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The effect of progressive muscle relaxation on anxiety and blood pressure among hypertension patients in east Kalimantan, Indonesia☆

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Abstract Hypertension remains a major problem in the health sector and affects both physical and psychological. Hypertension is a chronic disease that may lead to other serious illnesses and anxiety if it is treated improperly. One of the non-pharmacological treatment for lowering blood pressure and anxiety is by relaxation technique, specifically with progressive muscle relaxation technique (PMR). It is to determine the effect of progressive muscle relaxation on anxiety and blood pressure among hypertension patients in A.W. Sjahranie General Hospital, East Kalimantan. This study was conducted using a non-equivalent control group pretest-posttest design. The sampling technique used was the simple random sampling technique. This study involved 91 respondents in A.W. Sjahranie General Hospital, East Kalimantan. They were divided into two groups. The respondents of 71 people were in the intervention group health education and PMR, they exercised 2 times a week for 8 weeks and 20 respondents in the control group were given health education. The research instruments used were questionnaires and blood pressure observation sheets. Measurement of blood pressure (systolic and diastolic) and anxiety was carried out on the fourth week and eighth week. This study used the Paired t-test and Pearson Correlation Test as the data analysis technique. These findings showed that there was a significant difference before and after the fourth and eighth weeks of intervention on systolic and diastolic blood pressure and anxiety ($p = 0.000$). The results showed significant differences between the intervention group and the control group in systolic blood pressure ($p = 0.001$) and diastolic ($p = 0.000$), anxiety ($p = 0.000$). Intervention PMR provides the most powerful influence on systolic and diastolic blood pressure, and anxiety ($p = 0.000$). This study recommends the need

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for PMR exercises for 8 weeks to control blood pressure and anxiety in patients with primary hypertension, and for the hospital, it was suggested to develop PMR as a part of independent nursing practices.

Introduction

Hypertension is a disease that becomes a major problem of health. In 2008, 40% of adults aged 25 years above were diagnosed with hypertension. The mortality rate of the complications of hypertension reaches 9.4 million deaths worldwide each year.[1] Hypertension is often called a ''silent killer'' because it often appears without symptoms until it becomes severe and impacts on other organs.[2]

Hypertension affects both on physical and psychological. Several studies have found that hypertension can cause anxiety.[3,4] Hypertension requires comprehensive pharmacological and non-pharmacological treatment. Since 1983, the World Health Organisation has suggested the use of the non-pharmacological approach in hypertension treatment.[5] Progressive Muscle Relaxation (PMR) is one of the ten therapies that is mostly used in complementary therapy and alternative medication.[6,7]

PMR is a technique developed by Edmund Jacobson in 1920. This technique is designed to create a state of physiological and psychological relaxation in patients. It requires the patient to tense and relax various muscle groups while focusing awareness on proprioceptive and interoceptive sensations.[8,9]

Several studies have found that PMR exercise helps to reduce blood pressure.[6,7,10] Besides, PMR exercise can also reduce anxiety in various diseases.[8,11,12] Based on the explanation above, this study was conducted to determine the effectiveness of PMR exercise on anxiety and blood pressure changes in primary hypertensive patients.

Method

Design and sample

This study used a non-equivalent control group with a pretest–posttest design. The sampling technique used was simple random sampling involving 91 respondents which were divided into 2 groups. The respondents were hypertension patients in grade I and II, with compos mentis awareness (GCS = 15), aged between 26–65 years old with body mass index (BMI) <30 kg/m^2, and got standard antihypertension drugs such as diuretics, beta-blockers, calcium channel blockers and, ACE inhibitors. The study was conducted in April–June 2015 in the Outpatient Department and Cardiovascular Centre of Regional General Hospital of Abdul Wahab Sjahranie, East Kalimantan.

Instrument

Instruments used in this study were a blood pressure measurement tool, the calibrated ''Riester'' mercury sphygmomanometer, pre-test and post-test of blood pressure observation sheets, and a questionnaire to assess the level of anxiety using the Hamilton Anxiety Rating Scale (HARS).

Procedures

91 respondents were divided into 2 groups, 71 respondents in the intervention group, and 20 respondents in the control group. It gave the intervention group health education and PMR exercise 2 times a week for 8 weeks, while the control group was given health education. Measurement of blood pressure (systolic and diastolic) and anxiety was carried out on the fourth week and eighth week.

Data analysis

Validity and reliability tests were conducted before the study began on 30 respondents in the Outpatient Department of Dirgahayu Hospital, Samarinda, East Kalimantan. Data analysis was performed with univariate analysis which is used to present descriptive data, bivariate analysis was done by using a dependent *t*-test (Wilcoxon test) and independent *t*-test (Mann–Whitney test), and multivariate analysis was completed by using ordinal logistic regression test.

Results

Univariate analysis The data from 91 respondents were analysed. Table 1 showed the distribution of respondent characteristics. The majority of the respondents were female (57.1%) and 44% were aged from 56 to 65 years. 61.5% of respondents were primary school graduates while 39.6% of respondents were passive smokers. The data showed that the majority of respondents (61.5%) were e in the lower socio-economic level

Bivariate analysis

Table 2 showed that there was a significant decrease ($p < 0.05$) in systolic and diastolic BP and anxiety levels after the intervention in the fourth and eighth weeks.

Table 3 showed that there was a significant difference ($p < 0.05$) in BP (systolic and diastolic) and anxiety levels between the control and intervention groups in the fourth and eighth weeks.

Multivariate analysis

Based on Table 4, it could be concluded that the independent variables (PMR exercise, age, sex, education level, smoking

Table 1 Distribution of respondent characteristics.

No	Characteristic	*n*	(%)
1.	*Age*		
	26–35	2	(2.2)
	36–45	10	(11.0)
	46–55	39	(42.9)
	56–65	40	(44.0)
2.	*Sex*		
	Male	39	(42.9)
	Female	52	(57.1)
3.	*Education level*		
	None	5	(5.5)
	Primary school	56	(61.5)
	Senior high school	20	(22)
	University	10	(11)
4.	*Smoking history*		
	Do not smoke	32	(35.5)
	Passive smoker	36	(39.6)
	Smoking for a total of $\leq$10 cigarettes/day	3	(3.3)
	Smoking for a total of >10 cigarettes/day	20	(22)
5.	*Socioeconomic*		
	Low	56	(61.5)
	Middle	27	(29.7)
	High	8	(8.8)

Table 2 Dependent *T*-test result.

Variable Y	*p* Value		
	Pre-post 4th week	Pre-post 8th week	Post 4th–8th week
Systolic BP	0.000	0.000	0.000
Diastolic BP	0.000	0.000	0.000
Anxiety	0.000	0.000	0.000

Table 3 Independent *t*-test result.

Y variable	*p* Value	
	4th week	8th week
Systolic BP	0.001	0.000
Diastolic BP	0.000	0.000
Anxiety	0.000	0.000

Table 4 Pseudo *R*-square test.

Dependent variable	Intervention	Cox and snell value
Systolic BP	4th week	0.203
	8th week	0.413
Diastolic BP	4th week	0.195
	8th week	0.404
Anxiety level	4th week	0.258
	8th week	0.468

history, and socioeconomic) contributed to the decrease in blood pressure and anxiety starting from the fourth week of exercise and increasingly showed a good decrease on the eighth week.

Table 5 explained that PMR exercise had the greatest and most significant effect ($p < 0.1$) on systolic BP, diastolic BP, and anxiety in the fourth and eighth weeks of the intervention. Besides being influenced by PMR exercise, it also influences anxiety levels by sex and smoking history variables which have a significant influence on anxiety levels in the eighth week. The level of significant increases in the eighth week.

Table 6 showed that the independent variables (PMR exercise, age,

sex, education level, and socioeconomic) had the greatest effect on anxiety levels simultaneously in the fourth week whereas, in the eighth week, the independent variables had the greatest effect on the blood pressure simultaneously.

Table 5 The amount of each independent variable effect partially.

Independent variable	Parameters estimates 4th week		Parameters estimates 8th week	
	Estimate	*p* Value	Estimate	*p* Value
PMR systolic BP	−1.967	0.001	−4.545	0.000
PMR diastolic BP	−3.930	0.000	−4.545	0.000
PMR anxiety	−3.032	0.000	−5.789	0.000
Sex	0.877	0.165	1.914	0.020
Smoking history	−0.069	0.793	−0.657	0.079

Table 6 Parallel lines test on the fourth and eighth week.

Dependent variable	Intervention	*p* Value	Level
Systolic BP	4th week	0.210	V
	8th week	0.389	III
Diastolic BP	4th week	0.173	VI
	8th week	0.265	IV
Anxiety levels	4th week	0.710	I
	8th week	0.367	II

Discussion

Arterial blood pressure is a function of cardiac output (CO) and systemic vascular resistance (SVR). Either CO or SVR or both can influence the mechanism of regulating blood pressure. The sympathetic and parasympathetic nervous systems are short-term mechanisms in regulating blood pressure.[2,13,14] Hypertension requires patients to adhere to anti-hypertension medication which affects psychological conditions, especially anxiety and depression. Physiological responses associated with anxiety are a stimulus to the hypothalamus, which are the adrenal glands and the activation of the autonomic nervous system. The adrenal gland secretes the adrenaline or epinephrine which causes the increase of oxygen demand, arterial pressure, heart rate, glycogenolysis, and dilated pupils. If the critical condition or anxiety is over, the parasympathetic nerve will work for restoring the body to normal conditions.[4,15,16]

PMR exercise with calm, relaxed, and fully concentrated on muscle tension and relaxation that is performed in 15 min can cause the decrease of CRH (corticotropin-releasing hormone) and ACTH (adrenocorticotrophic hormone) secretion in the hypothalamus. Decreased secretion of these two hormones causes the activity of the sympathetic nerve to be decreased, which results in the reduction of epinephrine and norepinephrine production as neurotransmitters associated with anxiety. On the contrary, the acetylcholine hormone will increase due to the rise of parasympathetic nervous system stimulation.[2,17–19] The norepinephrine system is considered mediating the fight-or-flight response. It locates the norepinephrine in the locus coeruleus, which is connected by neurotransmitters to other structures in the brain associated with anxiety such as the amygdala, hippocampus, and cerebral cortex. Chronic stress causes changes in the amygdala, hippocampus, and cerebral cortex. PMR exercise will reduce epinephrine levels so that stress does not occur and the systemic response decreases.[17,18]

Decreased sympathetic nervous system activity will reduce HR and cardiac contractility, cause extensive vasodilation in peripheral arterioles, and inhibit renin release from the kidneys. The result of decreased sympathetic nervous system activation is a decrease in blood pressure by declining Cardiac Output (CO) and Systemic Vascular Resistance (SVR). Parasympathetic nerves will also decrease blood pressure by declining CO and SVR through the vagus nerve.[2] The effect of PMR exercise on BP (systolic and diastolic) and anxiety was statistically very strong because all tests revealed significant results. Interventions with progressive muscle relaxation techniques showed a significant decrease in systolic blood pressure (5.5 mmHg) and diastolic blood pressure (3.5 mmHg).[7] There was a significant difference in blood pressure before and after PMR exercise.[20,21] PMR significantly decreased patients' perception of stress and increased their perception of health.[12] Relaxation caused by physical/psychological procedures can be as effective as an anxiolytic agent in reducing brain activity during stressful conditions.[22]

The results showed that the effectiveness of PMR exercise was higher in the eighth week than in the fourth week. Based on the literature review, there were no clear sources that discuss the most effective time to do PMR exercises to reduce blood pressure. Previous studies conducted PMR exercise interventions with various practice time. Previous research showed intervened twice a week for eight weeks, with the result that there was a significant decrease in systolic and diastolic blood pressure (192.86/105.16 to 133.46/81.48).[10] Another study showed measured blood pressure 30 min after PMR exercise, with the results showed that there was a significant decrease in systolic blood pressure ($p < 0.01$) and diastolic blood pressure

($p = 0.05$) immediately after progressive muscle relaxation had been done.[5] However, Previous studies conducted PMR exercise twice a day for three months, showed results that only systolic blood pressure experienced a significant decrease in the intervention group after progressive muscle relaxation (137.87 mmHg vs. 142.93 mmHg).

Conflict of interest

The authors declare no conflict of interest.

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