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EFFECTIVENESS OF SLOW DEEP BREATHING ON DECREASING BLOOD PRESSURE IN PRIMARY HYPERTENSION: A RANDOMIZED CONTROLLED TRIAL OF PATIENTS IN ATAMBUA, EAST NUSA TENGGARA

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Abstract

SDB is a no pharmacology therapy applied to reduce blood pressure in patients with primary hypertension. The purpose of this study was to determine the effectiveness of slow deep breathing exercise to reduce blood pressure in patients with primary hypertension in Atambua, East Nusa Tenggara. The study was a quantitative research employing a randomized controlled trial design with pretest and posttest control group. The total number of the respondents was 142 including 33 respondents from the LS group, 37 respondents from the SDB group, 39 respondents from the combination of SDB-LS group, and 33 respondents from the control group. The results showed that there were differences in the reduction of systolic blood pressure between SDB group

accounting for 28.59 mmHg and diastolic blood pressure accounting for 16.92 mmHg. The result of Anova analysis showed that there was a significant decrease on average of systolic blood pressure (P value = 0.002) and diastolic blood pressure (P value = 0.007). This research suggests the application of non-pharmacological actions particularly toward SDB exercise in order to decrease the prevalence of hypertension. This will minimize consequences caused by this problem.

Keyword

Blood Pressure, Hypertension, Slow Deep Breathing

1. Introduction

Hypertension is believed to be the cause of an estimated 7.1 million deaths worldwide, or approximately 13% of total deaths. More than 60 million people in the United States have high blood pressure (Lovastatin, 2005). According to the National Health and Nutrition Examination Survey (NHNES III), in America there are at least 30% of patients with hypertension who are unaware of their condition, and only 31% of patients treated achieve the desired blood pressure targets below 140/90 mmHg (Lovastatin, 2005).

The incidence and prevalence of hypertension continue to increase. This situation is closely related to dietary changes, reduced physical activity, and increase in the incidence of stress and others (Lovastatin, 2005). Household Health Survey in 2004 showed the prevalence of hypertension in Indonesia is quite high at 14% with a range of 13.4% to 14.6%. The prevalence in areas outside Java and Bali is greater than that of in both islands. It is closely related to diet, especially salt intake, which is generally higher outside Java and Bali (Depkes, 2005).

(Vitahealth, 2005) has offered a variety of non-pharmacological attempts to overcome this hypertension, such as herbal therapy, nutritional therapy, progressive relaxation, meditation, yoga, acupuncture, akupressor, music therapy, aromatherapy, flower remedy therapy back, ect. In Atambua there have been a number of strategies applied including exercise "power within" and meditation intended to lower blood pressure. However, they are short-term strategies because they are difficult and require high skills. Due to the ineffectiveness of the strategies the researchers wanted to try a new approach that has never been used in Atambua, East Nusa Tenggara. The approach is Slow Deep Breathing (SDB). This technique is considered very suitable because it can be done anytime, anywhere and by anyone very easily (Sepdianto, 2008). Slow breathing

functions to reduce respiratory frequency from 16 -19 times per minute to 10 beats per minute or less (Anderson, 2008). Regular practice of deep and slow breathing can help regulate blood pressure. A-two-month clinical trial conducted by (Anderson, 2008) with for 2 months indicates that respondents who do slow breathing for 15 minutes per day were found to lower blood pressure by 10-15 points. (Joseph et al., 2005) have also reported in their research on breathing exercises with patients with hypertension that breathing exercises in the frequency of 6 times per minute can increase baroreceptor sensitivity and lower blood pressure. Deep breaths can reduce the activity of the sympathetic nervous system and increase the activity of the parasympathetic nervous system.

Based on the above illustration, the researchers wanted to see the extent to which: "the effectiveness of slow deep breathing to decrease blood pressure in patients with primary hypertension in Atambua, East Nusa Tenggara."

2. Methodology

This study used a Randomized Clinical Trial with the pretest - posttest approach control group design. This study aims to determine the effectiveness of slow deep breathing exercises on blood pressure in patients with essential hypertension in Atambua, East Nusa Tenggara. Respondents were randomly drawn and divided into four groups: low-salt (LS) group with 33 people, SDB group 37 people, a group of a combination of SDB-LS with 39 people, and a control group with 33 people. SDB exercise is performed 3 times a day for 15 minutes each for 14 days. LS is carried out with low-salt diet restrictions that is 2.4 grams / day in the form of sachetan consumed for 14 days. Blood pressure was measured before and after the intervention. While the control group is primary hypertension patients who only used standard antihypertensive drugs.

The participants were selected based on a number of inclusion criteria: (1) Respondents' systolic blood pressure was ≥ 140 mmHg and diastolic blood pressure was ≥ 90 mmHg; (2) Their age raged from 20 to70 years old; (3) They are not obese (BMI ≤ 30); (4) They had never received breathing exercises (yoga, meditation, reiki, gymnastics breath); and (5) Standard antihypertensive therapy. Exclusion criteria: (1) Those who have co-morbidities (diabetes, stroke and kidney failure) were excluded; (2) The ones with the degree of severe hypertension (systolic blood pressure> 200 mmHg and diastolic blood pressure > 120 mmHg) were excluded. Analysis in this study using Bivariate with the paired t-test and ANOVA.

3. Results

Univariate analysis

Table 1: *Distribution of Respondents by Age, Blood Glucose and Body Mass Index (N = 142)*

Variable	Group	N	Mean	SD	Min-Marks	95% CI
	LS	33	47,97	13,616	24 – 70	43,14; 52,80
Age	SDB	37	48,81	10,019	23 – 70	45,47; 52,15
	SDB-LS	39	48,46	7,280	34 – 64	46,10; 50,82
	Control	33	51,03	10,309	27 – 69	47,37; 54,69
	Total	**142**	**49,04**	**10,364**	**23 – 70**	**47,32; 50,75**
	LS	33	104,73	17,992	79 – 164	98,35; 111,111
Blood Glucose	SDB	37	111,00	21,521	83 – 165	103,82; 118,18
	SDB-LS	39	112,97	21,829	84 – 183	105,90; 120,05
	Control	33	104,58	18,298	86 – 145	98,09; 111,06
	Total	**142**	**108,59**	**20,254**	**79 – 183**	**105,23; 111,95**
	LS	33	21,46	2,969	15 – 27	20,41; 22,51
BMI	SDB	37	23,31	2,645	17 – 27	22,43; 24,19
	SDB-LS	39	23,97	2,082	19 – 28	23,29; 24,64
	Control	33	22,84	2,205	18 – 26	22,06; 23,62
	Total	**142**	**22,95**	**2,627**	**15 - 28**	**22,52; 23,39**

(Table 1) shows that the average age of the respondents was 49.04 years (95% CI: 47.32; 50.75), with the youngest age is 23 years old and the oldest is 70 years old. The average overall

blood glucose levels are 108.59 g% (95% CI: 105.23; 111.95), with the lowest value is 79 gr% and the highest is 183 gr%. Average BMI is 22.95 (95% CI: 22.52; 23.39), with the lowest is 15 and the highest is 28.

Table 2: *Distribution of Respondents by Gender, Family History Suffer Hypertension, smoking history, Anti Hypertension (N = 142)*

Variable	**Category**	**Total**	**%**
Gender	Male	63	44,4
	Female	79	55,6
Family	Yes	81	57,04
History	No	61	42,96
Smoking	Yes	37	26,1
History	No	105	73,9
Anti	1 type	91	64
Hypertension	> 1 type	51	36

Based on the (Table 2) it is known that the percentage of female and male respondents was 55.6% and 44.4% respectively. Respondents with and without family history of hypertension were 57.04 and 42.96% respectively. Participants with and without smoking history were 26.1% and 73.9% respectively. Of the respondents, 64% ever consumed one type of antihypertensive medication, while 36% consumed more than one type of antihypertensive drugs.

3.2 Bivariate analysis

Table 3: *The average of differences in Blood Pressure Before and After Intervention on LS Group, SDB, SDB-LS and Control Group in Atambua, East Nusa Tenggara March-May, 2010 (N = 142)*

Variable	Group		Mean	SD	Mean Diff (95% CI)	t	*P value*
TDs	LS	Pre	159,09	14,194	24,091	10,977	0,000*
		Post	135,00	9,080	(19,620 – 28,561)		

	SDB	Pre	157,65	17,694	29,595	10,380	0,000*
		Post	129,05	5,807	(23,007 – 34,182)		
	SDB-LS	Pre	161,41	15,355	23,949	13,599	0,000*
		Post	137,46	9,619	(20,384 – 27,514)		
	Control	Pre	163,70	12,368	16,000	7,681	0,000*
		Post	147,70	9,235	(11,757 – 20,243)		
TDd	LS	Pre	97,58	9,676	12,394	7,863	0,000*
		Post	85,18	4,620	(9,183 – 15,605)		
	SDB	Pre	99,84	7,946	16,919	11,647	0,000*
		Post	82,92	5,225	(13,973 – 19,865)		
	SDB-LS	Pre	99,97	12,138	11,000	7,261	0,000*
		Post	88,97	6,479	(7,914 – 14,086)		
	Control	Pre	99,70	8,053	9,242	4,951	0,000*
		Post	90,45	7,612	(5,440 – 13,045)		

(Table 3) shows that there are significant differences in systolic blood pressure before and after the intervention among LS Group, SDB, SDB-LS and the control group (p value = 0.000). Likewise, there are very significant differences in diastolic blood pressure before and after the intervention at LS group, SDB, SDB-LS and control (p value = 0.000) Trend of Changes in Systolic and Diastolic Blood Pressure after getting intervention.

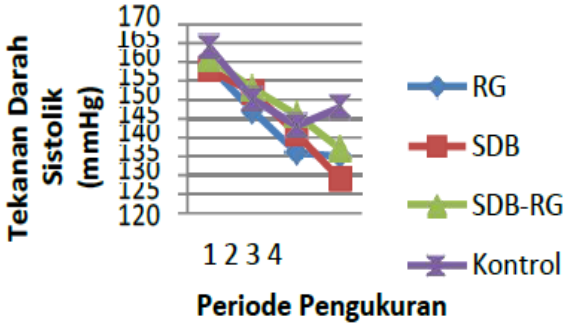

Figure 1: *Trend of Mean Change of Systolic Blood Pressure Measurement among the LS group, SDB, SDB-LS and Control Group in Atambua, East Nusa Tenggara March-May, 2010 (N = 142)*

Based on the (Figure 1) it is known that TDs decreased significantly in all intervention groups, except the control group. At the last evaluation the control group showed a tendency to rise again, while the LS group did not.

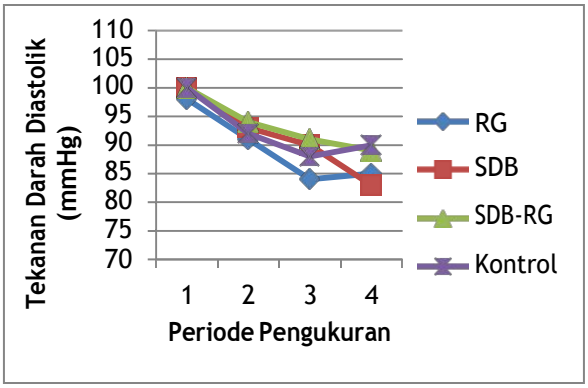

Figure 2: *Trend of Mean Changes in Diastolic Blood Pressure Measurement among the LS group, SDB, SDB-LS and Control Group in Atambua, East Nusa Tenggara March-May, 2010 (N= 142)*

(Figure 2) illustrates that TDD decreased significantly in all intervention groups, except LS group and the control group. At the last evaluation, the two groups showed a tendency to rise again.

Table 3: *The Average of decline in blood pressure in the LS group, SDB, SDB-LS and Control Group (N = 142)*

Variable	**Kel**	**Mean**	**SD**	**F**	***P value***	**Tukey**	***P value***
TDs	LS	24,09	12,6	5,3	0,002*	1-2 1-3	0,492 1,000
Begin-End	SDB	28,59	16,8			1-4 2-3	0,069 0,426
	SDB-LS	23,95	11			2-4	0,001*
	Control	16,00	12			3-4	0,060
TDd	LS	12,39	9,05	4,251	0,007*	1-2 1-3	0,200 0,926

Begin-End	SDB	16,92	8,84			1-4 2-3	0,538 0,038*
	SDB-LS	11,00	9,52			2-4	0,005*
	Control	9,24	10,72			3-4	0,864

(Table 3) shows that the average of reduction in systolic blood pressure in the LS group was 24.09 mmHg with a standard deviation of 12.61; SDB group was 28.59 mmHg with a standard deviation of 16.67; SDB-LS group was 23.95 mmHg with a standard deviation of 11.00; and the control group was 16.00 mmHg with a standard deviation of 12.00. Statistically, it is known that the 5% significance level, there are significant differences in systolic blood pressure after LS diet, exercise SDB, a combination between SDB-LS exercise and control groups at least one group difference (P value = 0.002). Further analysis based on Tukey's test proves that out of the four groups, the most significant decrease in systolic blood pressure occurred in SDB and the control group (P value = 0.001).

The average of reduction in diastolic blood pressure in LS group was 12.39 mmHg with a standard deviation of 9.05; SDB group was 16.92 mmHg with a standard deviation of 8.84; SDB-LS group was 11.00 mmHg with a standard deviation of 9.52; and the control group was 9.24 mmHg with a standard deviation of 10.72. Statistically, it is known that the 5% significance level, there are significant differences in diastolic blood pressure after LS diet, exercise SDB, a combination between SDB-LS exercise and control groups at least one group difference (P value = 0.007). Further analysis based on Tukey's test proves that diastolic blood pressure was significantly different in the four groups, between SDB groups and SDB-LS (P value = 0.038); SDB and the control group (P value = 0.005).

4. Discussion

4.1 Decrease in Blood Pressure after the Slow Deep Breathing Exercise, Low Salt Diet

The average of systolic and diastolic blood pressure is significantly different among the groups after RG diet, slow deep breathing exercise, and combination of SDB and RG as well as control group. The results of the current study confirm the research hypothesis that the average of blood pressure after performing the interventions including RG, SDB, combination of RG and ADB, and control group is different among the groups. The results of the current study indicate

that slow deep breathing can reduce systolic and diastolic blood pressure by 28.59 mmHg and 16.29 mmHg respectively.

The findings of the study are consistent with the results of the previous study by (Sepdianto, 2008) conducted with 56 respondents with primary hypertension (28 respondents were given SDB exercise and the rest were controlled with low salt diet and normal breathing). The results show that SDB can reduce systolic and diastolic blood pressure by 18.18 mmHg and 8.89 mmHg respectively.

(Joseph et al., 2005) conducted a study with a group of 20 respondents with primary hypertension (aged 56.4 ± 1.9 years), and a controlled group of 26 respondents (aged 52 ± 1.4 years). Both groups were given interventions including the exercise of normal breathing, and controlled slow and fast breathing with 6x/minute and 15x/ minute respectively. Blood pressure and breathing interval were measured with a sitting position while doing the intervention. Barorefleks sensitivity was measured with autoregressive spectral analysis and the alpha angle. From the results of his research it is concluded that slow breathing can reduce systolic and diastolic blood pressure in patients with primary hypertension (from 147.7 ± 3.7mmHg to 141 ± 4 mmHg, $p < 0.05$ and from 82.7 ± 3 be 77.8 ± 3.7 mmHg mmHg, $p < 0.01$).

The finding of the current study support the results of a study by Pal, (Velkumary & Madanmohan, 2003) which reports that the slow breathing exercises can improve autonomic function by changing the activity of the sympathetic and parasympathetic. Slow breathing exercises can increase parasympathetic tone, decrease sympathetic activity, improves cardiovascular and respiratory function and reduce the effects of stress.

In addition to exercise a deep breath, it is necessary to consider sodium intake in the daily life. (Astawan, 2009) said that excessive sodium intake increases the concentration of sodium in extracellular fluid. To neutralize it, intracellular fluid should be drawn out so that in the extracellular fluid volume increases. The increase of extracellular fluid will increase the volume of blood which causes the incidence of hypertension. WHO recommends salt intake of 2.4 grams / day equivalent to two tablespoons gelatin.

The results of the current study is contradictive to the findings of a previous study by David McCarron (2009 as cited in Pudjaastuti, 2010) which reported that hypertensive patients should not be afraid of eating foods that contain a lot of salt as salted cake, soy sauce, pickles, etc.

It is elucidated that the effect of salt that has been blamed as the cause of or supporting factor for high blood can be diminished. Rise in blood pressure is not solely because of the salt, but because of the low levels of calcium in the body. In addition to calcium, low magnesium and potassium also contribute to the occurrence of hypertension.

The result of this research is contrary to the opinion of David McCarron (2009, researchers from Oregon Health Sciences University, USA; in Pudjaastuti 2010) which says that people with hypertension do not be afraid to eat foods that contain a lot of salt as salt cake, soy sauce, pickles, etc. explained that the salt that has been blamed as a factor in increasing blood pressure turns the effect can be dieleminir. Rising blood pressure is not solely because of the salt, but because of the low levels of calcium in the body. In addition to calcium, low magnesium and potassium also contribute to the occurrence of hypertension.

According to researchers, the majority of respondents in this study came from the coastal areas where they are most likely to consume a high-salt since childhood. Their tongue has been patterned with a salty taste so eating low salt foods (fresh food) will cause bad taste. It is necessary to reduce the proportion of salt intake which can lead to lowering blood pressure. This is highly recommended especially for respondents who are in a high possibility for hypertension.

Although David (2009, as cited in Pudjaastuti, 2010) has said that people with hypertension do not be afraid of eating salty foods, but this should be anticipated with the understanding that it is necessary to balance the levels of potassium, calcium and magnesium in the daily diet. Researchers assume that salt intake should be regulated because high salt intake can cause high blood pressure as well.

5. Conclusion

The results of the current study show that slow deep breathing exercises can reduce systolic blood pressure and diastolic blood pressure by 28.59 mmHg and 16.92 mmHg respectively. There is a significant relationship between Slow Deep Breathing and Primary Hypertension among patients in Atambua, East Nusa Tenggara (p value = 0.001; $\alpha = 0.05$). Therefore, researchers recommend further research on the functions of slow deep breathing which are not covered in this study. The results can be used to contribute to tackling hypertension problem in Atambua and other similar settings.

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