

## THE EFFECT OF LOW-IMPACT AEROBIC EXERCISE ON REDUCING BLOOD PRESSURE IN ELDERLY HYPERTENSION

Renita Theresya Br Purba<sup>1</sup>, Dame Evalina Simangunsong<sup>2</sup>

<sup>1</sup>Politeknik Kesehatan Kementerian kesehatan Medan

Email : <sup>1</sup>renitatheresyapurba@gmail.com

### ABSTRACT

Hypertension, or high blood pressure, is known as "the silent killer" and is common in the elderly and a major risk factor for cardiovascular disease. The WHO estimates that hypertension cases will increase by 80% among elderly people in developing countries by 2025. There are 63 million cases of hypertension in Indonesia, with a mortality rate of 427,218. Various measures to address hypertension include both pharmacological and non-pharmacological therapies. Non-pharmacological measures include low-impact aerobic exercise. Low-impact aerobic exercise is a light movement that can increase heart and lung endurance. Low-impact aerobic exercise movements are done without jumping and one foot remains resting on the floor. This movement consists of 19 core movements, namely Mars, Kick, front-back, V-step, Step touch, Two steps, Double steps, Grive fine, Front lunges, side lunges, Back lunges, Back kick, Tup front, Tup side, Squat, Cha-cha step, High knee, cross High Knee, leg curl. This study observed the effect of low-impact aerobic exercise on reducing blood pressure in 37 elderly people suffering from hypertension. The exercise was carried out for 3 weeks with a frequency of 3 times a week and a duration of 30 minutes each exercise. The results of the study showed an effect on blood pressure before and after exercise. Systolic blood pressure decreased from 136.7 mmHg to 130.8 mmHg in the third week, and diastolic blood pressure decreased from 83.2 mmHg to 78.9 mmHg in the third week after exercise. Low-impact aerobics can be used as an alternative non-pharmacological treatment for elderly people suffering from hypertension. Exercise should be performed at least three times a week, each session lasting 30 minutes. This exercise can help lower blood pressure and even maintain elevated blood pressure in the elderly. It is recommended that Posbindu (Integrated Health Posts) and Nursing Homes (Panti Werdha) make this activity a routine activity for the elderly to support a more productive quality of life.

**Keywords :** Low Impact Aerobics, Blood Pressure, Elderly

## INTRODUCTION

Elderly individuals (elderly) are individuals who have reached a stage of maturity that shows signs of decline, namely those aged 60 and above. This group of individuals falls into the elderly category and are experiencing the aging process, characterized by a decline in the immune system (Wahyuni et al., 2022). Aging is a lifelong process, not just beginning at a specific point in time, but beginning from the very beginning of life.

The 2015 Intercensal Population Survey (SUPAS) reported that the number of elderly people in Indonesia was approximately 21.7 million, or 8.5%. This data includes 1.6 million (52.8%) female elderly and 10.2 million (47.2%) male elderly. According to the Central Statistics Agency (BPS), the proportion of elderly people in 2021 reached 10.82%, or approximately 29.3 million people. This figure indicates that Indonesia has entered a phase of an aging population structure, marked by the proportion of people aged 60 and over exceeding 10 percent of the total population (Ministry of Health, 2017). In 2022, the Central Statistics Agency (BPS) reported that the percentage of the elderly population (lansia) in Indonesia was 10.48% or 28.8 million people in 2022. This figure decreased by 0.34% points compared to the previous year which reached 10.82%, while the number of elderly in 2023 was 11.75% or 32,759,000 elderly, this figure increased by 1.27% compared to 2022 which was 10.48%. (Central Statistics Agency, 2023).

According to research conducted by Tsuryana Syarif, older adults often experience several health problems, such as hypertension, stroke, arthritis, COPD, diabetes, and even coronary heart disease, which can contribute to delayed degenerative changes, whether physical, cognitive, or emotional. (Nadhifah & Sjarqiah, 2022).

Hypertension is a condition characterized by an increase in systolic blood pressure of 140 mmHg or more and a diastolic blood pressure of 90 mmHg or more (Barbara Hearrison 2019) in (Luneto et al., 2023). Hypertension, often referred to as high blood pressure, is often referred to as "the silent killer" and is most often found in the elderly and is a major factor in cardiovascular disease (Ministry of Health of the Republic of Indonesia, 2018).

Hypertension has become a major global health problem, according to the World Health Organization, it is estimated that there will be an increase in hypertension sufferers of around 80% in 2025, especially in developing countries, from 630 million cases in 2000 to 1.15 billion in 2025.

Based on the data obtained, the number of hypertension sufferers in the world continues to increase every year.

In 2023, the prevalence of hypertension in Indonesia decreased to 30.8%. The highest prevalence of hypertension in Indonesia was in South Kalimantan at 44.1%, while the lowest prevalence was in Papua at 22.2%. In Indonesia, the number of cases of hypertension was 63,309,620, and the death rate from hypertension was 427,218. (Casmuti & Fibriana, 2023)

The prevalence of hypertension in North Sumatra province in 2022 reached 3,217,618 people, of which 395,690 had received healthcare services. In 2023, the prevalence of hypertension increased to 3,287,526, with 611,911 people receiving healthcare services. This data indicates a significant increase and is a serious health concern in North Sumatra.

General treatments for hypertension include pharmacological and nonpharmacological approaches. Pharmacological treatment involves medication, while nonpharmacological treatment involves diet, complementary therapies, and regular light physical activity or exercise. (Nafisah & Mariana, 2023). Various epidemiological studies have concluded that there is a link between a sedentary lifestyle and hypertension. Therefore, the WHO, ACSM, and the National Heart Foundation Joint Committee on Detection, Evaluation, and Treatment of High Blood Pressure strongly recommend increasing physical activity or exercise as the first line of treatment for hypertension prevention and treatment. (Nurafifah, 2021). One example of effective exercise for lowering hypertension is low-impact aerobic exercise. (Nafisah & Mariana, 2023).

Aerobic gymnastics is an exercise that involves various types of movements, rhythmic, regular, and directed, and is carried out cheerfully. Aerobic gymnastics has a series of exercises that are balanced between upper and lower body exercises. The movements are easy to use, entertaining, and varied, allowing a person to do it for a long period of time in a relaxed manner (Firdaus, 2022). Low Impact Aerobic Gymnastics is a gymnastic activity that has light movements in it that can increase cardiovascular endurance. This low impact aerobic gymnastics movement is done without jumping and one foot remains resting on the floor. This gymnastics is very suitable for the elderly because it is a gymnastics exercise that is not high risk. Low impact aerobic gymnastics movements consist of 19 core movements: Mars, Kick, front-back, V-step, Step touch, Two steps, Double steps, Grive fine, Front lunges, side lunges, Back lunges, Back kick, Tup front, Tup side, Squat, Cha-cha step, High knee, cross High Knee, leg curl.

Based on the results of a preliminary study conducted at the UPTD for Elderly Social Services in Binjai, the population of elderly people suffering from hypertension from January to December 2024 was 42 elderly people. Hypertension sufferers said they had never done Low Impact Aerobic exercise to lower blood pressure. The UPTD for Elderly Social Services in Binjai holds prolanis exercise every Friday, however, there are still some elderly people who do not regularly participate in the exercise.

Based on the background above, researchers need to conduct research on "the effect of Low Impact Aerobic exercise on reducing blood pressure in elderly people with hypertension at the UPTD for Elderly Social Services in Binjai as a non-pharmacological treatment for hypertension."

## METHOD

This type of research is quantitative, with a pre-experimental design using a One Group Pretest Posttest Design. The research was conducted at the Binjai Elderly Social Services Unit.

## RESULTS AND DISCUSSION

This study was conducted on 37 elderly respondents with hypertension. This study aimed to examine the effect of low-impact aerobic exercise on lowering blood pressure in elderly individuals with hypertension. The results of the study and data processing are as follows:

### 1. Univariate Analysis

#### a. Respondent Characteristics

**Tabel 4.1**

Distribution of respondent characteristics based on age, gender, education level, and ethnicity data in the Binjai Elderly Social Services Unit in 2025

<b>Respondent characteristics</b>	<b>Frequency</b>	<b>Persentase (%)</b>
<b>age</b>		
60 – 65 years	9	24.3
66 – 70 years	24	64.9
71 – 75 years	4	10.8
<b>Total</b>	37	100.0
<b>Gender</b>		
Man	16	43.2
Women	21	56.8
<b>Total</b>	37	100.0
<b>Level of education</b>		

Elementary school		
Junior high school	2	5.4
Senior high school	8	21.6
	27	73.0
<b>Total</b>	37	100.0
<b>Ethnic group</b>		
Batak	21	56.8
Jawa	15	40.5
Nias	1	2.7
<b>Total</b>	37	100.0
<b>History of Hypertension</b>		
Pre hipertensi	19	51.4
Hipertensi derajat 1	18	48.6
<b>Total</b>	37	100

Based on table 4.1, it can be seen that of the 37 respondents, the majority of respondents were aged 66-70 years, namely 24 respondents (64.9%). In the gender group, the majority of respondents were female, namely 21 respondents (56.8%). Based on education level, the majority had a high school education, namely 27 respondents (73.0%). Based on ethnicity, the Batak tribe was the majority, namely 21 respondents (56.8%). Based on the history of hypertension, the majority of elderly people had a history of pre-hypertension, namely 19 respondents (51.4%), and a history of grade 1 hypertension, namely 18 respondents (48.6%).

**b. Distribution of Blood Pressure Frequency Before Low Impact Aerobic Exercise**

**Tabel 4.2**

Frequency Distribution of Respondents' Blood Pressure Examination Results Before Being Given Low Impact Aerobic Exercise in Elderly with Hypertension at the Binjai Elderly Social Services unit

<b>TD</b>	<b>Int</b>	<b>%</b>	<b>Int</b>	<b>%</b>	<b>Int</b>	<b>%</b>
<b>sisto</b>	<b>erv</b>		<b>erv</b>		<b>erv</b>	
<b>lik</b>	<b>ens</b>		<b>ens</b>		<b>ens</b>	
	<b>i</b>		<b>i</b>		<b>i</b>	
	<b>1</b>		<b>2</b>		<b>3</b>	
120	4	10.8	9	24.3	11	29.7
mm		%		%		%
Hg						

130 mm Hg	14	37.8 %	11	29.7 %	13	35.1 %
140 mm Hg	9	24.3 %	12	32.4 %	12	32.4 %
150 mm Hg	10	27.1 %	5	13.5 %	1	2.7 %
<b>Tota l</b>	<b>37</b>	<b>100 %</b>	<b>37</b>	<b>100 %</b>	<b>37</b>	<b>100 %</b>

<b>TD Dias tolik</b>	<b>Int erv ens i 1</b>	<b>%</b>	<b>Int erv ens i 2</b>	<b>%</b>	<b>Int erv ens i 3</b>	<b>%</b>
80 mm Hg	18	48.6 %	20	54.1 %	23	62.2 %
90 mm Hg	19	51.4 %	17	45.9 %	14	37.8 %
<b>Tota l</b>	<b>37</b>	<b>100 %</b>	<b>37</b>	<b>100 %</b>	<b>37</b>	<b>100 %</b>

Based on Table 4.2 above, it shows that 37 respondents experienced an increase in blood pressure above normal values, namely in the pre-hypertension and grade 1 hypertension categories.

## 2. Data Normality

**Tabel 4.3**  
Data Normality Test Results

<b>Shapiro – Wilk</b>				
<b>Variabel</b>		<b>p- Value</b>		<b>Status</b>
Intervensi 1	sistol	pre test	< 0.001	Abnormal
		Post test	0.002	Abnormal
	Diastol	Pre test	< 0.001	Abnormal
		Post test	< 0.001	Abnormal
Intervensi 2	Sistol	Pre test	0.001	Abnormal

		Post test	< 0.001	Abnormal
	Diastol	Pre test	< 0.001	Abnormal
		Post test	< 0.001	Abnormal
Intervensi 3		Sistol	Pre test	< 0.001
	Post test		0.001	Abnormal
	Diastol	Pre test	< 0.001	Abnormal
		Post test	< 0.001	Abnormal

Based on table 4.3 above, a data normality test was carried out with a sample of <50, so the normality test used was Shapiro - Wilk (Adila, 2021) and each blood pressure variable before and after low impact aerobic exercise showed a sig value <0.05, so the data was declared not normally distributed so a non-parametric test was used, namely Wilcoxon.

### 3. Bivariate disis

#### a. Distribution of Blood Pressure Check Frequency After Low Impact Aerobic Exercise

**Tabel 4.4**

Frequency Distribution of Respondents' Blood Pressure Examination Results After Low Impact Aerobic Exercise in Elderly with Hypertension at the Binjai Elderly Social Services Unit

<b>TD Sistol</b>	<b>Interven si 1</b>	<b>%</b>	<b>Intervensi 2</b>	<b>%</b>	<b>Intervensi 3</b>	<b>%</b>
110 mm Hg	2	5.4 %	6	16.2 %	8	21.6 %
120 mm Hg	12	32.4 %	9	24.3 %	14	37.8 %
130 mm Hg	11	29.7 %	16	43.2 %	11	29.7 %

140 mm Hg	11	29.7 %	6	16.2 %	4	10.8 %
150 mm Hg	1	2.7 %	0	0%	0	0%
<b>Total</b>	<b>37</b>	<b>100 %</b>	<b>37</b>	<b>100 %</b>	<b>37</b>	<b>100 %</b>

<b>TD</b>	<b>Inte</b>	<b>%</b>	<b>Int</b>	<b>%</b>	<b>Int</b>	<b>%</b>
<b>Dias</b>	<b>rven</b>		<b>erv</b>		<b>erv</b>	
<b>tol</b>	<b>si</b>		<b>ens</b>		<b>ens</b>	
	<b>1</b>		<b>i</b>		<b>i</b>	
			<b>2</b>		<b>3</b>	
70 mm Hg	0	0%	5	13.5 %	8	21.6 %
80 mm Hg	25	67.6 %	26	70.3 %	25	67.6 %
90 mm Hg	12	32.4 %	6	16.2 %	4	10.8 %
<b>Total</b>	<b>37</b>	<b>100 %</b>	<b>37</b>	<b>100 %</b>	<b>37</b>	<b>100 %</b>

Based on table 4.4 above, the average decrease in systolic and diastolic blood pressure of 37 respondents after 3 weeks of low-impact aerobic exercise was observed. This was supported by a decrease in the number of respondents with systolic blood pressure values of 150 mmHg and 140 mmHg, and an increase in the number of respondents with blood pressure values of 110 mmHg and 120 mmHg. Similarly, the number of respondents with diastolic blood pressure values of 90 mmHg decreased.

**b. Wolcoxon Test Results**

**Tabel 4.5**

Frequency Distribution of Differences in Mean Blood Pressure of Hypertensive Elderly Before and After Low Impact Aerobic Exercise

Treatment	TD	Mean Pre ± SD	Mean Post ± SD	Selisih	p-value uji Wilcoxon
Intervensi 1	Sistolik	136.7 ± 10	129.1 ± 9.8	7.6	< 0.001
	Diastolik	85.1 ± 5	83.2 ± 4.7	1.9	0.008
Intervensi 2	Sistolik	133.5 ± 10	125.9 ± 9.5	7.6	< 0.001
	Diastolik	84.5 ± 5	80.2 ± 5.5	4.3	< 0.001
Intervensi 3	Sistolik	130.8 ± 8.6	122.9 ± 9.3	7.9	< 0.001
	Diastolik	83.7 ± 4.9	78.9 ± 5.6	4.8	< 0.001

Based on table 4.5 in intervention 1, it is known that the average systolic blood pressure before Aerobic Low Impact exercise was 136.7 mmHg with a standard deviation of 10, and after Aerobic Low Impact exercise, the average systolic blood pressure decreased to 129.1 mmHg with a standard deviation of 9.8. The difference in the average systolic blood pressure pre and post test is 7.6. It is known that the average diastolic blood pressure before Aerobic Low Impact exercise was 85.1 with a standard deviation of 5, the average diastolic blood pressure after Aerobic Low Impact exercise was 80.2 with a standard deviation of 5.5. The difference in the difference in diastolic blood pressure pre and post test was 1.9.

In intervention 2, the average systolic blood pressure before doing Low Impact Aerobic gymnastics was 133.5 mmHg with a standard deviation of 10, and the average systolic blood pressure after doing Low Impact Aerobic gymnastics was 125.9 mmHg with a standard deviation of 9.5. The difference in the average systolic blood pressure was 7.6. It is known that the average diastolic blood pressure before doing low impact aerobic gymnastics was 84.5 mmHg with a standard deviation of 5, the average diastolic blood pressure after low impact aerobic gymnastics was 80.2 mmHg with a standard deviation of 5.5. The difference in the average diastolic blood pressure pre and post was 4.3.

In intervention 3, the average systolic blood pressure before Aerobic Low Impact exercise was 130.8 mmHg with a standard deviation of 8.6 and the average systolic blood pressure after

Aerobic Low Impact exercise was 122.9 mmHg with a standard deviation of 9.3. The difference in the average systolic blood pressure pre and post test was 7.84. Furthermore, the average diastolic blood pressure before Aerobic Low Impact exercise was 83.7 with a standard deviation of 4.9 and the average diastolic blood pressure after Aerobic Low Impact exercise was 78.9 mmHg with a standard deviation of 5.6. The difference in the average diastolic blood pressure pre and post test was 4.8.

## DISCUSSION

### 1. Characteristics of Hypertension Patients in the Binjai Elderly Social Services Unit in 2025

The results of the study showed that of the 37 respondents, the majority were aged 66-70 years, with 24 respondents (64.9%). Blood pressure tends to be higher in the elderly, putting them at greater risk of developing hypertension. Increasing age causes blood pressure to rise because the artery walls thicken, leading to a buildup of collagen in the muscle layer. This causes the blood vessels to gradually narrow and stiffen, forcing the heart to work harder to pump blood throughout the body. This is what causes hypertension (Pebrisiana et al., 2022)

Based on the gender of the 37 respondents, the majority of respondents were women, amounting to 21 respondents (56.8%). According to the P2PTM of the Indonesian Ministry of Health, men have a 2.3 times greater risk of experiencing increased systolic blood pressure than women, but the prevalence of hypertension in women after entering menopause increases, this is caused by hormonal factors, where women will experience a decrease in the hormone estrogen which functions to increase HDL levels which are a protective factor for the occurrence of the atherosclerosis process, so the incidence of hypertension in women is higher than in men with the age of over 60 years (choi et al., 2017) in (Khasanah, 2022)..

Based on the education level of the 37 respondents, the majority of respondents had a high school education (27 respondents (73%). Education level did not affect blood pressure in the elderly, which is in line with research conducted by Dewi Cahyanungrum in 2022, which assumed there was no significant relationship between education and blood pressure because the respondents in this study were already experiencing the aging process, so blood pressure values would increase with age.

Based on ethnicity, of the 37 respondents, 21 (56.8%) were of the Batak ethnic group, with the majority being from the Batak ethnic group. Ethnicity can influence the incidence of hypertension due to varying lifestyle habits and customs. For example, the Batak ethnic group is known for its high meat-consuming diet. Besides diet, another Batak habit that contributes to high blood pressure is smoking.

## **2. Blood Pressure in Elderly People with Hypertension Before Low Impact Aerobic Exercise**

The results of this study indicate that in the first week before low-impact aerobic exercise, the majority of elderly people's systolic blood pressure values were 130 mmHg (14 respondents), and 10 respondents had systolic blood pressure values of 150 mmHg. The majority of elderly people's diastolic blood pressure values were 90 mmHg (19 respondents). The average systolic blood pressure of respondents was 136.76 mmHg and the diastolic was 85.14 mmHg..

In the second week, the majority of elderly people's systolic blood pressure values were 130 mmHg and 140 mmHg, with 11 respondents each. The majority of diastolic blood pressure values were 80 mmHg, with 20 respondents. The average systolic blood pressure before low-impact aerobic exercise in the second week was 133.51 mmHg and the diastolic blood pressure was 84.59 mmHg.

In the third week, the majority of elderly people's systolic blood pressure values were 130 mmHg (13 respondents), while the majority of diastolic blood pressure values were 80 mmHg (23 respondents). The average systolic blood pressure before doing Low Impact Aerobic exercise in the third week was 130.81 mmHg and the diastolic was 83.78 mmHg.

## **3. Blood Pressure in Elderly People with Hypertension After Low Impact Aerobic Exercise**

The results of this study indicate that in the first week after being given low impact aerobic exercise there was a decrease in systolic blood pressure in the elderly where the majority of systolic blood pressure values were 120 mmHg as many as 12 respondents, and the majority of diastolic values were 80 mmHg as many as 25 respondents. The average systolic and diastolic blood pressure after being given low impact aerobic exercise was 129.19 mmHg with a diastolic of 83.24 mmHg.

In the second week, the majority of systolic blood pressure values were 130 mmHg (16 respondents), and the majority of diastolic blood pressure values were 80 mmHg (26 respondents). The average systolic and diastolic blood pressure in the second week after low-impact aerobic exercise was 125.95 mmHg with a diastolic of 80.27 mmHg..

In the third week, there was also a decrease in blood pressure, where the majority of systolic blood pressure values were 120 mmHg (14 respondents), while the majority of diastolic blood pressure values were 80 mmHg (25 respondents). In the third week, the average systolic and diastolic blood pressure after low-impact aerobic exercise was 122.29 mmHg and the diastolic was 78.92 mmHg.

#### **4. Effect of Low Impact Aerobic Exercise on Reducing Blood Pressure in Elderly People with Hypertension at the Binjai Elderly Social Services**

Based on the results of the Wilcoxon test that has been conducted in the first, second and third weeks, the probability value (p) is  $<0.05$ . This indicates the effect of low-impact aerobic exercise on reducing blood pressure in elderly with hypertension at the UPTD for elderly social services in Binjai. Therefore, it can be concluded that  $H_0$  is rejected and  $H_a$  is accepted, which means there is an effect of low-impact aerobic exercise on reducing blood pressure in elderly with hypertension at the UPTD for elderly social services in Binjai.

The results of this study agree with a study conducted by Nun in 2024, which was conducted for 8 weeks, 2-3 times per week, for 15 minutes. Based on the Wilcoxon p-value test, systolic blood pressure was 0.001 and diastolic blood pressure was 0.001. Low-impact aerobic exercise can improve and maintain the health and endurance of the cardiovascular and respiratory systems. These data indicate that low-impact aerobic exercise has an effect on lowering blood pressure in people with hypertension.

This research is also supported by research conducted by Siskamulyani in 2020 which stated that blood pressure in elderly people with hypertension decreased after doing low-impact aerobic exercise which is able to encourage the heart to work optimally and increase energy needs by cells, tissues and organs of the body where the increase will increase respiratory activity and skeletal muscles.

## **CONCLUSION**

Based on the research and discussion on the effect of Low-Impact Aerobic Exercise on lowering blood pressure in the elderly at the Binjai Elderly Social Services Unit (UPTD) in 2025, the following conclusions can be drawn.

1. Before Low-Impact Aerobic Exercise, the average systolic blood pressure in the elderly was 136.7 mmHg in the first week, 133.5 mmHg in the second week, and 130.8 mmHg in the third week. Diastolic blood pressure was 85.1 mmHg in the first week, 84.5 mmHg in the second week, and 83.7 mmHg in the third week.
2. After performing Low-Impact Aerobic Exercise, the average systolic blood pressure in the elderly in the first week was 129.1 mmHg, in the second week it was 125.9 mmHg, and in the third week it was 122.9 mmHg. Diastolic blood pressure in the first week was 83.2 mmHg, in the second week it was 80.2 mmHg, and in the third week it was 78.9 mmHg.
3. There was an effect of reducing blood pressure in elderly with hypertension at the Binjai Elderly Social Services Unit after performing Low-Impact Aerobic Exercise

### ACKNOWLEDGEMENT

Praise and gratitude the researcher says to God Almighty who has given all the wisdom and opportunity to the researcher so that the researcher can complete the research entitled the effect of low impact aerobic exercise on reducing blood pressure in the elderly. the researcher also thanks the supervisor, namely Mrs. Dr. Dame Evalina Simangansong SKM, M.Kes who has helped a lot in this research, and especially the researcher thanks her beloved parents who have always been the encouragement of the researcher in completing this research. the researcher realizes that in this writing there are still many shortcomings and far from perfect, so with all humility the researcher thanks

### REFERENCES

- Adila, v M. (2021). *Mengenal Uji Asumsi Klasik*. Jakarta: Gramedia Blog. [gramedia.com/literasi/uji-asumsi-klasik/#google\\_vignette](https://www.gramedia.com/literasi/uji-asumsi-klasik/#google_vignette).
- Adrian, S. J. (2019). Diagnosis dan tatalaksana terbaru pada dewasa. *Cdk-274*, 46(3), 172–178.

jakarta : [http://www.cdkjournal.com/index.php/CDK/article /view/503%0A](http://www.cdkjournal.com/index.php/CDK/article/view/503%0A)Diakses pada tanggal 28 oktober 2020

- Casmuti, C., & Fibriana, A. I. (2023). Kejadian Hipertensi di Wilayah Kerja Puskesmas Kedungmundu Kota Semarang. Semarang : *HIGEIA (Journal of Public Health Research and Development)*, 7(1), 123–134.
- Dlis, F., Haqiyah, A., Susianti, E., Hidayah, N., Basri, H., & Riyadi, D. N. (2021). Senam Aerobic Low Impact untuk meningkatkan imunitas tubuh dimasa Pandemi Covid-19. Bekasi : *Maddana : Jurnal Pengabdian Kepada Masyarakat*, 2(1), 1–7. [http://jurnal.unismabekasi.ac.id/index.php/maddana/ index](http://jurnal.unismabekasi.ac.id/index.php/maddana/index)
- Kemendes. (2018). Laporan Riskesdas 2018 Nasional.pdf. Jakarta: *Lembaga Penerbit Balitbangkes* (p. hal 156).
- Khasanah, N. A. H. (2022). Hubungan Usia, Jenis Kelamin Dan Status Obesitas Dengan Kejadian Hipertensi Di Wilayah Puskesmas Sumbang Ii Kabupaten Banyumas: *Jurnal Bina Cipta Husada*, XVIII(1), 43–55.
- Luneto, M. F. P., Studi, P., Fakultas, N., Kesehatan, I., & Manado, U. M. (2023). *Pengaruh Senam Aerobic Low Impact Terhadap Perubahan Tekanan Darah Pada Lansia Hipertensi di Panti Werda Damai Ranomuut Manado Program Studi Ners Fakultas Ilmu Kesehatan I Made Rantiasa Bayu Dwisetoyo yang monoton dan pola hidup yang tidak sehat seperti ke. I(4).Manado.*
- Nadhifah, T. A., & Sjarqiah, U. (2022). *Gambaran Pasien Stroke Pada Lansia di Rumah Sakit Islam Jakarta Sukapura Tahun 2019*. 3(1), 23–30.
- Nafisah, D., & Mariana, M. (2023). Peningkatan Kesadaran Hidup Sehat Masyarakat melalui Senam Aerobic Low Impact sebagai Upaya Pencegahan dan Penanganan Hipertensi pada Lansia. Ponorogo : *Social Science Academic*, 505–516.
- Nurafifah, A. S. (2021). Senam Aerobik Low Impact dapat Menurunkan Tekanan Darah pada Lansia dengan Hipertensi. Cianjur: *Indonesian Scholar Journal of Nursing and Midwifery Science (ISJNMS)*, 1(01), 36–41.
- Pebrisiana, P., Tambunan, L. N., & Baringbing, E. P. (2022). Hubungan Karakteristik dengan

Kejadian Hipertensi pada Pasien Rawat Jalan di RSUD Dr. Doris Sylvanus Provinsi Kalimantan Tengah : *Jurnal Surya Medika*, 8(3), 176–186.

Wahyuni, W., Romadhoni, D. L., & Ramadhani, A. N. (2022). The effect of exercise on the reduction of blood pressure among elderly with hypertension: a systematic literature review. Surakarta : *International Journal of Public Health Science*, 11(2), 384–390.