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Effect of isometric handgrip exercise on blood pressure and comfort among hypertensive patients

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ABSTRACT

Introduction: Hypertension patients with uncontrolled blood pressure will experience some physical complaints. Controlled blood pressure will reduce physical complaints and improve comfort. Physical activity can help in making blood pressure controlled. However, due to limited time and access, many hypertensive patients rarely do some exercise. This study aimed to investigate the Isometric Handgrip Exercise's effect on blood pressure and comfort of hypertension patients.

Methods: The research design is a quasi-experimental pre and post-test with the control group. The population was hypertension patients who were members of the chronic program disease, had hypertension pre and grade 1, and no further complication or physical impairment. The sample used unpaired numerical analytical formulas, obtained by 25 patients for each group. The intervention of an Isometric Handgrip was conducted for ten days. In one day, there is one session with 4x3 minutes.

Results: The results showed a significant relationship between isometric handgrip exercise with a decrease in blood pressure and increased patient comfort.

Conclusions: Isometric handgrip exercise can be an alternative activity for patients that influences helping to maintain stable blood pressure and reduce the physical discomfort.

Keywords: physical activity, hypertension, blood pressure, comfort

Introduction

Hypertension has a significant effect on public health (Manimala, 2015). It is already a significant healthcare burden worldwide (Jørgensen et al., 2018). Hypertension is the third primary cause of death globally (WHO, 2021). World Health Organization (WHO data showed that around 972 million (26.4%) worldwide suffer from hypertension, which is expected to reach 29.2% by 2025 (WHO, 2021). The prevalence of hypertension in Indonesia has increased by 34.1% compared to the prevalence in 2013 by 25.8%. North Sumatra is ranked third in hypertension cases in Indonesia, with 32,944 cases (Ministry of Health RI, 2018).

Uncontrolled high blood pressure can result in long-term and potentially fatal complications such as coronary artery disease, heart failure, stroke, and kidney failure. In addition, patients will experience cognitive decline and overall poor quality of life (WHO, 2021). Patients with uncontrolled hypertension have symptoms such as dizziness, headache, anxiety, difficulty sleeping, shortness of breath, buzzing ears, fatigue, nosebleeds, and sunken eyes (Makruf, 2019). Symptoms of hypertension cause discomfort; research shows that most hypertension sufferers, 75.2%, experience discomfort (Insana, 2018).

Discomfort among people with hypertension requires a proper management. Management in

overcoming hypertension can use pharmacological and non-pharmacological therapies. Physical activity is one of the alternatives to non-pharmacological therapies developed to lower blood pressure (Carlson et al., 2014). Physical activity increases the blood flow which promotes comfort (Naldi et al., 2022). In Indonesian Public Health centers, there was an existing chronic disease program called Prolanis. Hypertensive patients received medication and an educational program with physical activity included. However, many patients still lack physical activity because they are busy with work or have no time. Physical activity is challenging due to limited time and access to sports activities provided. European and United States of America (USA) treatment guidelines recommend physical activity through Isometric Handgrip Exercise therapy (Okamoto et al., 2020).

Isometric handgrips exercises are simple physical exercises that do not require many facilities or rooms. Moreover, it does not take much time and is not affected by the weather because it can be done indoors (Owen et al., 2010). Isometric handgrip exercises reduce blood pressure in hypertension by about seven mmHg for systolic and five mmHg for diastolic (Farah et al., 2017), prevent muscle atrophy, build muscle volume, improve joint stability, and reduce edema (Rahmawati et al., 2018). Physical activities such as ergonomic stretching reduce the pain score in musculoskeletal disorders so that it will achieve a state of comfort (Andari, 2019). Increased physical activity will help increase the secretion of endorphin hormones to create comfort (Naldi et al., 2022). Therefore, researchers are interested in researching physical activity using isometric handgrip exercises to reduce pressure and improve comfort. The purpose of this study was to investigate the effect of isometric handgrip exercises on blood pressure and comfort in hypertension patients in healthcare centers.

Materials and Methods.

Design

The research design used was quasi-experimental quantitative research with control group. A repeated measure design for blood pressure variables and a pre-test and post-test design for comfort variables were used.

Population and sample

The population in this study was 523 hypertensive patients who underwent treatment at the local public Health Center. Determining samples by randomized sampling is a method of selecting samples. There were 25 subjects in the intervention group and 25 in the control group. The inclusion criteria in this study were: stage one and two uncontrolled hypertension patients who consume antihypertensive drugs with a single dose (Amlodipine or Captopril); experienced symptoms of discomfort; attended the chronic disease program (Prolanis) for at least the last three months. The exclusion criteria were hypertension patients who experience disorders in the upper extremities, such as arthritis; patients who experience further complications.

Intervention

The intervention in this study used a handgrip device with the brand “Speeds." The isometric handgrip exercise (IHE) was conducted in one session for ten days routine without stopping with a frequency of 4 x 3 minutes on both hands alternately (McGowan et al., 2017) Before the subject performed the IHE, the researcher did some simple training to the patients to obtain each subject's grip ability. The day before the intervention began, researchers measured blood pressure using a digital sphygmomanometer and comfort with the General Comfort Questionnaire (GCQ).

Furthermore, the researchers asked the subjects to do IHE at 09.00 am every day until the tenth day. Researchers visited the subject's home on the sixth, eighth and tenth days to measure the subject's blood pressure at 9:00 am. On the tenth day, the researchers also re-measured the subjects' comfort (post-test) with the GCQ questionnaire again. During the research process, from the first to the tenth day, researchers communicated via telephone to ensure that the subjects took antihypertensive drugs and conducted isometric handgrip exercises.

Instruments

Comfort measurement was measured by the General Comfort Questionnaire (GCQ). This research is adapted from the GCQ, which is adapted to the concept of comfort consisting of relief, ease, and transcendence. There were 48 questions with a response format of a four-point Likert scale. There were three questions

about relief; five about ease, questions, and four about transcendents. The 12 questions consist of seven positive questions and five negative questions. Likert scores range from 1 (strongly disagree) to 4 (strongly agree) (Kolcaba, 2003).

Meanwhile, researchers also documented the discomfort complaints reported by the patients at the first day and which are symptoms of the presence of discomfort the subject feels. These complaints of discomfort were obtained using an observation sheet containing complaints of discomfort: headaches, stiffness, difficulty sleeping, sunken eyes, and fatigue.

Data analysis

Univariate analysis in the study used frequency distribution for characteristics using computer SPSS version 2.3 software. Bivariate analysis of this study related to the mean blood pressure of systole and diastole using the Repeated Measure Anova test, comfort measurements using Wilcoxon analysis tests, and comfort differences between the two groups using the Mann-Whitney test.

Ethical clearance

This research has received recommendations and ethical clearance from the Ethics Commission of Hangtuah University Pekanbaru. It has obtained permission from the Sihepeng Health Center. This research has gone through an ethical review procedure and was declared feasible to be carried out and is valid from July-September 2022 with Number: 515/KEPK/STIKes-HTP/VII/2022.

Results

The intervention group conducted IHE with one session per day on both hands alternately with a total duration of three minutes for ten days and continued to take antihypertensive drugs. The number of samples was 50, with 25 in the intervention group and 25 in the control group using randomized sampling techniques. The control group was not given IHE treatment and continued to take anti-hypertension drugs.

Characteristics of respondents

Table 1 shows the characteristics of respondents in both the intervention and control groups. Most respondents were the early elderly (46-55 years), female, taking the anti-hypertension drug amlodipine, have grade 1 hypertension, and have different levels of education and different types of work.

Table 1 Frequency distribution of subject characteristics (n=50)

No	Subject Characteristics	Group Intervention		Control Group	
		f	%	f	%
1.	Age				
	Age 36 – 45 years	14	56	7	28
	Age 46 – 55 years	11	44	18	72
2.	Gender				
	Man	8	32	8	32
	Woman	17	68	17	68
3.	Occupation				
	Farmer	3	12	4	16
	Self-employed	2	8	1	4
	Private	5	20	5	20
	Civil servants	6	24	3	12
	Housewives	9	36	12	48
4.	Education Level				
	Junior	6	24	6	24
	High School	11	44	14	56
	Diploma	2	8	2	8
	Bachelor	6	24	3	12
5.	Types of Drugs				
	Amlodipine	21	84	23	92
	Captopril	4	16	2	8
6.	Grade				
	Hypertension	24	96	25	100
	Grade 1	1	4	0	0
	Grade 2				

Average value of blood pressure pretest and day 6, 8, 10 intervention group and control group

Systole Blood Pressure

Based on Figure 1, it was found that there was a decrease in the average blood pressure of systole in both groups. The intervention group averaged systole blood pressure at the pre-period was 154 mmHg, on the sixth day 145 mmHg, day to day 142 mmHg, and on day ten 140 mmHg. The control group averaged systole blood pressure at pre-time of 152 mmHg on day six, 149 mmHg, day to day 148 mmHg, and day ten 148 mmHg. The mean results show that the intervention group's average systole blood pressure is significant.

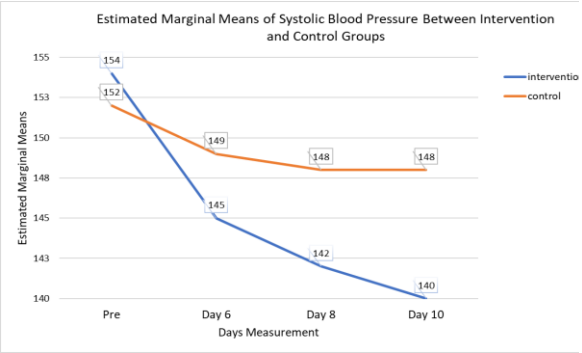

Figure 1 Average blood pressure of systole pretest and day 6, 8, 10 intervention group and control group

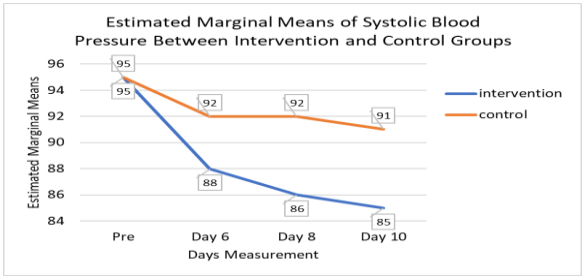

Figure 2 Average diastole pretest blood pressure and days 6, 8, and 10 intervention groups and control groups

Diastole Blood Pressure

Based on Figure 2, there was an average decrease in diastole blood pressure in both groups. The intervention group averaged diastole blood pressure at pre was 95 mmHg, 88 mmHg on the sixth day, 86 mmHg on the eighth day, and 85 mmHg on the tenth day. The control group averaged systole blood pressure at 95 mmHg pre, 92 mmHg on the sixth day, 92 mmHg on day eight, and 91 mmHg on the tenth day. Based on the mean results, it shows that the average blood pressure of diastole is significant in the intervention group.

Differences in pre- and post-comfort in intervention groups and control groups

Based on Table 2, it was found that for pre, in both groups there was no difference in comfort, as indicated by the value of p = 0.159. However, ten days after monitoring, the difference in comfort between the two groups was shown with a p-value = 0.000. There was an increase in comfort in the intervention group after conducting IHE for ten days.

Effect of isometric handgrip exercise on the comfort of hypertensive patients

Table 3 shows the effect of isometric handgrip exercise on the comfort of hypertensive patients with a p-value = 0.000. The increase in comfort in the intervention group was experienced in 20 subjects, three subjects did not experience a change in comfort in the intervention group and in two subjects there was a decrease in comfort.

Table 3 Effect of isometric handgrip exercise on hypertension patient comfort

		n	Mean Rank	Number of positive ratings	Z	ρ-value
Pre-test and Post-test Group Interventions	Decreased comfort	2	1.50	3.00	-4.031	0.000
	Increased comfort	20	12.50	250.00		
	No change	3				
	Total	25				

Discussions

This study aims to mitigate the effect of isometric handgrip exercise (IHE) on blood pressure and comfort in patients with hypertension at the public health center. The results showed a change in the average blood pressure value in the intervention group given IHE for ten days. A significant decrease in blood pressure was seen in the intervention group compared to the control group. IHE lowers blood pressure through physiological pathways such as changes in the autonomic nervous system, vascular function, and heart rate. In the IHE procedure, the handgrip mechanism shows that a grip works in three ways: balancing the autonomic nervous system, including blood pressure, repairing damage, and encouraging blood vessels to dilate, which allows more accessible blood flow. This exercise can lower blood pressure if the individual can perform training regularly (Pratiwi, 2020).

Furthermore, the shear stress mechanism happened when IHE is carried out. The shear stress mechanism is the friction of blood with the endothelium, which will trigger a longitudinal force. The shear stress mechanism causes the release of nitrite oxide (NO)-endothelium as derivatives produced by endothelial cells that are vasodilators of blood vessels. Nitrite oxide is a crucial mediator of endothelial cells, which are the inside of the lumen of blood vessels throughout the body and have an essential role as a link between blood circulation and smooth muscle cells in blood vessels (McGowan et al., 2017).

Table 2 Differences in pre and post-comfort in intervention groups and control groups

Comforts	Group	n	Mean Rank	Sum of Rank	Z	ρ-value
Pre	Intervention	25	28.34	708.50	-1.409	0.159
	Control	25	22.66	566.50		
	Total	50				
Post	Intervention	25	34.26	856.50	-4.292	0.000
	Control	25	16.74	418.50		
	Total	50				

This study showed a decrease in the average systolic and diastolic blood pressure in the intervention group, where a decrease in blood pressure values led to a decrease in hypertension grade (from hypertension grade 1 to pre-hypertension) (Joint National Committee 8, 2014). Meanwhile, in the control group, there was also a decrease in blood pressure, but it did not significantly show a change in hypertension grades. This is in line with study from Susiladewi (2017) which showed the same results, that there was a significant difference also occurred in the average post-test results of the control group who only consumed hypertension drugs and the treatment group that carried out IHE.

Hormonally, isometric exercise will increase the secretion of the hormone b-endorphin in the body as an effect of exercise or physical activity as a natural analgesic that can provide a sense of relaxation to the body. Physical activity is one way to meet the needs of a sense of comfort. Increased physical activity will help increase the secretion of endorphine hormones. Physical activity will stimulate the pituitary gland to release endorphin hormones so that there is an increase in endorphin levels in the blood. This hormone can function as a natural sedative produced by the brain that channels a sense of comfort (Naldi et al., 2022).

Providing physical activity in the form of IHE meets the needs of comfort for people with hypertension. Kolcaba's comfort theory is used to explain the discomfort felt due to the symptoms of hypertension (relief) and then help solve it so that the client feels free from problems and is at peace, namely a decrease in blood pressure and the presence of comfort felt (Kolcaba., 2003). The GCQ questionnaire is a comfort questionnaire with the Kolcaba Comfort theory approach, where three aspects of comfort, namely relief, ease, and transcendence, are measured. The results showed significant changes in all aspects of comfort. In this study, on day 10 researchers asked the subjects about the benefits after doing IHE, and they said that they would continue to do IHE because of the benefits that had been felt. The comfort felt by the subject is due to the absence of complaints of discomfort due to the symptoms of hypertension. According to research based on Kolcaba's theory, the type of comfort that the subject feels IHE gives has entered into the transcendence type of comfort. This study also found a change in respondents' complaints before and after getting the IHE. Before getting IHE, the most common complaints felt were fatigue, headaches and stiffness, but after being given an IHE then the complaints felt were just headaches. This is because there are still patients who experience sleep deprivation, which affects complaints during the measurement day.

Research conducted by Andari (2019) on the effect of physical activity in the form of ergonomic gymnastics stretching on the pain score of musculoskeletal disorders (MSDs), shows the results of decreasing MSDs pain scores so that the benefits that can be felt directly are the achievement of a condition of comfort. In this study, the IHE which was carried out for ten days was part of the physical activity of the results of this study and obtained a value of p = 0.000, which means that there is an influence of IHE administration on the comfort of hypertensive patients.

Even though this study has proven that IHE has an impact on blood pressure and comfort of hypertension patients, there is some limitation. The limitations in this study are dietary arrangements and stress levels in hypertensive patients that can affect blood pressure and discomfort have not been fully noticed by researchers.

Conclusions

This study has proven that isometric handgrip exercise (IHE) conducted regularly once a day significantly influences hypertensive patients' blood pressure and physical comfort. In addition, IHE also influences reducing physical complaints felt by patients. Isometric handgrip exercise influences controlling blood pressure in patients with hypertension. The implication of this study is that IHE can become an independent modality therapy for hypertensive patients in lowering blood pressure and increasing comfort. This exercise also can be considered an integrative therapy modality for hypertensive patients in the public health centers.

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Conflict of Interest

There is no conflict of interest to declare from this study.

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