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Effect of Deep Breathing Relaxation and Progressive Muscle Relaxation on Blood Pressure

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Abstract: Hypertension, characterized by diastolic pressure exceeding 90 mmHg and systolic pressure surpassing 140 mmHg, poses a significant health challenge often addressed through pharmacological antihypertensive therapy. This research endeavors to evaluate the impact of complementary interventions, specifically deep breathing relaxation and progressive muscle relaxation, on reducing blood pressure among hypertensive patients within the operational domain of the Kertasemaya Community Health Center in the Indramayu Regency in 2023. Adopting a Quasi-Experimental Design with a Pretest-Posttest and Control Group paradigm, the study engaged a cohort of 70 respondents stratified into intervention and control groups. The intervention group underwent a combined therapy of deep breathing relaxation and progressive muscle relaxation, followed by a meticulous post-test for final observations. Meanwhile, the control group underwent an initial blood pressure measurement (pre-test), a relaxation period of 15-30 minutes, and concluded with a post-test for final measurements. The study revealed a statistically significant influence (p=0.013) on average blood pressure within the intervention group compared to the control group. This disparity was observed both before and after the implementation of deep breathing relaxation and progressive muscle relaxation techniques among hypertensive respondents. These findings underscore the potential efficacy of non-pharmacological interventions in mitigating hypertension and enhancing patient well-being. The combination of deep breathing relaxation and progressive muscle relaxation emerges as a highly effective strategy in reducing blood pressure among hypertensive individuals. This integrative therapeutic approach showcases promising potential for promoting cardiovascular well-being, offering a valuable non-pharmacological avenue for hypertension management.

Keywords: Deep breathing relaxation; Hypertension; Muscle relaxation; Progressive

Introduction

Heart failure, stroke, and kidney failure are primarily caused by hypertension. When diastolic pressure rises above 90 mmHg and systolic pressure exceeds 140 mmHg, this condition is termed hypertension. Hypertensive individuals often exhibit no symptoms, earning the condition the moniker of the "silent killer" (Brunner & Suddarth, 2016). Approximately 80% of the global increase in hypertension cases, particularly in developing countries, is attributable to this ailment, making it a significant health issue in Indonesia and worldwide. There were 639 reported cases in 2000, and it is estimated to escalate to 1.15 billion cases by 2025.

Globally, 972 million people, or 26.4% of the population, suffer from hypertension, according to WHO (2019); this figure is expected to rise to 29.2% in 2021 (Yonata & Pratama, 2016). An estimated 9.4 million deaths worldwide are caused by complications of hypertension each year. Of the 972 million hypertensive individuals, 333 million reside in developed nations, while the remainder, including Indonesia, live in developing countries (Yonata & Pratama, 2016). Rikesdas (2020) reports that among adults aged 18 and above, 9.4% have been diagnosed with hypertension by

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medical professionals, with 9.5% undergoing treatment for the condition. Additionally, 0.1% of individuals take antihypertensive medication without a formal diagnosis from healthcare professionals. According to Rikesdas (2020), there was a 34.1% prevalence of hypertension in Indonesia in 2018, higher than the 25.8% prevalence in 2013. West Java province ranked 12th out of 39 provinces in Indonesia, with a hypertension prevalence of 29.40% in 2018, a growth of 39.60% from 2013.

Lifestyle changes contribute to the high prevalence of hypertension; however, it is crucial to note, as stated by Modey Amoah et al. (2020) and Valenzuela et al. (2021), that there is a risk of death if hypertension is not promptly treated. Heart attacks, strokes, or kidney failure are among the side effects of hypertension. Serious attention has been given to the prevention and control of non-communicable diseases, such as hypertension, by the Indonesian government. The establishment of the Directorate of Non-Communicable Disease Control in accordance with Minister of Health Regulation Number 1575 of 2005 is one such initiative. Regular blood pressure monitoring, smoke-free healthy lifestyle programs, and increased physical activity are part of the Ministry of Health's efforts to control hypertension (Hatta et al., 2022; Sugiyo, 2020). Government initiatives to manage hypertension are often ineffective, and many hypertensive patients still require pharmacological therapy. The use of pharmacological antihypertensive therapy has several drawbacks, including side effects, dependency effects, high costs, and other complicating issues for patients, according to Duthie and Katz's report (Bin-Jumah et al., 2022; Colombo et al., 2020). Adjunct therapy is needed to reduce dependence on medication and maintain the quality of life for hypertensive patients, although drug therapy is not the only alternative therapy option available.

The goal of relaxation therapy is to help patients feel more comfortable and relaxed. It is not intended to replace the treatment currently received by hypertensive patients. Endorphins, the body's natural analgesics, are produced by the brain when the body is in a relaxed state and can alleviate pain (physical complaints). Moreover, when the body is calm, the parasympathetic nervous system becomes active, reducing blood pressure, heart rate, and respiratory rate (Sulistyarini, 2013).

Relaxation therapy has been proven to reduce psychological symptoms such as anxiety and depression, enhance self-control and self-confidence, reduce cardiovascular events caused by myocardial ischemia in hypertensive patients, myocardial infarction, and coronary heart disease, and reduce sympathetic manifestations indicated by a decrease in hemodynamic and cardiovascular variables. Various studies on the benefits of physical exercise therapy in heart failure patients show that aerobic, resistance, and/or walking exercises can activate muscle endurance, improve activity tolerance, and stimulate oxygen use. Patients with heart failure can benefit from relaxation and exercise therapy to improve their physiological and psychological well-being. Additionally, it can be applied as a standalone therapeutic approach to disease management plans (Yu et al., 2007). This encourages researchers to develop non-pharmacological treatments, such as progressive muscle relaxation and deep breathing exercises.

Deep breathing relaxation technique teaches you how to take deep breaths, gently exhale, and maintain inspiration for as long as possible. One benefit of deep breathing relaxation is its ease of use anytime, anywhere (Parinduri, 2020). Research by Juwita et al. (2018) shows that blood pressure decreases after this relaxation technique because deep breathing (expiration and inspiration) causes cardiopulmonary stretching. This stretching sends impulses to the brain's cardiovascular regulation center, which in turn stimulates the parasympathetic nervous system, causing systemic vasodilation throughout the body, including the heart. As the entire body has sufficient oxygen to function, heart rate, cardiac output, and blood vessel dilation, all of which reduce blood pressure, decrease.

On the other hand, progressive muscle relaxation is a systematic approach to achieving a relaxed state, chosen using a progressive strategy with continuous exercise phases. Tightening and relaxing skeletal muscles can result in progressive muscle relaxation, thus reducing stress levels and lowering blood pressure in hypertensive patients (Wardani, 2015). By reducing stress and cultivating a calm state to counter anxiety, progressive muscle relaxation can help lower blood pressure (Ermayani et al., 2020; Gallego-Gómez et al., 2020; Korkut et al., 2021). There is a significant difference in the blood pressure of hypertensive patients in the Kerobokan Semarang Community Health Center area before and after guided imagery relaxation techniques, according to research conducted by (Aghakhani et al., 2022; Kulthe & Bhattacharya, 2020; Mulyati et al., 2021; Smith et al., 2020; Sumartini & Bachtiar, 2016).

In 2020, out of 49 Community Health Centers in Indramayu Regency, Kertasemaya Community Health Center ranked 11th in the highest number of hypertension clients, serving 562 individuals (3.17%) out of 17,715 hypertension clients served by all Community Health Centers in Indramayu Regency. The preliminary study results from December 2022, during which the researcher monitored intern students, found an average of 30-40 hypertension patients per month. A survey of 10 hypertension clients revealed that 6 of them claimed to only receive medication. This is the reason for choosing the research object on the influence of complementary

therapy of deep breathing relaxation and progressive muscle relaxation on reducing blood pressure in hypertensive patients in Kertasemaya Community Health Center (Pathan et al., 2023).

Method

Study Design

This study employed a Quasi-Experimental Design with a Pretest-Posttest with Control Group Design. The intervention group received a combination of Deep Breathing Relaxation (RND) and Progressive Muscle Relaxation (ROP) techniques, followed by a post-test for final observations (Salimi Akinabadi et al., 2024). In contrast, the control group, after initial blood pressure measurement (pre-test), underwent a 15-30 minute rest period before the final measurement was conducted as a post-test.

Settings and Respondents

The research was conducted from January to December 2023, with the study location in the Working Area of Kertasemaya Community Health Center. The sample consisted of 70 respondents, with 35 in the intervention group and 35 in the control group. Sample selection was done using purposive sampling, with specific inclusion criteria: (1) Residing in the working area of Kertasemaya Community Health Center and willing to participate as respondents, (2) Not consuming hypertension medications, either chemical or herbal, during the study, (3) Not consuming salt exceeding 30 grams per day, not consuming goat meat and offal, not drinking alcoholic beverages, not smoking. Exclusion criteria included respondents who were not hypertensive patients with various complications.

Data Analysis

Descriptive analysis was conducted to provide general information about the respondents, and the Mann-Whitney test was employed to assess the intervention's impact on both groups.

Ethical Consideration

This study has received a research ethics permit from the Research Ethics Committee of STIKep PPNI Jabar with a registration number of No. IX/001/KEPK-SLE/STIKEP/PPNI/JABAR/VI/2023.

Result and Discussion

Results

Table 1 reveals a predominant representation of female participants, predominantly aged between 55 and 59 years, with a substantial majority exhibiting hypertension stage I. Concurrently, Table 2 assesses the efficacy of the integrated therapeutic intervention on the hypertension scale, demonstrating a significant level of effectiveness, as evidenced by a statistically significant (p-value<0.013). This empirical evidence underscores the impactful outcomes of the integrated therapy in addressing hypertension within the studied demographic.

Table 1. Characteristics of the Respondents (n=70)

Characteristic	Intervention Group (n=35)	Control Groups (n=35)
Gender		
Male	11 (31.4%)	14 (40%)
Female	24 (68.6%)	21 (60%)
Age. Years		
45 – 54	4 (11.4%)	12 (25.7%)
55 -59	19 (54.3%)	12 (34.3%)
60 – 69	12 (34.3%)	14 (40.0%)
Stage		
Hypertention Stage I	26 (74.3%)	26 (74.3%)
Hypertention Stage II	9 (25.7%)	9 (25.7%)

Table 2. Distribution of Mean Blood Pressure Differences between the Intervention Group and Control Group After Treatment (n=70)

Groups	n	Mean		Standar Deviation		Z Test	P Value
		Sistolic	Diastolic	Sistolic	Diastolic		
Intervention	35	138.28	86.57	7.06	8.02	1.587	0.013
Control	35	140.85	86.85	8.53	6.76		

Discussions

Blood Pressure Differences in the Intervention Group

The average systolic blood pressure in the intervention group significantly differed before and after the treatment. Prior to the combination, the mean systolic blood pressure was 149.14 mmHg. Following the application of deep breathing relaxation and progressive muscle relaxation, the average systolic blood pressure decreased by 10.86 mmHg to 138.28 mmHg. Similar findings were reported for diastolic readings, where a p-value of 0.000 indicates a significant difference in the average diastolic blood pressure within the intervention group before and after the treatment. The diastolic blood pressure averaged 94.57 mmHg before the intervention, decreasing to 86.57 mmHg post-treatment, representing an 8.00 mmHg reduction.\

The results align with a study by Wijayanti et al. (2017) titled "The Influence of Deep Breathing Relaxation Technique on Decreasing Blood Pressure in Hypertensive Patients at Dr. Loekmono Hadi Kudus Hospital," which observed significant differences in blood pressure before and after the application of deep breathing relaxation, with systolic and diastolic p-values of 0.000. This consistency further supports the findings of the present study. Additional evidence supporting the significant impact of progressive muscle relaxation on blood pressure reduction comes from a study by Mahardhini et al. (2018) titled "Effectiveness of Progressive Muscle Relaxation and Deep Breathing Relaxation on Blood Pressure in Hypertensive Patients in Begal Village, Kedunggalar Subdistrict, Ngawi Regency," with p-values of 0.000 ($p<0.05$) and 0.001 ($P<0.05$). Given that the effects of deep breathing and progressive muscle relaxation techniques are immediately felt post-treatment, this phenomenon suggests the potential for these relaxation techniques to significantly lower blood pressure. Relaxation techniques involving deep breathing have demonstrated the ability to reduce blood pressure by alleviating sympathetic stress reactions, diminishing emotional stimuli, and reducing anterior hypothalamus stimulation (Daniela et al., 2022; Jitsuhara et al., 2024; Nakamura & Morrison, 2022).

Blood Pressure Discrepancy in the Control Group

The average systolic blood pressure in the control group before treatment was 146.87 mmHg, and post-treatment remained at 146.87 mmHg, indicated by a P-value of 0.130 ($P>0.005$), suggesting no significant difference. Respondents' blood pressure was reassessed after a 15-30 minute rest, revealing a mere 6.02 mmHg decrease or 140.85 mmHg on average. Similarly, no noticeable variation was observed in average diastolic measurements. The p-value of 0.134 ($P>0.005$) indicates that the average diastolic blood pressure in the control group showed no significant difference before and after therapy. Specifically, the diastolic blood pressure averaged 90.28 mmHg before treatment, decreasing to 86.85 mmHg post-treatment, indicating an 3.43 mmHg decrease.

This contrasts with the findings of a study by (Masnina & Setyawan, 2018) titled "The Effect of Deep Breathing Relaxation Therapy on Decreasing Blood Pressure in Elderly Hypertensive Patients," which reported a significant difference in blood pressure in the control group before and after a 15-minute rest (P-value = 0.000; $P<0.005$).

Balestra et al. (2021), light or low-intensity physical activity is equivalent to aerobic exercises that do not significantly alter the respiratory rate. This explains why the 15-30 minute rest period in the control group, classified as light rest, was more significant in lowering blood pressure in this study. Such activities included standing, slow movement or casual walking, light household chores, brief play, lying down, or sleeping for less than sixty minutes. Furthermore, the British Heart Foundation listed the characteristics of control group respondents, with the majority being 60% females and almost all falling into the elderly category: 1) Aging: Growing older may reduce physical activity. 2) Gender: Compared to women, men engage in more physical exercise.

Physical activity can impact blood pressure stability. When someone does not engage in regular physical exercise, their heart rate is often higher than when they do. The heart muscle must exert more effort during each contraction if the heart rate is higher. The pressure applied to the artery walls increases as the heart muscle works harder to pump blood, raising peripheral resistance and ultimately elevating blood pressure (Magder, 2021; Saghiv et al., 2020; Widrich & Shetty, 2020). Systolic blood pressure naturally increases after the age of 45 and continues to rise until the age of 70.

The stiffness of blood arteries is caused by increased collagen, weakened and calcified elastin fibers. Left ventricular work may increase due to these changes, as it can raise resistance to blood flow from the heart. Moreover, the main arterial baroreceptor's ability to regulate blood pressure decreases. Considering these changes, arterial stiffness will increase, raising systolic blood pressure (Boutouyrie et al., 2021). Meanwhile, diastolic blood pressure increases between the ages of 50 and 60, then remains stable or tends to decrease (Feitosa et al., 2020). This is due to arterial stiffness of 17 degrees, limiting its capacity to expand and increase systolic blood pressure as arteries cannot support heart pressure adequately. However, arteries become less able to contract during diastole, resulting in a decrease in diastolic blood pressure (Schiffrin, 2020).

The Influence of the Combination of Deep Breathing Relaxation and Progressive Muscle Relaxation on Blood Pressure Reduction in the Intervention and Control Groups

The implementation of deep breathing relaxation (DBR) and progressive muscle relaxation (PMR) in the intervention group resulted in a statistically significant difference in average blood pressure. Following the RND and ROP therapy, the intervention group's average blood pressure was 138.28 mmHg systolic and 86.57 mmHg diastolic, whereas the control group's average blood pressure was 140.85 mmHg systolic and 86.85 mmHg diastolic after a 15-30 minute rest period. Statistical test findings show a P-value of 0.000 ($p < 0.05$), indicating that compared to the 15-30 minute rest period, the application of progressive muscle relaxation and deep breathing relaxation techniques significantly

accelerated the reduction of both systolic and diastolic blood pressure.

Azwaldi et al. (2022) study titled "The Influence of the Combination of Deep Breathing Relaxation and Progressive Muscle Relaxation on Blood Pressure in Hypertensive Patients in the Working Area of Padang Salasa Palembang Health Center" found a significant influence. This finding aligns with the current study, with a P-value = 0.029 (P < 0.05) identified. Moreover, it is supported by Ekarini et al. (2019) research titled "The Effect of Progressive Muscle Relaxation Therapy on Physiological Responses of Hypertensive Patients," which discovered that progressive muscle relaxation therapy significantly reduced blood pressure in hypertensive patients, indicated by a p-value of systolic = 0.000.

Deep breathing relaxation therapy, as described by Mas'ud (2009), involves diaphragmatic breathing, causing the heart to pump oxygen-rich blood to the aorta, arteries, and other arterioles. Blood then enters the microcirculation from the arterioles to the arteriole highways and finally to the capillary branches, controlled by the pre-capillary sphincter. While Himmah et al. (2024) study on the use of Progressive Muscle Relaxation Therapy states that performing progressive muscle exercises in a calm, relaxed state with full concentration on tension and relaxation of trained muscles for 15 minutes, the hypothalamus will function well. The secretion of CRH (Corticotropin Releasing Hormone) and ACTH (adrenocorticotropic Hormone) decreases. The decrease in hormone levels leads to a reduction in sympathetic nervous system activity, which, in turn, reduces the release of adrenaline and non-adrenaline. Consequently, heart rate decreases, blood vessels dilate, vascular resistance decreases, and the heart pump's force declines, contributing to the reduction of arterial blood pressure within the heart. The decreased sympathetic nervous system activity due to the reduction in ACTH and CRH lowers the release of adrenaline and noradrenaline, ultimately lowering heart rate. Blood vessels dilate, vascular resistance decreases, and the heart pump weakens, collectively leading to a reduction in arterial blood pressure in the heart and, consequently, lowering blood pressure in clients.

Conclusion

In conclusion, a statistically significant impact is evident between the average blood pressure of the intervention group and the control group both before and after the implementation of deep breathing relaxation and progressive muscle relaxation techniques among hypertensive respondents. The calculated p-value of 0.013 (P<0.05) underscores the significance of this impact, affirming that the integrated therapeutic approach effectively influences blood pressure levels in hypertensive individuals. This finding provides robust support for the efficacy of combining deep breathing relaxation and progressive muscle relaxation techniques as a complementary intervention for hypertensive patients, emphasizing its potential role in contributing to blood pressure management strategies.

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Conflicts of Interest
The authors declare no conflict of interest.

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