participants had elementary school education, while most of the control group participants had junior high school education. This result is in line with the results of previous studies showing that most of the control group participants had junior high school education. This result is also in line with the results of previous studies showing that most of the intervention group participants had elementary school education (Novitaningtyas, Puspowati, & Purwani, 2014). Education affects the incidence of hypertension because people with higher education are usually more knowledgeable about health and prefer to maintain their health (Notoatmodjo, 2007).

The results of the analysis showed that the difference in pre- and post-test knowledge scores about hypertension management and preventive exercises increased in the intervention group by 2.450 with a p value of 0.000. This shows that the intervention of hypertension care education and preventive exercises through audio-visual media and hypertension prevention exercise learning modules has a significant impact on increasing knowledge. The results of the study are in accordance with previous findings, namely that low-salt diet health education has an impact on changes in patient knowledge about hypertension with a p value = 0.001. In addition, hypertension diet health education has an impact on increasing respondents' knowledge with a p value = 0.015, while in the control group there was no significant impact with a p value = 0.089 (Nelwan & Sumampouw, 2019; Afelya, Syam, & Mangemba, 2024). Other studies also show that hypertension diet health education interventions through a continuous nursing service approach have a significant effect on increasing respondents' knowledge scores by 4.091 with a p value of 0.000 (Suratun, Ekarini, & Sumartini, 2018).

The knowledge that a person obtains about an object through their five senses is called knowledge. The intensity or level of knowledge that a person obtains about an object is greatly influenced by the intensity of a person's attention and perception of the object. The knowledge that a person obtains about an object is mostly obtained through the five senses, namely hearing and sight. One very important aspect in a person's actions is knowledge (Notoatmodjo, 2007). Factors that influence increased knowledge are health workers who are skilled in providing information clearly and easily understood, and using sufficient media because most people with hypertension are elderly. In this study, hypertension prevention training and hypertension management were taught in groups through the use of guide modules and videos that included practice questions, discussions, and questions and answers.

The results of the analysis of patient compliance with hypertension prevention training showed a p value = 0.000, this indicates that there is a significant

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difference in compliance with hypertension prevention training in the intervention group. The intervention group had an average difference in pre- and post-test compliance with hypertension prevention training of 5.216. This shows that the use of video media and training modules on patient compliance in preventing and treating hypertension has a significant effect. The results of this study are in accordance with previous studies showing that aerobic exercise can lower blood pressure, especially in patients with resistant hypertension. Aerobic exercise can improve the quality of life of patients and lower ambulatory blood pressure. However, it is important to consult a doctor before starting any exercise (Dimeo et al., 2012).

Compliance is defined as the degree of patient loyalty to the treatment and behavior recommended by a doctor or other person. The degree of patient compliance with clinical recommendations given by their doctor is known as compliance. In the medical world, "compliance" is defined as the degree of patient compliance with instructions or procedures given by health workers. Compliance is defined as the degree of patient compliance with instructions given by health workers. Patients who understand hypertension treatment and exercise well can behave according to the directions given by authorized persons, such as doctors, nurses, and other health workers (Gao et al., 2013; Park et al., 2015; Yin et al., 2022).

The results showed that there was a difference in the decrease in systolic blood pressure pre and post test in the intervention group of 4.17 mmHg and a decrease in diastolic blood pressure of 3.50 mmHg with a p value = 0.000. In contrast, the difference in the decrease in systolic blood pressure in the control group was 2.33 mmHg and a decrease in diastolic blood pressure of 0.60 mmHg. The results showed that sports education for the prevention of hypertension had a significant effect on the decrease in systolic and diastolic blood pressure in the intervention group, compared to the control group. The results of previous studies are in accordance with this study which found that the intervention of a continuous nursing service approach had a significant effect on systolic and diastolic blood pressure between the intervention group and the control group, namely with a p value = 0.005 and p = 0.025 (Surti et al., 2017; Novitaningtyas et al., 2014).

There was a significant difference in systolic and diastolic blood pressure of hypertensive patients in the intervention group before and after being given hypertension prevention training with a p value = 0.005. In the intervention group, there was a decrease in systolic blood pressure of 8.62 mmHg and diastolic blood pressure of 4.00 mmHg. The median systolic blood pressure was 160.00 mmHg with a range of 140-160 mmHg and the median diastolic blood pressure was 100.00 mmHg at 90-100 mmHg (Ifansyah, Herawati, & Diani, 2015; Hernawan & Rosyid, 2017). Neurohumorally, a decrease in blood pressure is characterized by a decrease in sympathetic nervous system activity in peripheral blood vessels. In addition, changes in vascular response after physical exercise affect the decrease in blood pressure. Blood vessel response is also important for lowering blood pressure after physical exercise. Physical exercise is thought to have the potential to change the strong vasoconstrictor (narrowing of blood vessels) response to vasodilator (reducing vasoconstriction or widening of blood vessels) and increase nitric oxide production. Increased respiratory activity, venous return will increase, thereby increasing stroke volume which in turn results in increased cardiac output. This causes arterial blood pressure to increase, then the resting phase, namely increased sympathetic nerve activity, decreased heart rate, decreased stroke volume, and arteriolar venous vasodilation. Decreased total peripheral resistance and cardiac output cause decreased blood pressure (Ayu, Achmad, Wijayaningsih, & Nurajizah, 2024).

The results showed that the difference in health status scores of respondents in the intervention group before and after was significantly different by 6,166. In contrast, the health status of respondents in the control group did not experience significant changes with an average score difference of only 2 points. The results showed that education on hypertension management and hypertension prevention exercises had a significant effect on the health status of hypertension patients (p = 0.000). The results of the interview showed that participants who participated in the hypertension prevention and

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management exercise program succeeded in lowering blood pressure, reducing dizziness or headaches for six hours every day.

Hypertension prevention exercises can significantly improve sleep quality in healthy adults and patients with chronic health problems, improve physical appearance, reduce pain, and psychological well-being. In addition, the results of this study are in line with previous research findings stating that tai-chi exercises can improve sleep quality in healthy adults and patients with chronic health problems (Priana, 2016; Hikmaharidha & Hardian, 2011; Arija, Villalobos, Pedret, Vinuesa, Jovani, Pascual, & Basora, 2018).

The results showed that the health status of the control group did not change significantly. Although participants participated in sports activities organized by the health center and health workers, they did not succeed in improving their health (Cornelissen & Smart, 2013). This shows that physical exercise for the prevention and treatment of hypertension plays a significant role in improving the quality of life of hypertensive patients. Therefore, health center nurses must continue to monitor patients and carry out physical exercise for the prevention and treatment of hypertension.

CONCLUSION

Health education and ergonomic exercise using videos in preventing hypertension can improve knowledge, compliance, health status, and lower blood pressure in hypertension sufferers.

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