

The relationship between leg muscle strength and functional mobility in the elderly



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ABSTRACT

Background: The elderly are individuals who experience a slow ageing process that can cause a decrease in physical function and condition. A noticeable decrease in function in the elderly is a decrease in muscle mass. This study aimed to determine the relationship between leg muscle strength and functional mobility ability in the elderly. This study aimed to determine the relationship between leg muscle strength and functional mobility in the elderly.

Methods: The design of this study was observational analytic with a cross-sectional study direction. At the research site at Puskesmas II Tabanan, the number of research subjects was 63 older people aged 60-69 years. A 30-second chair stand test measures leg muscle strength, while a timed up-and-go test measures functional mobility ability.

Results: The results of the association test using *Spearman's Rho* Test obtained a correlation coefficient value (r) -0.535 with a p -value=0.000 ($p<0.05$), which means there is a strong significant relationship that is negative in both variables.

Conclusion: There was a strong negative significant relationship between leg muscle strength and functional mobility ability in the elderly at Puskesmas II Tabanan.

Keywords: elderly, functional mobility, leg muscle strength, 30-second chair stand test, timed-up-and-go test.

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INTRODUCTION

The elderly are individuals who experience the ageing process slowly, which can cause a decrease in function and physical condition. The onset of ageing will cause morphological alterations in functioning muscles.¹ A marked decline in function in the elderly is a decrease in muscle mass.² Decreased muscle mass is an important factor causing decreased muscle strength. Decreased muscle strength, especially in the leg muscles, decreases the ability to maintain postural balance in the elderly.³ This condition indicates that the elderly risk falling if they focus on one leg in daily activities.⁴

One study reported that more than 2% of falls caused hip fractures, and more than 5% caused other fractures. More than 10% caused more serious injuries, such as head injuries.^{5,6} Other studies also state that decreased balance in the elderly is closely related to the functional limitations of the elderly in carrying out activities of daily living, especially for mobility and walking. This has an impact on the level of

dependence of the elderly in carrying out activities of daily life.⁷

Functional mobility is the capacity to move from one position in space to another, allowing the individual to participate in daily life and activities.⁸ Decreased mobility can create various obstacles for the elderly. It can cause injury to the elderly.⁹ The ability of functional mobility, especially walking, is influenced by the ability to maintain balance. Several factors, including leg muscle strength, influence balance.¹⁰

In previous studies to determine the relationship between leg muscle strength and the functional ability of the elderly. Muscle strength is measured with a dynamometer, and functional mobility ability is assessed by The Late Life Function and Disability Instrument questionnaire, which results in a relationship between leg muscle strength and functional ability.¹¹ Therefore, researchers were interested in finding out the relationship between leg muscle strength and the functional mobility ability of the elderly in the elderly.

METHODS

This study used a type of analytical observational study with a cross-sectional design. The independent variable in this study was leg muscle strength, and the dependent variable was functional mobility ability. The control variables in this study were age and BMI (normal). This research has been reviewed by the Research Ethics Commission of the Faculty of Medicine, Universitas Udayana/Sanglah Hospital Denpasar with the number 1682/UN14.2.2.VII.14/LT/2023 and passed the ethical feasibility test. The research will be conducted on 18 August 2023 at Puskesmas II Tabanan.

The total number of subjects in the study was 63. The inclusion criteria in this study were those aged 60-69 years with a normal BMI according to the BMI category of adult Asian adults (18.5-22.9). Willing to be the subject of research and sign informed consent. Exclusion criteria were the elderly with comorbidities who are taking drugs and the elderly with walkers.

The procedure for measuring muscle strength used a 30-second chair stand test. The muscle strength score was seen from how much movement was involved in standing upright and sitting for 30 seconds. The measurement of functional mobility in this study was carried out using a timed up-and-go test (TUGT).¹²⁻¹⁴

This study consisted of 2 data analyses, the first being a univariate analysis, which aimed to present a general picture of age, BMI, the results of measuring leg muscle strength (30 seconds chair stand test), and the results of measuring functional mobility ability (timed up-and-go test). The second was bivariate analysis, which used non-parametric spearman-rho to determine the value of the strength of the relationship between 2 variables.

RESULTS

From a total of 63 respondents, the descriptive characteristics of the respondents in this study were obtained: age, gender, BMI, leg muscle strength, and functional mobility capabilities can be seen in the following table.

Table 1 shows the number of samples that participated in the study, which amounted to 63 elderly people consisting of men and women. The sample's age in this study was based on inclusion and exclusion criteria, with the distribution of 60-64 years old amounting to 34 people (53.97%) and 65-69 years old amounting to 29 people (46.03%). The sample in this study had a normal body mass index with an average BMI of 21.44 kg/m². Leg muscle strength from 63 samples consisted of three categories, namely below average with 29 people (46.0%), an average category with 30 people (47.7%), and above average with four people (6.3%). In this study, functional mobility ability was divided into three categories, namely the normal mobility category of 20 people (31.7%), the good mobility category of 42 people

(66.7), and the category of requiring assistance with one person (1.6%).

Table 2 shows 34 people between the ages of 60 and 64, with the majority falling into the average category. With 17 people (50.0%), there is one person (2.9%) above average and up to 16 (47.1%) below average. There were 29 persons aged 65 to 69 years. In the average group, with 13 persons (44.8%), three people were above the average (10.4%), and the other 13 people (44.8%) were below the average.

Table 3 shows 34 persons aged 60-

64 years; the majority of them have high mobility (20 people, 58.8%), 13 people fall into the typical group (38.8%), and one person requires assistance (2.9%). There were 29 persons aged 65 to 69 years. The majority also had good mobility, with 22 people (75.9%) and the remaining seven (24.1%) falling into the normal group. At this age, none of the study individuals required any mobility aids.

The results of the association test using Spearman's Rho Test obtained a correlation coefficient value (r) -0.535 with a

Table 1. Characteristic respondents

Characteristics	Frequency (n)	Percentage (%)
Age (years)		
60-64 years old	34	54
65-69 year old	29	46
Gender		
Woman	48	76.2
Man	15	23.8
Normal Body Mass Index (average BMI 21.44 kg/m ²)	63	100
Leg Muscle Strength		
Below Average	29	46
Average	30	47.7
Above Average	4	6.3
Functional Mobility Capabilities		
Normal Mobility	20	31.7
Good Mobility	42	66.7
Need Help	1	1.6

Table 2. Distribution of leg muscle strength by age group

Leg Muscle Strength	Age Group			
	60-64 years old		65-69-year-old	
Below Average	16	(47.1%)	13	(44.8%)
Average	17	(50%)	13	(44.8%)
Above Average	1	(2.9%)	3	(10.4%)

Table 3. Distribution of functional mobility capabilities by age group

Functional Mobility Capabilities	Age Group			
	60-64 year old		65-69 year old	
Normal Mobility	13	(38.3%)	7	(24.1%)
Good Mobility	20	(58.8%)	22	(75.9%)
Need Help	1	(2.9%)	0	(0%)

Table 4. Test results of Spearman's rho association of limb muscle strength and functional mobility ability

Leg Muscle Strength	Functional Mobility Capabilities			Total	Correlation coefficient (r)	P-value
	Normal Mobility	Good Mobility	Need Help			
Below Average	3 (4.8%)	25 (39.7%)	1 (1.6%)	29 (46%)	-0.535	<0.001
Average	14 (22.2%)	16 (25.4%)	0 (0%)	30 (47.6%)		
Above Average	3 (4.8%)	1 (1.6%)	0 (0%)	4 (6.3%)		
Total	20 (31.7%)	42 (66.7%)	1 (1.6%)	63 (100%)		

p -value=0.000 ($p<0.05$), which means there is a strong significant relationship that is negative in both variables.

DISCUSSION

This study is consistent with another study by Lee et al. (2020), which found that the elderly population with excess BMI (obesity) had poor balance ability, which was associated with decreased leg muscle strength and impaired postural stability, reducing mobilization ability and increasing the risk of falls in the elderly. In this study, BMI control was carried out to minimize the influence of BMI on leg muscle strength and functional mobility ability so that the study could focus on analyzing the relationship between leg muscle strength and functional mobility ability in the elderly.¹⁵

Muscle strength is closely related to the neuromuscular system, which is how much the nervous system's ability activates muscles to contract so that the more muscle fibres that are activated, the greater the strength produced by the muscle.¹⁶ Plantar flexor and dorsiflexor muscles of the ankle, flexor muscles and extensors of the knee, and abductor and adductor hip muscles are major contributors to creating postural stability or balance.² The muscle strength of the legs, knees, and hips must be adequate for the lower limbs to perform their functional movements.^{17,18} Regular strength training and physical activity can help you gain muscle strength, reduce discomfort, and improve mobility.¹⁹ In research conducted by Rininta Adi Putri (2021), adding leg muscle strengthening exercises with elastic bands for six weeks can improve balance in the elderly and increase mobility ability as measured by timed up-and-go tests.²⁰

If muscle strength is optimal, it helps the elderly in maintaining body balance. Decreased muscle strength can cause decreased balance and affect the mobility ability of the elderly.²¹ This is an inseparable cycle because when muscle strength decreases, the legs cannot tread strongly, which will cause the body to wobble easily. When the body is easily shaken, the risk of falling increases.²² It will indirectly affect mobility in the elderly, such as the ability to step, walk, and balance. The impact often occurs in the elderly who experience

a decrease in leg muscle strength, usually not strong standing, easily wobbly, and falling.²³ Yuliadarwati's research (2020) states that a decrease in muscle strength will cause a decrease in the ability to maintain body balance, inhibit sitting to standing movements, cause posture changes, and increase the risk of falling.²⁴

CONCLUSION

Based on the research and analysis tests, it can be concluded that there is a strong negative significant relationship between leg muscle strength and functional mobility ability in the elderly at Puskesmas II Tabanan.

ETHICAL CLEARANCE

The Research Ethics Commission, College of Medicine, Universitas Udayana, stated that this research is ethically feasible with number 1682/UN14.2.2.VII.14/LT/2023.

CONFLICT OF INTEREST

This study has no conflicts of interest.

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AUTHOR CONTRIBUTIONS

IGMNG prepares study designs, collects data, processes data, and writes manuscripts. IMNW, AAGAPN, and NLNA are directing data collection and revising the manuscript.

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