

EFFECT OF PROGRESSIVE MUSCLE RELAXATION EXERCISE TO DECREASE BLOOD PRESSURE FOR PATIENTS WITH PRIMARY HYPERTENSION

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ABSTRACT

Primary hypertension is defined as high BP in which secondary causes such as renovascular disease, renal failure, pheochromocytoma, aldosteronism, or other causes of secondary hypertension or mendelian forms (monogenic) are not present. Essential hypertension accounts for 95% of all cases of hypertension. Hypertension is predicted as the cause of worldwide diseases for 4.5%. Its prevalence is nearly as large in developing countries and in developed countries. The increase of hypertension case is predicted for about 80% in 2025 occurring in developing countries. There are many kinds of treatment for hypertension; one of them is progressive muscle relaxation exercises. To examine the effect of progressive muscle relaxation exercises to decrease blood pressure for patient with primary hypertension. Quasi experimental study with one group pre test and post test design involved 15 adult patients with age range 34-70 years old. They did progressive muscle relaxation exercises twice a day for twenty minutes for seven days in a row. There was a lowering in systolic Blood Pressure about 7.46 mmHg and 5.73 mmHg for diastolic Blood pressure. It was found that Wilcoxon signed ranks test available value of Z -2.669 (p-value 0.008) in systolic blood pressure and the available value of Z -1.769 (p-value 0.077) in diastolic blood pressure. Progressive muscle relaxation exercises effect to decrease in systolic blood pressure for patients with primary hypertension, whereas diastolic blood pressure showed no different effect.

Keywords: Primary Hypertension, progressive muscle relaxation, blood pressure.

Presenting Author's Biography



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INTRODUCTION

Hypertension has become a major public health problem in Indonesia as well as in several countries in the world. It was predicted that there will be an increase of hypertension case is estimated at about 80%, especially in developing countries in 2025. Of the 639 million cases in 2000, it is estimated to be 1:15 billion cases in 2025. This prediction is based on rates of hypertension and the current population growth. In Indonesia, hypertension is the third

cause of death after stroke and tuberculosis. According to the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure VII (JNC VII), nearly one billion people, or one out of four adults suffer from hypertension [1]. According to the National Basic Health Survey (2013), the prevalence of hypertension in Indonesia at the age of 35-44 years old was 24.8%, age 45-54 years old was 35.6%, age 55-64 years old was 45.9%, aged 65-74 years old was 57.6% and aged over 75 years old was 63.8% [2].

Most people with hypertension are treated with antihypertensive medications. One study stated that patients who discontinued anti-hypertensive therapy would have five times more likely to have a stroke. On the other hand, the drugs used to lower blood pressure if consumed in a long term can cause organs damage. Many non-drug therapies such as diet, exercise and relaxation therapies have proved superior compared to drugs in cases of borderline to mild hypertension. It can be used to control and bring down the blood pressure with no side effects. One of non-pharmacological treatment is relaxation training as Progressive Muscle Relaxation (PMR) [3]. Progressive muscle relaxation is an exercise to attain relaxing sensation by tensing a muscle group and stop muscle voltage [4]. Progressive muscle relaxation exercises have proven to lower blood pressure in patients with hypertension [5]. Another study showed a decrease in blood pressure in patients with essential hypertension who performed progressive muscle relaxation exercises [6]. Meanwhile, progressive muscle relaxation can reduce stress and blood pressure in elderly hypertensive [7].

The preliminary research was conducted in Desa Gondang. There were 40 people who suffered from hypertension; 35 were women and 5 were men. However, only 25 people met the inclusion and exclusion criteria.

Hypertension is abnormal high blood pressure and is measured at least three times on different occasions, which showed systolic pressure over 140 mmHg and diastolic pressure over 90 mmHg in a state of relaxed body [8]. While on the elderly, hypertension is expressed as systolic pressure over 160 mmHg and diastolic blood pressure over 90 mmHg [9]. According to Seven Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7), the classifications of hypertension are as follows:

Table 1. Classification of Blood Pressure

Category	Sistole		Diastole
Optimal	< 120	And	< 80
Normal	< 130	And	< 85
High Normal/ Pre Hypertension	130 - 139	Or	85 - 89
Hypertension Stage I	140 - 159	Or	90 - 99
Hypertension Stage II	160 - 179	Or	100 - 109
Hypertension Stage III	≥ 180	Or	≥ 110

Hypertension is a major risk factor for stroke, myocardial infarction, heart failure, chronic kidney disease, progressive atherosclerosis, dementia, and heart problems. The disease is responsible for the high cost of treatment due to the reasons of the high number of physician visits, hospitalization and/or long-term drug use. Hypertension is a risk factor of cardiovascular disease which is the leading cause of death in Indonesia. The Ministry of Health research data indicated that the number of hypertension and cardiovascular disease were still quite high and even tended to increase with the unhealthy lifestyle and behaviors

[10]. Hypertension and cardiovascular disease usually strikes without signs, so often referred to as the "silent killer".

The triggering factors of hypertension include heredity, gender, and age (factors that can not be controlled) and obesity, lack of exercise, smoking, and alcohol and salt consumption (factors that can be controlled). People with hypertension are very heterogeneous prove that the disease is like a mosaic, suffered by people who come from various subgroups at risk in the community. It also means that hypertension is influenced by multiple risk factors, both endogenous as neurotransmitters, hormones and genetics, as well as exogenous, such as smoking, nutrition and stressor [11]. For people with high blood pressure, it is important to know about hypertension by making positive lifestyle changes. Hypertension can be prevented by setting a good diet and enough physical activity.

The control system plays a role in maintaining blood pressure including arterial baroreceptor system, volume of liquid control, the renin-angiotensin system and vascular autoregulation [12]. Blood pressure is constantly monitored by the body and adjusted constantly to meet the needs of your body. This monitoring is performed by baroreceptors. Baroreceptors are special receptors that detect changes in the blood pressure. Baroreceptors are found within the walls of your blood vessels. The arcusaorta and the carotid sinus contain important baroreceptors which constantly monitor blood pressure fluctuations. These baroreceptors transmit their data to the central nervous system, and more specifically, to the cardio regulatory center of the medulla oblongata. Recent studies revealed that baroreceptors control sympathetic output on a more long-term basis and participate in fluid volume regulation by the kidney, and thus have the potential to adjust blood pressure chronically. However, in patients with hypertension, these controls of hypertension failed to lower blood pressure and it is not clear.

When salt and water level in the body is excessive, the blood pressure will rise through a complex physiological mechanism that alter venous return to the heart and results in increased cardiac output. When the kidneys are working properly, an increase in arterial pressure can increase diuresis and decrease blood pressures. Pathological conditions that change the pressure threshold to excrete salt and water of the kidneys will increase the systemic arterial pressure. Renin and angiotensin play their important roles in regulating blood pressure. The mechanism of hypertension is through the formation of angiotensin II from angiotensin I. Angiotensin I converting enzyme (ACE) is a central component of the renin-angiotensin system (RAS), which controls blood pressure by regulating the volume of fluids in the body. It converts the hormone angiotensin I to the active vasoconstrictor angiotensin II. Angiotensin II also plays a role in the secretion of aldosterone by the adrenal cortex.

Aldosterone is a steroid hormone that has an important role in the kidney. The biological action of aldosterone is to increase the retention of sodium and water and to increase the excretion of potassium by the kidneys (and to a lesser extent by the skin and intestines). It acts by binding to and activating a receptor in the cytoplasm of renal tubular cells. The activated receptor then stimulates the production of ion channels in the renal tubular cells, thereby increasing sodium re-absorption into the blood and increasing potassium excretion into the urine. To adjust the volume of extracellular fluid, aldosterone will reduce the excretion of sodium chloride (salt). The increasing concentration of sodium will be diluted by increasing the extracellular fluid volume which in turn will increase the volume and blood pressure [13].

Hypertension can cause organ damage, either directly or indirectly. Several studies have found that the damage to these organs can be caused by the increased blood pressure directly or indirectly, such as antibodies to receptor AT1 angiotensin II, oxidative stress, down-regulation of the expression of nitric oxide synthase, and others. Other studies also showed that high-salt diet and salt sensitivity play a major role in the onset of organ damage, such as damage to blood vessels due to increased expression of transforming growth factor- β (TGF- β)[14].

Relaxation is one of self-management technique that is based on the workings of the sympathetic and parasympathetic nervous system [3]. Relaxation techniques are increasingly being done because it proved effective in reducing tension and anxiety, insomnia and asthma [15].

Progressive muscle relaxation (PMR) is a systematic technique used to achieve a deep state of relaxation and has been shown to improve health-related Quality of Life (QOL) in a variety of medical and psychiatric illnesses. The aim of progressive muscle relaxation is to consciously **experience the difference between tensing and relaxation as well as the application of pressure and pressure relief**. All the muscles of the body - from head to toe - are consciously tensed and then relaxed again. The benefit of this exercise is to reduce muscle tension, stress, and lower blood pressure [9]. Progressive muscle relaxation can reduce stress and blood pressure in elderly hypertensive [7].

Progressive muscle relaxation exercises can be done in a sitting position for all movements and performed in a convenience place [15].The movement included:

- 1) Train the muscles of the hand by grasping the right hand while making a fist stronger, feeling the tension, then fist released. After completion of the right hand and then proceed to the left hand.
- 2) Train the back arm muscles by straightening the arms and moving the dorsi flexion of the wrist so that the muscles in the hand and forearm back stretched, fingers facing the ceiling.
- 3) Train the biceps muscle by grasping both hands like a fist then brought them to the shoulders so that the biceps muscles will be tense
- 4) Train the muscles of the shoulder by raising both shoulders up as high as touched both ears. This movement generates strain on the shoulders, upper back and neck
- 5) Exercise the forehead muscles to frown and eyebrows until the skin wrinkles
- 6) Exercise the muscles of the eye with eyes closed tightly so that tension around the eyes and the muscles that control eye movements can be felt
- 7) Train the muscles of the jaw with a clenched jaw, followed by biting teeth so that the tension around the jaw muscles can be reduced
- 8) Exercise the muscles around the mouth with pursed lips as strong as possible so that it will be felt the tension around the mouth
- 9) Train the muscles of the neck to lay the head, then asked to emphasize the head on the back such that the respondents could feel the tension in the back of the neck and upper back
- 10) Train the anterior neck muscles so the respondents could feel the tension in the anterior part of the neck region
- 11) Arch your back, sticking out your chest, and feel the tension in your upper back...and relax. Arch your back, sticking out your chest, and feel the tension in your upper back. Tense condition is maintained for 10 seconds and then relaxes.

- 12) Take a deep breath and hold it, feeling the tightness in the muscles around your **chest**. Hold it...and then relax, breathing deeply from the abdomen.
- 13) Tighten the muscles of your **stomach**, making the stomach very hard. Hold...and relax
- 14) Stretch both of your legs, straight out in front of you, until you can feel the tension in the backs of your **thighs**. Hold...and then relax.
- 15) Tense both **calf** muscles by stretching your feet and pointing your toes up toward your head. Hold...and then relax.

All the movements were performed each twice and hold the position for 10 seconds and tense when stretched lasting 15-20 seconds.

When people experience tension and anxiety, the sympathetic nervous system works, on the other hand, while at rest, the parasympathetic nervous system works. Thus, muscle relaxation exercises that is performed by tightening and loosening the muscles can reduce tension and anxiety simultaneously; therefore, the resulting counter conditioning between the parasympathetic nervous system and the sympathetic nervous system which would give rise to a feeling of calm and relaxed [16]. When the body relaxes, the heart rate is slowed; hence, it encourages effective blood pumping throughout the body to be effective and decrease blood pressure [17]. The relaxation response that occurs is as part of a general decline in cognitive, physiological, and behavioral stimulation [5]. Relaxation resulting strain on the arteries which causes vasodilatation in arterioles and veins that is facilitated by the vasomotor center, the baroreceptor reflex. Relaxation would reduce the activity of the sympathetic nerves and epinephrine and increase the activity of the parasympathetic nervous system that decreases heart rate, stroke volume (CO), and the arterioles and venules vasodilatation occurs. Cardiac output and total peripheral resistance also decreases and lowers blood pressure.

METHODS

The study was designed as a quasi experimental study. This research was conducted in Desa Gondang, Karangbangun, Matesih on April 2015. Fifteen patients of essential hypertension were recruited for treatment of 7 days. The samples were obtained by purposive sampling. The inclusion criteria for the study were: a) age 34 – 59 years old, with previous Hypertension diagnosis, i.e. systolic blood pressure (SBP)>140 mm Hg and/or diastolic blood pressure (DBP)>90 mm Hg, b) Age> 60 years old, with sistolic pressure > 160 mmHg and diastolic pressure > 90 mmHg. The respondents were not taking any antihypertensive medication and had not been getting physical exercise. The exclusion criteria were: the presence of any comorbidity (i.e., diabetes, chronic heart failure, etc), unstable angina, myocardial infarction, chronicmetabolic, orthopedic, or infectious disease; treatment with steroids, hormones, or cancer chemotherapy. The individuals with sistolic pressure of > 180 mmHg and diastolic pressure > 120 mmHg, and had muscular disorder and back painwere not recruited.

The independent variable in this studywas a progressive muscle relaxation and the dependent variable was blood pressure. Progressive muscle relaxation therapy performed by tensing and relaxing muscles in the arms, hands, shoulders, neck, face, abdomen, and legs for 20 minutes a day for 7 days and twice a day. The subjects' blood pressure was measured twice by digital spigmomanometer Omron Hem-7203.

The data were then analyzed by computer software using the Wilcoxon Signed Ranks Test to determine the difference in blood pressure before and after the progressive muscle relaxation exercises.

RESULT

This research has been conducted in Desa Gondang. All respondents followed a progressive muscle relaxation exercise for 7 days in a row and two times a day.

Table 2. Characteristics of Respondents

No	characteristics	Mean
1.	Age	53.13 year
2.	Body mass index	24.79
3.	Systolic Blood Pressure	
	Pre test	164.86 mmHg
	Post Test	157.40 mmHg
4.	Diastolic Blood Pressure	
	Pre test	96.60 mmHg
	Post test	92.86 mmHg

All of the respondents were female (100%) with a mean age of 53.13 years. An average value of systole blood pressure was 164.86 mmHg with range 140 mmHg to 180 mm Hg. The diastolic blood pressure average was 96.60 mmHg with range 81 mmHg to 110 mm Hg. After being given the treatment of progressive muscle relaxation exercises, there was a decrease in systolic blood pressure by an average of 7.46 mmHg and diastolic blood pressure by an average of 5.73 mmHg (see Tab. 3).

Table 3. Blood Pressure

No	Category	Pre test		Post test	
		SBP (n)	DBP(n)	SBP (n)	DBP (n)
1.	Normal	0	0	0	2
2.	Pre Hypertension	0	2	3	5
3.	Hypertension Stage 1	4	7	3	2
4.	Hypertension Stage 2	11	6	9	6
Total		15	15	15	15

Note: SBP : Systolic Blood Pressure; DBP : Diastolic Blood Pressure

Wilcoxon test with SPSS for systolic blood pressure values obtained $p = 0.008$, which meant that there was a significant difference between the systolic blood pressure on pre-test and post test. This showed that progressive muscle relaxation exercises influenced the decrease in systolic blood pressure in patients with primary hypertension. For diastolic blood pressure results, it was obtained $p = 0.077$, which meant there was no effect of progressive muscle relaxation exercise in lowering diastolic blood pressure in patients with primary hypertension.

DISCUSSION

The results were consistent with the theory that progressive muscle relaxation served as a method to help reduce stress; therefore, encouraged the body to be in the state of relax. The purpose of relaxation is to generate a response that can reduce stress; thus, if relaxation is achieved, then the hypothalamus will adjust and decreased the activity of sympathetic and

parasympathetic nervous systems [9]. A stimulation of sympathetic and parasympathetic nerves affects blood vessels and the systemic arterial pressure. Most of the systemic blood vessels constrict when there is a stimulation of the sympathetic nervous [18].

One of the factors that affects the systolic blood pressure is a psychological condition that the relaxation will give you the sense of tranquility that makes baroreceptor issues action in the hypothalamus to reduce levels of cortisol, epinephrine and norepinephrine which can cause a decrease in blood pressure and pulse rate. The cortisol levels in the blood affect the vasoconstriction of blood vessels. The decreased levels of epinephrine and norepinephrine can cause vasodilation of blood vessels. Vasodilation of blood vessels caused by decreased levels of epinephrine and norepinephrine can decrease total peripheral resistance that will lower blood pressure [19].

Diastolic blood pressure did not decline significantly due to the stable diastolic blood pressure and slightly decreased with age due to a thickening of the myocardium and became less elastic. Heart valves were also more rigid so that when relaxation occurred, the valve could not close properly and the blood flow circulated throughout the body was inhibited; therefore, the heart pumped blood harder leading to high diastolic blood pressure [20]. According to Frank Starling law, the greater the content of the heart during diastole, the greater the amount of blood pumped into the aorta. Physiologically, the heart pumps blood throughout the body and blood back to the heart without causing buildup in the veins. The heart can pump the level of blood count, either it is a lot or few, depends on the amount of blood to flow back from the veins [20].

CONCLUSIONS

It was concluded that progressive muscle relaxation exercise could lower systolic blood pressure in patients with primary hypertension in Gondang; however, similar exercise did not lower diastolic blood pressure. Routine and regular exercise could control the blood pressure of hypertensive patients; therefore, the patients did not need to be dependent on the drugs. Exercise should be done under medical supervision, and it was also important to get their blood pressure checked regularly at the nearest health unit.

For further studies, it would be suggested to increase the number of respondents and pay attention to other factors that can affect blood pressure, such as family history, history of hypertension occurrence, diet, and lifestyle. Other studies had also suggested to combine progressive muscle relaxation exercise with relaxation exercises such as meditation, yoga, deep breathing relaxation (deep breathing); therefore, the obtained results would be much better and the expected results could also be used for long-term treatment.

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