THE EFFECT OF LOW IMPACT AEROBIC EXERCISE ON REDUCING BLOOD PRESSURE IN ADULTS WITH HYPERTENSION IN JATI MELATI VILLAGE

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ABSTRACT

Background: Adulthood is the peak phase of human physical growth and the phase where a person is ready to enter society. Changes in lifestyle cause an increase in cases of non-communicable diseases. The increase in non-communicable diseases that often occur is hypertension. Hypertension is a major problem in world health. Aerobic low impact exercise is effective in lowering blood pressure. Lack of physical activity can increase the risk of hypertension. The heart muscle in inactive people will work harder when contracting because the heart rate frequency in inactive people tends to be higher. The more often the heart muscle receives a heavy load when pumping, the greater the pressure in the arteries, which affects the increase in blood pressure. Aerobic exercise is effective in lowering blood pressure in adults with hypertension. **Objective**: The effect of low impact aerobic exercise on blood pressure in adults with hypertension in Jati Melati Village. **Method**: The design of this study used a Quasi Experimental Design with a Pretest - Posttest with Control Group which was conducted at Jatimelati Village . The sampling technique was carried out by Purposive Sampling, blood pressure measurement using a Sphymomanometer with a sample size of 24 respondents, namely 12 respondents in the treatment group were given Aerobic Low Impact Exercise which was carried out 3 times a week with a duration of 40 minutes for 4 weeks, 12 respondents in the control group were not given treatment. **Results**: The difference test carried out using the Independent Sample T-Test obtained a p-value of 0.000 (systolic BP) and 0.003 (diastolic BP) which means there is a significant difference in the two groups. **Conclusion**: Aerobic low impact exercise significantly affects the decrease of blood pressure in adults with hypertension.

Keywords: Hypertension, Blood Pressure, Aerobic Low Impact Exercise

ABSTRAK

Latar Belakang: Dewasa merupakan fase puncak manusia dari pertumbuhan fisik dan fase dimana seseorang sudah siap untuk masuk kedalam masyarakat. Perubahan pola hidup menjadi penyebab peningkatan kasus penyakit tidak menular (*non cummunicable disease*). Peningkatan penyakit tidak menular yang banyak terjadi yaitu hipertensi. Hipertensi merupakan masalah utama dalam kesehatan dunia. *Aerobic low impact exercise* efektif menurunkan tekanan darah. Kurang melakukan aktivitas fisik dapat meningkatkan resiko kejadian hipertensi. Otot jantung pada orang yang tidak aktif akan bekerja lebih keras saat berkontraksi dikarenakan frekuensi denyut jantung pada orang yang tidak aktif cenderung lebih tinggi. Semakin sering beban berat diterima otot jantung saat memompa menjadikan tekanan dalam arteri semakin besar sehingga berpengaruh pada peningkatan tekanan darah. Latihan aerobik efektif menurunkan tekanan darah pada orang dewasa dengan hipertensi. **Tujuan:** Mengetahui pengaruh senam aerobik low impact terhadap tekanan darah pada orang dewasa dengan hipertensi di Kelurahan Jati Melati. **Metode:** *Quasi Experimental Design* dengan rancangan *Pretest – Posttest with Control Group* yang dilakukan di Kelurahan Jatimelati. Teknik pengambilan sampel dilakukan dengan *Purposive Sampling,* pengukuran tekanan darah menggunakan *Sphymomanometer* dengan jumlah sampel sebanyak 24 responden yaitu 12 responden pada kelompok perlakuan diberikan

Aerobic Low Impact Exercise yang dilakukan 3 kali dalam seminggu dengan durasi 40 menit selama 4 minggu, 12 responden pada kelompok kontrol tidak diberikan intervensi. **Hasil:** Hasil uji beda yang dilakukan menggunakan *Independent Sample T-Test* didapatkan hasil p-*value* 0,000 (TD sistolik) dan 0,003 (TD diastolik) yang berarti terdapat perbedaan yang bermakna pada kedua kelompok. **Simpulan:** *Aerobic low impact exercise* secara signifikan berpengaruh terhadap penurunan tekanan darah pada orang dewasa dengan hipertensi.

Kata Kunci: Hipertensi, Tekanan Darah, *Aerobic Low Impact Exercise*

INTRODUCTION

Current lifestyle changes are the cause of the increase in the incidence of non-communicable diseases (NCDs). Non-communicable diseases (NCDs) are one of the health problems that occur quite a lot and will continue to increase every year. The increase in health problems in non-communicable diseases that occur a lot, one of which is hypertension (Anggreini et al., 2023). According to Republik (2018), the main problem in world health is hypertension. The World Health Organization predicts that in 2025, hypertension sufferers will increase by around 80%, especially in developing countries. The prevalence of hypertension according to the 2023 Indonesian Health Survey reached 30.8%. The prevalence of hypertension based on the results of measurements in 2023 in the population aged ≥ 18 years in West Java Province was 34.4% (SKI, 2023). Hypertension if not treated properly will be the main factor in stroke, heart failure which causes death (Riskesdas, 2018). Cases of death due to hypertension reach 8 million people each year. The World Health Organization (WHO) (2015) estimates that 10.44 million people die each year from hypertension and its complications. The death rate in Indonesia due to hypertension is 427,218 deaths (Riskesdas, 2018).

The prevalence of hypertension risk factors shows that 35.5% of the population lacks physical activity, 29.3% smoke, 31% of people with central obesity and 21.8% of people experience general obesity (Riskesdas, 2018). The increase in hypertension cases is caused by an unhealthy lifestyle (LS, et al., 2017). Lack of exercise or physical activity can increase the risk of hypertension. The heart muscle in people who do not exercise enough will work harder when contracting. The more often the heavy load received by the heart muscle when pumping, the greater the pressure in the arteries, which affects increased blood pressure (Rihiantoro & Widodo, 2018).

Physiotherapy is an important role in controlling blood pressure to prevent complications from hypertension. One of the physiotherapy treatments in this case is aerobic low impact exercise which can help increase the strength of the heart pump, so that blood flow can return to normal (Ferawati et al., 2020). This exercise can be done with a frequency of 3-5 times a week with a duration of 20-60 minutes in one exercise. Physical activity, especially aerobics, can increase blood flow which encourages the production of nitric oxide (No) and stimulates the formation of the release of endothelial drive relaxing factor (EDRF) which relaxes and widens blood vessels so that high blood pressure will decrease (Nurafifah, 2021). The results of observations that have been carried out at the Jatimelati Village Posbindu, found that the majority of people experience hypertension and have never received physiotherapy services and aerobic exercise. Based on this background, the formulation of the problem in this study is "Does aerobic low impact exercise affect blood pressure in adults with hypertension?". The purpose of this study was to determine the effect of aerobic low impact exercise on blood pressure in adults with hypertension.

METHOD

The research design used is Quasi Experimental Design with the Pretest - Posttest with Control Group model. There are two measurements in this study to determine changes in blood

pressure, namely before (pretest) and after (posttest) the intervention in the form of Aerobic Low Impact Exercise using a digital Sphymomanometer. The population is adults in Jatimelati Village, which is 93 people. The sampling technique used is purposive sampling. The results of the sample calculation obtained 12 respondents in the treatment group and 12 respondents in the control group with a total sample of 24 respondents. The inclusion criteria for the samples taken are women or men aged ≥ 45-64 years, Able to carry out daily activities without using assistive devices and able to do aerobic activities, Cooperative and communicative, Have blood pressure with hypertension classification, namely systolic ≥ 140 mmHg and diastolic ≥ 90 mmHg, willing to follow the research program regularly, Follow aerobic exercise consistently during the study. Meanwhile, the exclusion criteria in this study were having comorbidities that are at risk if doing aerobic activities such as heart failure, myocardial infarction, asthma, COPD and being another research respondent.

The independent variable in this study is Aerobic Low Impact Exercise and the dependent variable is blood pressure in individuals with hypertension. The study was conducted at the Jatimelati Village Posbindu. Data collection was carried out for 4 weeks (September 8-30, 2024). Before the intervention, blood pressure checks were carried out before the intervention in both groups. The intervention was carried out 3 times a week with a duration of 40 minutes for 4 weeks with 34 types of movements. After the intervention was carried out for 12 meetings, blood pressure checks were carried out again to see the results after the intervention in both groups.

Data analysis was carried out after all data was collected with the editing, data coding and data entering stages. Univariate analysis in this study was in the form of demographic data, age (mean, minimum and maximum), gender (frequency distribution) and blood pressure check results (mean and standard deviation) before and after doing aerobic low impact exercise. The bivariate analysis test was carried out using the Shapiro Wilk Test for normality first. The results of the data normality test in this study were normally distributed, so the Paired Sample T-Test hypothesis test was carried out. Furthermore, a difference test was carried out on the two groups using the Independent Sample T-Test. This study has obtained ethical approval from the Research Ethics Committee of the Jakarta III Ministry of Health Polytechnic with Letter Number: LB.02.02 / F.XIX.21 / 4804/2024 on April 26, 2024.

RESULTS

1. Univariate Analysis
   a. Age
      1) Treatment Group

Table 1. Frequency Distribution of Age in Treatment Group in 2024

Aerobic Low Impact Exercise						
Age	**Frequency**	**Percentage (%)**	**CI 95%**	**Mean**	**Median**	**Min-Max**
45-54	5	41,7%	52,02 – 64,65	58,33	57,50	45 – 74
55-65	4	33,3%				
66-74	3	25%				
Total	12	100%				

Table 1 shows the age of the largest number of respondents in the treatment group, namely 45-54 years, amounting to 41.7% or 5 people.

      2) Control Group

Table 2. Frequency Distribution of Age in Control Group in 2024

Tidak Diberikan Intervensi						
Age	**Frequency**	**Percentage (%)**	**CI 95%**	**Mean**	**Median**	**Min-Max**

45-54	5	41,7%	51,68 – 60,99	56,33	57,00	45 – 67
55-65	6	50%				
66-74	1	8,3%				
Total	12	100%				

Table 2 shows that the age of the largest number of respondents in the control group was 55-65 years old, which was 50% or 5 people.

b. Gender

Table 3. Gender Frequency Distribution of Treatment Group

Gender	Frequency	Percentage(%)
Female	12	100%
Total	12	100%

Table 3 distribution of respondents based on gender in the treatment group shows a percentage of 100% of respondents were female with a total of 12 people.

Table 4. Distribusi Frekuensi Jenis Kelamin Kelompok Kontrol

Gender	Frequency	Percentage(%)
Female	8	66,7%
Male	4	33,3%
Total	12	100%

Table 4 distribution of respondents based on gender in the control group shows that the majority of respondents were female with a percentage of 66.7% totaling 8 people.

c. Systolic Blood Pressure Before and After

Table 5. Results of Systolic Blood Pressure Measurement Before and After Intervention in the Treatment Group

	Mean ± SD	CI 95%	Median	Minimum	Maximum
Before	151,92 ± 11,603	144,54 – 159,29	149,50	140	172
After	135,50 ± 10,775	128,65 – 142,35	133,50	116	160
difference	16,42 ± 11,720	8,97 – 23,86	13,50	1	34

Table 5 shows the average results of systolic blood pressure in the treatment group, there was a decrease after the intervention was given from 151.92 to 135.50 with a standard deviation before the intervention of 11.603 and after the intervention of 10.775.

Table 6. Systolic Blood Pressure Measurement Results Before and After Intervention in the Control Group

	Mean ± SD	CI 95%	Median	Minimum	Maximum
Before	156,50 ± 12,767	148,39 – 164,61	156,50	140	173
After	159,58 ± 13,399	151,07 – 168,10	157,50	143	185
difference	-3,08 ± 5,248	-6,42 – 0,25	-3,00	-13	4

Table 6 shows the average results of systolic blood pressure in the control group increased from 156.50 to 159.58 with a standard deviation before 12.767 and after 13.399. While the median before the value was 156.50 and after the value was 157.50.

d. Tekanan Darah Diastolik Sebelum dan Sesudah

Table 7. Diastolic Blood Pressure Measurement Results Before and After Intervention in the Treatment Group

	Mean ± SD	CI 95%	Median	Minimum	Maximum
Before	95,83 ± 5,718	92,20 – 99,47	93,50	90	107
After	84,58 ± 9,472	78,57 – 90,60	85,00	68	98
difference	11,25 ± 7,521	6,47 – 16,03	11,50	-2	24

Table 7 shows that the average results of diastolic blood pressure in the treatment group decreased after the intervention was given, from 95.83 to 84.58 with a standard deviation before the intervention of 5.718 and after the intervention of 9.472.

Table 8. Diastolic Blood Pressure Measurement Results Before and After Intervention in the Control Group

	Mean ± SD	CI 95%	Median	Minimum	Maximum
Before	97,42 ± 5,961	93,63 – 101,20	97,50	90	105
After	97,25 ± 11,561	89,90 – 104,60	93,50	84	125
difference	0,17 ± 8,902	-5,49 – 5,82	2,00	-23	12

Table 8 showed that the average diastolic blood pressure in the control group decreased from 97.42 to 97.25 with a standard deviation before of 5.961 and after of 11.561.

2. Bivariate Analysis
   a. Data Normality Test with Shapiro Wilk Test

Table 9. Shapiro Wilk Test Normality Results

Group	Blood Pressure	Data Group	Mean ± SD	p	Note
Treatment Group	Systolic	Before	151,92 ± 11,603	0,052	Normal
		After	135,50 ± 10,775	0,396	Normal
		difference	16,42 ± 11,720	0,187	Normal
	Diastolic	Before	95,83 ± 5,718	0,103	Normal
		After	84,58 ± 9,472	0,702	Normal
		difference	11,25 ± 7,521	0,944	Normal
Control Group	Systolic	Before	156,50 ± 12,767	0,138	Normal
		After	159,58 ± 13,399	0,382	Normal
		difference	-3,08 ± 5,248	0,750	Normal
	Diastolic	Before	97,42 ± 5,961	0,058	Normal
		After	97,25 ± 11,561	0,133	Normal
		difference	0,17 ± 8,902	0,060	Normal

The results of the normality test shown in table 9 show that the p-value of systolic blood pressure for the treatment group before the intervention was 0.052 and after the intervention was 0.396 which has a p-value> 0.05, so it can be said that the data is normally distributed, the systolic difference in the treatment group is also normally distributed. Likewise, the p-value of diastolic blood pressure in the treatment group before the intervention was 0.103 and after the intervention was 0.702 which has a p-value> 0.05, so the data is normally distributed, the diastolic difference in the treatment group is also normally distributed. In the control group, the p-value of systolic blood pressure before was 0.138 and after 0.382 which has a p-value> 0.05, so the data is normally distributed, the systolic difference in the control group is also normally distributed. The value obtained p-value of diastolic blood pressure before was 0.058 and after 0.133 which means that the data is normally distributed, the diastolic difference in the control group is also normally distributed.

   b. Hypothesis Test with Paired Sample T-Test

Table 10. Paired Sample T-Test Results for Treatment Groups

		Mean ± SD	CI 95%	p value	Note
Treatment Groups	**BP Systolic**	16,417 ± 11,720	8,970 – 23,863	0,001	Significant
	BP Diastolic	11,250 ± 7,521	6,471 – 16,029	0,000	Significant

Table 10 shows the results of the paired sample T-Test for systolic blood pressure in the treatment group with a p-value of 0.001, meaning (p <0.05) shows significant data between before and after the intervention, as well as the results of diastolic blood pressure in the treatment group with a p-value of 0.000, meaning (p <0.05) shows significant data between before and after the intervention.

Table 11. Paired Sample T-Test Results for Control Group

		Mean ± SD	CI 95%	p value	Note
Control Group	**BP Systolic**	-3,083 ± 5,246	-6,418 – 0,251	0,067	Not Significant
	BP Diastolic	0,167 ± 8,902	-5,489 – 5,823	0,949	Not Significant

Table 11 shows the results of the paired sample T-Test for systolic blood pressure in the control group with a p-value of 0.067, meaning (p>0.05) shows insignificant data between before and after, as well as the results of diastolic blood pressure in the control group with a p-value of 0.949, meaning (p>0.05) shows insignificant data between before and after.

c. Independent Sample T-Test

Table 12. Independent Sample T-Test Results for Systolic BP

	Group	Mean ± SD	CI 95%	t	p	Note
Systolic	Treatment	16,42 ± 11,720	11,812 – 27,188	5,260	0,000	**There are differences in influence**
	Control	-3,08 ± 5,248	11,610 – 27,390		0,000	
					There are differences in influence 0,000	

Table 12 shows the results of the independent t-test of systolic blood pressure in both groups obtained a p value of 0.000, then the p-value <0.05 is obtained, which means there is a significant difference between the treatment group and the control group. It can be concluded that aerobic low impact exercise has a significant effect on systolic blood pressure in adults with hypertension.

Table 13. Independent Sample T-Test Results for Diastolic BP

	Group	Mean ± SD	CI 95%	t	p	Ket
Diastolic	Treatment	11,25 ± 7,521	4,106 – 18,060	3,295	0,003	**There are differences in influence**
	Control	0,17 ± 8,902	4,095 – 18,071		0,003	
					There are differences in	

	influenc e 0,000

Table 13 shows the results of the independent t-test of diastolic blood pressure in both groups obtained a p value of 0.003, then the p-value <0.05 is obtained, which means there is a significant difference between the treatment group and the control group. It can be concluded that aerobic low impact exercise has a significant effect on diastolic blood pressure in adults with hypertension.

DISCUSSION

1. Respondent Characteristics Based on Age

   Based on the research that has been conducted, the characteristics of respondents with the highest age are 45-54 years with a percentage of 41.7% in the treatment group, while in the control group, the age is 55-65 years with a percentage of 50%. According to Safariyah et al., (2018) generally blood pressure will increase with age, especially after 40 years. At that age, several physiological changes occur so that the risk of developing hypertension becomes greater, this happens because the arteries will lose their elasticity and flexibility which causes blood vessels to be susceptible to atherosclerosis or blockages, resulting in the heart working harder in pumping blood, so the pressure experienced by the blood will increase with age.
2. Respondent Characteristics Based on Gender

   The research that has been conducted shows that respondents in the treatment group were female with a percentage of 100% and the control group 66.7%. According to Pebrisiana et al., (2022) women will experience an increased risk of high blood pressure after menopause, namely over 45 years of age, so the prevalence is higher than men. This is because the production of the hormone estrogen decreases during menopause, causing an increase in blood pressure. Women who have not experienced menopause are protected by the hormone estrogen which plays a role in increasing High Density Lipoprotein (HDL) levels. High HDL cholesterol levels are a protective factor in preventing the process of atherosclerosis. In premenopause, women begin to lose little by little the hormone estrogen which has protected blood vessels from damage. At the age of >60 years, the occurrence of hypertension due to hormonal factors in women is higher than in men (Kusumawaty et al., 2016).
3. Mean Value of Blood Pressure Difference Before and After in the Treatment Group

   The results of the study showed that there was a decrease in blood pressure in the treatment group after being given aerobic low impact exercise intervention with an average value before the intervention of 151.92 (systolic), 95.83 (diastolic) and after the intervention became 135.50 (systolic), 84.58 (diastolic). The average result of the blood pressure difference in the treatment group can decrease after being given aerobic low impact exercise, this is because physical activity, especially aerobics, can increase blood flow which is wavy which encourages the production of nitric oxide (No) and stimulates the formation of endothelial derived relaxing factor (EDRF) release, which relaxes and widens blood vessels. If the blood vessels shrink, the pressure will increase and vice versa if the blood vessels widen, blood pressure will decrease. One of the results of regular physical exercise is the widening of blood vessels, so that high blood pressure will decrease. All of the above factors contribute to lowering blood pressure (Ferawati et al., 2020).
4. Average Value of Blood Pressure Difference Before and After in the Control Group

   The average value before in the control group was 156.50 (systolic), 97.42 (diastolic) and after became 159.58 (systolic), 97.25 (diastolic). The control group with hypertension did not

receive treatment in the form of aerobic low impact exercise, but a decrease in systolic blood pressure from the control group could have occurred with several factors including taking medication that researchers could not control.

5. Difference in Blood Pressure Before and After Treatment

   Based on the results of the analysis using the paired sample t-test hypothesis test in the treatment group, the p-value of the systolic blood pressure results was 0.001 and the diastolic was 0.000, which means that there was a significant change between the pre-test and post-test results after being given aerobic low impact exercise. These results are different from the control group which did not have a significant change with a p-value of systolic blood pressure of 0.067 and diastolic of 0.949 ($p>0.05$). The results of the independent sample t-test showed a systolic blood pressure value with a p value of 0.000 and a diastolic blood pressure with a p value of 0.003 ($p<0.05$), which means that there was a significant difference in influence between the treatment group and the control group. This test proves that there is an effect of Aerobic Low Impact Exercise on blood pressure in adults with hypertension. The difference in influence between the treatment group and the control group is because people who do aerobic low impact exercise will have strong heart muscles to be able to pump blood. Meanwhile, the heart muscle in people who do not do the exercise tends to work harder to pump the same amount of blood. Blood pressure can be affected by the pumping activity of the heart (Fetriwahyuni et al., 2015).

   Baroreceptors will work when the average arterial pressure increases above normal temporarily, this can be triggered by doing aerobic low impact exercise. When blood pressure increases, the carotid sinus and aortic arch baroreceptors increase the discharge rate in each of their afferent neurons. The cardiovascular control center will get information from the discharge that blood pressure is too high, then the cardiovascular control center will respond by reducing sympathetic activity and increasing parasympathetic activity to the cardiovascular system. These afferent signals will reduce the heart rate, reduce stroke volume and cause arteriolar and venous vasodilation which will affect the decrease in cardiac output and total peripheral resistance, then blood pressure will decrease and return to normal (Sherwood, 2014).

CONCLUSION

1. Aerobic low impact exercise has an effect on decreasing blood pressure, proven by the results of the paired sample t-test with a p-value of 0.001 on systolic blood pressure and 0.000 on diastolic blood pressure, which means there is a significant change in the treatment group.
2. There is no effect on decreasing blood pressure in the control group that was not given Aerobic low impact exercise, proven by the results of the paired sample t-test with a p-value of 0.067 on systolic blood pressure and 0.949 on diastolic blood pressure, which means there is no significant change in the control group.
3. There is a difference in the effect of blood pressure between the treatment group and the control group with a p-value of systolic blood pressure of 0.000 and a p-value of diastolic blood pressure of 0.003, which means that Aerobic low impact exercise is effective in decreasing blood pressure in adults with hypertension.

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