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THE IMPLEMENTATION OF ISOMETRIC HANDGRIP EXERCISES TO REDUCE BLOOD PRESSURE IN PATIENTS WITH HYPERTENSION: CASE STUDY

Lu'lu Nurhaliza[1]*, Agis Taufik[2]
[1]Program Profesi Ners, Faculty of Health Sciences, Jenderal Soedirman University, Purwokerto
[2]Department of Nursing, Faculty of Health Sciences, Jenderal Soedirman University, Purwokerto

*Correspondence Author:
Lu'lu Nurhaliza; Program Profesi Ners, Faculty of Health Sciences, Jenderal Soedirman University, Purwokerto.
lulu.nurhaliza047@mhs.unsoed

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ABSTRACT

Introduction: As we age, decreased physiological function coupled with an unhealthy lifestyle can increase the risk of hypertension. Hypertension is a non-communicable disease characterized by systolic blood pressure ≥140 mmHg and diastolic pressure ≥90 mmHg. Lifestyle modification, such as physical activity, is a non-pharmacological treatment of hypertension. One static physical activity that can be done to control blood pressure is isometric handgrip exercise. **Purpose**: This case study aims to determine the results of Isometric Handgrip Exercise therapy on lowering blood pressure in patients with hypertension. **Methods**: Case study research with isometric handgrip exercise intervention as Evidence-Based Nursing. The intervention was carried out once per day for five days, with a contraction duration of 45 seconds and relaxation of 15 seconds. Each hand has two contractions. **Discussion**: The case study results showed a decrease in blood pressure in patients with hypertension after the intervention for 5 days. The first respondent's blood pressure decreased from 144/94 mmHg to 120/87 mmHg. The second respondent's blood pressure, originally 151/98 mmHg, decreased to 132/86 mmHg. **Conclusion:** Isometric handgrip exercise intervention is proven to be successful in reducing blood pressure in hypertensive patients.

Keywords: Handgrip, Hypertension, and Isometric.

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INTRODUCTION

A decline in physiological function will occur during the late adult stage. Several risk factors contribute to this decline. These include lifestyle factors such as smoking, excessive salt consumption, excess weight, a low-fiber diet, a lack of physical activity, alcohol consumption, dyslipidemia, and stress (Sudirjo & Nur Alif, 2018; Choirillaily & Ratnawati, 2020). Such factors can contribute to an elevated risk of disease in adulthood, with hypertension being a notable example.

Hypertension is a non-communicable disease, defined by a systolic blood pressure of ≥140 mmHg and a diastolic pressure of ≥90 mmHg. Hypertension is colloquially referred to as a "silent killer" due to its insidious development and the absence of symptoms until severe organ damage has already occurred (Widiyawati et al. 2022). As indicated by available data, an estimated 1.28 billion adults between the ages of 30 and 79 years worldwide are affected by hypertension. A significant proportion of these cases, up to 46%, are unaware of their condition (WHO 2023). The majority of individuals with hypertension reside in countries with low and middle incomes. The 2018 Riskesdas results indicate that the prevalence of hypertension in the population aged 18 years and above was 34.1%, representing an increase from the 2013 Riskesdas results of 25.8% (Kemenkes 2018). In the Banyumas Regency, hypertension affected 9.26% of the entire Banyumas population, comprising 68,505 male patients and 103,517 female patients (Dinas Kesehatan Kabupaten Banyumas, 2024).

Symptoms of hypertension can generally interfere with the comfort of the sufferer,

such as headache, stiffness or tension in the nape of the neck, difficulty sleeping, and many others. Discomfort can interfere with the patient's daily activities if it occurs continuously. For this reason, management is needed to reduce high blood pressure and its effects. The management of hypertension is generally by using pharmacological therapy, namely the consumption of anti-hypertensive drugs. In addition, prevention is needed with lifestyle modifications to reduce the incidence of hypertension and control high blood pressure, such as reducing the consumption of high salt and fat, increasing the consumption of fruits and vegetables, doing regular physical activity, and avoiding alcohol and cigarettes (WHO 2023).

Efforts to reduce the incidence of hypertension include regular physical activity such as exercise. Research by Andri *et al.* (2018) and Choirillaily & Ratnawati (2020) state that regular physical activity can control blood pressure. It is stated that regular activity can reduce the prevalence of hypertension by 50%. One activity that can be done to control blood pressure is the Isometric Handgrip Exercise. The American Heart Association (AHA) in Silva *et al.* (2018) classifies Isometric Handgrip Exercise therapy as a potential therapy to reduce blood pressure in patients with hypertension.

Isometric Handgrip Exercise is a static exercise using a handgrip that involves skeletal muscle contraction without changes in muscle length, such as lifting or pushing heavy loads (Karthikkeyan *et* al., 2020).). This exercise can stimulate ischemic stimulus and shear stress mechanisms due to muscle contraction in blood vessels. This can activate nitric oxide in endothelial cells, which continues to smooth the muscle by diffusion. Furthermore, guanylate cyclase production will be stimulated, and blood vessels will be dilated by relaxing smooth muscles so that this exercise can smooth blood vessels and lower blood pressure (Andri et al. 2018). This is in line with the research of Carlson *et al.* (2016) and Choirillaily & Ratnawati (2020), which revealed that Isometric Handgrip Exercise influences blood pressure lowering.

METHODS

This research type uses a descriptive case study approach compiled from nursing care reports using the nursing process. This case study research implements evidence-based nursing (EBN) to reduce blood pressure, namely, the Isometric Handgrip Exercise. The intervention was carried out on two respondents who had systolic blood pressure ≥140 mmHg and or diastolic blood pressure ≥90 mmHg after two measurements and were 36-55 years old. Blood pressure was measured before and after the intervention. The exercise was performed using a Happyfit brand handgrip device. The intervention was given once per day for 5 days. During the intervention, the hands were contracted for 45 seconds and relaxed for 15 seconds. Each hand received two contractions. Blood pressure was measured again after a 30-minute rest.

RESULT

The intervention was carried out for 45 seconds per contraction and interspersed with 15 seconds of relaxation on both hands. Blood pressure measurements were taken after a 30-minute break by Choirillaily & Ratnawati (2020). The following are the results of blood pressure measurements at each visit:

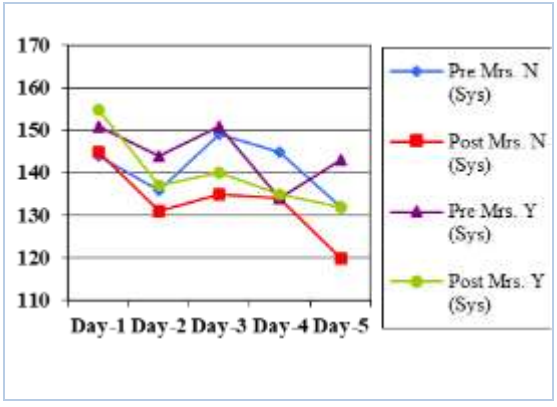

Figure 1. Diagram of systolic blood pressure measurement results

Figure 1 shows the results of systolic blood pressure during the 5-day intervention. The systolic pressure of both respondents tended to decrease. However, Mrs. Y's blood pressure increased by 1 mmHg on the fourth day after the intervention.

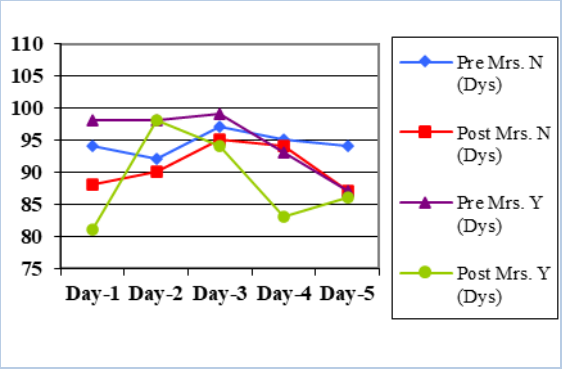

Figure 2. Diagram of diastolic blood pressure measurement results.

Figure 2 shows the diastolic blood pressure results in both respondents. Mrs. N's diastolic blood pressure decreased gradually every day. Meanwhile, Mrs. Y's diastolic blood pressure decreased quite drastically between before and after the intervention. However, on day 2 and day 5, Mrs. Y's diastolic blood pressure after the intervention tended not to decrease.

The decrease in blood pressure is quite large, as seen from the measurement of day 1 before the intervention and the measurement of day 5 after the intervention. Before the Isometric Handgrip Exercise intervention, Mrs. N's blood pressure of 144/94 mmHg decreased on day 5 to 120/87 mmHg. Mrs. Y's blood pressure before the intervention was 151/98 mmHg, and it decreased to 132/86 mmHg.

DISCUSSION

Isometric Handgrip Exercise is a handgrip exercise that causes muscle pressure on blood vessels. This pressure creates an ischemic stimulus so that a shear stress mechanism occurs. Shear stress is a force generated due to friction between blood flow and the endothelial wall of blood vessels. Muscle contraction in this exercise causes ischemic conditions due to pressure on the blood vessels, so when relaxation will stimulate increased blood flow in the brachial artery and increased shear stress. This increase in shear stress results in the release of Nitric Oxide (NO), which functions as a vasodilator. Therefore, NO is essential in reducing blood pressure and improving vascular function (Darajat & Luqiana, 2022; Veralia, Malini & Gusty, 2023).

The results of this case study research show that the Isometric Handgrip Exercise intervention for 5 days can reduce blood pressure in patients with hypertension. This downward trend in blood pressure can be seen in the measurement results before the intervention and after the intervention for 5 days. These results are in line with the research of Choirillaily & Ratnawati (2020), which shows that Isometric Handgrip Exercise influences the lowering of blood pressure. According to Badrov (dalam Andri *et al.*, 2018), isometric handgrip exercise can reduce cardiovascular reactivity to psychophysiological stressors in people with hypertension.

The results in this case study appear insignificant, especially in respondent 2 (Mrs. Y). In line with the research of Mortimer & McKune (2011), who also applied the intervention for 5 days, it was found that although there was a decrease in blood pressure, the results showed no significant difference between the decrease in systolic and diastolic blood pressure. In addition, the researcher assumed that this happened because other factors were not studied, namely that both respondents had hypertension that was not controlled with medication. Lifestyle may also affect herbal consumption, physical activity, diet, rest patterns, and mental stress (Amelia, Fajrianti & Murniani, 2024). The results of blood pressure measurements in respondent 1 tend to decrease and get better. This is possible because respondent one consumed cucumber to lower his blood pressure even though it was not measured. Cucumber reduces and stabilizes blood pressure in people with hypertension (Mahbubah, Rahman & Hafifah, 2022; Mutmainna *et al.*, 2022).

The lack of significance in this case study was influenced by several things, such as the frequency and duration of the intervention, the method of implementing the intervention, and the muscle strength used during the intervention. Different training

frequencies may also affect the significance of blood pressure reduction. Other studies applying isometric handgrip training for 8 weeks and 20 weeks showed significant blood pressure reduction (Carlson et al. 2016; Jørgensen et al. 2018). In addition, another study recommended a contraction duration of 4x2 minutes at 20-50% Maximal Voluntary Contraction (MVC) with 1-5 minutes rest (Stefani et al. 2019).

This case study did not consider the strength of contractions, so it is assumed that it affects the instability of blood pressure reduction. Research by Muliya, Hartutik & Sutarto (2023) said that the higher the contraction intensity, the more significant the decrease in blood pressure achieved. This is corroborated by research (Carlson et al. 2016) which shows that isometric handgrip training using 30% MVC significantly reduces systolic blood pressure and mean arterial pressure compared to using 5% MVC.

The effectiveness of this application is also influenced by supporting factors from the individual himself. For example, people with hypertension controlled with medication may have better intervention effectiveness (Putri & Melizza, 2022). The client in this case study did not consume anti-hypertensive drugs, so the effectiveness obtained was still not maximized, as indicated by the re-increase in blood pressure before the intervention at each visit, even though the intervention had been carried out one day earlier.

CONCLUSION

The results of this case study show that after the intervention for 5 days, both respondents had a decrease in blood pressure. Mrs. N's blood pressure on the first day before the intervention was 144/94 mmHg, and on the fifth day after the intervention decreased to 120/87 mmHg. The same result was also seen in Mrs. Y; the blood pressure before the first day of intervention was 151/98 mmHg, which decreased to 132/86 mmHg. However, these results were not significant because both respondents had non-drug controlled hypertension, and the habit of consuming cucumber influenced the blood pressure results of respondent 1, which was better than respondent 2.

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