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## Research Article

# The Effects of Progressive Muscle Relaxation on Blood Pressure and Headache in Hypertension

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### Abstract

**Aims:** Hypertension is a condition of increased blood pressure that causes the heart to work harder to circulate blood throughout the body. Patients with hypertension more frequently complain of headaches. Progressive Muscle Relaxation (PMR) is a non-pharmacological treatment to overcome hypertension, headache symptoms, and maintain a deep relaxation state.

**Objective:** The study aimed to determine PMR's effects on blood pressure and headache in hypertensive patients.

**Methods:** This study utilized a quasi-experimental design with one group pretest and posttest design. A sample of 30 respondents with hypertension and headaches was obtained through convenience sampling. Data were then analyzed using paired t-test.

**Results:** The results showed a decrease in blood pressure and headache intensity after administrated PMR. The number of respondents with stage 2 hypertension decreased from nine (30%) in the pretest to zero respondents (0%) in the posttest. There was a significant effect of giving PMR to clients with increased blood pressure accompanied by headaches (*p*-value of 0.000).

**Conclusion:** PMR is a significant measure that can be used to reduce blood pressure and headache. It can be done independently from ten to 15 minutes daily for a more effective outcome. Therefore, it is suggested that clients with increased blood pressure can do the PMR exercise independently every day for 10-15 minutes to reduce blood pressure and headache intensity.

### Keywords:

Headache, Hypertension, Progressive Muscle Relaxation

## INTRODUCTION

Hypertension is when the blood pressure in the arteries continues to increase. This rise in blood pressure has forced the heart to work much harder to drain the blood through the veins. Blood pressure measurement involves two components, namely systolic and diastolic (1). The results of blood pressure measurement consisting of three stages, namely stage 1 hypertension (systolic 130-139 mmHg and diastolic 80-89 mmHg), stage 2

hypertension (systolic  $\geq 140$  mmHg, diastolic  $\geq 90$  mmHg), and a hypertensive crisis (Systolic  $> 180$  mmHg, diastolic  $> 120$  mmHg) (2). Hypertension has several typical symptoms, such as "headaches, nosebleeds, irregular heart rhythms, vision changes, and buzzing in the ears. Severe hypertension can cause fatigue, nausea, vomiting, confusion, anxiety, chest pain, and muscle tremors" (3). Headache occurs due to muscle contractions triggered by psychogenic factors like anxiety and depression or certain diseases in the head

and neck. Patients with tension-type headaches usually experience pain and muscle stiffness (muscle spasm). Muscle stiffness alone will cause pain complaints in which the head, forehead, and neck feel stiff (4). According to Kowalak, Welsh, and Mayer (2012), arterial blood pressure is a total product or a result of peripheral resistance and cardiac output. Cardiac output increases because of the increment in cardiac frequency, stroke volume, or both. The increase of peripheral resistance is due to escalating blood viscosity or decreasing blood vessels' lumen, especially arterioles. It causes a restriction of blood flow to essential organs and damage. The spasm of the arteries and reduced oxygen can lead to headaches or distention of structures in the head or neck (5).

According to WHO, the highest prevalence of blood pressure is in Africa. On the other hand, the lowest prevalence of blood pressure within WHO regions is America, with 35% for men and women. Men in America have a higher prevalence of 39% than women, with only 32%. According to WHO, in all its regions, "men have a slightly higher prevalence of raised blood pressure than women. This difference was only statistically significant in the Americas and Europe" (3). Basic Health Research (2015) reveals that hypertension is one of the health issues with a data prevalence of 25.8%. In other words, there are around 65,048,110 people who have hypertension (6). Based on data from the South Tangerang Health Office, there are 20,891 people with hypertension in South Tangerang. Based on the existing villages, the percentage share of that number was 41.9% at East Ciputat Health Center, 32.5% at Pamulang Health Center, 32.4% at Sawah Baru Village, and 29% at Kampung Sawah Village (7). Hypertension is an incurable yet a controllable disease. Patients with hypertension, especially those in the community, rarely control their blood pressure. One of the reasons is due to their low socioeconomic status. Indonesia is one of the Low Middle-Income Countries,

indicated by the high number of people with low socioeconomic status in rural areas (8). Based on statistical data in March 2018, 25.95 million people or 9.82% of Indonesia's total population live within the poverty line with monthly expenditure below IDR 374,478. The poverty rate of Bali Province even reaches 171.76 thousand people or 4.72% (9). Hypertension can be handled using pharmacological and non-pharmacological treatments. Non-pharmacological treatments involve providing relaxation techniques. The relaxation techniques for pain management alone include muscle relaxation, deep breathing, massage, meditation, and behavior (10). Edmund Jacobson developed progressive Muscle Relaxation (PMR) in 1938. His original method includes many sessions intended for relaxing 30 different muscle groups in the patient's body" (11).

PMR is an activity of stretching and loosening muscles to reduce muscle tension and increase psychological relaxation. It can be taught quickly and relatively inexpensively. PMR is a kind of therapy that helps to cure tension. It requires tension and relaxation from different muscle groups, along with deep breathing. Relaxation exercise here includes maximum muscle contraction on the face, neck, shoulders, arms, neck, back, abdomen, hips, femur, and legs for 5 seconds and another relaxation for 30 seconds while staying focused on the breath. This method is repeated for each muscle group and is completed in 20 minutes, followed by a five-minute break before re-measuring blood pressure(11).

The previous research about Progressive Muscle Relaxation (PMR) done by Fraser, Matsuzakawal, Lee, and Minen (2017) states that PMR is one of the nonpharmacologic treatments for the patients with post-traumatic headache (12). Furthermore, Sabar and Lestari (2020) mention that after getting a 15-minute-treatment of PMR, the systolic and diastolic blood pressure in hypertensive patients is reduced. Based on these findings, the

researchers intend to analyze the PMR technique's effect on lowering blood pressure and headaches (13). This research aimed to examine the effects of PMR on blood pressure and headache in patients with hypertension.

## METHODS

This study was pre-experimental research with one group pretest and posttest design. Using a convenience sampling technique, the sample in the study was 30 respondents. This study's inclusion criteria were hypertensive clients with headache complaints and those without hypertension drugs and pain medications. Meanwhile, the exclusion criteria were clients who were not willing to be respondents in this study. The researcher conducted the study from March-May 2020 at three different places, namely Surbakti Village (North Sumatra), Karawaci (Tangerang), and Galuga Village (Tangerang), to obtain the complete results.

Two variables in this study were blood pressure measurement and pain assessment. To measure the blood pressure variable, researchers used a sphygmomanometer and stethoscope. The researchers used the numeric pain scale developed by Downie in 1978 to assess headache severity, which has four levels, namely no pain (0), mild pain (1-3), moderate pain (4-6), severe pain (7-10) (14).

This study involved hypertensive patients accompanied by headaches without any prior timing. Before carrying out PMR exercise, the researchers first measured patients' blood pressure and checked whether they suffered from headaches. It was then followed by identifying the patients' names and ages. After data were complete, they were given PMR exercise for 15 minutes, and respondents rested for 5 minutes before a reassessment of blood pressure and headache intensity. The

researchers documented the results obtained on the assessment sheets.

The researchers upheld the ethical principles of autonomy, confidentiality, justice, beneficence, and nonmaleficence (15). The researchers also allowed prospective respondents to sign informed consent if they were willing to participate in this research. This research received ethical approval from the Ethics Committee, Faculty of Nursing, Pelita Harapan University, with number 122/KEP-FON/III/2020. The researchers performed bivariate analysis and statistical tests using a paired *t*-test.

## RESULTS

The researchers obtained the respondents' characteristics, including gender, age, blood pressure assessment (pre and post), and headaches intensity (pre and post). A total of 30 respondents sample was taken from three different places, namely Surbakti village at North Sumatra, Karawaci, and Galuga village, Tangerang. Table 1 shows the characteristics of the study sample. The data are categorized based on the characteristics of respondents (gender, age, blood pressure assessment [before and after], and headaches intensity [before and after]).

**Table 1. Data on Age and Gender of Respondents**

Characteristic	Frequency (n)	Percentage (%)
Age (year)		
25 – 40	13	43%
41 – 50	11	37%
51 – 60	6	20%
Sex		
Female	18	60%
Male	12	40%
Total	30	100%

Table 2 implies that 17% of respondents had stage 1 hypertension, and 83% of respondents had stage 2 hypertension before PMR intervention. Whereas after PMR intervention, 37% of respondents experienced normal blood pressure, 33% had stage 1 hypertension, and 30% had stage 2 hypertension.

**Table 2. Hypertension Before and After PMR Intervention**

Blood Pressure	Before		After	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
<u>Normal</u>				
Systolic (<120 mmHg), Diastolic (<80 mmHg)	0	0	11	37%
<u>Stage 1 Hypertension:</u>				
Systolic (130 - 139 mmHg), Diastolic (80 - 89 mmHg)	5	17%	10	33%
<u>Stage 2 Hypertension:</u>				
Systolic ( $\geq$ 140 mmHg), Diastolic ( $\geq$ 90 mmHg)	25	83%	9	30%
<u>Hypertensive Crisis:</u>				
Systolic (>180 mmHg), Diastolic (>120 mmHg)	0	0	0	0
<b>Total</b>	<b>30</b>	<b>100%</b>	<b>30</b>	<b>100</b>

Furthermore, table 3 shows that before PMR intervention, 50% out of 30 respondents did not have mild headaches, and 50% of respondents had moderate headaches. The next results showed that 17% of respondents had no headaches after the PMR intervention, 80% had mild headaches, and 3% had moderate headaches.

**Table 3. Headache Scale Before and After PMR Intervention**

Scale	Before		After	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
No	0		5%	17%
1 - 3	15	50%	24%	80%
4 - 6	15	50%	1%	3%
7 - 8	0	0	0	0
<b>Total</b>	<b>30</b>	<b>100</b>	<b>30</b>	<b>100</b>

Based on table 4, the Sig. (2-tailed) on the blood pressure before and after PMR exercise was 0.004 <0.05 (systolic) and 0.12 <0.05 (diastolic), which means that there was a significant correlation between pre and post PMR exercise.

In line with this, the Sig. (2-tailed) on the pain (during activity) before and after PMR exercise was 0.009 <0.05. It vividly indicates a significant relationship between pre and post PMR exercise. On the other hand, the value of Sig. (2-tailed) on pain (at rest condition) before and after PMR exercise is 0.278 > 0.05, meaning no significant correlation between pre and post PMR exercise.

**Table 4. Correlation test between Pre and Post Progressive Muscle Relaxation Exercise.**

		Systolic blood pressure (after)	Diastolic blood pressure (after)	Headache during activity (after)	Headache during rest (after)
Systolic blood pressure (before)	<i>Pearson Correlation</i>	<b>.513**</b>	.2	-0.14	-0.098
	<i>Sig. (2-tailed)</i>	<b>.004</b>	.289	.462	.608
	<i>N</i>	<b>30</b>	30	30	30
Diastolic blood pressure (before)	<i>Pearson Correlation</i>	-0.06	<b>.452*</b>	-0.057	.08
	<i>Sig. (2-tailed)</i>	.752	<b>.012</b>	.763	.673
	<i>N</i>	30	<b>30</b>	30	30
Headache during activity (before)	<i>Pearson Correlation</i>	.082	0	<b>.469**</b>	.364*
	<i>Sig. (2-tailed)</i>	.667	1	<b>.009</b>	.048
	<i>N</i>	30	30	<b>30</b>	30
Headache during rest (before)	<i>Pearson Correlation</i>	.026	.175	.28	<b>.204</b>
	<i>Sig. (2-tailed)</i>	.893	.356	.133	<b>.278</b>
	<i>N</i>	30	30	30	<b>30</b>

\*\**. Correlation is significant at the 0.01 level (2-tailed).*

\**. Correlation is significant at the 0.05 level (2-tailed).*

The *p*-value of 0.000 in table 5 indicates a significant effect of giving PMR intervention to respondents with increased blood pressure and headache.

**Table 5. Paired Samples Test Results**

	<i>Paired Differences</i>					<i>T</i>	<i>Df</i>	<i>Sig. (2-tailed)</i>
	<i>Mean</i>	<i>Std. Dev</i>	<i>Std. Error Mean</i>	<i>95% CI of the Diff.</i>				
				<i>Lower</i>	<i>Upper</i>			
Systolic blood pressure (before & after)	.900	.712	.130	.634	1.166	6.924	29	.000
Diastolic blood pressure (before & after)	.500	.572	.104	.286	.714	4.785	29	.000
Headache during activity (before and after)	.633	.490	.089	.450	.816	7.077	29	.000
Headache during rest (before and after)	.433	.568	.104	.221	.646	4.176	29	.000

## DISCUSSION

In this study, most respondents were women (60%) aged 25 to 60. This result is similar to the research conducted by Dendra & Oktavia (2017), in which 42 out of 74 respondents were female (56.8%) (16). Those two results strengthen the statement that women are at greater risk of developing hypertension than men (17). Additionally, around 43% of respondents in this study were between 25 and 40 years old. In line with this, research conducted by Diana & Sarumaha in 2017 implies that around 122 young adults (51.7%) in 20-40 years of age tend to be more at risk of developing hypertension than older adults (18).

PMR is a relaxation and breathing technique done by tightening and relaxing body muscles so people feel relaxed, have a calm mind, and get their high blood pressure decreased. The results obtained in this study are in line with the research results done by Sucipto (2014) that PMR is beneficial for reducing peripheral resistance and increasing the elasticity of blood vessels (19). The muscles and blood circulation will be more able to bring and circulate oxygen. Moreover, progressive muscle relaxation can be a vasodilator whose effect widens blood vessels and lowers blood pressure. Physiologically, PMR exercise will activate the parasympathetic nervous system and manipulate the hypothalamus. It produces alpha-wave frequencies in the brain. It also suppresses the production of cortisol, epinephrine, and norepinephrine. Hence, it leads to vasodilation of blood vessels, which gives muscle relaxing effect (20).

In this study, the researcher measured blood pressure after resting for five minutes after PMR. According to Aksu, Erdogan, & Ozgur (2018), the respondents were given a five-minute break before taking blood pressure measurements after doing the PMR exercise. The researcher also found that respondents' systolic blood pressure after PMR had decreased significantly (p-

value <0.05) from stages 1 and 2 into stage 1 and even normal. These results are related to Akhriansya's (2018) study results that had a significant decrease in systolic value (p-value <0.05) from 159.3 mmHg to 130.6 mmHg after receiving PMR intervention (21).

The result also showed a significant difference in the blood pressure, either systolic or diastolic, before and after the respondents received PMR exercise. The difference in systolic and diastolic blood pressure supports this result. This result is in line with the notion that PMR exercises significantly decrease blood pressure in patients with hypertension. This therapy can be one of the non-pharmacological alternative therapies for reducing blood pressure for hypertensive patients (22).

Headaches are a common health problem for hypertensive patients (23). This study indicated a valuable reduction in the tension-type headache intensity, which happens when the neck, shoulders, and head muscles tense shortly after the respondents receive PMR exercise. Supporting these findings, Canadian research (2020) states that PMR exercise can help reduce tension, overall stress levels, and anxiety by making them feel relaxed (24). It can also help reduce physical problems such as stomachache and headaches and improve sleep quality. If PMR exercise is done regularly and gradually, it can reduce pain intensity so that patients are not dependent on medical therapy (25).

Research conducted by Ghoncheh & Smith (2014) revealed that PMR techniques are better than yoga because yoga takes much time and emphasizes muscle flexibility. Meanwhile, the PMR technique can be performed briefly, so it is very efficient and can help to achieve optimal results even though it is only done once a week in a month (26). If done for up to five weeks, PMR techniques can increase happiness and calm the mental state due to the increased oxygen it makes. Besides, PMR therapy is also helpful in reducing muscle tension,

anxiety, neck and back pain, high blood pressure, heart rate, and metabolic rate (27).

According to Fatima (2014), humans can adapt to various stimuli entering the body; however, not all stimuli will be responded well (adaptive). It highly depends on one's characteristics and the increase in stimulus exposure. If there is too much stimulus exposure, the human body will be confused about which to respond. Hence, the body needs to be re-reset to get calm and return to zero. One of the ways to reset the body is by relaxing using PMR techniques. The mind will calm down when the body feels relaxed, and the nervous system will become more focused. This condition will help the body develop an adaptive ability to adapt to stimuli that expose (28). The theory above follows this study's results: after receiving PMR exercise, headache complaints among hypertensive patients decreased, even if some patients did not feel dizzy anymore. This result is because inhalation and exhalation processes maximize the brain's oxygen supply to reduce headache intensity and severity.

## CONCLUSION

The results highlight the difference in blood pressure and headache severity before and after PMR among hypertensive respondents. Therefore, it is suggested that clients with increased blood pressure can do PMR exercise independently every day for 10-15 minutes to reduce blood pressure and headache intensity. A study of the PMR exercise with the control group is recommended to obtain an accurate result.

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