

HATHA YOGA AND TAI CHI DECREASE BLOOD PRESSURE IN PRE ELDERLY

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ABSTRACT

Increasing of life expectation the health problem that suffered by the elderly become more complex. The problem in health which is often occurred that is instability of blood pressure which dominated by hypertension. One of methods to decrease high blood pressure is by increasing physical activity. Physical activity reduces the risk of hypertension by decreasing resistance of blood pressure and suppressing the activity in sympathetic nerves and renin-angiotensin system. This research aims to discover Hatha Yoga and Tai Chi in decreasing blood pressure in pre-elderly with grade I hypertension in Banjar Batu, Badung Regency. This research used experimental design with pretest and posttest two group design. Group I was given Hatha Yoga and Group II was given Tai Chi. The sample in this research was 20 people who suffered grade I hypertension and aged in 45-49 years old. The training was done in 6 weeks. The result of the research shows that the decrease of blood pressure is shown Group I in systolic is $5,60 \pm 1,43$ mmHg and diastolic is $4,00 \pm 1,94$ mmHg, with value $p=0,00$. In Group II, there is a decrease in systolic blood pressure is $4,90 \pm 0,99$ mmHg and diastolic $4,30 \pm 2,05$ mmHg, with value $p=0,00$. There is no significant difference in the decrease of blood pressure between Group I and Group II with blood pressure in systolic is $p=0,378$ ($p>0,05$) and in diastolic is $p=0,805$ ($p>0,05$). Hatha Yoga is as good as Tai Chi in decreasing blood pressure in pre-elderly with grade I hypertension.

Keywords: *Hatha Yoga; Tai Chi; Pre Elderly; Grade I Hypertension*

INTRODUCTION

Indonesia in one of countries in South East Asia which has a history of significant increasing number of elderly people along with the increase of health quality that affects the increase of its citizen's life expectancy. As the time goes by and increasing age will affect a person's physical and mental condition. This process is naturally happened in all living things and is the last phase of life span. This condition needs to have more attention from government and society, so that a person who is in his/her old age can improve his/her life quality. The elderly will experience degenerative process in physiologically and morphologically which affect in the change of their physic, mental and psychosocial.

Health problem which oftenly occurred in old age is unstable blood pressure which dominates by high blood pressure. Hypertension is the increasing blood pressure in persistent or continuous condition which exceed the normal limits where the systolic pressure is above 140 mmHg and diastolic is above 90 mmHg. Hypertension is one of the main factors to heart problems. In the most cases, hypertension is detected during physical examination because of certain disease, which is often called as silent killer. The patients experience complication in vital organs, such as heart, brain and kidney. The symptoms of hypertension are dizziness, visual disturbance and headaches which often occur when the blood pressure has reach certain significant levels¹.

Based on World Health Organization (WHO), cardiovascular disease is one of disorders in heart and blood vessels which cause 17,9 million people died in each year with estimation 31% in worldwide deaths and hypertension is one of the main cause of early death. It is approximately 1,13 million people in all around the world suffer from hypertension, especially in low and middle income countries². The treatments for hypertension is broadly divided into 2, those are medicine treatment (pharmacology) and non-medicine treatment (nonpharmacology). Nonpharmacology treatment is a method which modifies the energy that is by doing organized, targeted and programmed active movement training. The purpose

of hypertension medication is not only to decrease the blood pressure, but also decrease and prevent complication that can be happened due to hypertension in the patients ¹.

Physical activities reduce the risk of hypertension by decreasing resistance of blood pressure and suppressing the activity in sympathetic nerves system and renin-angiotensin system. Doing aerobic for 30-45 minutes/day reduces the risk of hypertension for 19-30%. Type of effective exercise in decreasing hypertension is aerobic exercise with moderate intensity (60-75%) which is done for 15 until 60 minutes for 3 times in a day ³. The medical condition of hypertension is different with healthy people, therefore exercise needs to be done gradually in particular and should not strain ourselves which will affect to physical and pshycological stress. Type of exercise which is suitable for this case is Hatha Yoga and Tai Chi.

Hatha Yoga is an exercise which uses various techniques to form postures (asana) included breathing technique (pranayama) to achieve a balance to different powers in the body with physical movement from gentle to athletic that can help blood flow so the body becomes healthy. Meanwhile, Tai Chi is a low impact exercise program which combines breathing practice, relaxation and structure of slow and smooth movements. The basic movement in Tai Chi is a series of individual movements which is connected together in a continuous manner that flow smoothly from one movement to another, maintain deep diaphragmatic and rhythmic breathing also integrates into body movements to harmonize body balance. Based on the background above, then the research was done towards Hatha Yoga and Tai Chi in decreasing blood pressure in pre-elderly with grade I hypertension.

METHODS

a. Methodology

Study Design

This research used experimental design approach with pre test and post test two group design. There were two groups which were chosen randomly, where Group I was given Hatha Yoga training and Group II was given Tai Chi training. The scope of this research is limited geriatric physiotherapy to verify the research result of Hatha Yoga and Tai Chi training in decreasing blood pressure in pre-elderly with grade I hypertension.

Subjects Recruitment

The population in this research is all pre-elderly citizen with grade I hypertension in Jalan Pantai Pererenan, Banjar Batu, Canggu village, Mengwi sub-distric, Badung regency, Bali. The used sample is all population which qualify with inclusion criteria that is those who aged in between 45 until 59 years old, diagnosed with grade I hypertension (however not taking regular medication), normal BMI (18,50-25,00 kg/m²). The exclusion criteria is the pre-elderly who diagnosed with other heart diseases, Diabetes Mellitus, respiratory disease, kidney illness and there are injuries or limb defects which cause movement disorders, while the drop out criteria is those who experienced injuries during training and do not participate in the training for 6 times.

Sampling Technique

Sampling techniques used in this research is purposive sampling that is a technique to determine the sample with certain consideration based on the desired purposes. The sample which is used in this research is 20 people which are divided into two training groups. Group I was given Hatha Yoga training and Group II was given Tai Chi training.

b. Material and Procedure

- i. The selection of sample was obtained from the population that had meet the inclusion criteria, then agreement form (informed consent) was signed and random allocation was redone by randomizing the names of sample until it was divided into Group I and Group II. The measurement of systolic and diastolic blood pressure using digital measuring instruments is prepare the respondents to sit or lie down, try to relax before inflating the cuff, press the button start and record the blood pressure when the results are visible.



Figure 1. Measuring of Blood Pressure

- ii. Group I was given Hatha Yoga which is a training system by using techniques to form postures (asana) includes with breathing techniques (pranayama) which focused in long inhalations, breath retention and conscious exhalation, concentrate while doing the postures and movements ⁴. In Group II was given Tai Chi that is a training with slow speed which is done in 24 movements (opening posture of Tai chi, wild horse shakes its mane, white crane spreads its wings, brush knee, playing the guitar, step back and repulse monkey, hold the ball, grasp sparrows tail, waving hands like clouds, single whip, clouds hands, put the horse on the back, kick with right heel, both fists, kick with left heel, snake creeps down, fair lady works the shuttles, pick up the needle from the bottom of the sea, flashing the arms like a fan, right back fist, deflect parry and punch, apparent close and push, cross hands, closinh pusture of Tai chi) ⁵. The training dose which was given to both group is in 3 times a week, with 45 minutes duration and led by training instructors.
 - iii. Pretest in measuring initial blood pressure of Group I and Group II was given before training. Then posttest was done to remeasure blood pressure after 6 weeks of training in both Group I and Group II. The collected data was analysed and report was done which is related with the conducted research.
- c. Assessment
- Variabel measured in this research were pre-elderly who had been diagnosed with grade I hypertension (systolic blood pressure >130-140 mmHg and diastolic >80-90 mmHg). Measured using an automatic sphygmomanometer.
- d. Data Analysis
- After all data was collected, the data was proceeded and analysed by using computer program IBM SPSS Statistics for Windows, Version 16.0. Armonk, NY: IBM Corporation.
1. Data normality test was done by using Saphiro-Wilk test, The value is $p > 0,05$ which means that the data is normally distributed
 2. Data homogeneity test was done by using Levene's test, which the value is $p > 0,05$. It can be stated that the data is homogeneous
 3. Hypothesis test
 - a. Comparative test of both groups used Paired-Sample T Test to discover the effect of training toward blood pressure in before and after 6 weeks training with the significance limit is $\alpha = 0,05$
 - b. Comparative differential test result after 6 weeks of training in both groups by using Independent-Sample T Test with significance limit is $\alpha = 0,05$

RESULT

Table 1. The Characteristics of Research Subject

Subject Characteristics	N (people)	Group I Average±SB	Group II Average±SB
Age (year old)	10	53,60±3,80	55,00±4,08
BMI (kg/m ²)	10	23,22±2,19	23,60±1,35
Systolic blood pressure (mmHg)	10	145,20±6,02	147,10±5,32
Diastolic blood pressure (mmHg)	10	92,10±6,26	92,90±3,07

Table 1 shows that the characteristics of 20 samples which include the data of age, BMI, systolic and diastolic blood pressure before training.

Table 2. Descriptive Data of Initial Blood Pressure and After 6 Weeks of Training

	Group I Average±SB		Group II Average±SB	
	Systolic	Diastolic	Systolic	Diastolic
Pre (mmHg)	145,20±6,02	92,10±6,26	147,10±5,32	92,90±3,07
Post (mmHg)	139,60±5,58	88,10±5,54	141,80±5,30	88,60±3,02
Decrease (mmHg)	5,60±1,43	4,00±1,94	4,90±0,99	4,30±2,05

Table 2 indicates that there is a decrease of systolic and diastolic blood pressure after 6 weeks of training. In Group I, the average of systolic blood pressure is decreased for 5,6 mmHg and diastolic blood pressure is decreased for 4 mmHg. Meanwhile in Group II the average of systolic and diastolic blood pressure are decreased in each for 4,9 mmHg and 4,3 mmHg.

Table 3. The Result of Normality and Homogeneity Test of of Initial Blood Pressure Data and After 6 Weeks of Training

		Normality Data ¹		Homogeneity ²
		Group I	Group II	
Pre (mmHg)	Systolic	0,064	0,052	0,834
	Diastolic	0,219	0,332	0,169
Post (mmHg)	Systolic	0,089	0,097	0,738
	Diastolic	0,521	0,267	0,107

¹Saphiro Wilk Test

²Levene's Tests

Table 4. Differential Test of Blood Pressure in Before and After 6 Weeks of Training

	Pre (mmHg) Average±SB		Post (mmHg) Average ±SB		P Value ³
	Sistol	Diastol	Sistol	Diastol	
Group I	145,20±6,03	92,10±6,26	139,60±5,58	88,10±5,54	0,00
Group II	147,10±5,32	92,90±3,07	141,80±5,30	88,60±3,02	0,00

³Paired-Sample T Test

Table 4 shows that the blood pressure in before and after training of Group I and Group II the value is $p = 0,000 (<0,05)$. So that, from the result it is stated that Hatha Yoga and Tai Chi training can decrease systolic and diastolic blood pressure in pre-elderly with grade I hypertension.

Table 5. Differential Test of Blood Pressure in Before and After 6 Weeks of Training in Group I and Group II

Blood Pressure (mmHg)		Group I	Group II	P Value ⁴
		Average±SB	Average ±SB	
After 6 Weeks	Systolic	139,60±5,58	141,80±5,30	0,378
	Diastolic	88,10±5,54	88,60±3,02	0,805

⁴Independent-Sample T Test

Table 5 shows that the differential average analysis result of blood pressure between Group I and Group II after training for 6 weeks is that systolic blood pressure is $p=0,378 (>0,05)$ and diastolic blood pressure is $p=0,805 (>0,05)$. This indicates that there is no significant difference, means that Hatha Yoga has a similar effect with Tai Chi in decreasing blood pressure.

DISCUSSION

The result of this study shows that age is the risk factor of hypertension which cannot be modified. The increase of age will also increase the risk of hypertension. It is caused by lack of elasticity in arterial vessels. Gender is also a risk factor which cannot be modified. It is expected that men suffer from hypertension more than women due to a lifestyle which tends to increase blood pressure. After menopause the prevalence of female hypertension is increased⁶. However, from the result of this study it is obtained that the pre-elderly who suffers from hypertension is more in women (17 people) compared to men (3 people). In the previous study finds that increasing prevalence of hypertension in both men and women who are between 35 until 64 years old with increasing in aged and it is proved to be happened more in women than men. The prevalence is increasing approximately 20% in every 10 years. As the age is increasing, there is a possibility that the number of pre-hypertension respondents will develop to be full hypertension due to external factors (lack of physical activity, obesity, exceed salt consumption, smoking and others)⁷. Other studies find in the result that the elderly who are female have a 0.980 times risk of suffering from hypertension compared to men⁸.

The theory of obesity is related with hypertension cases (renin-angiotensin-aldosterone system) and as a risk factor which can be modified. Unmobiiled lifestyle and energy dense food consumption can cause a person to be overweight and then become obese. However, from the research result obtains BMI is still categorized as normal with the lowest is $18,75 \text{ kg/m}^2$ and the highest is 25 kg/m^2 has a possibility to experience hypertension. The previous study which is done to 202 respondents with cross sectional approach, the BMI is categorized as underweight in 24 respondents, normal in 71 respondents, overweight in 31 respondents and obesity in 76 respondents. The measurement result in the correlation of BMI and blood pressures is $p<0,05$ shows that there is a correlation between BMI and systolic blood pressure and diastolic blood pressure⁹.

Anti-hypertensive medication therapy which is not regularly applied also affects blood pressure so it tends to be uncontrolled with systolic blood pressure is $>140 \text{ mmHg}$ and diastolic blood pressure is $>90 \text{ mmHg}$ that can cause complication. While performing aerobic physical activities, the blood pressure during doing exercise will sufficiently increase but then immediately drop after exercise to below normal and last in minimum for 30 minutes. If this physical activity is performed repeatedly and regularly, the decrease in blood pressure will be longer because of the adaptation in the body. In the previous study toward 10 people who suffer hypertension, despite of the different kind of exercise which is given, that is walking for 30 minutes for 6 weeks shows that regular physical activity has an effect to work efficiency of the heart. The controlled blood pressure in hypertension is happened because of the volume adjustment of liquid, blood vessels are dilated and there is relaxation of blood vessels, so that blood pressure decrease¹⁰.

The Effect of Hatha Yoga and Tai Chi Towards Blood Pressure

Based on the result of data analysis in before and after treatments of both groups by using paired sample t-test (Table 4), it is obtained that $p<0,05$, which means that the treatment of Hatha Yoga and Tai Chi can decrease systolic and diastolic blood pressure in pre-elderly who suffers hypertension.

The increase of age which is followed with the decrease function of organ and body system which happened naturally have caused many cases in heart and blood vessels which impact the increase of blood pressure. When the blood pressure rises, a method which can be used to decrease it is by increasing physical activity which is performed in planned and regularly schedule. In the previous research, it is proved that there is a decrease in blood pressure by performing physical activities with the result of 17 meta analysis and the result is that physical activity reduces blood pressure in prehypertension and hypertension, less number of evidence is provided to determine whether factors such as gender, ethnicity, socioeconomic status, BMI affects the correlation between physical activity and blood pressure¹¹.

Muscle exercise causes the development of an inhibitory mechanism in the brain and impact to low adrenergic activity in resting time. It is due to the occurrence of blood pressure mechanism which work quickly which consists of neural feedback mechanism, hormonal mechanism and fluid shifting

through capillaries¹². This is in accordance with the previous research which states that there is a significant difference between systolic blood pressure in before and after training¹³.

Yoga training teaches the way to integrate yoga pose with breath, and meditation technique (deep inhale, time for conscious relaxation and concentration) improves circulation by stretching the body and empowers people to manage their stress (reduce stress hormones level in the body). The decrease of local O₂ causes pulmonary arteriolar vasoconstriction which supplies the capillaries so that blood flow is reduced to match the small airflow. Meanwhile in skeletal muscles, arteriolar vasodilation will occur so that the blood needed for the tissue is sufficiently fulfilled. Hatha Yoga movements which is combined with breathing makes the body is balance in adjusting blood flow and air flow so that there is a balance inside the body. In the previous research states that cardio training is can be well-achieved through continuous flow or movement between posture and breathing practice (pranayama) help to improve lungs capacity, cleanse the blood, reduce blood pressure and meditation technique help to improve heart health and emotional security by increasing parasympathetic dominance in the body¹⁴. The previous study is also found that by performing 6 weeks of training has affected the significant decreased of systolic and diastolic blood pressure. While performing asana, pranayama and meditation the body is stretched and cleansed though the work of nerves system at the end branched and synapses. Increasing γ -amino butyric acid (GABA) activity that is neurotransmitter system which helps the work in the function of human nerves. GABA inhibits neurological reactions and responses which are unfavorable. Yoga increases the release of endorphin in blood flow so that produce happy feeling¹⁵. In accordance with the previous study about stress level in elderly with different measurement method that is geriatric depression scale (GSD) questionnaire form shows the effects of yoga towards depression in elderly with $p=0,00$ ¹⁶.

Tai Chi uses slow and smooth movement by moving body weight in between feet while moving the hands. This training consists of elements which combine martial arts, meditation, imagery and deep breathing. Tai Chi movement is mostly done in a standing position so that because of gravitation effect, there are regional differences in ventilation and perfusion from the top to the bottom of lung. The apex of the lung will receive less water and blood than the lower part of the lung, but will receive more air than blood, while the basal part of the lung will receive more water and blood than the upper part, but relatively will receive less air than blood. However, due to hands movement which is followed by head movement, a balance between air and blood flow is occurred inside the body. Tai Chi can produce heat inside the body, which then is taken in a form of sweat as one of methods in removing salt from the body. Tai Chi training program which is recommended by ACSM for 6-12 weeks can decrease systolic and diastolic blood pressure after training. The mechanism of changing blood pressure can be caused by the loss of sodium in sweat during exercise, where one of the methods to decrease blood pressure is by adjusting the volume of blood in the body which is done by the kidneys. Beside that sympathetic nerve activity generated by exercise is considered to be one of the mechanisms involved in decreasing blood pressure in hypertension. The anti-hypertensive effects of training can decrease plasma norepinephrine, increase prostaglandin E and decrease plasma renin activity. It is related with the previous study stated that Tai Chi can improve health and decrease systolic and diastolic blood pressure¹⁷. Furthermore, the other previous research about the effect of Tai Chi toward physics, balance and life quality in type 2 diabetes patients and the result shows that Tai Chi is effective in decreasing systolic and diastolic blood pressure¹⁸.

Hatha Yoga and Tai Chi Have Similar Effects in Decreasing Blood Pressure

Based on the result of analysis in blood pressure of Group I and II (Table 5) by using independent sample t-test, it is obtained that systolic blood pressure is $p=0,378$ and diastolic blood pressure is $p=0,805$. It indicates that the average of decrease in blood pressure of both experimental groups has no significant difference.

The treatments in Group I and Group II were given with similar intensity and training duration. In the causes of hypertention, exercise for hypertension is adjusted with its purposes. Based on the result in the previous study, Hatha Yoga and Tai Chi can decrease systolic and diastolic blood pressure by using movements in each of trainings. When the skeletal muscles contract during exercise, the local concentrations of the number of organ chemicals change (the decrease of O₂ is occurred because of active cells which metabolize and absorb more O₂ to produce ATP, the rate of O₂ from the body by the lung, increase of carbonic acid and lactic acid, increase level of ions H⁺, K⁺ which overpower the ability of Na⁺-K⁺ to restore the resting concentration gradient causes the increase of K⁺ in the

interstitial fluid of more active tissue, increase osmolarity and release the adenosine, especially in the heart muscles as the response to the lack of O_2)¹⁹. There is a change of local biochemistry which causes endothelial cells to release paracrine that is nitric oxide (NO) which causes local arteriolar vasodilation by triggering relaxation of the surrounding arteriolar smooth muscle so can equalize blood flow to the tissues which need it. Vasodilation also occurs due to decreased sympathetic vasoconstriction activity and increased parasympathetic activity. In the renin-angiotensin-aldosterone system, renin secretion is inhibited and causes angiotensinogen becomes inactivated so that aldosterone secretion is not stimulated, Na^+ and Cl^- can be excreted in the form of sweat and urine. The change which is occurred causes decreased in the average of arterial pressure and blood flow to the tissues becomes normal even though the pressure to move is reduced¹². It is in accordance with the previous study by collecting various articles to observe the suitable training for hypertension patients. Yoga and Tai Chi are effective in decreasing blood pressure by using techniques, breathing elements and meditation while doing training are common approaches to reduce cardiovascular disease and reducing anxiety level²⁰.

Despite of the movements of Hatha Yoga and Tai Chi give direct effects to muscles and use breathing technique which create various reaction inside the body, so that decrease blood pressure, however it is important to find out how often and how long to do training is also effected to blood pressure. By the duration that is 6 weeks (3 times in a week) is an adequate duration to obtain a significant decrease in blood pressure of both groups so that body will adapt for 2 weeks¹². The result of other studies have provide half of Yoga that is pranayama and meditation give effect to significant decrease in blood pressure for 4 weeks, while the significant decrease of blood pressure is occurred in the second week of treatment²¹. Moreover, the other research also obtains the result that by performing Tai Chi for 35 until 90 minutes in 3 until 5 times in a week, is very effective in decreasing anxiety, maintaining a good sleep and useful for cardiopulmonary system²².

CONCLUSION

The conclusion of this study is Hatha Yoga and Tai Chi decrease blood pressure in pre-elderly with grade I hypertension. And doing Hatha Yoga is as good as doing Tai Chi in lowering blood pressure in pre-elderly with grade I hypertension in Banjar batu, Badung district. For further researchers it is expected to measure pulse rates, control physical activity, nutritional intake, and measure the level of anxiety of research respondents so that the results can be seen properly.

CONFLICT OF INTEREST

For people with hypertension, it is important to maintain blood pressure so as not to cause other diseases that can be fatal to the body, so the Hatha Yoga and Tai Chi should be continued and applied regularly with a purpose to control and decrease systolic and diastolic blood pressure.

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