



## THE EFFECT OF PROGRESSIVE MUSCLE RELAXATION TECHNIQUES ON REDUCING SYSTOLE BLOOD PRESSURE IN ELDERLY PEOPLE WITH HYPERTENSION

Wardah Fauziah<sup>OR</sup>, Novian Mahayu Adiutama<sup>OR</sup>, Teja Krisna\*<sup>OR</sup>

State Polytechnic Subang, Indonesia

### Original Research

### ABSTRACT

**Introduction:** Hypertension is a disease that is often not felt but can have serious consequences for health. One way to prevent and overcome hypertension is using non-pharmacological therapy, one of which is the progressive muscle relaxation technique which is useful for lowering blood pressure. This study aims to analyze the effect of progressive muscle relaxation techniques on reducing systolic blood pressure in elderly people with hypertension. **Methods:** The method used is quantitative research with a pre-post test quasi-experimental research design with a control group. Sampling using a simple random sampling technique with a total of 60 respondents divided into 2 groups, namely, 30 intervention groups and 30 control groups. Data analysis using the Independent Sample T-test parametric test. **Results:** The results showed the average value of pre-test blood pressure in the intervention group was 157 mmHg and the control group was 149 mmHg, while in the post-test the intervention group after being given the progressive muscle relaxation technique was 136 mmHg and the control group was 134 mmHg. Data analysis using the Independent Sample T-test test obtained a p-value of 0.000 which indicates the effect of progressive muscle relaxation techniques on the elderly with hypertension. **Conclusions:** Therefore, it can be concluded that progressive muscle relaxation techniques can have an effect on reducing systolic blood pressure in the elderly with hypertension and it is recommended that this study be used as a reference material and implementation in performing progressive muscle relaxation techniques to prevent and control hypertension.

### INTRODUCTION

The leading cause of death in the world is hypertension. Hypertension is sometimes referred to as the silent killer because it silently contributes to other comorbidities that may be fatal. Moreover, if a person does not check their blood pressure, they may not realize that they have hypertension, making it a silent disease. Serious side effects of hypertension include stroke, heart failure, kidney failure, and other diseases that increase the chances of death (Simanjutak & Situmorang, 2022). 33% of people worldwide suffer from high blood pressure. Globally, 1.3 billion people were suffering from hypertension in 2019. In Southeast Asia alone, 32% of the population suffered from hypertension in 2019 (WHO, 2023).

Systole blood pressure occurs when the pressure in the arteries when the heart beats. High systole values are at risk of death, not only high systole blood pressure is a major factor in stroke, kidney failure, and heart failure due to the hardening of the arteries. Systole has a high-risk effect on CVD (Cardiovascular Disease), which has been proven (Chan et al., 2021). Explained that systole blood pressure has a major effect on cardiovascular outcomes (Flint, et al., 2019). In 2021 the death rate due to high systole blood pressure in Southeast Asia is 2.4

million people from the total population in Southeast Asia (WHO, 2023).

According to a 2018 report by the Indonesian Ministry of Health, the elderly population in Indonesia contributes to the increasing incidence of hypertension. Data from the 2018 Riskesdas shows that 39.60% of people in West Java province have hypertension. Based on the results of measuring the prevalence of hypertension by age group, age 45-54 (52.27%), age 55-64 (62.15%), age 65-74 (71.08%), and age 75+ (77.77%) (Riskesdas, 2018).

Based on the measurement results, 41.21% of the population of Subang Regency aged  $\geq 18$  years and above as a whole suffered from hypertension. Hypertension data in the Subang district increased from 2020 with a presentation of 14.6%, and it experienced an increase in 2021 of 22.8%. The profile of the Subang district health office found the fact that in 2021, hypertension was among the 10 biggest diseases in Subang district, with a total of 4,429 cases of people with hypertension at the Subang district health center (Profil Kesehatan Subang, 2021).

The most influential factor is the decline in body function due to the degenerative process. Cardiovascular

### ARTICLE INFO

Received June 27, 2024

Accepted August 29, 2024

Online Oktober 30, 2024

\*Correspondence:

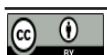
Teja Krisna

E-mail:

[thejakrisna06@gmail.com](mailto:thejakrisna06@gmail.com)

### Keywords:

Elderly, Hypertension, Progressive Muscle Relaxation, Systole Blood Pressure



disease is a disease that is often experienced by the elderly, especially hypertension. Elderly people can prevent hypertension by always monitoring their blood pressure regularly (Susilawati, 2022). Hypertension has two methods of management, namely pharmacological and non-pharmacological. In addition to requiring very high costs, pharmacological treatment can also cause side effects, such as dizziness, weight loss, and nausea or vomiting (Dafriani, 2019). Not using non-pharmacological methods This approach is very important as it is low-risk, inexpensive, and can be done at home. It is an example of a healthy lifestyle. Patients with hypertension in the categories of prehypertension (120-139 mmHg) and grade 1 hypertension (140-159 mmHg) can practice progressive muscle relaxation techniques (Murhan, et al., 2020).

This method of gradual muscle relaxation can regulate the hypothalamus and strengthen the parasympathetic nervous system. A phenomenon known as trophotropic activation occurs in the parasympathetic nervous system and causes a shift in the desire to rest. Improved blood circulation is a result of the parasympathetic reaction. When used in conjunction with progressive muscle relaxation techniques, the blood pressure of the elderly can be lowered and their bodies can experience a calm and relaxed state (Susilawati, 2022).

The information above discusses the benefits of progressive muscle relaxation techniques in reducing systolic blood pressure. This study aimed to determine the effect of progressive muscle relaxation techniques on reducing systolic blood pressure in elderly people with hypertension.

## MATERIALS AND METHODS

This research used a quasi-experimental design with a pre-post test with a control group. The research was conducted from April to March 2024 at Puskesmas

Sukarahayu. The decrease in systolic blood pressure is the dependent variable, and the progressive muscle relaxation approach is the independent variable. The target demographics were 150 elderly at Sukarahayu Health Center who had hypertension in January 2024. Based on pre-existing data, a basic random sampling technique was used to obtain the sample. The sample data, obtained from the results of the Slovin formula, consisted of 60 people. These individuals were divided into two groups: 30 were assigned as the control group and 30 as the intervention group. The intervention group received the progressive muscle relaxation technique after their blood pressure was measured (pre-test). Blood pressure measurement (pre-test), if the intervention group has completed the progressive muscle relaxation technique and then the next control group carried out progressive muscle relaxation techniques but it was done after measuring blood pressure (post-test). In this study, sampling was carried out using a spin to determine 30 intervention and 30 control respondents, the spin was carried out 1-30 the data that came out included the intervention group and 31-60 included the control group after the spin results came out the researcher provided objectives and explanations related to the research to be carried out, then the researcher gave informed consent to prospective respondents whether they agreed or not to become research respondents. The instruments in this study were observation sheets, SOP sheets, sphygmomanometers, and watches. Data were analyzed in two ways: univariately, which only looked for the mean pre-post test values in the intervention and control groups, and bivariately, which used an independent sample t-test to look for the mean reduction in systolic blood pressure in the intervention and control groups. However, because parametric tests require normality and homogeneity tests, this step must be completed before conducting an independent sample t-test. And this study has been ethically feasible with No. 136/KEPK/EC/V/2024.

## RESULTS

**Table 1.** Characteristics Respondents Based on Age, Gender, Employment, and Education at Puskesmas Sukarahayu 2024 (n=30)

Characteristics	Intervention Group		Control Group	
	Frequency (F)	Percentage (%)	Frequency (F)	Percentage (%)
<b>Age (years)</b>				
50-55	4	13.3	9	30
56-60	10	33.4	9	30
61-70	15	50	12	4
71-80	1	3.3	0	0
<b>Gender</b>				
Female	19	63.3	19	63.3
Male	11	36.7	11	36.7
<b>Employment</b>				
Not-employed	12	40	12	40
Self-employed	9	30	12	40
Farmers	4	13.3	4	13.3
ASN	5	16.7	2	6.7

Characteristics	Intervention Group		Control Group	
	Frequency (F)	Percentage (%)	Frequency (F)	Percentage (%)
<b>Education</b>				
Primary School	14	46.7	10	33.3
Junior High School	6	20	7	23.3
Senior High School	5	16.7	5	16.7
Diploma 3	1	3.3	5	16.7
Bachelor	4	13.3	3	10
<b>Total</b>	<b>30</b>	<b>100</b>	<b>30</b>	<b>100</b>

Table 1 shows that most of the respondents in the treatment/intervention group were aged 61-70 years (50%) and in the control group (40%), a small percentage (3.3%) of the intervention group's age range was 71-80 years, a smaller percentage (30%) of the control group's age range was 50-55 years and 56-60 years. The percentage of females was highest in the intervention group (63.3%) and control group (63.3%), while the percentage of males was lowest in both groups (intervention group: 36.7%, or 11 people), and (control group: 36.7%, or 11 men). Most of the elderly were not employed, as shown by the percentage in the intervention group (40%) and control group (40%). In addition, most of the elderly in the intervention group (46.7%) and control group (33.3%) had only completed elementary school.

**Table 2.** Descriptive Analysis of Pre-Test & Post-Test Blood Pressure Values in Intervention and Control Groups (n=30)

	Mean	SD	Min	Max
Intervention Pre-Test	157	5.8	150	168
Intervention Post-Test	136	4.9	128	146
Control Pre-Test	149	8.1	136	162
Control Post-Test	134	5.3	123	146

Based on table 2, Specifically, the mean score in the intervention group pre-test was 157, but 149 in the control group. Similarly, the mean value on the post-test findings of the intervention group was 136, while that of the control group was 134.

**Table 3.** Normally Test Results (Kolmogorov-Smirnov)

		Kolmogorov-Smirnov <sup>a</sup>		
		Statistics	df	Sig
<b>Systole Blood Pressure Result</b>	Intervention Pre-Test	.140	30	.139
	Intervention Post-Test	.139	30	.145
	Control Pre-Test	.134	30	.113
	Control Post-Test	.118	30	.083

In table 3 get all data is regularly distributed if the results of the normality test for each point produce significant data that is > from 0.05.

**Table 4.** Homogeneity Test Results (Levene)

		Lavene Statistic	df1	df2	Sig
<b>Systole Blood Pressure Result</b>	Based on Mean	.129	1	58	.720
	Based on Median	.173	1	58	.679
	Based on Median and with adjusted df	.173	1	57.801	.679
	Based on Trimmed Mean	.125	1	58	.725

Table 4 the homogeneity test on based on mean  $0.720 > 0.05$  results in significant data that is more than  $> 0.05$  which means that all data is homogeneous.

**Table 5.** Independent Sample T-Test Results Progressive Muscle Relaxation Technique Intervention Control Group

	Group			
	Intervention		Control	
	Mean	SD	Mean	SD
<b>Systole Blood Pressure Delta Value Independent Sample T-test</b>	20.90	5.9	14.40	5.9
P-value = 0.000				

Researchers can continue with the independent sample t-test because the results of the homogeneity and normality tests obtained a significant value ( $\text{sig}$ )  $> 0.05$  which indicates that the data is homogeneous and normal. Based on these findings, a significant difference in systolic blood pressure reduction between the intervention group and the control group can be concluded from the p-value (0.000) which shows less than the established significance level (0.05). This shows that in the elderly with hypertension at the Sukarahayu Health Center, progressive muscle relaxation techniques significantly reduce systolic blood pressure.

## DISCUSSION

### Systole blood pressure before progressive muscle relaxation technique intervention

Based on the results of the descriptive analysis test, all respondents had blood pressure greater than the normal limit which can be interpreted as hypertension. The average value before (pre-test) in the intervention group was 157 mmHg, and the control group was 149 mmHg. The results of a study conducted (Fadilah & Rakhmawati, 2023) found that elevated systole blood pressure is more accurate as a clue to heart disease that can cause stroke or heart attack, the higher the systole blood pressure, it can cause rupture of blood vessels caused by blockages in blood vessels that have narrowed and will cause cerebral hemorrhage which can be a factor in death. and menstrual cycles in nursing students at a private university in Tangerang. Stressors that make new demands for a job will result in a delayed menstrual cycle every month. According to Prawiroharjo (2014), a reaction that occurs in the body during stress where the amygdala of the limbic system is activated so that it will stimulate the hypothalamus to produce the hormone Gonadotropin Releasing Hormone (GnRH), where the GnRH hormone will secrete the hormones FSH and LH which are very instrumental in the menstrual cycle.

This systole blood pressure is produced by the heart muscle which increases peripheral vascular resistance when the left ventricle pumps, and systole blood pressure increases. Thus, systole blood pressure depends on the strength and volume of the arteriolar wall (Arthini, et al., 2015).

Hypertension in elderly people is caused by decreased elasticity of the aortic wall, stiff and thickened heart valves, decreased ability of the heart to pump blood, which results in decreased volume and contraction of blood vessels, and decreased elasticity of peripheral blood vessels due to decreased ability of peripheral blood vessels to absorb oxygen (Mulyadi et al., 2019).

Based on the results of the respondent characteristics test, 40.0% of the control group and 50.0% of the intervention group were between 61 and 70 years old. The same results were also found by (Suprpti, 2023) that age affects the likelihood of hypertension. This is due to the increase in blood pressure associated with age, due to reduced arterial elasticity. Besides (Astuti, et

al., 2020) explained that lifestyle changes made by the elderly at the age of 61 to 70 years can contribute to increased rates of hypertension in those who are older, especially those who do not do any activity, resulting in increased blood pressure due to reduced activity. This hardens the blood arteries, which disrupts blood flow and increases blood pressure.

With a ratio of 63.3% in the intervention group and 63.3% in the control group, females made up the majority of respondents. This shows that women experience more hypertension than men. Seen in research (Suprpti, 2023) which shows that hypertension in women. Research conducted by (Ali, et al., 2021) explains that women are one of the sexes most prone to hypertension every year. According to research (Amelia et al., 2020), menopause is a natural thing that happens to women. Women's ovaries begin to release fewer eggs, reduce menstrual activity, and eventually stop it altogether due to a decrease the hormones progesterone and estrogen. During this period, there is a decrease in the amount of estrogen hormones that are essential for maintaining body functions. This decrease may make women prone to hypertension compared to men.

The test results showed that the percentage of people who did not work with the percentage rate in the intervention group (40.0%) and control group (40.0%). Not working can also be one of the causes of hypertension. By research findings (Isra K et al., 2017) unemployed individuals are more likely to develop hypertension because they are inactive. Sedentary people have a faster heart rate, which means each heartbeat requires more effort from the heart muscle. Researchers (Nurjaha Taisoet al., 2021) showed that jobs that do not depend on physical activity affect blood pressure, while jobs that depend on physical activity can prevent hypertension (Akbar, et al., 2021) outline how the risk of hypertension increases with reduced employment and less physical activity. In addition, those who do not exercise frequently have a greater heart rate, meaning that each time their heart contracts, the heart muscles have to work harder. The pressure on the arteries increases along with the need for the heart muscle to pump stronger and more frequently.

In terms of respondent characteristics, most of the elderly had only completed primary school, with 46.7% of the intervention group and 33.3% of the control group having completed this level of education. This suggests that a lower level of education may be associated with a higher risk of hypertension. Hypertension can be caused by ignorance or inappropriate information gathering. The findings of this study are consistent with the findings of previous studies (Nugroho & Sari, 2019), which found that the low education level was 38.6% of the population. As a result, a lack of knowledge about the importance of health and a lack of exposure to appropriate information can be one of the causes of hypertension. According to research (Isra K et al., 2022), education has an impact on hypertension, as individuals with low education have



difficulty or delay in receiving information from nurses, which impacts their healthy lifestyle. (Rindriani, et al., 2021) explains that low education can affect the ability or knowledge of the elderly regarding lifestyle or behavior that causes hypertension. The level of education can affect the ability of the elderly to receive information related to hypertension it causes the elderly to not know about efforts to prevent and control their hypertension.

Researchers then found that the average blood pressure before progressive muscle relaxation techniques in both intervention and control groups exceeded normal limits and was considered hypertension. Not only that, there are several factors of hypertension, namely age with a vulnerable age of 61-70 years, female gender has a risk of developing hypertension, not working can also cause hypertension, and low education factors will cause hypertension due to lack of knowledge

### **Systole blood pressure after progressive muscle relaxation technique intervention**

The results showed that after (post-test) the application of progressive muscle relaxation techniques, the mean value dropped significantly in both groups with 15 movements of progressive author relaxation techniques, done twice a week in 1 month, and 10-15 minutes of administration time. The mean value of the control group was 134 mmHg, while the mean value of the intervention group was 136 mmHg. The study found that the majority of respondents experienced a blood pressure reduction of 10-20 mmHg (Anita Yusiana & Suprihatin, 2018), The mean value of the control group was 137 mmHg, significantly lower than the mean value of the intervention group which was 128 mmHg (Afriani Khasanah et al., 2018). In addition, research conducted (Yudanari & Puspitasari, 2022) claimed that there was a marked reduction in blood pressure readings as a result of this progressive muscle relaxation technique.

Reducing stress reactions in the sympathetic nervous system and promoting relaxation in arterial and venous smooth muscles, progressive relaxation techniques lower the heart rate frequency. This produces a calming and relaxing impact that affects norepinephrine, which relaxes the veins and arteries. Vasodilation occurs in this state, causing blood vessels to dilate and systolic blood pressure to drop (Bahri, et al., 2023).

After muscle relaxation makes muscles healthier, feelings of happiness will increase over time (Rosidin et al., 2019), The elderly may also experience a decrease in systolic blood pressure due to the release of endorphins and serotonin, which act as vasodilators of blood vessels. Progressive muscle relaxation techniques concentrate on muscle activity, which lowers peripheral resistance, increases blood vessel flexibility, and relaxes muscles to improve blood circulation. By dilating blood arteries, this method acts as a vasodilator to relax blood vessel muscles and lower systolic blood pressure (Afrioza & Clarissa Agustin, 2023).

The findings of this study, according to the researchers, showed that the average blood pressure of both groups dropped significantly as a consequence of the progressive muscle relaxation technique. After the intervention, blood pressure dropped by 10-20 mmHg. In addition, this method may encourage the release of serotonin and endorphins, two hormones that help lower systolic blood pressure.

### **The effect of progressive muscle relaxation technique on reducing systole blood pressure**

The intervention group had a greater average or difference in decline than the control group, based on the results of the independent sample t-test, which showed that the delta value in the intervention group was 20.90 and the control group was 14.40. In both groups, the p-value is 0.000, which indicates that 0.000 is smaller than 0.05. The systolic blood pressure of elderly people with hypertension at the Sukarahayu Health Center can be reduced by using progressive muscle relaxation techniques.

The results of the independent sample T-test are in line with the findings of other studies, with a p-value of 0.012 (Rahayu, et al., 2020), showing a significant effect. Research conducted (Afrioza & Clarissa Agustin, 2023) a p-value of 0.001 which indicates the effect of progressive muscle relaxation techniques on reducing systolic blood pressure was found in a study entitled "The Effect of Progressive Muscle Relaxation Techniques on Systolic Blood Pressure in Adults in Sukatani Village Tangerang."

According to (Bahri, et al., 2023) progressive relaxation techniques aim to lower heart rate by reducing the stress response of the sympathetic nervous system and inducing relaxation in smooth muscles in arteries and veins. It has a calming and relaxing impact that affects norepinephrine. This relaxes arterial and venous blood vessels, leading to dilation of blood vessels and a drop in blood pressure.

Based on research by (Theodorin, et al., 2017) explains how the most effective progressive muscle relaxation technique, which stimulates the hypothalamus by releasing the pituitary and lowering adrenaline and norepinephrine levels, as well as lowering heart rate frequency (up to 24 beats per minute), can be used to cause vasodilation, which is the brief dilation of blood vessels that occurs after the technique is completed. This vasodilating effect lowers blood pressure.

Progressive muscle relaxation therapy introduced by Dr. Edmund Jacobson in the 1920s aims to reduce blood pressure by teaching individuals to consciously relax their muscles gradually. A reduction in blood pressure is a benefit derived from progressive muscle relaxation therapy, especially if blood pressure is high (hypertension). When a person relaxes, his blood pressure will decrease optimally (Toussain et al., 2021). According to research conducted (Akhriansyah, 2019), a study conducted at Panti Tresna Wherda Palembang showed that the gradual muscle relaxation method

significantly lowered the blood pressure of hypertensive patients. The very low p-value of 0.000 in the data indicates a significant reduction in systolic blood pressure with this treatment.

Thus, the results of the independent sample T-test test with a p value of 0.000 indicate that progressive muscle relaxation therapy can help reduce systolic blood pressure in the elderly suffering from hypertension. Progressive muscle relaxation has been shown to have a positive effect on blood pressure even though it is not intended as a means of treatment.

## CONCLUSIONS

It can be stated that the progressive muscle relaxation technique affects reducing systolic blood pressure in elderly hypertensive patients at the Sukarahayu Health Center based on the test results that have been carried out and discussed. Sukarahayu Health Center can incorporate this progressive muscle relaxation technique into the Standard Operating Procedure (SOP) to help manage the health conditions of elderly hypertensive patients. The elderly can learn and practice this technique as a natural way to lower blood pressure. The paired sample t-test which compares the difference in pre-post test values can be used as a reference by future researchers to add insight. The disadvantage of this study is that it does not compare the difference in pre-post tests using a paired sample t-test because it only uses an independent sample t-test in this study which functions as a hypothesis test.

## REFERENCES

- Afriani Khasanah, D., Herawati, I., Studi Fisioterapi, P., Ilmu Kesehatan, F., & Muhammadiyah Surakarta, U. (2018). Efektivitas Progressive Muscle Relaxation Therapy Terhadap Penurunan Tekanan Darah Sistolik Pada Wanita Lanjut Usia Dengan Hipertensi Primer. The 7 Th University Research Colloquium STIKES PKU Muhammadiyah Surakarta.
- Afrioza, S., & Clarissa Agustin, G. (2023). Pengaruh Teknik Relaksasi Otot Progresif Terhadap Tekanan Darah Sistolik Dewasa Di Kelurahan Sukatani Tangerang. *Jurnal Kesehatan*, 12(2), 181-188. <https://doi.org/10.37048/kesehatan.v12i2.291>
- Akbar, H., Royke Calvin Langingi, A., & Rahmawati Hamzah, S. (2021). Analisis Hubungan Pola Makan Dengan Kejadian Hipertensi Pada Lansia. *Journal Health and Science; Gorontalo Journal Health & Science Community*, 5(1). <https://doi.org/10.35971/gojhes.v5i1.10039>
- Akhriansyah, M. (2019). Pengaruh Progressive Muscle Relaxation (PMR) terhadap Penurunan Tekanan Darah pada Lansia Hipertensi di Panti Sosial Tresna Werdha Palembang Provinsi Sumatera Selatan Tahun 2018. *Jurnal Ilmiah Universitas Batanghari Jambi*, 19(1), 11-16. <https://doi.org/10.33087/jjubj.v19i1.544>
- Ali, I. H., Hiola, T. T., & Tumulo, I. (2021). Gambaran Umum Penyakit Hipertensi di Puskesmas Bone Pantai Tahun 2020. *Journal Of Noncommunicable Disease*, 1(1), 24-32. <http://dx.doi.org/10.52365/jond.v1i1.223>
- Amelia, P. K., Gita Maringga, E., & Sari, Y. N. (2020). Analisis Faktor yang Mempengaruhi Kejadian Hipertensi Pada Wanita Menopause. *Midwifera: Jurnal Kebidanan*, 6(1), 21-25. <https://doi.org/10.21070/midwifera.v6i1.449>
- Anita Yusiana, M., & Suprihatin. (2017). Efektivitas Terapi Nafas Dalam dan Terapi Relaksasi Otot Progresif Terhadap Penurunan Tekanan Darah Pada Penderita Hipertensi di Puskesmas Pesantren 1 Kota Kediri. Seminar Nasional Dan Workshop Publikasi Ilmiah, 104-113.
- Arthini, W. B., Sawitri, K. A., & Nurhesti, O. Y. (2015). Pengaruh Terapi Warna Hijau Terhadap Tekanan Darah Sistolik Pada Lansia di Panti Sosial Tresna Werdha Wana Seraya Denpasar. *COPING NERS (Community of Publishing in Nursing)*, 3(1).
- Astuti, D. E., Suryani, E., & Andriyani, A. (2020). Pengaruh Brisk Walking Exercise Terhadap Tekanan Darah Pada Lansia Dengan Hi-pertensi di Klinik Mitra Husada Gunungkidul. *Jurnal Kesehatan Masyarakat dan Lingkungan Hidup*, 5(2), 112-118.
- Bahri, K., Firmansyah, M., Lestari, S., Rahayu, I. L., Febriyanti, S. S., & Manisingsari, D. (2023). Penurunan Tekanan Darah dengan Teknik Relaksasi Otot Progresif pada Pasien Hipertensi di Desa Sumur Batu Bogor. *Jurnal Kreativitas Pengabdian Kepada Masyarakat (PKM)*, 6(1), 52-61. <https://doi.org/10.33024/jkpm.v6i1.7999>
- Chan, I. I., Kwok, M. K., & Schooling, C. M. (2021). The total and direct effects of systolic and diastolic blood pressure on cardiovascular disease and longevity using Mendelian randomisation. *Scientific Reports*, 11(1). <https://doi.org/10.1038/s41598-021-00895-2>
- Dafriani, P. (2019). *Pendekatan Herbal Dalam Mengatasi Hipertensi*. Solok: CV Berkah Prima
- Fadilah, R., & Rakhmawati, A. (2023). Pengaruh Slow Deep Breathing Terhadap Tekanan Darah pada Penderita Hipertensi di Wilayah Puskesmas Tarumajaya Tahun 2023. *Mahesa: Malahayati Health Student Journal*, 3(11), 3480-3496. <https://doi.org/10.33024/mahesa.v3i11.11088>
- Flint, A. C., Conell, C., Ren, X., Banki, N. M., Chan, S. L., Rao, V. A., Melles, R. B., & Bhatt, D. L. (2019). Effect of Systolic and Diastolic Blood Pressure on Cardiovascular Outcomes. *New England Journal of Medicine*, 381(3), 243-251. <https://doi.org/10.1056/nejmoa1803180>
- Isra K, Kepel J Billy, & Mulyadi. (2017). Hubungan Dukungan Keluarga Dengan Derajat Hipertensi Pada Pasien Hipertensi Di Puskesmas Ranomuut Kota Manado. *E-Journal Keperawatan*, 5(1). <https://doi.org/10.35790/jkp.v5i1.14947>
- Mulyadi, A., Cahyo Sepdianto, T., Hernanto, D., Kemenkes, P., & Keperawatan, M. J. (2019). Gambaran Perubahan Tekanan Darah Pada Lansia Hipertensi Yang Melakukan Senam Lansia. *In Journal of*

- Borneo Holistic Health*, 2(2), 148-157. <https://doi.org/10.35334/borticalth.v2i2.740>
- Murhan, A., Purbianto, & Sulastri. (2020). Pengaruh Relaksasi otot Progresif terhadap penurunan tekanan Darah Pada Lansia. *Jurnal Ilmiah Keperawatan Sai Betik*, 16(2), <https://doi.org/10.26630/jkep.v16i2.3101>
- Nugroho, P. S., & Sari, Y. (2019). Hubungan Tingkat Pendidikan dan Usia Dengan Kejadian Hipertensi di Wilayah Kerja Puskesmas Palaran. *Jurnal Dunia Kemas*, 8(4), 233-238. <https://doi.org/10.33024/jdk.v8i4.2261>
- Nurjaha Taiso, S., Putu Sudayasa, I., Paddo, J., Oleo, H., Kesehatan Kota Kendari, D., & Sulawesi Tenggara, P. (2021). Analisis Hubungan Sosiodemografis Dengan Kejadian Hipertensi di Wilayah Kerja Puskesmas Lasalepa, Kabupaten Muna. *Nursing Care and Health Technology Journal (NCHAT)*, 1(2), 102–109. <https://doi.org/10.56742/nchat.v1i2.10>
- Profil Kesehatan Subang. (2021). Profil Kesehatan Subang.