

Deep Breathing Relaxation Techniques to Lowering Systolic Blood Pressure in the Elderly: Randomized Control Trial

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ABSTRACT

Background: Continuous high blood pressure causes the heart to work extra hard, eventually this condition results in damage to the blood vessels of the heart, kidneys, brain, and eyes. Hypertension management is recommended to minimize pharmacological therapy with the aim of avoiding side effects. Non-pharmacological efforts that can be done in patients with hypertension are by controlling various aspects such as deep breathing techniques.

Purpose: This study aims to determine the effect of deep breathing relaxation techniques to reducing blood pressure in the elderly with hypertension. Quasy-experiment pre-post-test with control group was conducted on 108 elderlies with hypertension at a Puskesmas located in Subang with simple random sampling technique.

Methods: This study was conducted by providing deep breathing techniques to the elderly in the treatment group for 3 months. The statistical test used was the independent t test and chi-square.

Results: The deep breathing relaxation technique given at a dose of 15 minutes 3 times a day for 3 months has been shown to have an effect on reducing blood pressure in the elderly.

Conclusion: Future research can conduct research on deep breathing by paying more attention to confounding variables such as stress, anxiety, and diet.

Keywords: deep breathing, hypertension, relaxation

Received March 10, 2022; Revised April 1, 2022; Accepted April 29, 2022

DOI: <https://doi.org/10.30994/jnp.v5i2.213>



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BACKGROUND

Hypertension basically reduces the life expectancy of the sufferers. This disease is the estuary of various diseases that can lead to death. Continuous high blood pressure causes the heart to work extra hard, eventually this condition results in damage to the blood vessels of the heart, kidneys, brain and eyes (Wittler, 2016). Williams (2018) conducted a study on primary hypertension clients by doing breathing control exercises to reduce blood pressure, the results showed that there was a decrease in systolic blood pressure of 0.91 mmHg and a decrease in diastolic blood pressure of 1.81 mmHg. Until now, the effect of deep breathing relaxation techniques on lowering blood pressure is not known.

The ten diseases that cause the highest outpatient care are hypertension (Sismulyanto, 2021). Based on the results of the study on morbidity and disability in the Indonesian Health Profile, it shows that the prevalence of hypertension sufferers is 68-79% annually (Kemenkes RI, 2018). In addition, increasing age is closely related to an increase in arterial stiffness (Friedman et al., 2016). The results of the Indonesian Ministry of Health report, the number 3 cause of death in 15 districts/cities is hypertension, 4.4% of deaths at the age <50 years, while those aged >50 years are 4.6% (Health, 2018). The results of a preliminary study conducted on January 28, 2022 at the research location found that 58% of the elderly suffer from hypertension. Consumption of green bananas, green tea and exercise every Friday is considered not to have a significant impact. Independent actions that can be taken by nurses to control blood pressure are by applying distraction techniques on an ongoing basis, one of which is deep breathing relaxation techniques.

Hypertension in addition to causing a high mortality rate also has an impact on the high cost of treatment and care that must be borne by the sufferer. It should also be remembered that hypertension also has an impact on decreasing quality of life. If a person has high blood pressure and does not get regular treatment and regular control, this will lead to serious cases and even death. Hypertension requires treatment without causing side effects which aims to prevent morbidity and mortality and maintain normal blood pressure (Mitchell et al., 2016). This is reinforced by Guyton & Hall (2014) that with the aim of treating clients with hypertension is to reduce blood pressure to near normal and one of the management actions of hypertension management is recommended to minimize pharmacological therapy with the aim of avoiding side effects. Non-pharmacological efforts that can be done in patients with hypertension are by controlling various aspects such as deep breathing techniques.

Deep breathing technique is one part of independent nursing intervention that aims to provide various benefits. According to Ahern (2017) the effects of deep breathing techniques include a decrease in blood pressure, a decrease in pulse, a decrease in muscle tension, a decrease in metabolic rate, an increase in global awareness, a feeling of peace and well-being and a relaxed period of alertness. The advantage of this deep breathing technique is that it can be done anytime, anywhere, the method is very easy and can be done independently by the client without a medium and can relax tense muscles (Wittler, 2016).

According to the functional consequence theory, hypertension is a negative functional consequence, while deep breathing interventions will produce positive functional consequences with the aim of relaxing and comfortable so that the H.P.A axis is activated which causes the hypothalamus to decrease CRF so that in the pituitary there is also a decrease in ACTH (Kramer et al., 2019). This causes the adrenal medulla to decrease the production of catecholamines resulting in vasodilation of blood vessels which ultimately has an optimal impact in the form of positive consequences, namely a decrease in blood pressure (Williams, 2018). Thus, deep breathing relaxation that is done correctly and regularly is believed to be able to lower blood pressure, so it is necessary to do a lesson for people with hypertension so

that they can do deep breathing relaxation correctly and regularly (Dorans et al., 2018). Deep breathing is a series of breathing actions performed to circulate air throughout the lung fields which consists of the process of inhaling slowly and deeply for 4 counts, then holding for 3 seconds and exhaling slowly for 6-8 counts or according to the patient's tolerance. This deep breathing exercise is done 5 to 10 times for 15 minutes 3 times a day (Hamasaki, 2020).

Based on the above phenomenon, researchers are interested in conducting research that aims to explain the effect of giving deep breathing relaxation techniques to reducing blood pressure in employees with hypertension.

OBJECTIVE

This study aims to determine the effect of deep breathing relaxation techniques to reducing blood pressure in the elderly with hypertension.

METHODS

Quasy-experiment pre-post-test with control group was conducted on 108 elderlies with hypertension at a Puskesmas located in Subang with simple random sampling technique. This study was conducted by providing deep breathing techniques to the elderly in the treatment group for 3 months. The statistical analysis was conducted using independent t test and chi-square.

The criteria for the sample of the intervention and control groups were the same to maintain the equality of characteristics between the two groups. Patients who were recruited to become respondents were who diagnosed with hypertension by a doctor, elderly with hypertension for more than 6 months, and willing to take part in the study to completion, these criteria are made so that there is no research bias. Elderly people with dementia, suffer from acute respiratory disease, the elderly who do not do deep breathing exercises completely, elderly who resigned in the middle of the research, elderly who died were excluded from the study. The respondents were recruited using the simple random sampling. Data was collected from September 1 to December 1, 2021. This study was conducted by providing deep breathing techniques to the elderly in the treatment group for 3 months. The statistical test used was the independent t test and chi-square ($\alpha = 0.05$).

RESULTS

The socio-demographic characteristics in table 1 show that 108 respondents in this study gave a 100% response. Based on the results of the chi-square test, it shows that there is no difference in the characteristics of the respondents on gender, age, and marital status with a p value > 0.05 , meaning that the two groups are equal.

Table 1. Socio-demographic Characteristics (n=108)

	Group				p-value
	Treatment (n=54)		Control (n=54)		
	n	%	n	%	
Gender					
Male	32	65.6	28	53.1	0.309
Female	22	34.4	26	46.9	
Age					
56 - 65	29	56.3	30	59.4	0.801
> 65	25	43.7	24	40.6	
Occupation					

Working	27	81.3	29	56.3	0.061
Nor working	21	18.7	25	43.7	
Marital status					
Married	18	56.3	17	53.1	0.802
Unmarried	14	43.7	15	46.7	

The following will present a bivariate data analysis. The data presented is the mean pre-test and post-test systole values in each group, along with the difference/difference (delta) between pre and post-test in each group. According to Ghozali (2014) to analyze the effect of variable X on Y by using two or more independent sample groups, the data tested is the data difference (delta) between the pre-test and post-test in each group, this is aims to avoid bias due to inhomogeneous data so that it can meet the assumptions of parametric tests.

Table 2. Paired t –test of blood pressure *systole* before and after intervention (n=108)

Data	Blood Pressure <i>Systole</i>		
	Mean	delta δ	p value
Before Intervention	158.64	-5.91	0.005
After Intervention	152.73		

Paired t test results showed that there was a significant difference between the mean systolic blood pressure values before and before the intervention in the treatment group (p = 0.005).

Table 3. Paired T-test before and after intervention

Data	Blood Pressure <i>Systole</i>		
	Mean	delta δ	p value
Before Intervention	161.36	-0.45	0.724
After Intervention	160.91		

The results of the paired t test showed that there was no significant difference between the mean pre and posttest systolic blood pressure values in the control group (p = 0.724).

Table 4. Independent T-test between treatment and control group

Group	Mean (delta)	p value
Treatment	-5.91	0.015
Control	-0.45	

The results of further statistical analysis using an independent t test between the treatment and control groups showed that there was a significant difference in the systolic blood pressure delta value with p = 0.015, this value indicates that the difference in the pre- and post-test systolic blood pressure values in the treatment group has a difference. which is significant when compared to the difference between the pre and post-test values of the control group, meaning that relaxation techniques are proven to reduce systolic blood pressure.

DISCUSSION

The results of the study found that the systolic blood pressure (pretest) in the treatment and control groups respectively showed a mean value of 158.64 mmHg and 161.36 mmHg. Diastolic blood pressure (pretest) in the treatment and control groups respectively showed a mean value of 93.64 mmHg and 91.82 mmHg. The results found in this study indicate that the

respondents in this study on average suffered from hypertension with the classification of stage 1 hypertension based on the classification of hypertension (Wittler, 2016).

According to Williams (2018) those aged 46-65 years tend to experience an increase in blood pressure which is influenced by various risk factors, including gender and associated with increasing age. The researcher believes that the factor that causes hypertension in this study is the age factor, because in this study most of the respondents in both groups were aged 56-65 years, namely 45.5% in the treatment group and 54.5% in the control group. According to Bundy et al. (2018), adult blood pressure increases with age, especially when entering old age, blood pressure increases due to a decrease in the elasticity of blood vessels. This study is in accordance with research conducted by Ahmadi et al. (2021) which states that most of the incidence of hypertension increases rapidly at the age of 50 years and over with a prevalence of 69.7%.

Based on this, the researcher argues that the older you get, the higher the risk of suffering from hypertension, this is related to changes in anatomical and physiological structures, especially from the cardiovascular system due to the aging process. This occurs due to decreased elasticity of blood vessels, decreased tensile strength of blood vessels, and decreased smooth muscle relaxation. Factors that contribute to thickening and stiffness of vascular endothelium in the aging process include increased collagen, reduced elastin, calcification, fat deposits and increased calcium (Williams, 2018).

The increase in blood pressure at the age approaching the respondent may also be caused by gender, the results of this study found that sex with the highest proportion in both groups was female, namely 63.6% in the treatment group and 72.7% in the control group. This shows that most of the respondent who suffers from hypertension has a female gender. This statement is supported by the theory according to Cernes & Zimlichman (2017) which states that women are strongly influenced by several hormones including the hormones estrogen and progesterone which function to protect women from hypertension and its complications including thickening of blood vessel walls or atherosclerosis. After menopause the protective effects provided by hormones begin to wear off, as women's hormone levels drop rapidly.

Based on this, researchers argue that women have a higher risk of suffering from hypertension than men after menopause. This is because most of the female respondents in this study had entered menopause, resulting in changes in the hormones estrogen and progesterone. This opinion is also in accordance with research by Hassoun (2021) which states that hypertension tends to be higher in women (58.3%) compared to men (41.7%).

The results of the study found that the systolic blood pressure (pre-test) in the treatment and control groups respectively showed a mean value of 152.73 mmHg and 160.91 mmHg. Meanwhile, the diastolic blood pressure (pre-test) in the treatment and control groups respectively showed a mean value of 88.64 mmHg and 92.72 mmHg. The decrease in systolic and diastolic blood pressure in this study was only found in the group of respondents who received deep breathing relaxation techniques for 7 days. This study agrees with Guyton & Hall (2014) which explains that a slow breathing rate can increase vasodilation of blood vessels which activates the Hering-Beurer reflex which in turn can reduce chemo reflex sensitivity and increase baroreflex. Another effect is to lower blood pressure and sympathetic nerve activity. When blood pressure decreases, the sympathetic nerves will be stimulated, post-ganglionic sympathetic nerve neurons will secrete the neurotransmitter norepinephrine (NE), commonly called adrenergic fibers, which in turn will cause vasoconstriction and contraction of the heart muscle. Conversely, if blood pressure increases, the parasympathetic nervous system will be stimulated, the post-ganglionic parasympathetic neurons will secrete the neurotransmitter acetylcholine (ACh).

Acetylcholine will be captured by acetylcholine receptors (Ach-R) found on endothelial cells. As a result, endothelial cells will synthesize and secrete Nitric Oxide (NO) also called Endothelium Derived Relaxing Factor (EDRF), a powerful vasodilator that also causes relaxation of the heart muscle and blood vessels (Guyton and Hall, 2014). Sympathetic stimulation increases heart activity, heart rate, and pumping power. While the parasympathetic system causes a decrease in heart rate and a slight decrease in heart muscle contractility (Wittler, 2016).

In the control group after 7 days, it was found that the average increase in diastolic blood pressure was 92.72 mmHg; the increase experienced was 0.91 mmHg. In this control group, there were 2 respondents, who experienced an increase in diastolic blood pressure, this happened because during the posttest the respondents said they were having trouble sleeping due to stress. According to Bundy et al. (2018) stress is anything in which non-specific demands require an individual to respond or act. The occurrence of stress because the stressor is felt and perceived by the individual as a threat, causing anxiety which is a common and early sign of physical and psychological health disorders. Symptoms that can arise include fatigue, headaches, muscle tension, heart palpitations, increased pulse rate, and increased blood pressure. According to Nursalam et al. (2022), to avoid stress, nurses must treat hypertensive patients with culturally sensitive caring. And to improve the symptoms that arise according to Yuliana et al. (2017), it is necessary to do treadmill exercise.

The researcher argues that there are 2 respondents who experienced an increase in blood pressure due to stress which affects the increase in blood pressure so that the functional consequences become negative. This is supported by the opinion of Bundy et al. (2018) that one of the modifiable risk factors for hypertension is stress. Stress increases peripheral vascular resistance and cardiac output and stimulates sympathetic nerve activity, then hypertension can occur.

The results of the study found that the systolic blood pressure (pre-test) in the treatment and control groups respectively showed a mean value of 158.64 mmHg and 161.36 mmHg. After being given a deep breathing relaxation intervention for 7 days, it was found that the mean value of systolic blood pressure in the treatment group experienced a significant decrease to 152.73 mmHg, while in the control group the results tended to be persistent, namely 160.91 mmHg. Diastolic blood pressure (pretest) in the treatment and control groups respectively showed a mean value of 93.64 mmHg and 91.82 mmHg. After being given a deep breathing relaxation intervention for 7 days, it was found that the average value of diastolic blood pressure in the treatment group decreased significantly to 88.64 mmHg, while in the control group there were no significant results or tended to stay with a value of 92.72 mmHg.

The data obtained in this study meet the assumptions of the parametric test, because all the data obtained have a normal distribution. Test of Normality using Kolmogorov-Smirnov shows the following values: systole pre-test = 0.104; pre-test diastole = 0.272; systole post-test = 0.740; post-test diastole = 0.082. All data shows a value of more than 0.05, meaning that all data in this study are normally distributed, so hypothesis testing can be continued using parametric tests.

The results of the paired t test showed that there was no significant difference between the mean systolic blood pressure values before and after the intervention in the control group ($p = 0.724$). The results of the paired t test showed that there was a significant difference between the mean systolic blood pressure values before and after the intervention in treatment group ($p = 0.005$). The results of further statistical analysis using an independent t test between the treatment and control groups showed that there was a significant difference in the systolic blood pressure delta value with $p = 0.015$, this value indicates that the difference in the pre-

and post-test systolic blood pressure values in the treatment group has a difference which is significant when compared to the difference between the pre and post-test values of the control group, meaning that relaxation techniques are proven to reduce systolic blood pressure.

The results of the paired t test showed that there was a significant difference between the mean diastolic blood pressure values before and after the intervention in the treatment group ($p = 0.008$). The results of the paired t test showed that there was no significant difference between the mean diastolic blood pressure values before and after the intervention in the control group ($p = 0.441$). The results of further statistical analysis using an independent t test between the treatment and control groups showed that there was a significant difference in the diastolic blood pressure delta value with $p = 0.021$, this value indicates that the difference in the pre- and post-test diastolic blood pressure values in the treatment group has a difference which is significant when compared to the difference between the pre and post-test values of the control group, meaning that relaxation techniques have been proven to reduce diastolic blood pressure.

According to Williams (2018) in the theory of functional consequences states that a person tends to experience negative functional consequences. The negative consequence experienced by respondents in this study was an increase in blood pressure. This study proves that through the provision of independent nursing interventions, deep breathing relaxation can change negative consequences into positive ones, namely a decrease in blood pressure. This is in accordance with the opinion of Bundy et al. (2018) that deep breathing is useful for relaxing tense muscles, decreasing metabolic rate, increasing feelings of peace and alertness, and lowering blood pressure.

According to the theory from Hamasaki (2020) the purpose of deep breathing is to lower blood pressure, induce relaxation, reduce anxiety, reduce stress, reduce pain, increase vocal strength, and reduce the risk of respiratory infections. According to Cernes & Zimlichman (2017) breathing exercises in the form of slow breathing cause changes in the interval of breathing patterns and an increase in the interval of breathing patterns which results in an increase in baroreflex efficiency so that it can reduce blood pressure. This can also change the functional consequences experienced by someone who initially had negative functional consequences in the form of an increase in blood pressure by being given independent nursing interventions in the form of deep breathing, causing blood pressure to drop and turn into positive functional consequences.

The researcher argues that the role of gerontic nursing is to identify the factors that cause negative functional consequences after starting deep breathing interventions that will produce positive functional consequences with the aim of making relaxation, relaxing, and comfortable so that the H.P.A axis activation occurs which causes the hypothalamus to decrease CRF so that the pituitary also occurs decrease in ACTH. This causes the adrenal medulla to decrease the production of catecholamines resulting in vasodilation of blood vessels which ultimately gives an optimal impact in the form of positive consequences, namely a decrease in blood pressure in respondents who intervene in deep breathing. This is supported by Williams (2018) which states that a slowed breathing frequency triggers a general decrease in impulse travel for the respiratory and cardiovascular systems. The respiratory and cardiovascular systems have the same regulatory mechanisms. Changes in one system will affect the function of other systems, deep breathing also maximizes lung expansion when breathing and the existence of a breath holding phase aims to maximize oxygen diffusion in the lungs for better oxygen fulfillment for metabolism.

All the facts found in this study, both in terms of the control group and the treatment group, all prove that the administration of deep breathing relaxation techniques with a dose of 15 minutes 3 times a day for 7 days with three combinations of movements in accordance with

standard operating procedures can reduce blood pressure.

CONCLUSION

The deep breathing relaxation technique given at a dose of 15 minutes 3 times a day for 3 months has been shown to influence reducing blood pressure in the elderly. Nurses can provide deep breathing relaxation techniques independently to clients, so that they can be used as independent nursing interventions (non-pharmacological) in dealing with hypertension cases.

Future research can conduct research on deep breathing by paying more attention to confounding variables such as stress, anxiety, and diet. Deep breathing exercises can also be considered as additional material for practicum activities for students in dealing with mild and moderate hypertension patients non-pharmacologically. The results of this study can also be used as additional data in the teaching and learning process, especially for Medical Surgical Nursing. Health workers at the Puskesmas can socialize and provide health education to hypertensive clients by using independent nursing interventions in the form of deep breathing relaxation techniques to reduce systolic and diastolic blood pressure. Health workers at the Puskesmas can recommend deep breathing as a companion to pharmacological therapy because it can be done anywhere, anytime, and is economical for employees with hypertension.

ACKNOWLEDGMENTS

The author is thankful for respondents for their valuable information and its awareness to participate in this research. We also thank to STIKes YPIB Majalengka and Politeknik Negeri Subang for providing financial and motivational support to complete this study.

CONFLICTS OF INTEREST

The author declares that they have no conflict of interest.

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