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Research Article

ANALYSIS OF PHYSICAL ACTIVITY AND NITRIC OXIDE ON THE INCIDENCE OF HYPERTENSION AMONG THE ELDERLY IN THE WORKING AREA OF NANGGALO PUBLIC HEALTH CENTER IN 2025

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ABSTRACT

Background:
Hypertension is a condition characterized by blood pressure rising above normal levels, commonly referred to as high blood pressure. Hypertension is defined as a systolic blood pressure of ≥140 mmHg and diastolic pressure of >90 mmHg. It is a disease with a high prevalence of disability and mortality rates each year and is often referred to as "the silent killer." This study aimed to determine the relationship between physical activity and nitric oxide levels with the incidence of hypertension among the elderly at Nanggalo Public Health Center.
Methods: This study employed a quantitative approach with a cross-sectional design. A total of 137 respondents were selected using a simple random sampling technique. The research was conducted from March to April 2025. Data analysis was performed using Chi-square and Pearson Correlation tests.
Results: The Chi-square test showed a significant relationship between physical activity and the incidence of hypertension (p = 0.006) at Nanggalo Public Health Center, indicating that physical activity is associated with hypertension among the elderly. Meanwhile, the Pearson Correlation analysis revealed no significant relationship between nitric oxide intake and hypertension (p = 0.146; p > 0.05).
Conclusion: There is a significant relationship between physical activity and the incidence of hypertension among the elderly. However, there is no significant relationship between nitric oxide intake and the incidence of hypertension.

Keywords: *Physical activity, Nitric oxide, Hypertension, Elderly*

INTRODUCTION

Hypertension is a condition in which blood pressure rises above normal levels, commonly referred to as high blood pressure. Hypertension is defined as an increase in systolic blood pressure to 140 mmHg and diastolic blood pressure above 90 mmHg[1]. It is a disease with a high prevalence of disability and mortality year after year and is also known as "the silent killer"[2].

Globally, the World Health Organization (WHO) estimated that the prevalence of hypertension reached 33% in 2023, with two-thirds of cases found in low- and middle-income countries[3]. The number of individuals with hypertension is expected to continue increasing and is projected to reach 1.5 billion people worldwide by 2025[4].

Factors influencing hypertension include decreased physical activity, which can potentially raise blood pressure. In elderly individuals, reduced physical activity can lead to high blood pressure which, if left untreated, may damage nerve cells and result in stroke. Adequate physical activity strengthens the heart, enabling it to function more efficiently. Regular exercise can also help clear cholesterol deposits in the arteries. Such physical activities include full-body exercises such as walking, swimming, and cycling[5].

Nitric oxide is a compound that acts as a signaling molecule to relax smooth muscles in the lining of blood vessels, leading to vasodilation and a consequent reduction in blood pressure. Research by Astutik et al. (2013) on the role of blood nitric oxide (NO) levels and fat intake in hypertensive and non-hypertensive patients reported a correlation where the hypertensive group tended to have lower NO levels[6].

Based on the Indonesian Basic Health Research (Riskesdas) of 2018, the prevalence of hypertension in Indonesia was 34.1%, with the highest percentage in South Kalimantan. The prevalence in West Sumatra was 25.1%, and specifically in Padang City, it ranked 18th at 21.7%[7].

According to the 2023 Indonesian Health Survey (SKI), the prevalence of diseases among residents aged ≥15 years in Indonesia remains high. The highest prevalence of hypertension was in East Java Province at 32.8%, and in West Sumatra, it was 22.6%[8].

Based on the 2023 Annual Report of the Padang City Health Office, hypertension ranked first among the ten most common diseases in the city, with the highest number of outpatient visits. High blood pressure cases are increasingly found in younger populations (≥15 years). Of the 168,130 residents aged ≥15 years in 2023, 105,148 were diagnosed with hypertension, accounting for 62.5%. The majority of cases were in women (61,730) compared to men (43,418). The highest number of hypertensive patients based on outpatient visits in 2023 was at Nanggalo Health Center (21.7%) and Lubuk Buaya Health Center (21.6%)[9].

Multiple factors contribute to hypertension, with low physical activity and insufficient nitric oxide intake being potential causes of increased blood pressure. The purpose of this study was to determine the relationship between physical activity and hypertension among elderly individuals at Nanggalo Health Center.

MATERIAL AND METHODS

This study employed a quantitative approach using a cross-sectional design, with a sample size of 137 participants. The sampling technique was simple random sampling, and the research was conducted from March to April 2025. Data analysis used the Chi-square test for physical activity

variables and Pearson correlation for nitric oxide intake data.

RESULTS

Blood Pressure, Physical Activity, and Nitric Oxide Levels

Univariate analysis aimed to describe each research variable: respondent characteristics, independent variables (physical activity and nitric oxide), and the dependent variable (hypertension).

Table 1. Frequency Distribution of Respondents Based on Blood Pressure at Nanggalo Health Center.

Variabel	Mean	Min-Max
Systolic Blood Pressure	142,12	95-180
Kategorik	**n**	**%**
Hypertensive	91	66,4
Non-hypertensive	46	33,6

Table 1 shows the mean systolic blood pressure of respondents was 142.12 mmHg (range: 95–180 mmHg). Categorically, 66.4% (91 respondents) were hypertensive, while 33.6% (46 respondents) were not.

Table 2. Physical Activity Levels of Elderly at Nanggalo Health Center

Category	n	%
Low Physical Activity	89	65,0
Moderate Physical Activity	36	26,3
High Physical Activity	12	8,7
Total	137	100

Table 2 shows that more than half of the respondents performed low-level physical activity (65%). Moderate activity was seen in 26.3% of respondents, and high activity in 8.7%.

Table 3. Nitric Oxide Levels of Elderly at N anggalo Health Center

Variable	Mean ±SD	Min – Max
Total NO Amount	11,767 ±12,3	0,00-43,19
Average NO Amount	2,444 ±1,53	0,00-480

Table 3 shows that the total nitric oxide intake averaged 11.767 µmol/L (range: 0.00–43.19 µmol/L), which is below the normal healthy range of 20–60 µmol/L.

Physical Activity and Hypertension

Table 4. Relationship Between Physical Activity and Hypertension

Physical Activity	Hypertensive		Non-hypertensive		Total		*p-Value*
	n	%	n	%	n	%	
Rendah	64	70,3	25	54,3	79	100	
Sedang	24	26,4	12	26,1	36	100	0,005
Berat	3	3,3	9	19,6	12	100	

Table 4 shows that among 79 respondents with low physical activity, 70.3% were hypertensive. Among 36 respondents with moderate activity, 26.4% were hypertensive. Statistical analysis revealed a significant relationship between physical activity and hypertension (p = 0.005).

Table 5. Relationship Between Nitric Oxide and Hypertension

Variable		n	r (Pearson Correlation)	p-Value
Total Amount	NO	137	-0,147	0,087
Average Amount	NO	137	-0,258	0,002

Table 5 shows a weak negative correlation between total nitric oxide and blood pressure (r = -0.147, p = 0.087), which is not statistically significant. However, there was a significant negative correlation between average nitric oxide levels and blood pressure (r = -0.258, p = 0.002), indicating that higher average NO levels tend to lower blood pressure. This study found a significant relationship between physical activity levels and hypertension among elderly individuals at Nanggalo Health Center (p = 0.005). Elderly with low physical activity had a hypertension prevalence of 70.3%, higher than those with moderate (26.4%) or high physical activity (3.3%).

This finding aligns with research by Kamriana (2024), which showed a significant relationship between physical activity and hypertension in the elderly (p = 0.000)[10]. It is also supported by Natasaya et al. (2025), who reported a significant relationship between physical activity and hypertension in the elderly (p = 0.008)[11].

Insufficient physical activity increases the risk of high blood pressure. Inactive individuals often have higher heart rates, causing the heart to work harder with each contraction, which in turn places greater pressure on the arteries, resulting in elevated blood pressure[12].

Those who rarely engage in physical activity have a 20–30% higher risk of developing hypertension compared to physically active individuals[13].

In this study, most respondents were retirees who only engaged in light activities such as sitting and watching TV or light morning walks and household chores.

Pearson correlation analysis showed a weak negative correlation between total nitric oxide and blood pressure (r = -0.147, p = 0.087). Although not statistically significant, this indicates that higher nitric oxide levels may be associated with lower blood pressure.

This nonsignificant result may be due to individual variation or confounding factors such as age, nutritional status, medical history, and use of antihypertensive medications. Additionally, dietary factors or oxidative stress may impair NO bioavailability. According to Forstermann & Sessa (2012), high sodium intake, low antioxidant consumption (e.g., vitamins C and E), and sedentary lifestyles can accelerate NO degradation by increasing reactive oxygen species (ROS)[14].

CONCLUSION

There is a significant relationship between physical activity levels and hypertension, where low physical activity is associated with higher hypertension prevalence. No significant relationship was found between total nitric oxide levels and blood pressure.

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