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The relationship between blood pressure and risk of fall of the elderly in Kelating Village, Tabanan, Bali

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ABSTRACT

Background: Increasing the age of the elderly will cause a decrease in body functions. One is a decreased cardiovascular function, triggering cardiovascular disorders such as increased blood pressure. Increased blood pressure in the elderly can affect postural balance, so that it can cause an increase in the risk of falls in the elderly.

Methods: The study used a cross-sectional analytic design. This study was conducted on May 22, 2022. The sample in this study was selected using a simple random sampling technique. The number of samples in this study was 78 people. The data was analyzed using the SPSS software, which was divided into three parts, namely univariate analysis to describe the frequency distribution of each variable, normality test to determine whether the distribution of data was normally distributed or not where the normality test used the *Kolmogrov-Smirnov* test and bivariate analysis to determine the relationship between the two variables analysis method used *Spearman's Rho* test.

Results: The relationship between systolic blood pressure and risk of fall was p=0.000 and r=0.866, while the relationship between diastolic blood pressure and risk of fall was p=0.000 and r=0.520.

Conclusion: This study concludes that there was a relationship between blood pressure and the risk of falls in the elderly in Kelating Village.

Keywords: balance, blood pressure, elderly, risk of fall.

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INTRODUCTION

Aging is a developmental process in the final stages of human life marked by decreased physical, mental, psychological, and social functions and the risk of disease that can lead to death in the elderly.[1] Based on Laws of the Republic of Indonesia No. 13 of 1998, the elderly are individuals who reached the age of more than 60 years.[2] According to the World Health Organization, in 2019, it was stated that the number of people aged 60 years and over reached 1 billion.[3] According to the Ministry of Health of the Republic of Indonesia, in 2019, the Indonesian elderly population increased to 27.5 million or 10.3%, and 57.0 million people or 17.9% in 2045.[4] According to the Central Statistics Agency for the Province of Bali, in 2022, the elderly population who has an age range of 60-64 years is 2.082%, aged 65-69 years is 1.579 %, the age of 70 - 74 years is 1.098%, while the age of more than 75 years is 1.27%.[5]

Increasing age in the elderly population impacts increasing health problems associated with aging. One of them is cardiovascular disorders, where there is a decrease in baroreceptor reflexes that function as a regulator of blood pressure sensitivity.[6] Blood pressure is the pressure that comes from blood flow in the arteries or veins. Blood pressure disorders are divided into low or hypotension and high blood pressure or hypertension.[7]

Disturbances in blood pressure can trigger symptoms that cause a decline in health conditions in elderly individuals. Elderly individuals who experience blood pressure disorders such as hypertension will affect perfusion to body tissues such as the brain. The brain is the center of balance and awareness of the human body. When individuals experience a decrease in perfusion to the brain, it will cause a decrease in balance in elderly individuals.[8] A decreased balance in elderly individuals can trigger the incidence of falls in the elderly to increase. A physical problem that usually prevents older people from carrying out daily activities is a fall accident.[9]

Falls in elderly are common and may lead to serious health problems. They can be associated with various risk factors, including intrinsic and extrinsic factors.[10,11] Falls in the elderly can cause femur fractures, soft tissue injury, wrist injury, and death. In addition, it can cause pain, limited mobility, and functional limitations.[12]

Based on the background described above, the researcher wants to prove the relationship between blood pressure and fall risk in the elderly in Kelating Village, Tabanan, Bali.

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METHODS

The study used cross-sectional analytic design. This study was conducted on May 22, 2022. Research subjects were determined based on inclusion criteria (willing to be a research sample by signing informed consent, age 60-79 years, body mass index in the normal and overweight categories, not using a walker, able to understand instructions well) and exclusion criteria (elderly with Parkinson's disease, elderly with hemiparesis and history of stroke, elderly with osteoarthritis grades III and IV, elderly with history of lower extremity fracture).

The independent variable in this study was blood pressure measured using a sphygmomanometer. In contrast, the dependent variable in this study was the risk of falling, as measured using the time up-and-go test. The sample in this study was selected using a simple random sampling technique. The number of samples in this study was 78 people. The data analysis used is SPSS software which is divided into three, namely univariate analysis to describe the frequency distribution of each variable, normality test to determine whether the distribution of data is normally distributed or not where the normality test used is the *KoImogrov-Smirnov* test, and bivariate analysis to determine the relationship between the two variables analysis method using *Spearman's Rho* test.

Table 1. Frequency distribution of respondent's characteristics

Variables	Frequency (n)	Percentage (%)
Gender		
Male	23	29.5
Female	55	70.5
Systolic Blood Pressure		
Normal	17	21.8
Pre-Hypertension	33	42.3
Stage 1 Hypertension	21	26.9
Stage 2 Hypertension	7	9.0
Diastolic Blood Pressure		
Normal	21	26.9
Pre-Hypertension	32	41.0
Stage 1 Hypertension	19	24.4
Stage 2 Hypertension	6	7.7
Risk of Fall		
Low Risk	66	84.6
Low to Moderate Risk	12	15.4

Table 2. Normality test with *Kolmogorov-Smirnov*

Variables	Average	Standard deviation	*P*-value
Systolic Blood Pressure	129.41	16.424	0.003
Diastolic Blood Pressure	81.59	8.938	0.000
Risk of Fall	8.96	2.66	0.000

Table 3. Relationship between systolic and diastolic blood pressure with risk of fall

Blood Pressure	Risk of Fall	
	P-value	*r*
Systolic Blood Pressure	0.000	0.866
Diastolic Blood Pressure	0.000	0.520

RESULTS

The following are the study results based on systolic, diastolic, and fall risk in Kelating Village, which totaled 78 people. Table 1 shows a total sample of 78 people, where the number of females was 55 subjects (70.5%) and the number of males was 23 subjects (29.5%). Based on the distribution of systolic blood pressure, most of the samples were categorized as pre-hypertension, with as many as 33 people (42.3%). On diastolic blood pressure, most research subjects had pre-hypertension diastolic blood pressure, as many as 32 people (41.0%). Data on the risk of falling in the sample was obtained in two categories in this study: the sample with a low fall risk of 66 people (84.6%), while the low to moderate fall risk was 12 people (15.4%).

Table 2 shows the results of the normality test for data on systolic blood pressure, diastolic blood pressure, and risk of falling. The significance value of p for the systolic blood pressure variable was 0.003, the diastolic blood pressure variable was 0.000, and the fall risk variable was 0.000 ($p<0.05$), which means the data obtained were not normally distributed.

Table 3 shows the results of hypothesis testing conducted to determine the relationship between systolic blood pressure with the risk of falling and diastolic blood pressure with the risk of falling with the Spearman's rho test p-value=0.000 (which indicates there is a significant relationship between systolic blood pressure and the risk of fall and a significant relationship between diastolic blood pressure and the risk of fall). The results above show that the correlation coefficient or r on systolic blood pressure with the risk of falling is 0.866, which shows a strong relationship. While the value of r=0.520 on the relationship between diastolic blood pressure and the risk of falling so that the closeness of the two variables is moderate. The relationship between the two variables of blood pressure and the risk of falling is positive, which means that the higher the blood pressure value, the higher the risk of falling.

DISCUSSION

The results showed that systolic and diastolic blood pressure had a significant relationship with the risk of falling in elderly individuals. The higher the blood pressure in elderly individuals, the risk

of falling in the elderly increased. Based on the results of data analysis with the *Spearman's Rho* test, *p*-value = 0.000, which means that there is a relationship between blood pressure and the risk of falling. According to a 2021 study, blood pressure is correlated with age, with women having a greater association between age and systolic blood pressure than men. It was explained that women have systolic blood pressure that tends to be the same as men at a young age and experience a higher increase in systolic blood pressure after menopause than men at the same age.[13]

A previous study in 2021 found that the prevalence of falls in the elderly with hypertension was 32.2%. Hypertension that occurs in elderly individuals can increase the risk of falling.[14] Falls are events when the individual experiences a loss of his center of gravity, and no effort is made to restore balance.[15] Balance is needed by the elderly to maintain body position and stability while in static motion and dynamic conditions or moving from one position to another.[16]

According to research by Abate and Hentschel, hypertension can negatively impact balance with damage to arterial tissue, and hypertension can damage large arteries and reduce circulation in certain functional areas.[17,18] The rapid changes in blood pressure seen in hypertension and the sudden decrease in blood flow can also impair mechanisms for controlling postural balance.[19] Age has been shown to affect decreasing arterial elasticity and decreasing baroreflex sensitivity, which regulates short-term blood pressure regulation. One study found that arterial stiffness in the upper extremities was significantly higher in patients with orthostatic hypotension and a history of falls.[20]

Poor balance in elderly individuals can trigger the risk of falling, one of which can be caused by increased blood pressure conditions. Postural balance is controlled by involving several systems. The systems that include cardiovascular, somatosensory, visual, vestibular, musculoskeletal, and central nervous system integration from input to peripheral and motor systems decrease with age.[21] When individuals have hypertension, it will cause disturbances in visual abilities caused by retinopathy. Therefore, it can be said that most of the components of postural balance control can be affected by hypertension. Balance or normal postural control is important for mobility and stability during functional activities because balance deficits can cause falls in the elderly.[22]

This study's limitation is not using the methods used to assess the risk of bias in the included studies. In the future, studies can be carried out with more advanced methods.

CONCLUSIONS

Based on the study results, it can be concluded that there is a relationship between blood pressure and the risk of falling in the elderly in Kelating Village. The relationship between the two variables of blood pressure and the risk of falling is positive, which means that the higher the blood pressure value, the higher the risk of falling.

ETHICAL CLEARANCE

This study has used informed consent and does not conflict with the Declaration of Helsinki.

CONFLICT OF INTEREST

The author reports no conflicts of interest in this work.

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AUTHOR CONTRIBUTION

DAKIP and DMWA conceived the study design and data collection and drafted the manuscript; GV and MHSN collected the data and revised the manuscript.

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