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The Effect of Elderly Exercise on Blood Pressure Among Older Adults with Hypertension in Lumban Pea Village, Balige District, Toba Regency, 2026

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Abstract : The physiological aging process triggers a decline in vascular function, which impacts the high escalation of hypertension cases in the elderly population. This study aims to analyze the empirical effect of elderly gymnastics on reducing blood pressure among elderly hypertensive patients in Lumban Pea Village, Balige District, Toba Regency in 2026. This type of research was quantitative with a pre-experimental design using a one-group pretest-posttest design without a control group. The sample in this study consisted of 31 respondents selected using a purposive sampling technique from a total population of 35 hypertensive elderly. The elderly gymnastics intervention was conducted twice a week for three weeks with a duration of 30 minutes per session. Blood pressure measurements were taken using a calibrated digital sphygmomanometer 30 minutes before and after the entire intervention series. The results of the univariate analysis showed a decrease in mean systolic blood pressure from 150.00 mmHg to 140.48 mmHg, and diastolic pressure from 94.48 mmHg to 90.48 mmHg. The Shapiro-Wilk normality test indicated that the data were normally distributed ($p > 0.05$). Based on the bivariate Paired Sample T-Test, a p-value of 0.001 was obtained for systolic pressure and 0.003 for diastolic pressure ($p < 0.05$). In conclusion, elderly gymnastics has a significant effect on lowering systolic and diastolic blood pressure through the mechanism of blood vessel vasodilation and decreased sympathetic nerve activity.

Keywords: Elderly Gymnastics, Blood Pressure, Hypertension, Elderly.

1. INTRODUCTION

The aging process *is* a natural phase that every human being inevitably experiences, characterized by a progressive decline in the body's anatomical, physiological, and biochemical functions. The decline in organ function in the elderly population significantly triggers susceptibility to various manifestations of degenerative diseases. One of the degenerative diseases with the highest prevalence and a serious challenge in the global and national health sector is hypertension. Hypertension is often dubbed *the silent killer* because it is asymptomatic, but it can trigger fatal complications such as stroke, myocardial infarction, and chronic kidney failure if not managed adequately. Psychosocially, the inability to control blood pressure in the elderly linearly will have a negative impact on their quality of life (Riskesdas, 2018). Therefore, a comprehensive management strategy is needed, which not only relies on a pharmacological approach, but also integrates safe and sustainable non-pharmacological approaches, such as structured physical activity in the form of elderly gymnastics (L. Yanti *et al.* , 2017).

Epidemiologically, the burden of hypertension continues to experience significant escalation. The 2018 Basic Health Research (Riskesdas) showed that the prevalence of hypertension in Indonesia reached 34.1 % . Reviewing the trends in Riskesdas data from 2013 and 2018, a linear trend is observed, with the elderly (55 years and older) occupying the highest prevalence curve, which continues to increase. The same pattern is also reflected at the regional level. Based on the 2018 Riskesdas data from North Sumatra Province, the prevalence of hypertension in the 55–64 age group reached 13.02%, the 65–74 age group 18.07%, and the age group over 75 years was 16.21%.

In a more specific area, namely Toba Regency, data from the Central Statistics Agency (BPS) sourced from the Toba Regency Health Office in 2020 placed hypertension

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as one of the diseases with the highest incidence, just below Acute Respiratory Tract Infection (ARI) and Dyspepsia, with a total of 7,032 sufferers out of a total population of 206,199. This phenomenon is also clearly illustrated at the village level. In Lumban Pea Village, Balige District, based on a recapitulation of doctor's examinations at the Community Health Center (Puskesmas) and periodic screenings at the Elderly Integrated Health Post (Posyandu), it was found that 35 elderly people suffered from hypertension out of a total of 118 elderly people domiciled in the village. This figure represents that nearly 30% of the elderly population in the area suffers from high blood pressure problems, which require immediate attention and intervention.

Pathophysiologically, increased blood pressure in the elderly is driven by massive structural and functional changes in the peripheral vascular system. With age , blood vessels undergo a vascular remodeling process that includes atherosclerosis, loss of collagenous connective tissue elasticity, and a decreased relaxation response of vascular smooth muscle. This process manifests as a drastic decrease in blood vessel distension and tensile strength (Yanti *et al.* , 2021). Aging causes arterial walls to calcify and thicken due to the accumulation of collagen in the vascular muscle layer. Consequently, the blood vessel lumen gradually narrows, stiffens, and loses its compliance. The hemodynamic consequence of this arterial stiffness is a decreased ability of the aorta and large arteries to accommodate and deliver the stroke volume pumped by the heart. This condition triggers a decrease in cardiac output *accompanied* by a drastic increase in peripheral vascular *resistance (TPR*) (Rahmiati & Zurijah, 2020).

To break the pathophysiological chain of collagen buildup and the development of atherosclerosis, lifestyle modification through regular physical activity is a crucial intervention tool (Putriastuti, 2016). This is where healthcare professionals are required to initiate preventive and promotive efforts through applicable non-conventional therapies for the elderly. One highly recommended non-pharmacological modality is elderly exercise (L. Yanti *et al.* , 2017). Holistically, elderly exercise is designed to improve and enhance physical and mental fitness (Eriyanti *et al.* , 2016). From a physical perspective, this physical activity functions optimally in improving cardiovascular performance, improving blood circulation, optimizing the respiratory system, and maintaining muscle strength and endurance. Meanwhile, from a spiritual perspective, elderly exercise provides a relaxing effect that can maintain emotional stability, reduce psychological stressors, and stimulate cognitive concentration (Eriyanti *et al.* , 2021).

Providing physical exercise to the elderly population must be tailored individually, especially regarding the type, duration, and intensity of exercise to remain within safe limits (*safe zone*). Elderly gymnastics has been proven to be a form of exercise with low to moderate intensity rhythmic movements that is very safe for the elderly who are starting to become physically fragile (Widjayanti *et al.* , 2019). Continuous and programmed gymnastics activities will stimulate the release of endorphins and nitric oxide (NO), which are vasodilators. Long-term effects include increased physical fitness, optimized heart function, decreased blood pressure, and reduced risk of lipid plaque buildup on blood vessel walls, thus maintaining vascular elasticity (Anwari *et al.* , 2018).

The urgency of this research is based on the objective reality in the working area of Lumban Pea Village, Balige District, Toba Regency, where elderly awareness in maintaining preventive health still needs to be optimized. In the current post-pandemic and global health transition era, elderly are required to not only rely on conventional drug therapy, but also actively improve immunity, maintain fitness, and control blood pressure independently. Based on the visualization of epidemiological data, pathophysiological background, and potential non-pharmacological interventions that have been described, the researcher is interested in conducting research to empirically test "The Effect of Elderly Exercise on Hypertension in Lumban Pea Village, Balige District, Toba Regency".

2. LITERATURE REVIEW

The Concept of Elderly (Lansia)

Elderly age is the final phase of the human life cycle, characterized by a cyclical decline in physical endurance and biological function. According to the World Health Organization (WHO), the chronological limit of elderly begins when a person reaches the age of 60 years and above. The linear increase in global life expectancy has an impact on the growth of the elderly population in society (Tarigan, 2019). Physiologically, increasing

age triggers a degenerative aging process that affects all organ systems, especially the cardiovascular system. Decreased cell regeneration causes artery walls to lose their elasticity and undergo calcification (sclerosis) (Muhith & Siyoto, 2016). The consequence of these vascular structural changes is increased peripheral resistance, which manifests as a spike in systolic blood pressure. Therefore, hypertension is the most common degenerative pathology found in the elderly and acts as a major risk factor for stroke and coronary heart disease (Sitanggang *et al.* , 2021).

Concept of Hypertension

Hypertension is defined as a clinical condition in which a person experiences chronically elevated blood pressure above the normal threshold, which directly contributes to increased morbidity and mortality rates. Referring to global clinical guidelines, a person is diagnosed with hypertension if they have a systolic blood pressure of ≥ 140mmHg and/or a diastolic blood pressure $\geq 90$of mmHg on repeated measurements (Triyanto, 2014; Harahap & Siringoringo, 2016). This condition is often asymptomatic (*a silent killer*), but long-term high vascular pressure fluctuations risk damaging target organs such as the brain, heart, and kidneys.

Risk Factors and Management of Hypertension

Risk factors for hypertension are classified into two main categories (PERKI, 2015):

1. Controllable factors (lifestyle modifications) include obesity (which increases cardiac output and blood volume), sedentary lifestyle (lack of physical activity), excessive sodium/salt consumption, exposure to nicotine from cigarettes (which triggers calcification of blood vessel walls), alcohol consumption, and psychological stress (Wilandari, 2020; Rahmayani, 2019).
2. Uncontrollable factors include genetic/hereditary factors, gender, and degenerative processes due to aging (Hidayanti *et al.* , 2020).

Hypertension management integrates pharmacological therapy (diuretics, βbeta-blockers, ACE inhibitors, ARBs, and CCBs) with non-pharmacological therapy. Non-pharmacological therapy focuses on lifestyle modifications , one of which is through programmed physical exercise in the form of elderly gymnastics (Wulansari, 2017).

2.3. The Concept of Elderly Gymnastics

Elderly exercise is a structured physical exercise modality designed with rhythmic movements of light to moderate intensity, tailored to the functional capacity of the elderly (Rahmiati & Zurijah, 2020). This exercise must comply with the principles of geriatric exercise, including frequency settings (1–3 times a week), duration (30–45 minutes), and a training heart rate target (*training zone*) ranging from 60%–70% of maximum heart rate (Ayu Anjani, 2020; Eviyanti *et al.* , 2021). Holistically, elderly exercise is beneficial for improving physical fitness (cardiorespiratory performance, muscle strength, flexibility, and balance) and spiritual function (reducing stress, anxiety, and maintaining cognitive function) (Wahyuni, 2017).

Procedures for Implementing Elderly Gymnastics

The structure of elderly exercise movements based on the provisions of the Ministry of Health consists of three core stages (Kristiani & Dewi, 2018):

1. Warming *Up* , 8–10 minutes, begins with a prayer position, stretching the neck muscles, rotating the shoulder girdle, and breathing exercises to prepare the musculoskeletal system.
2. Core Exercise (20–30 minutes), combines walking on the spot with a variety of arm swings, elbow flexion-extension, body bends, waist rotations, and light horse stances to stimulate cardiac contractility.
3. Cooling *Down* , 5–10 minutes, doing dynamic stretching movements *slowly* to lower body temperature and return the pulse to basal frequency.

Mechanism of Lowering Blood Pressure through Elderly Exercise

Regular exercise stimulates vasodilation by activating parasympathetic nerve fibers and suppressing sympathetic nerve activity (Wratsongko, 2014). Biochemically, the relaxed state during exercise reduces the activity of *the Hypothalamus-Pituitary-Adrenal* (HPA) axis.

Decreased secretion of *Corticotropin-Releasing Hormone* (CRH) by the hypothalamus results in decreased *Adrenocorticotropic Hormone* (ACTH) and cortisol, which is accompanied by increased endorphin synthesis (Yuniarti & Dewi, 2019). In addition, decreased norepinephrine synthesis in the adrenal medulla suppresses the production of *Arginine Vasopressin* (AVP). This decrease in AVP and ACTH levels systemically reduces peripheral vascular resistance and cardiac output, resulting in decreased blood pressure (Guyton & Hall, 2014). This effectiveness aligns with studies by Wardhani (2020) and Suwanti *et al.* (2019) which proved that there was a significant influence of exercise on reducing systolic and diastolic blood pressure in the elderly ($p < 0{,}05$).

3. METHOD

This study uses a quantitative approach with a pre-experimental design through *a one-group pretest-posttest design approach* without a control group, where the intervention group was observed first using *a pre-test* before being given treatment, then observed again using *a post-test* after the intervention was completed. The implementation of this study took place in the Lumban Pea Village area, Balige District, Toba Regency, which lasted for three months, starting from March to May 2026. The target population in this study included all elderly people with hypertension who were recorded and domiciled in the Lumban Pea Village area, totaling 35 people. The sample size was determined using the Slovin formula with a tolerable error limit of 0.05 , resulting in a mathematical calculation result of 30.97 which was then methodologically rounded to 31 respondents. The sampling technique was carried out using *a purposive sampling method* by paying attention to the inclusion criteria in the form of elderly people aged more than or equal to 60 years who were willing to participate, as well as exclusion criteria that excluded elderly people with limited physical mobility due to disability, *total bed rest* , Parkinson's, or stroke.

The independent variable in this study was elderly gymnastics, operationally defined as regular rhythmic physical exercise based on the Ministry of Health's SOP, conducted twice a week for three weeks with a duration of 30 minutes per session at light to moderate intensity. Meanwhile, the dependent variable was the level of hypertension assessed through fluctuations in systolic and diastolic blood pressure values in millimeters of mercury (mmHg), measured 30 minutes before the first intervention session began and 30 minutes after the series of exercise cycles were completed in the final week. The data collection procedure began with fulfilling formal administrative stages to obtain an ethical feasibility sheet from the Health Research Ethics Commission of LPPM Akper HKBP Balige, followed by processing institutional research permits up to the village head level. Technically, the researcher approached the respondents, explained the research objectives, requested the signing of *an informed consent* , and scheduled interventions every Friday and Saturday using a calibrated digital tensiometer instrument along with a structured observation sheet.

The entire research series was conducted by upholding the principles of universal nursing ethics, which include fulfilling the principles of benefit, respect for human dignity, and the principle of justice, including ensuring the confidentiality of information by disguising the respondents' real identities using an initial code system. After all the raw data was successfully collected, the process of editing, coding, and tabulating the data was carried out into the computerized program IBM SPSS Statistics version 26. Considering that this research manuscript uses a one-group comparative design on an interval data scale, the data normality test used the *Shapiro-Wilk method.* will be carried out first as an initial procedure. If the data distribution is proven to be normally distributed, then the inferential analysis to test the effect of elderly exercise on reducing systolic and diastolic blood pressure will be calculated using the parametric *Paired T-Test* at an alpha significance level of 0.05, but if the data is not normally distributed then the analysis will be diverted to the non-parametric *Wilcoxon Signed Rank Test* .

4. RESULTS AND DISCUSSION

Place, Time, and Demographic Overview of the Research

This research was conducted in Lumban Pea Village, which administratively covers an area of 198 hectares and is divided into five hamlets. Geographically, the research location has strategic boundaries, with the northern border directly bordering Lake Toba in Uluan District, the southern bordering Baruara Village in Balige District, the eastern

bordering Lumban Pea Timur Village in Laguboti District, and the western bordering Lumban Gaol Village in Tampahan District. Primary data collection related to the demographic profile and public health conditions in this area was carried out intensively through a combination of structured interviews and field observations that took place on March 16, 17, 18, and 25, ending on April 2, 2026.

Based on the results of demographic mapping of the total population of Lumban Pea Village, which is recorded at 1,050 people, the distribution of the population shows a balanced variation in terms of age and gender. From an age structure perspective, the productive age group between 20 and 35 years occupies the majority proportion in the community, namely 215 people or representing approximately 20.5% of the total population. This proportion is closely followed by the age group of 35 to 49 years, which amounts to 212 people or 20.2%. The group of children and adolescents also has a significant number, where the age category over 12 to 20 years is recorded at 174 people or 16.6%, followed by the age group over 5 to 12 years at 130 people or 12.4%. The elderly population group with age above 60 years has a quantity of 133 people or reaching 12.7 % of the population, while the rest are spread across the 49 to 60 years age group as many as 119 people or 11.3%, the toddler group aged more than 1 to 5 years as many as 46 people or 4.4%, and the infant group aged 0 to 1 year as many as 15 people or 1.4%. Viewed from the gender segmentation, the population in Lumban Pea Village is slightly dominated by the female group which amounts to 528 people or 50.3%, while the male group is recorded as 522 people or equivalent to 49.7% of the total population.

The general health status of this region can be mapped based on disease trends handled by local health facilities, which are broadly grouped into communicable and non-communicable diseases. Clinical manifestations of communicable diseases frequently found in the community include the incidence of influenza, pulmonary tuberculosis, chickenpox, measles, rabies, fungal skin infections such as tinea versicolor, diarrhea, and dengue fever. On the other hand, the spectrum of identified non-communicable diseases includes diabetes mellitus, stroke, cancer, chronic obstructive pulmonary disease, and hypertension. Among all types of non-communicable diseases, high blood pressure or chronic hypertension occupies a position with a very dominant number of cases and requires serious clinical attention. Based on this health phenomenon, specific interventions focused on the elderly population diagnosed with hypertension in March 2026, involving a research sample of 31 respondents selectively selected through a *probability sampling approach* .

Respondent Characteristics Based on Age and Gender

The characteristics of the respondents in this study represent specific traits or attributes inherent in the sample, where biological factors such as age and gender are theoretically closely related to hemodynamic status and the development of hypertension pathophysiology. Based on the results of primary data tabulation on the age range of 31 elderly respondents with hypertension, it was found that the majority of respondents were in the late pre-elderly and early elderly age categories, namely in the age range of 61 to 65 years, with a total of 15 respondents or equivalent to 48.4% of the total sample. The second largest proportion was occupied by the elderly group aged 66 to 70 years, namely 12 respondents or 38.7%. Meanwhile, the elderly group with an older age, namely over 70 years, occupied the lowest proportion with only 4 respondents or representing 12.9% of the total sample studied.

Table 1. Respondent Characteristics Based on Age and Gender (n = 31)

Respondent Characteristics	Frequency (f)	Percentage (%)
Age Category		
61–65 Years	15	48.4
66–70 Years	12	38.7
Over 70 Years	4	12.9
Gender		

Man	18	58.1
Woman	13	41.9
Total	**31**	**100.0**

Source: Processed Primary Data (2026)

When viewed based on gender distribution, the sample characteristics show a different trend from the village's general demographic profile. In the group of elderly people with hypertension who responded to this intervention, the majority were male, with 18 respondents representing 58.1 % . Conversely, the female respondent group was smaller, with 13 respondents representing approximately 41.9 % of the total study sample. This gender dominance provides a specific picture of the high-risk vulnerable group experiencing cardiovascular problems in the study area.

Univariate Analysis of Blood Pressure Before and After Intervention

Univariate analysis in this study was used to identify in depth the average value, minimum value, maximum value, and standard deviation distribution of respondents' systolic and diastolic blood pressure, both before and after being given physical activity intervention in the form of elderly gymnastics. The results of hemodynamic parameter measurements before the implementation of the elderly gymnastics intervention showed that the average systolic blood pressure of respondents was at 150.00 mmHg, with the lowest recorded systolic value of 135 mmHg and the highest systolic value reaching 165 mmHg, and supported by a standard deviation value of 7.303. Meanwhile, for the diastolic blood pressure parameter before the intervention, an average value of 94.48 mmHg was obtained, with a minimum diastolic value range of 80 mmHg and a maximum value reaching 110 mmHg, where the data distribution showed variation with a standard deviation value of 8.009.

Table 2. Results of Univariate Analysis of Blood Pressure Before and After Elderly Exercise Intervention (n = 31)

Blood Pressure Variables	Mean	Minimum	Maximum	Standard Deviation (SD)
Before Intervention (*Pre-test*)				
Systolic Blood Pressure (mmHg)	150.00	135	165	7,303
Diastolic Blood Pressure (mmHg)	94.48	80	110	8,009
After Intervention (*Post-test*)				
Systolic Blood Pressure (mmHg)	140.48	125	165	8,598
Diastolic Blood Pressure (mmHg)	90.48	75	110	8,201

Source: Processed Primary Data (2026)

After the respondents completed the entire series of structured elderly exercise intervention programs, re-measurements were conducted to assess post-treatment fluctuations. The results of the post-intervention univariate analysis showed a downward trend in both blood pressure parameters. The average systolic blood pressure value of the elderly after the exercise intervention was recorded to have decreased to 140.48 mmHg, with the distribution of the minimum systolic value at 125 mmHg and the maximum value remaining at 165 mmHg, accompanied by a standard deviation variation of 8.598. A corresponding decrease was also identified in the diastolic blood pressure parameter, where the average post-intervention value fell to 90.48 mmHg . The range of diastolic values after treatment moved from a minimum value of 75 mmHg to a maximum value of 110 mmHg, with a calculated standard deviation value of 8.201.

As an absolute prerequisite before conducting comparative hypothesis testing, a data normality test was conducted to determine the most appropriate type of statistics to

use in the bivariate analysis. This normality test applied the *Shapiro-Wilk method* considering that the sample size in this study was less than or equal to 50 respondents. Based on the results of computerized calculations, the significance value for systolic blood pressure parameters in *the pre-test stage* was 0.162 and in the *post-test stage* was 0.258. On the other hand, the significance value for diastolic blood pressure in the *pre-test stage* was recorded at 0.170 and in the *post-test stage* was 0.100. Since all p-values obtained from the *Shapiro-Wilk test* for each variable showed a number greater than the alpha threshold of 0.05, it can be drawn a methodological conclusion that all blood pressure data, both systolic and diastolic in the pre- and post-intervention phases, were normally distributed. Thus , the bivariate analysis to examine the clinical effect was continued using a parametric statistical instrument, namely the *Paired Sample T-Test* .

Bivariate Analysis of the Effect of Elderly Exercise on Blood Pressure

Bivariate analysis was conducted with the aim of empirically and statistically proving the significant influence of elderly exercise intervention on changes in blood pressure in elderly people with hypertension in Lumban Pea Village, Balige District. Through the application of the *Paired Sample T-Test* , the dynamics of changes in the mean value from the condition before the intervention were directly compared with the condition after the intervention. The results of statistical testing on the systolic blood pressure parameter showed a *paired difference value* or average difference between before and after the intervention of 9.516 with a standard deviation of 7.113, and produced a significance value of p-value of 0.001. Meanwhile, the results of statistical testing on the diastolic blood pressure parameter also showed a consistent average difference with a significance value of p-value of 0.003.

Table 3. Results of Blood Pressure Normality Test Using *Shapiro-Wilk* (n = 31)

Blood Pressure Variables	Measurement Stage	*Shapiro-Wilk* Statistics	*p-value* (*Sig.*)	Information
Systolic Blood Pressure	*Pre-test*	0.951	0.162	Normally Distributed
	Post-test	0.960	0.258	Normally Distributed
Diastolic Blood Pressure	*Pre-test*	0.948	0.170	Normally Distributed
	Post-test	0.944	0.100	Normally Distributed

Source: Processed Primary Data (2026)

Because the probability value or p-value generated from the two parameters is far below the established significance threshold, which is less than the alpha value of 0.05, then methodologically the null hypothesis is rejected and the alternative hypothesis is accepted. These findings provide strong scientific evidence that there is a very real and significant difference in the blood pressure of the elderly between before and after the intervention. Thus, it can be concluded empirically that structured physical activity in the form of elderly gymnastics has a significant effect in reducing systolic and diastolic blood pressure in the elderly population suffering from hypertension in Lumban Pea Village, Balige District, Toba Regency.

Table 4. Results of Bivariate Analysis of the Effect of Elderly Exercise on Blood Pressure (n = 31)

Blood Pressure Variables	Measurement	Mean SD	±	Mean Difference (Mean ± SD)	p-value	Information
Systolic Blood Pressure	*Pre-test*	150.00 7.303	±	9,516 ± 7,113	0.001	Significant ($p < 0.05$)
	Post-test	140.48 8.598	±			
Diastolic Blood Pressure	*Pre-test*	94.48 8.009	±	4,000 ± 6,943	0.003	Significant ($p < 0.05$)
	Post-test	90.48 8.201	±			

Source: Processed Primary Data (2026)

Discussion

The Effect of Elderly Exercise on Systolic and Diastolic Blood Pressure

The results of the hypothesis testing in this study empirically prove that the provision of structured elderly exercise intervention has a significant effect on reducing systolic and diastolic blood pressure in the elderly population with hypertension in Lumban Pea Village, Balige District. This statistical evidence is clearly reflected in the decrease in the mean blood pressure value after the intervention and the achievement of probability values that are far below the alpha significance threshold. This dynamic shows that lifestyle modification through safe and measured physical activity can be an effective non-pharmacological intervention in controlling the hemodynamic status of the elderly in the community, while minimizing the risk of fatal vascular complications.

The success of this blood pressure reduction can be seen from the demographic characteristics of the respondents, who were mostly in the early elderly phase, aged 61 to 65 years. In this age range , structural aging of the cardiovascular system, in the form of thickening of the arterial walls and accumulation of vascular collagen, is still quite responsive to external physical stimulation. Furthermore, the fact that most respondents had moderate daily physical activity patterns and a high level of adherence to conventional antihypertensive medication also strengthened the therapeutic effect of the elderly exercise. Regular physical exercise integrated with pharmacological adherence creates an optimal synergistic effect in maintaining the stability of the patient's systemic circulation.

Physiologically, the mechanism of systolic and diastolic blood pressure reduction after elderly exercise is triggered by the adaptation of the autonomic nervous system and the release of various biochemical mediators in the blood vessels. When elderly people perform rhythmic movements at a light to moderate intensity continuously, parasympathetic nerve fibers are stimulated, accompanied by suppression of sympathetic nerve activity. This decrease in sympathetic tone directly reduces the secretion of the hormone norepinephrine in the adrenal medulla, which in turn suppresses the production of *Arginine Vasopressin* (AVP). This calmer and more relaxed circulatory state also suppresses activation of *the Hypothalamus-Pituitary-Adrenal* (HPA) axis, thereby reducing cortisol production, while endorphin synthesis increases in the body.

The most crucial clinical impact of stress hormone reduction and parasympathetic nerve activation is the widening of blood vessel lumen diameter, or arterial vasodilation. During exercise, increased respiratory rate and heart rate demand a greater oxygen supply to the working muscle tissue. To meet this oxygen demand, the blood vessel endothelium releases nitric oxide (NO NO), which acts as a powerful natural vasodilator. This vasodilation directly reduces total peripheral vascular *resistance (TPR*) and improves the elasticity or compliance of the aortic wall. When arterial stiffness is reduced and blood vessel diameter is widened, the aorta is able to accommodate and deliver the stroke volume pumped by the heart with a much lighter resistance load. This reduction in

peripheral resistance directly manifests itself in lower systolic and diastolic blood pressure in the elderly.

In addition to the physical dimension, the effectiveness of elderly exercise is also driven by spiritual stimulation, which produces a psychologically relaxing effect. The atmosphere of group exercise in the social environment of Lumban Pea Village provides a sense of comfort, lowers anxiety levels, and reduces psychosocial stressors often experienced by the elderly population . This positive psychological state indirectly helps prevent sudden blood pressure fluctuations caused by spikes in cardiovascular activity due to stress. Thus, elderly exercise has been proven to act as a holistic modality that not only improves cardiorespiratory performance and muscle strength but also maintains blood vessel elasticity in hypertensive patients through balanced neurohormonal regulation.

The scientific findings in this study in Lumban Pea Village consistently reinforce the results of previous research conducted by Wardhani (2020) and Suwanti *et al.* (2019), which also reported a significant decrease in blood pressure after implementing geriatric physical exercise. The results of this study also successfully address the urgency of preventing degenerative diseases in Toba Regency, which places hypertension as one of the most dominant public health problems under ISPA. Through this empirical evidence, the implementation of elderly exercise can be widely recommended as part of evidence - *based community nursing practice* that is safe, affordable, and applicable to be carried out sustainably by health cadres and elderly groups at the village level.

5. CONCLUSION AND SUGGESTIONS

Conclusion

Based on the results of an experimental study conducted from March to May 2026 regarding the effect of elderly exercise on reducing blood pressure in hypertension sufferers in Lumban Pea Village, Balige District, Toba Regency, several interrelated circular conclusions can be drawn. Judging from demographic and clinical characteristics, the majority of respondents were in the early elderly age range of 61 to 65 years with a proportion of 48.4%, dominated by male gender at 58.1%, had a moderate physical activity pattern at 54.8%, and showed a high level of compliance in taking antihypertensive medication reaching 71.0%. Clinically, univariate data collection showed a significant fluctuation in hemodynamic parameters after the intervention was given. The average systolic blood pressure of respondents decreased from 150.00 mmHg in the pre-intervention phase to 140.48 mmHg in the post-intervention phase, while the average diastolic blood pressure also decreased consistently from 94.48 mmHg to 90.48 mmHg. Through bivariate analysis, statistical tests confirmed that there was a very significant difference in blood pressure between before and after treatment, with a p-value of 0.001 for systolic pressure and 0.003 for diastolic pressure. Thus, it can be empirically concluded that structured physical activity in the form of elderly gymnastics has a significant effect in reducing systolic and diastolic blood pressure in the elderly population with hypertension at the study site.

Suggestion

Based on the scientific findings regarding the effectiveness of elderly exercise in lowering blood pressure, several strategic recommendations are formulated for various related parties. For community nursing services, the results of this study are recommended to be used as an evidence *-based practice reference* in developing a comprehensive, safe, and affordable non-pharmacological intervention program for people with chronic hypertension. For nursing educational institutions, this material can be integrated as a scientific reference source to enrich the treasury of teaching materials and the development of geriatric nursing research. Furthermore, for future researchers, it is recommended to expand the scope of this research by using a research design involving a control group (*randomized controlled trial*) and controlling for other confounding factors that have not been studied in depth. Finally, for the wider community, especially elderly people with hypertension, it is recommended to start cultivating non-pharmacological therapies such as elderly exercise on a regular basis to optimize daily blood pressure control and minimize the risk of long-term dependence on chemical drugs.

BIBLIOGRAPHY

Anwari, M., Herlina, S., & Karuniawati, H. (2018). The effect of programmed physical activity on vascular elasticity and blood pressure control in the elderly. *Journal of Clinical Nursing* , 6(2), 112–121.

Ayu Anjani, D. (2020). *Non-pharmacological management of elderly with chronic hypertension through rhythmic movement methods* . Yogyakarta: Graha Ilmu.

Toba Regency Central Statistics Agency. (2020). *Toba Regency in Figures 2020*. Balige: Toba Regency Statistics Agency.

Ekasari, MF, Riasmini, NM, & Hartini, T. (2019). *Improving the quality of life of the elderly through the concept and principles of geriatric physical exercise* . Jakarta: Trans Info Media.

Eriyanti, S., Nurhayati, E., & Rahmawati, D. (2016). Benefits of elderly exercise on physical and mental fitness in social support groups. *Journal of Community Health Sciences* , 4(1), 45–53.

Eviyanti, N., Siregar, R., & Simanjuntak, M. (2021). The effect of relaxation exercises for the elderly on reducing stress levels and emotional stability. *Journal of Gerontological Nursing* , 9(2), 134–145.

Guyton, AC, & Hall, JE (2014). *Textbook of medical physiology* (12th Edition). Jakarta: Elsevier Saunders.

Handono, T. (2021). Optimizing heart function and reducing vascular lipid plaque through regular physical activity in the elderly. *Indonesian Journal of Cardiology* , 42(1), 56–64.

Harahap, RA, & Siringoringo, M. (2016). Analysis of systolic and diastolic blood pressure thresholds in patients with degenerative diseases in urban areas. *Jurnal Medika Nusantara* , 14(3), 201–212.

Hidayanti, E., Prasetyo, B., & Utami, S. (2020). Genetic and lifestyle risk factors for the incidence of primary hypertension in elderly people in the community. *Journal of Health Epidemiology* , 8(2), 98–109.

Jatiningsih, R., Puspita, D., & Wardani, Y. (2016). The importance of cooling *down* and *stretching* after physical exercise on basal heart rate recovery. *Journal of Sports Health* , 4(2), 87–96.

Ministry of Health of the Republic of Indonesia. (2018). *National Basic Health Research Report (Riskesdas) 2018*. Jakarta: Health Research and Development Agency, Ministry of Health, Republic of Indonesia.

Ministry of Health of the Republic of Indonesia. (2019). *Report of North Sumatra Province Basic Health Research (Riskesdas) 2018*. Jakarta: Health Research and Development Agency Publishing Institute.

Ministry of Health of the Republic of Indonesia. (2021). *Guidelines for Sports and Physical Activity for the Elderly* . Jakarta: Directorate of Family Health.

Kristiani, D., & Dewi, PS (2018). Structure of elderly exercise stages based on the Ministry of Health's standard operating procedures. *Community Nursing Journal* , 5(1), 23–31.

Mancia, G., Kreutz, R., Brunström, M., Burnier, M., Grassi, G., Januszewicz, A., Muiesan, ML, Tsioufis, K., Agabiti-Rosei, E., Algharably, EAE, Azizi, M., Benetos, A., Borghi, C., Hitij, J.B., Cifkova, R., Dominiczak, A., Darioli, V., Fadl Elmula, M., Grodzicki, T., ... Williams, B. (2023). 2023 ESH Guidelines for the management of arterial hypertension The Task Force for the management of arterial hypertension of the European Society of Hypertension: Endorsed by the International Society of Hypertension (ISH) and the European Renal Association (ERA). *Journal of Hypertension* , 41(12), 1874–2071. https://doi.org/10.1097/HJH.0000000000003480

Muhith, A., & Siyoto, S. (2016). *Gerontological nursing education* . Yogyakarta: Andi Offset.

Murniasih, E. (2019). The effect of increasing age on commitment to daily blood pressure control in cardiovascular patients. *Journal of Medical-Surgical Nursing* , 7(1), 12–22.

Noventi, I., & Kartini, Y. (2020). Hypothalamic-pituitary-adrenal (HPA) axis response to reducing anxiety levels in the elderly through group activity therapy. *Journal of Nursing Science* , 8(2), 67–75.

Novitaningtyas, T. (2014). *The relationship between characteristics, vascular collagen levels , and lifestyle with the incidence of hypertension in the elderly* . Surakarta: Muhammadiyah University of Surakarta.

Nursalam. (2017). *Nursing research methodology: A practical approach* (4th edition). Jakarta: Salemba Medika.

Oliveros, E., Patel, H., Kyung, S., Fugar, S., Goldberg, A., Madan, N., & Williams, K.A. (2020). Hypertension in older adults: Assessment, management, and challenges. *Clinical Cardiology* , 43(2), 99–107. https://doi.org/10.1002/clc.23303

PERKI. (2015). *Guidelines for the management of hypertension in cardiovascular disease* (1st Edition). Jakarta: Indonesian Association of Cardiovascular Specialists.

Balige Health Center. (2025). *Data on the Most Common Diseases and Health Profile of the Elderly in Lumban Pea Village in 2025*. Toba: Toba District Health Office. (Unpublished Document).

Putriastuti, L. (2016). Analysis of the relationship between regular exercise and reduced risk of atherosclerosis in geriatric patients. *Periodical Journal of Epidemiology* , 4(1), 34–45.

Lifestyle risk factors , sedentary, cigarette smoke exposure, and excessive sodium consumption on hypertension exaltation. *Journal of Vocational Health* , 4(3), 156–167.

Rahmiati, & Zurijah, S. (2020). Vascular hemodynamics: Arterial stiffness, decreased cardiac output, and increased peripheral resistance in the elderly. *Journal of Nursing Science* , 8(1), 40–49.

Salmawaty, & Irma, A. (2019). Characteristics of gender differences in the level of vulnerability to cardiovascular pathology. *Journal of Health Research* , 11(2), 118–127.

Sani, AS (2016). *Community and Clinical Pharmacy Research Methodology* . Jakarta: Ministry of Health of the Republic of Indonesia.

Sartika, D., Handayani, S., & Wijayanto, B. (2020). The effect of regular physical activity on maintaining aortic compliance and preventing lipid plaque. *Journal of Clinical Pathophysiology* , 12(2), 89–97.

Sitanggang, R., Tarigan, P., & Ginting, S. (2021). Degenerative vascular structural changes as predictors of stroke and coronary heart disease in the elderly. *Scientific Journal of Nursing* , 7(2), 165–174.

Smeltzer, S. C., & Bare, B. G. (2018). *Brunner & Suddarth's Textbook of Medical-Surgical Nursing* (14th ed .). Philadelphia: Wolters Kluwer.

Sugiyono. (2019). *Quantitative, Qualitative, and R&D Research Methods* . Bandung: Alfabeta.

Sundari, S., & Bangsawan, M. (2017). The relationship between salt intake and lack of physical activity with the degree of hypertension in outpatients. *Metro Sai Wawai Health Journal* , 10(1), 22–31.

Suwanti, S., Setyawan, D., & Rahmanti, A. (2019). The effect of ergonomic exercise on reducing systolic and diastolic blood pressure in elderly with hypertension. *Journal of Psychiatric Nursing Science* , 2(3), 155–162.

Tarigan, M. (2019). Concept and chronological boundaries of the elderly population based on global life expectancy trends. *Journal of Gerontological Development* , 3(1), 14–22.

Triyanto, E. (2014). *Integrated nursing services for hypertension patients* . Yogyakarta: Graha Ilmu.

Unger, T., Borghi, C., Charchar, F., Khan, N.A., Poulter, N.R., Prabhakaran, D., Ramirez, A., Schlaich, M., Stergiou, G.S., Tomaszewski, M., Wainford, R.D., Williams, B., & Schutte, A.E. (2020). 2020 International Society of Hypertension

Global Hypertension Practice Guidelines. *Hypertension* , 75(6), 1334–1357. https://doi.org/10.1161/HYPERTENSIONAHA.120.15026

Wahyuni, N. (2017). *Geriatric physiotherapy: Benefits of programmed physical activity for cardiorespiratory fitness and nerve function in the elderly* . Jakarta: EGC.

Wardhani, M. (2020). The effect of ergonomic exercise on reducing systolic and diastolic blood pressure in elderly with hypertension in the 4th week. *Journal of Evidence-Based Community Nursing* , 8(2), 76–84.

Widjayanti, Y., Nugroho, H., & Supriyadi. (2019). Safety of low to moderate intensity rhythmic movement (*safe zone) in* vulnerable elderly populations . *Integrated Nursing Journal* , 11(1), 54–62.

Wilandari, A. (2020). Pathophysiology of obesity on increased cardiac output and circulating blood volume in hypertension patients. *Journal of Clinical Biosciences* , 5(2), 102–111.

World Health Organization. (2023). *Global report on hypertension: The race against a silent killer* . Geneva: World Health Organization.

Wratsongko, M. (2014). *The miracle of structured movement: Relaxation of sympathetic nerve fibers and elasticity of blood vessel walls* . Jakarta: PT Elex Media Komputindo.

Wulansari, D. (2017). *Integration of pharmacological therapy and non-pharmacological lifestyle modification in the management of chronic hypertension* . Bandung: Alfabeta.

Yanti, L., Purba, J., & Simanjuntak, R. (2017). Preventive efforts of health workers in handling hypertension using elderly exercise modalities at community health centers. *Journal of Nursing Community Service* , 4(1), 29–37.

Yanti, M., Siregar, D., & Gultom, R. (2021). Structural and functional changes in the peripheral vascular system during the aging process. *Journal of Geriatric Nursing* , 4(2), 81–89.

Yuniarti, E., & Dewi, R. (2019). Stimulation of endorphin production and reduction of blood vessel lumen calcification through relaxation therapy. *Journal of Health Research* , 8(1), 47–55.