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Original Article

Exploring the impact of aerobic gymnastics on reducing blood: with hypertension medications vs without hypertension medications

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Abstract:
This study aims to prove how effective aerobic gymnastics is in reducing blood pressure in hypertension sufferers for 4 weeks, carried out 3 times a week in 40 level 1 hypertensive sufferers aged 25 years and over who were divided into 2 groups, namely taking medication vs not taking medication. Unstable changes in blood pressure will affect someone who rarely gymnastics. If someone is stressed, unstable blood will be very dangerous because it can cause disease, including stroke, coronary heart disease, diabetes and kidney disease. We can control this with pharmacological and non-pharmacological therapy, one of which is by taking hypertension medication and aerobic gymnastics. Aerobic gymnastics is a low impact sport that can activate the Hypothalamus Pituitary Adrenal axis (HPA axis) to release endorphin and enkephalin hormones, thereby providing a relaxing effect on someone who does it. This research used an experimental method (experimental research), consisting of 2 groups with aerobic gymnastics interventions, namely the group not taking medication and those taking medication. The effectiveness of aerobic gymnastics treatment was measured by comparing the blood pressure of the group given aerobic gymnastics to patients taking hypertension medication with the blood pressure results of the group given aerobic gymnastics to patients not taking medication. The data analysis used paired to t test. The results showed that the blood pressure in both groups experienced a significant decrease with p = 0.000 for systolic blood pressure and 0.000 for diastolic blood pressure. After the mean difference test, it was discovered that the group that had more reduction in blood pressure was the aerobic gymnastics intervention group who took hypertension medication because the heart valves that previously experienced sclerosis and thickening gradually return to normal, the myocardium is no longer stiff, the heart muscle contracts, stroke volume and cardiac output no longer increase. The conclusion of this study is that aerobic with hypertension who participate in gymnastics have a reduction in blood pressure with the biggest reduction in hypertensive sufferers who take medication.
Keywords: **Aerobics, Hypertension, Gymnastics, Blood pressure**

Introduction

A rise in systolic blood pressure (above 140 mmHg) and diastolic blood pressure (above 90 mmHg) above the normal range is referred to as hypertension (Slade et al., 2023). Hypertension is an irreversible degenerative illness that cannot be spread (Hoffeld et al., 2023; Sakarin et al., 2021, 2022). It is clear that non-communicable diseases have increased significantly throughout Southeast Asia, notably in Indonesia (Al-Kindi et al., 2020; Asri et al., 2022; Prokopets et al., 2021). As a silent killer, hypertension is one of the world's leading causes of morbidity (Gunnarsson, 2022; Iatridi et al., 2022; Pokharel et al., 2022). Hypertension is the main coronary heart disease, heart failure, and stroke are all risk factors (Arnaud et al., 2020; Biddinger et al., 2022; Shao et al., 2020).

Hypertension affects 22% of the world's population, and there is little effort to reduce blood pressure (Mills et al., 2020). Two-thirds of hypertension sufferers are in economically developing countries, when heart disease and stroke are caused by hypertension occur in sufferers at a younger age (Benetos et al., 2019; Wang et al., 2020; Campbell et al., 2022). Most people with hypertension are unaware that they have it because hypertension often has no symptoms (Boulestreau et al., 2022; Sutton et al., 2018). Therefore, hypertension is also known as “silent killer” (Iellamo et al., 2021).

Certainly, hypertension is associated with various factors, including genetic variables, age, gender, obesity, salt intake, smoking habits, and physical activity. Physical activity is broadly defined as any movement that engages our physical bodies. Insufficient physical activity can lead to an elevated heart rate, necessitating increased effort from the heart muscle during each contraction. As the heart muscle enlarges and pumps more frequently, it exerts greater pressure on the arteries, resulting in an elevation in blood pressure (Indika et al., 2023). Regular physical activity trains the cardiac muscle and peripheral resistance, which can help prevent

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hypertension from rising (Torma et al., 2021). Regular exercise can trigger the release of endorphins, which cause euphoria and muscle relaxation, preventing hypertension (Prokopets et al., 2021).

Reducing salt intake, not smoking, keeping a healthy weight, and testing blood pressure frequently can all help lower a person's chance of developing hypertension (Sari et al., 2023). Blood vessel rupture, renal damage, and paralysis are all consequences of hypertension. As well as non-pharmacological measures that can reduce blood pressure, namely acupressure, juice therapy, massage, yoga, herbal medicine, breathing and relaxation, progressive muscle relaxation (Iatridi et al., 2022; Prokopets et al., 2021)

Furthermore, aerobic gymnastics are suggested as a way to lower blood pressure in hypertension patients for hypertensive sufferers who are taking medication or who are not taking medication. Low impact aerobic gymnastics where all ages can participate in these gymnastics movements (Ampuero et al., 2023; Pokharel et al., 2022; Sari et al., 2023). If done on a regular basis, the intense routines and cheery songs can improve endurance and muscle strength (Tóth-Hosnyanszki et al., 2023).

Clearly, aerobic gymnastics is a sport that involves vigorous and cheerful movements (Ampuero et al., 2023; Kokarev et al., 2023; Tóth-Hosnyanszki et al., 2023). Apart from making the body fit, aerobic gymnastics can also lift your spirits and make your heart happy through the variety of movements (Desai et al., 2019; Tan et al., 2016). The following is an explanation of the movements in aerobic gymnastics, starting from warm-up, basic movements, to variations (de Oliveira et al., 2020; Marques et al., 2011; Olajos et al., 2020; Yang & Chen, 2018). The aerobic gymnastics series starts with; 1) warming up, 2) core (aerobic gymnastics), 3) cooling down (Kjær et al., 2021; Pieters et al., 2022; Van Crombrugge et al., 2019). Aerobic gymnastics is a low impact sports activity that is a non-pharmacological therapy option because it can activate the Hypothalamus Pituitary Adrenal axis (HPA axis) to release endorphins and enkephalins, thereby providing a relaxing effect for those who do it, especially the elderly (Biana et al., 2021; Burton et al., 2021; Ferreira et al., 2019; Verma et al., 2021). Aerobic gymnastics is able to stimulate serotonin synthesis and parasympathetic nerve activation to reduce catecholamines, epinephrine and norepinephrine so that it is easier to fall asleep (Sajedi et al., 2021; Tsai & Pan, 2023).

In addition, Aerobic gymnastics can lower blood pressure by increasing oxygen and blood flow to the bones and active muscles, particularly the heart muscle (Bourbeau et al., 2023; Lapidaire et al., 2023; Moris et al., 2023). Following a period of rest, the blood vessels will expand or stretch, causing a temporary drop in blood flow lasting between 30 and 120 minutes before returning to pre-gymnastic levels (Hinton et al., 2021; Neutel et al., 2023; Stone, 2022). If gymnastics regularly, blood vessels are more flexible, and the duration of the blood pressure drop (Jezek et al., 2022; Pierce et al., 2022). By widening the blood vessels, following physical activity, blood pressure will drop. (Leitão et al., 2022; Lönnberg et al., 2020; Sjúrðarson et al., 2022; Torma et al., 2021).

Numerous studies on decreasing blood pressure have been conducted although there are several restrictions for some age groups, especially the elderly (Benetos et al., 2019a; El-Hajj & Kyriacou, 2020). For example, exercise significantly lowers blood pressure in elderly individuals. (Ge et al., 2022; Zhang et al., 2022). Taichi exercise's ability to decrease elderly people's blood pressure patients with a history of hypertension varies. (Kang et al., 2022). Two researchers' study had several drawbacks, including age-based samples, a lack of control over dietary consumption, and the use of only senior gymnastics. While those with hypertension range in age from 18 to 30, they are not solely elderly. (Di Renzo et al., 2020; Motsa et al., 2021).

To date, aerobic exercise with or without medication has not been reported to decrease level 1 hypertension. This study aims to prove how effective aerobic gymnastics is in lowering blood pressure in those who have hypertension who take hypertension medication and those who do not take hypertension medication.

Material & methods

Design

This study adopts an experimental research approach, with a primary objective of exploring the impact or correlation between the independent variable (X), referred to as the treatment factor, and the dependent variable (Y), also known as the observation factor (McDonough, 2017). In this study, blood pressure in hypertension individuals was the dependent variable, and aerobic gymnastics was the independent variable. This study employed a pretest-posttest strategy to determine the degree to which aerobic gymnastics can lower blood pressure in hypertension patients who take medication and those who do not take medication.

Participants

A total of 40 people with hypertension participated in this study. The inclusion criteria in this study ranged from age 25 and above, not trained in sports, not physically impaired, able to see, hear, and suffer from level 1 hypertension. Subjects under the age of 25 were barred from participating in this study.Staying up late the night before doing aerobic exercise is the drop-out criterion for doing massage. The research subject was given instructions on the research methods and signed written consent to participate in the study.

Procedure

The steps of the research are as follows:

1. Collection of samples and explanations to the samples about the research to be conducted. If the sample was agreeable, it would fill out the informed consent form.

2. Perform a pre-test by taking your blood pressure with a sphygmomanometer. 15 minutes prior to performing gymnastics
3. The samples received an aerobic gymnastics intervention for four weeks, with three meetings each week.
4. At the 15th meeting, following 30 minutes of gymnastics, a posttest was performed by monitoring blood pressure again.
5. Once the data were collected, those were evaluated using the paired sampe t test.

Data analysis

The statistical analysis in this study involved the utilization of IBM SPSS version 25. Descriptive tests were conducted to derive the mean, standard deviation, and standard error. Subsequently, the Shapiro-Wilk method was employed for the normality test. If the data exhibited normal distribution, a paired t-test and an independent t-test were conducted to examine differences. Conversely, if the data did not follow a normal distribution, differences were assessed using the Wilcoxon Signed-Rank Test..

Results

Data regarding the description of each group and variable shown in Table 1.

Table 1. Description of data from the take medication and don't take medication groups

Data results	Mean	N	Std. Deviation	Std. Error Mean
Pretest systolic taking medication	159.85	20	9.207	2.059
Posttest systolic taking medication	136.80	20	13.332	2.981
Pretest diastolic taking medication	99.15	20	5.112	1.143
Posttest diastolic taking medication	86.20	20	4.686	1.048
Pretest systolic not taking medication	157.70	20	11.850	2.650
Posttest systolic not taking medication	149.05	20	12.547	2.806
Pretest diastolic not taking medication	97.40	20	8.413	1.881
Posttest diastolic not taking medication	90.65	20	5.815	1.300

Table 1 explains that the research sample consisted of 40 people. In the systolic take medication variable, the average difference between the pre-test and post-test was 23.05. For the Strength variable, the average difference between the pre-test and post-test was 0.13. The Agility variable resulted in an average difference between the pre-test and post-test of 0.22.

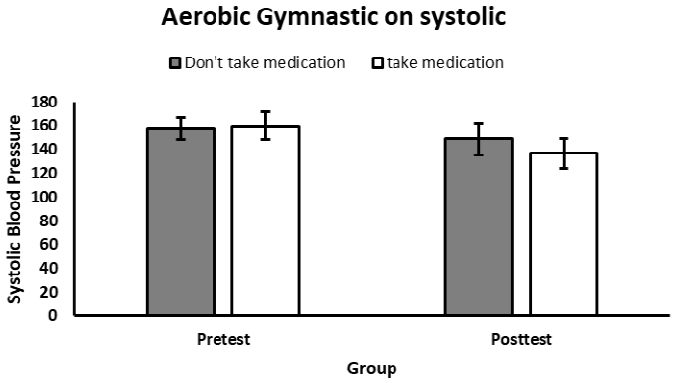

Figure. 1 Descriptive statistics (mean ± one standard deviation) for the aerobic gymnastic group on systolic.

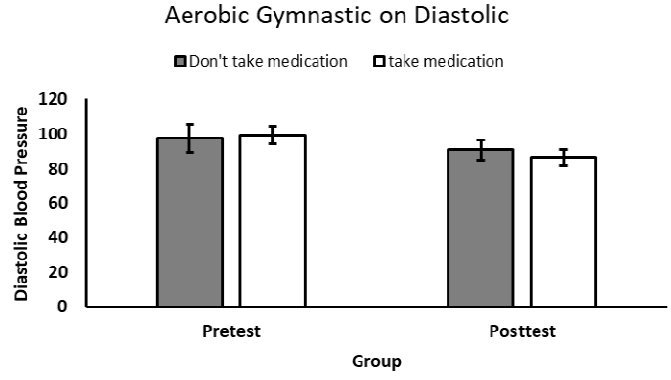

Figure. 2 Descriptive statistics (mean ± one standard deviation) for the aerobic gymnastic group on diastolic

As it can be seen in Figures 1 and 2, It can clearly be seen and compared the measurements obtained from systolic and diastolic blood pressure due to aerobic gymnastics from the pretest and posttest in the groups taking medication and not taking medication.

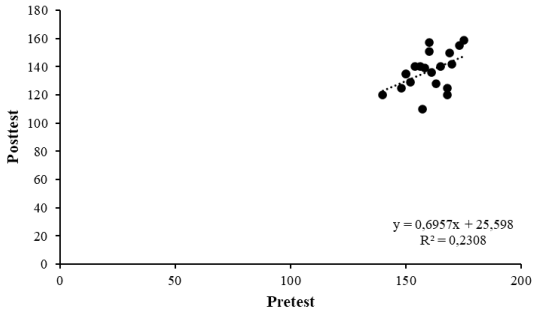

Figure. 3 Regression line and coefficient of determination pre post systolic regression Equation with medication group

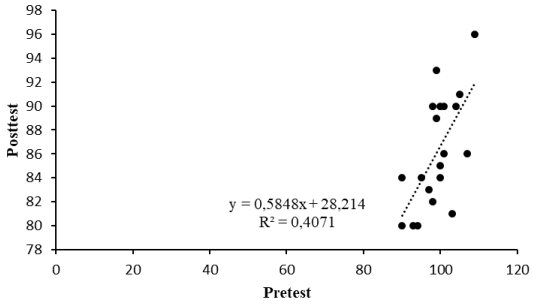

Figure. 4 Regression line and coefficient of determination pre post diastolic regression Equation with medication group

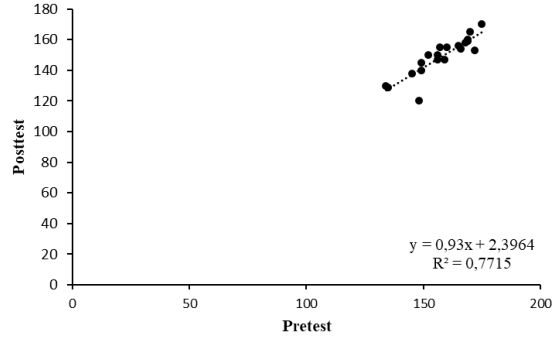

Figure. 5 Regression line and coefficient of determination pre post systolic regression Equation without medication group

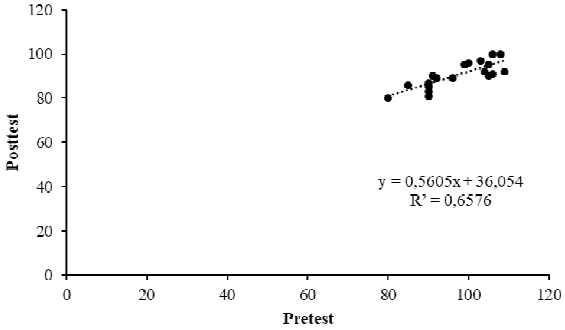

Figure. 6 Regression line and coefficient of determination pre post diastolic regression Equation without medication group

It is clear in Figures 3, 4, 5 and 6 that the adjusted R - Squared value shows how the influence of the independent variables together (simultaneously) influences the dependent variable. The coefficient of determination indicates how well the contribution of the independent variables in the regression model explains variation in systolic and diastolic blood pressure due to aerobic gymnastics from pretest and posttest in groups *taking medication* and *not taking medication.*

Table 2. Tests of Normality by Shapiro Wilk

Tests of Normality

		Shapiro-Wilk (don't take medication)			Shapiro-Wilk (take medication)		
	Group	Statistic	df	Sig.	Statistic	df	Sig.
Blood Pressure Test Results	Pretest Systole	.946	20	.315	.980	20	.928
	Posttest Systole	.953	20	.418	.971	20	.784
	Pretest Diastolic	.930	20	.152	.975	20	.852
	Posttest Diastolic	.969	20	.744	.939	20	.229

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Based on the results of the Shapiro Wilk normality test in the table, the significance value is > 0.05, so the Pretest Systolic group, Posttest Systolic group, Pretest diastolic group, and Posttest diastolic group in samples that did not consume medication obtained normal results. Normal results were also obtained from the Systolic Pretest group, Systolic Posttest group, Diastolic Pretest group and Diastolic Posttest group in samples that consumed medication.

Table 3. Paired Samples T Tests of Blood pressure in groups taking medication and not taking medication

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pretest systolic taking medication - Posttest systolic taking medication	23.050	12.024	2.689	17.423	28.677	8.573	19	.000
Pair 2	Pretest Diastolic taking medication - Posttest Diastolic taking medication	12.950	4.186	.936	10.991	14.909	13.835	19	.000
Pair 3	Pretest systolic not taking medication - Posttest systolic not taking take medication	8.650	6.055	1.354	5.816	11.484	6.389	19	.000
Pair 4	Pretest diastolic not taking take medication - Posttest diastolic not taking medication	6.750	5.025	1.124	4.398	9.102	6.007	19	.000

As in table 3 of the Paired Sample T Test above, the Asymp Sig value was obtained. (2-tailed) Systolic in the group not taking medication was 0.000 < 0.05, which means there is a significant effect of aerobic gymnastics on systolic blood pressure. Asymp value. Sig. (2-tailed) diastolic in the group not taking medication was 0.000 < 0.05, which means there is a significant effect of aerobic gymnastics on diastolic blood pressure. Asymp value. Sig. (2-tailed) systolic drug consumption group was 0.000 < 0.05, which means there is a significant effect of aerobic gymnastics on systolic blood pressure. Asymp value. Sig. (2-tailed) diastolic drug consumption group was 0.000 < 0.05, which means there is a significant effect of aerobic gymnastics on diastolic blood pressure.

To see the size of the difference between groups who consume medication and those who do not, namely from the difference in mean pre-post data which is the same as in table 1. With the systolic results for the group consuming medication 23,050 > 8,650 than the systolic results for the group not consuming medication. For the diastolic results of the drug consumption group, 12,950 was > 6,750 compared to the diastolic results of the group not consuming medication. Thus, these results provide a statement that the group that did aerobic gymnastics and took medication had a greater reduction in blood pressure compared to the aerobic gymnastics group that did not take medication.

Discussion

The aim of this study was to prove the effect of low-impact aerobics gymnastics on blood pressure in patients taking and not taking medication. Our results showed that the aerobic gymnastics group with patients not taking medication did not significantly reduce blood pressure, while the group given aerobic gymnastics to patients taking medication experienced a significant reduction in blood pressure.

Hypertension is caused by the production of angiotensin II from angiotensin I by angiotensin I converting enzyme (ACE) (Leitão et al., 2022; Lönnberg et al., 2020; Sjúrðarson et al., 2022; Torma et al., 2021). ACE serves a vital physiological role in blood pressure regulation. Angiotensinogen, which is created in the heart, is found in the blood. Furthermore, hormones convert renin (produced by the kidneys) into angiotensin I (Wu et al., 2020). Angiotensin I, an ACE present in the lungs, is transformed to angiotensin II (Gumashta & Gumashta, 2020; Nashiry et al., 2021). Angiotensin II is responsible for increasing blood pressure in two ways (Luo et al., 2023; Munawar et al., 2022; Stotter & Ferguson, 2019).

The first action is to enhance the secretion of antidiuretic hormone (ADH) and thirst (Cuzzo et al., 2023; Hui et al., 2023). The hypothalamus (gland pituitary) produces adrenal diahysterone (ADH), which regulates urine volume and osmolality in the kidneys (Iatridi et al., 2022). Antidiuresis, the reduction in urine production and excretion outside the body caused by an increase in ADH, causes urine to become concentrated and have a high osmolality. By removing fluid from the intracellular portion, the volume of liquid extracellular activity will be raised in order to dilute it (Stotter & Ferguson, 2019). Blood volume rises as a result, eventually raising blood pressure. The drug angiotensin II narrows blood arteries. The adrenal cortex's release of aldosterone is stimulated as the second action (Gumashta & Gumashta, 2020).

Lack of physical activity is one of the factors in increasing the risk of hypertension (Cheah et al., 2023; Ju et al., 2023; Wattanapisit et al., 2022). People who are inactive also tend to have a higher heart rate His heart muscle has to work harder with each contraction (Safran et al., 2022). The harder and more often the heart muscle has to pump, the more the amount of pressure imposed on the arteries results in pressure blood increases (Buchanan et al., 2023; Okamura et al., 2019).

Physical activity or sport is Due to isotonic gymnastics, which regularly lowers peripheral resistance and lowers blood pressure in hypertensive patients, it is widely linked to the management of non-communicable diseases. It also trains the heart muscle to become accustomed to the heart having to work harder due to specific conditions (Moke et al., 2023). A recent literature study reported that aerobic gymnastics can relax blood vessels, so that blood pressure decreases because blood vessels experience vasodilation (Bek, 2019; Yamada et al., 2022). Aerobic gymnastics can also cause nerve activity, hormone receptors, and the production of certain hormones to decrease (Wattanapisit et al., 2022). Supported by clinical trials which have proven that low impact aerobic gymnastics can reduce blood pressure (Li et al., 2023; Lu & Zhang, 2023).

We think that reducing blood pressure is necessary to support body function to avoid chronic disease. One study reported that systolic and diastolic blood pressure increased due to spasticity reduced large blood vessels (Gyimesi et al., 2020). Gymnastics allows extra oxygen and nutrients to be supplied to the muscles. This causes an increase in molecules such as carbon dioxide, which can cause blood vessels to widen because they need more nutrients and oxygen (Reid et al., 2022; Vasquez-Hidalgo et al., 2023). Recovery in reducing hypertension in patients taking medication and those not taking medication can maximize the value of gymnastics related to nutrition and lifestyle. On the other hand, the limitation of our research is not analyzing the patient's nutrition and lifestyle. We strongly recommend further research to analyze the effect of low impact aerobics gymnastics on hypertension with controlled nutrition and lifestyle. Therefore, our research is aimed at lazy adults. We hereby report that giving aerobic gymnastics to hypertension who are taking medication and not taking medication is highly recommended to reduce systolic and diastolic blood pressure.

Conclusions

This article discussed the effects of various methods to lower blood pressure, specifically aerobic exercise and aerobic exercise combined with taking hypertension medication. The study found that the group that performed aerobic exercise along with taking hypertension medication experienced a greater reduction in blood pressure compared to the group that only performed aerobic exercise. These results suggest that aerobic exercise is effective in lowering blood pressure and improving various aspects of the cardiovascular system. The study observed improved heart valve health, reduced stiffness in the myocardium, improved heart muscle contraction, and normalized blood volume and cardiac output. It is important to note that while both methods are effective, lifestyle factors such as a low-salt diet, not smoking or drinking alcohol, and maintaining a healthy weight are also important for managing hypertension. Overall, combining hypertension medication and aerobic exercise can be a practical approach to lowering blood pressure and preventing symptoms of stroke and coronary heart disease.

Conflicts of interest

The authors declare no conflict of interest

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