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The Effects of Chromotherapy on the Stress Level of Patients with Hypertension

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Abstract : *Hypertension contributes to 7.5 million deaths or 12.8% of the total mortality rate globally, making it one of the major health problems and is the leading cause of death every year. The high mortality and morbidity rate of hypertension are related to depression and stress. Hence, preventive actions in reducing the stress levels and blood pressure are required. Chromotherapy is a non-pharmacological therapy option to lower blood pressure that has several advantages; inexpensive, easy implementation, and minimal side effects. This research aimed to determine the effectiveness of chromotherapy on the stress level of patients with hypertension. This is a pre-and-post-test quasi-experimental study involving 120 patients with hypertension. The chromotherapy effectively reduce stress level and blood pressure of the treatment group (p<0.05). Moreover, the mean score of stress level of treatment group was decreased to 40.10 (± 10.516), while the control group experienced the opposite; an increased mean score to 80.90 (± 12.288). Furthermore, the decreased blood pressure of treatment group was observed by 10-14 mmHg after chromotherapy treatment was given. The chromotherapy is a new innovation in complimentary therapy and can be used as an alternative non-pharmacological treatment that effectively reduces stress level and blood pressure.*

Keywords: *Chromotherapy, Electromagnetic radiation, Hypertension, Stress level*

INTRODUCTION

The prevalence of hypertension is increasing every year and is a leading cause of 13% global mortality. This condition is projected to increase up to 30% of global mortality in 2025 (M. Z. I. Chowdhury et al., 2020). Most of the hypertension-related-death in the world occur in low-and-middle-income countries (31,5%) compared to high-income countries (28.5%) (Mills et al., 2016). Indonesia is one of the middle-income countries whose prevalence of hypertension has increased from 25.8% in 2013 to 34.1% in 2018 (Kemenkes RI, 2018). The national prevalence for coronary heart disease is 1.5%, and the highest prevalence is in East Nusa Tenggara (NTT) province at 4.4%. The main correlated conditions to the high morbidity and mortality rate of hypertension are mental illnesses such as stress, anxiety, and depression.

The World Health Organization (WHO) estimated that depression and stress will affect 300 million people, or about 4.4% of the global population increasing their blood pressure (Marcus et al., 2012). Stress treatment is an integral part of hypertension medication, which pharmacological treatment for this problem is considered more expensive (Giummarra et al., 2020). Although stress and hypertension treatment involve pharmacotherapy, people nowadays seek non-pharmacological alternatives to cure stress; due to the high-cost treatment and side effects. Therefore, people who experienced mild to the severe problem tend to reduce their stress level through a complementary therapy and alternative treatment (CAM) which is relatively cheaper and has minimal side effects (Khalifeh, 2017).

Complementary and alternative therapies are therapies, products, and medicinal intervention that are considered to have the same efficacy with pharmacological therapy, but has lower side effects (Manley, 2013). Chromotherapy is an alternative complementary treatment that might help to reduce stress levels and blood pressure in hypertension patients.

Chromotherapy or colour therapy is a complementary alternative treatment recommended globally, utilizing electromagnetic radiation and several colour frequencies to affect human neurohormonal pathways. With this mechanism, chromotherapy can cure various diseases (Ifdil et al., 2019), (Gul et al., 2015)(Azeemi et al., 2019). The colour effects work by intervening the action of the sympathetic and parasympathetic nerves. Colour therapy provides the relaxation element, reducing an individual's anxiety level (Zola et al., 2018), (Sembian & Malar, 2016). The use of green and blue lights in chromotherapy help reduce the stress levels and lower blood pressure in patients with hypertension via epinephrine hormone stimulation (S. Chowdhury & Chakraborty, 2017) , (Yousuf Azeemi & Raza, 2005). This study aimed to determine the effectiveness of chromotherapy in reducing stress level of hypertension patients in Oesapa Primary Health Care Centre (Puskesmas). It can be hypothesized that chromotherapy can significantly reduce stress level and lower blood pressure in patients with hypertension.

METHODS

This is a quasi-experimental study with one group pre- and post-test with one control group design. The treatment group was given chromotherapy treatment, while the control group was not. The stress level and blood pressure were measured at baseline (pre-test) and after the treatment was performed (post-test) for both groups (Luthfiyah & Fitriyah, 2017). A total of 120 hypertensie patients have participated in this study. The participants were divided equally into two groups; 60 participants in the treatment group and another 60 participants in the control group. Sample measurement using g power software. The stress level was measured at baseline using the Depression Anxiety Scale (DASS 24) questionnaire, as well as their blood pressure. Data were analysed using Mann-Whitney U test to determine any difference between the pre- and post-test scores for each group. The level of significance was determined at p-value < 0.05. Statistical analysis was performed using IBM SPSS™ software.

This study incorporating a combination of green and blue LED lights. Each device consists of 5 green and blue light bulbs arranged crosswise. The intervention was conducted in a closed room using a 50 cm light transmission device, and then hung or placed 210 cm above the participant's body and left for 15-35 minutes. Participants were requested to relax and close their eyes during the intervention. After the intervention, the respondent's stress level and blood press were measured again.

RESULTS

Characteristic of Participant

Table 1. Characteristics of Participants based on Gender, age, and education level of The Working Area of Oesapa Primary Health Care Center Kupang

Characteristic	Category	Groups				p-value
		Intervention		Control		
		N	%	N	%	
Gender	Male	28	46,7	30	50	
	Female	32	53,3	30	50	0,592
Total		60	100	60	100	
Age	40-45	18	30	17	28,3	
	46-50	29	48,3	29	48,3	0,201
	51-55	13	21,7	14	23,3	
Total		60	100	60	100	
	SD	3	5	3	5	
	SMP	4	6,7	8	13,3	
Level of Education	SMA	25	41,7	22	36,7	
	S1	26	43,3	26	43,3	
	S2	2	3,3	1	1,7	
Total		60	100	60	100	

Characteristic of Stress Levels of Hypertensive Patients

The pre-test was performed at baseline to understand the respondent's initial stress level and blood pressure before chromotherapy treatment was given, also ensure the quality and equal data distribution in both treatment and control groups. A normality test was performed using one-sample Kolmogorov Smirnov test, a normally distributed data should have a *p*-value > 0.05. The homogeneity test was performed using Levene's test of homogeneity of variance. A *p*-value > 0.05 indicates that the variance between treatment and control groups was considered as homogenous.

Table 2. Stress Level Of Hypertensi Sufferers Before Given Chromotherapy Of The Working Area Of Oesapa Primary Health Care Center Kupang

Variable	Groups	N	Mean	SD	Min-Max	Normality (p-value)
Stress Level	Intervention	60	18,77	2,295	15-24	0,001
	Control	60	18,88	2,210	15-24	
Homogeneity	(p=0,686)					
Chromotherapy	Intervention	60	1,00	0,000	1-1	0,000
	Control	60	2,00	0,00	2-2	

Table 2. shows that the stress level of hypertension patients in Oesapa Primary Health Care Centre was not normally distributed in both groups with *p*-value > 0.001. In term of homogeneity, there is a significant difference of mean score during pre-test and chromotherapy between treatment and control groups.

Table 3. Distribution Stress Level of Hypertension of The Working Area of Oesapa Primary Health Care Center Kupang

Variables	Category	Pre-test		Post-test	
	Intervention	**F**	**%**	**F**	**%**
Stress Level	Normal (0-14)	0	0	25	42
	Lower Stress (15-18)	28	47	31	52
	Moderate Stess (19-25)	32	53	4	6
	High Stress (26-33)	0	0	0	0
	Very High Stress (>34)	0	0	0	0
	Total	60	100%	30	100%
	Control			30	100
	Normal (0-14)	0	0	0	0
	Lower Stress (15-18)	28	47	27	45
	Moderate Stess (19-25)	32	53	33	55
	High Stress (26-33)	0	0	0	0
	Very High Stress (>34)	0	0	0	0
	Total	30	100%	30	100%
Blood Pressure	**Intervention**	**Pre-test**		**Post-test**	
	Normal	0	0		0
	Pre Hypertension	0	0	1	1,7
	Stage 1 Hypertension	13	21,7	38	63,3
	Stage 2 Hypertension	45	75	21	35
	Isolated Systolic Hypertension	2	3,3	0	0
	Total	60	100%	60	100%
	Control				
	Normal	0	0	0	0
	Pre Hypertension	3	5	0	0
	Stage 1 Hypertension	29	48,3	19	32,7
	Stage 2 Hypertension	27	45	39	65
	Isolated Systolic Hypertension	1	1,7	2	3,3
	Total	60	100%	60	100

Table 3 shows that chromotherapy treatment can reduce stress levels. Initially, the majority of the participants had moderate stress (53%). Then, after chromotherapy treatment, an improvement in stress level to mild (52%) was recorded. Meanwhile, there were no significant difference observed in the stress level of control group; moderate (53%) at pre-test and 55% at post-test. Most of the participants in treatment group had level II hypertension (75%) at pre-test. After receiving chromotherapy treatment and the blood pressure was re-evaluated, the blood pressure had improved to level I hypertension (63.3%). On the contrary, there was no significant decrease in blood pressure of for the control group; level I hypertension (48.3%) at pre-test and increased to level II hypertension (65%) at post-test.

Table 4. Distribution Blood Pressure Stress Intervention and Control Groups of Working Area of Oesapa Primary Health Care Center Kupang

Resp	Blood Pressure Reduction Intervention Groups	Blood Pressure Reduction Control Groups	Resp	Blood Pressure Reduction Intervention Groups	Blood Pressure Reduction Control Groups
1	5 mmHg	0 mmHg	31	20 mmHg	5 mmHg
2	10 mmHg	0 mmHg	32	15 mmHg	10 mmHg
3	5 mmHg	20 mmHg	33	15 mmHg	10 mmHg
4	0 mmHg	0 mmHg	34	20 mmHg	0 mmHg
5	5 mmHg	0 mmHg	35	10 mmHg	0 mmHg
6	5 mmHg	0 mmHg	36	10 mmHg	0 mmHg
7	10 mmHg	5 mmHg	37	10 mmHg	0 mmHg
8	10 mmHg	0 mmHg	38	10 mmHg	0 mmHg
9	10 mmHg	0 mmHg	39	10 mmHg	0 mmHg
10	5 mmHg	0 mmHg	40	10 mmHg	0 mmHg
11	10 mmHg	0 mmHg	41	10 mmHg	0 mmHg
12	15 mmHg	0 mmHg	42	15 mmHg	0 mmHg
13	5 mmHg	10 mmHg	43	10 mmHg	0 mmHg
14	5 mmHg	0 mmHg	44	10 mmHg	0 mmHg
15	10 mmHg	0 mmHg	45	0 mmHg	0 mmHg
16	10 mmHg	0 mmHg	46	10 mmHg	0 mmHg
17	10 mmHg	0 mmHg	47	20 mmHg	10 mmHg
18	0 mmHg	0 mmHg	48	20 mmHg	10 mmHg
19	180/90	0 mmHg	49	10 mmHg	10 mmHg
20	160/100	0 mmHg	50	10 mmHg	0 mmHg
21	5 mmHg	0 mmHg	51	10 mmHg	0 mmHg
22	20 mmHg	0 mmHg	52	10 mmHg	0 mmHg
23	0 mmHg	0 mmHg	53	10 mmHg	0 mmHg
24	10 mmHg	0 mmHg	54	10 mmHg	10 mmHg
25	10 mmHg	0 mmHg	55	10 mmHg	0 mmHg
26	10 mmHg	0 mmHg	56	10 mmHg	10 mmHg
27	10 mmHg	0 mmHg	57	20 mmHg	0 mmHg
28	10 mmHg	0 mmHg	58	15 mmHg	0 mmHg
29	15 mmHg	0 mmHg	59	20 mmHg	0 mmHg
30	10 mmHg	5 mmHg	60	10 mmHg	0 mmHg

Table 4. Showing the results of the blood pressure of the intervention and control groups before participating chromotherapy did not experience a significant difference, namely the mean blood pressure of the treatment group was 172/96 mmHg and the group 166/96 mmHg. Meanwhile, after

participating chromotherapy, there was a decrease in the average blood pressure of the intervention group, namely 168/93 mmHg and the control group did not experience a decrease in blood pressure, namely 166/97 mmHg. So that the average decrease in blood pressure after following chromotherapy is 10-14 mmHg

Table 5. Analysis Mean Level Stress Of Intervention And Control Groups

Stress Level	**Groups**	**Mean**	**SD**	**Min-Max**	**p-value**
Before intervention Chromotherapy	intervention (n=60)	59,48	2,295	15-24	0,745
	Control (n=60)	61,53	2,210	15-24	
After intervention Chromotherapy	intervention (n=60)	40,10	10,516	5-19	0,000
	Control (n=60)	80,90	12,288	15-22	
Blood Pressure	**Control**	**Mean**	**SD**	**Min-Max**	**p-value**
Before intervention Chromotherapy	intervention (n=60)	69,81	0,469	3-5	0,001
	Control (n=60)	51,19	0,596	2-5	
After intervention Chromotherapy	intervention (n=60)	49,99	0,510	2-4	0,000
	Control (n=60)	71,01	0,524	3-5	

Table 5 indicates that the mean stress level of treatment group before the intervention was 59.48, while the control group was 61.53 (± 13.101). Further analysis using the Mann-Whitney U test revealed no significant difference in stress level between the treatment and control groups (p= 0.745) before chromotherapy treatment. After chromotherapy treatment, stress level of the treatment group significantly decreased (p= 0.000) compared to the control group. Furthermore, the mean stress level in the treatment group lowered to 40.10 (± 10.516), while the mean stress level in the control group unexpectedly increased to 80.90 (± 12.288).

DISCUSSION

This quasi-experimental study is one of the initial studies exploring the effects of colour therapy on stress levels of hypertension patients. In chromotherapy, colour is a form of electromagnetic energy and visible light. When it enters the retina's photoreceptors, it will be translated as a colour that stimulates the pituitary and pineal glands to produce hormones such as serotonin and endorphin. These hormones are secreted as a response to light to maintain psychological health, balancing mood, feelings and behaviour (Hermida et al., 2018), (Paragas et al., 2019). This study uses green and blue light that specifically have been proven to reduce stress levels and blood pressure by utilizing reflected green and blue light. Combining these colours with light could selectively repair damaged cells and provide the healing energy needed (Rezende, 2021), (Azeemi et al., 2019), (S. Chowdhury & Chakraborty, 2017).

A report by Gul et al. (2016) reinforced the result of this study which exhibits both mild and severe stress in both groups during pre-test. After treatment group received chromotherapy treatment, there was a reduce in mean stress score up to 40.10 with a p-value of 0.000. This means that there was a change in the initial stress level. Moderate stress that initially accounted for 53% plummeted to 6%. Participants with mild stress rose to 52% from previously 47%. Furthermore, 42% of the participants recorded a significant change of stress level from mild stress to no stress or normal. Meanwhile in control group who did not receive chromotherapy, no improvement of stress level was recorded (Rezende, 2021), (Gul et al., 2015).

Additionally, chromotherapy not only reduce stress level, it also lowers blood pressure. Results indicated a decline of the mean blood pressure in treatment group from 172/96 mmHg during pre-test, to 158/93 during post-test. It suggests a drop of 10-14 mmHg. In the meantime, control group did not record any significant change with a mean blood pressure of 166/96 mmHg during pre-test and 166/97

during post-test. Still, a reduce in blood pressure can also be explained by categories of hypertension. Before the treatment, most of the participants in treatment group were at level II hypertension (75%). Post-test measurement after the chromotherapy treatment, displayed an improvement with 63.3% of the participants recorded level I hypertension. On the other hand, no signify cant change was found. Most of participants in control group recorded level I hypertension during pre-test (48.3%) and level II hypertension at post-test (65%).

The mechanism of chromotherapy in the body utilise electromagnetic radiation and different colour frequency by affecting the human neurohormonal system from the sympathetic and parasympathetic nerves thus giving it relaxation effect, which can reduce anxiety (Zola et al., 2018) (Ifdil et al., 2019) (Gupta & Delhi, 2021) (Dr. Meghamala. S. Tavaragi & Mrs. Sushma. C, 2016). Also, chromotherapy can heal various illnesses by utilising seven colour lights, for example yellow for gastric ulcer, a combination of red and blue for skin infection, etc. The effect of colour and light from chromotherapy can be used as an easy, inexpensive alternative nonpharmacologic treatment with minimum risk of side effects.

This study has several limitations, a relatively small sample size (120 participants) with a short time span to measure stress level and blood pressure which was within the three-times-intervention. However, this study has shown the efficacy of chromotherapy using green and blue lights after accounting for several biases during the study.

Nurses can implement chromotherapy in their environment as an alternative treatment aside from pharmacologic medication which is a new innovation in complementary therapy. Also, this study adds to the nursing reference regarding the efficacy of colour therapy in reducing stress and lowering blood pressure in hypertension patients. It is recommended for forthcoming studies to increase the sample size and lengthen the timespan of the measurement by also including other colour lights.

CONCLUSION

Chromotherapy with a combination of green and blue lights is proven to be effective to stimulate the pituitary and pineal glands to produce hormones such as serotonin and endorphin thus maintaining psychological health, balancing mood, feelings, repairing impaired cells and providing healing energy that the body needs. Therefore, this study recommends the use of chromotherapy to reduce stress and lower blood pressure for hypertension patients.

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