

RESEARCH ARTICLE

ASSOCIATION OF FEAR OF FALL WITH LOWER LIMB STRENGTH AMONG THE ELDERLY

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Abstract

Background: The elderly population in Asia is growing, with projections indicating that 24% of the population will be 60 or older by 2050. Falls lead to severe physical, social, and psychological consequences. Fear of fall affects balance and mobility, leading to lower activity levels. This reduced engagement in activities of daily living may lead to reduced lower limb strength. **Objectives:** To determine the association between fear of fall and lower limb strength. **Methodology:** In this analytical cross-sectional study, participants were recruited through convenience sampling. Male and female elderly of age 60 and above were included in the study. And those with neurological deficit, history of fall in more than 6 month and severe joint instability were excluded. Sample size of this study was 377. Falls Efficacy Scale Questionnaire was used for measuring fear of fall and lower limb strength was measured by modified sphygmomanometer. Data was collected from different old age homes across Lahore. **Results:** The study included 377 older adults, with a mean age of 63.54 ± 2.54 years. The sample consisted of 201 males (53.3%) and 176 females (46.7%). The average weight of participants was 81.77 ± 16.30 kg, and the average height was 168.56 ± 9.01 cm. In terms of muscle strength, males showed higher mean quadriceps (38.02 ± 9.06) and hamstring strength (32.92 ± 8.80) compared to females, who had mean values of 36.15 ± 6.80 for quadriceps and 25.20 ± 10.48 for hamstrings. Regarding fear of falling, the majority of males (69%) reported moderate concern, while nearly half of the females (46.3%) reported high concern. A significant association was observed between quadriceps strength and fear of falling in both males ($p = .008$) and females ($p < 0.001$), with lower strength linked to higher concern ($p = .236$). **Conclusion:** The study concluded an association between fear of falling and lower limb strength among the elderly. Specifically, lower quadriceps strength was associated with higher fear of falling in both males and females. Also, an association was observed between hamstring strength and fear of falling in females, but not in males.

Key Words: Elderly, Fall, Fear of Fall, Lower Limb strength, Strength.

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1. INTRODUCTION

A person aged 60 years or above is referred to as elderly (1). Approximately 11% of Asia's population is aged 60 and above, which is expected to rise to 24% by 2050 (2,3). This increase is seen due to an increase in life expectancy in recent times (4). In Pakistan, the population is also increasing due to the availability of better medical resources and the population of elderly is predicted to increase. By 2050, the country's geriatric population is predicted to increase from 12 to 13 million to 18 million (5). Among senior people who live in the community, falls are the most common cause of injury-related mortality among the elderly, according to the Centers for Disease Control and Prevention. The prevalence of falls is 3%; some studies have found that the prevalence ranges from 20.8 to 85% (6). With over 540,000 falls annually, there was a staggering 55% increase in fall-related injuries between 1990 and 2015. Patients who have falls and fall-related injuries face serious clinical and public health issues. These incidents can cause serious physical harm as well as psychological, social, and financial repercussions like anxiety, sadness, and low self-esteem. The self-perceived balance of these elderly individuals does not correspond with their true balance skills because of fear, resulting in severe physical harm. (7). According to literature, older persons who participate in balance related and strength relevant training programs experience less falls and have better static and dynamic balance skills (8). But those lacking the confidence to perform normal activities such as walking, standing from a seated position, and going up and down the stairs developed fear of fall which is further associated with low physical activity and chronic conditions (7). Fear of falling is characterized by low self-efficacy or low confidence in one's ability to prevent falls. The most common cause of death among the elderly is injuries brought on by falls. Fear of falling is the primary cause of falls and is linked to detrimental outcomes including a decrease in daily activities (8,9). Fear of falling is more common as people age and have experienced falls, although it is not exclusive to those who have experienced falls in the past (10). Similarly, older adults may become afraid of falling even if they have never fallen. Anxiety over potential falls might result in a fear of falling, which makes worries about falling during everyday activities worse (11). The worst effects of a fear of falling are probably the reduction in walking and daily activity of living, which results in deconditioning of muscles and a general decline in strength (12). Elderly people frequently experience a decrease in muscle mass as they age. In these situations, their muscle strength may drastically decline if they participate in less

activities since they are more likely to fall (13). Lower limb muscle strength is essential for independent living, activities of daily living and social and recreational engagement. It is thought to be a strong indicator of future functional performance and decrease disability (14). Lower limb muscle groups such the plantar flexors (calf muscles), hip flexors and extensors (quadriceps and hamstrings), and knee extensors (quadriceps) are the most affected muscle groups. The strength of these muscles can also be affected by decreased exercise, which is further impacted by a fear of falling. It could make it more difficult for older adults to do basic activities like getting out of a chair, walking, climbing stairs, etc. The number of falls among the older population has increased due to muscle weakening and fear of falling (15). High proportion of the geriatric population experiences fear of falling, which can impact physical activity levels. As individuals become more cautious and avoid activities or environments they perceive as risky, their lower limb strength, balance, and overall functional may be influenced. Lower limb strength plays a crucial role in maintaining balance, mobility, and the ability to perform activities of daily living, all of which are key factors in fall prevention. The primary objective of this study is to examine the relationship between lower limb strength and fear of falling in older adults. By investigating this connection, the study aims to provide valuable insights that could inform the development of interventions to address both the fear of falling and the maintenance of muscular strength

2. METHODS

In this analytical cross-sectional study, data were collected from various geriatric care facilities, including Old Age Homes from Lahore. A sample size of 377 participants was selected, the inclusion criteria were individuals aged 60 years and above, both male and female, those who could walk independently (with or without minimal assistance), and those who were cognitively able to comprehend and follow instructions. Participants who had a history of substance abuse, diagnosed neurological conditions (such as Alzheimer's disease, Parkinson's disease, or stroke), recent fractures within the past six months (especially involving the spine or hip), any form of amputation, musculoskeletal diseases such as severe low back pain, surgical interventions in the six months prior to data collection (e.g., hip arthroplasty), recent hospitalizations within three months, psychosomatic disorders such as depression, or any condition causing severely limiting arthritis or joint instability.

To assess fear of falling, the Falls Efficacy Scale-International (FES-I) was used. The scale measures the level of concern about falling while performing various daily activities. Scores range from 16 to 64, with the following interpretation: 16–19 indicates low concern, 20–27 moderate concern, and 28–64 high concern about falling. Lower limb muscle strength was evaluated using a modified sphygmomanometer. For quadriceps strength measurement, the sphygmomanometer cuff was folded into a bag-like shape and placed above the ankle. With the participant seated and the knee flexed at 90 degrees, the cuff was inflated to a baseline pressure of 20 mmHg. The participant was then asked to extend the knee, and the peak pressure generated during maximal voluntary contraction was recorded. A pressure of 40 mmHg or more was considered normal; values below this indicated reduced quadriceps strength. For hamstring strength, the same procedure was followed, but the cuff was positioned on the posterior side of the lower leg, just below the calf muscle. After inflating to a baseline pressure of 20–30 mmHg, the participant was instructed to flex the knee. Peak cuff pressure during contraction was recorded. A reading of 20 mmHg or more was considered normal; values below this threshold were interpreted as reduced hamstring strength.

3. RESULTS

The study included 377 older adults aged 60 years and above, with a mean age of 63.54 ± 2.54 years. The sample consisted of 201 males (53.3%) and 176 females (46.7%). The average weight of participants was 81.77 ± 16.30 kg, and the average height was 168.56 ± 9.01 cm. In terms of muscle strength, males showed higher mean quadriceps (38.02 ± 9.06) and hamstring strength (32.92 ± 8.80) compared to females, who had mean values of 36.15 ± 6.80 for quadriceps and 25.20 ± 10.48 for hamstrings. Regarding fear of falling, the majority of males (69%) reported moderate concern, while nearly half of the females (46.3%) reported high concern. A significant association was observed between quadriceps strength and fear of falling in both males ($p = .008$) and females ($p < 0.001$), with lower strength linked to higher concern. For hamstring strength, a significant relationship with fear of falling was found only in females ($p < 0.001$), while no significant association was observed in males ($p = .236$).

Table 1. Distribution of quadriceps strength with Fear of Fall

GENDER		N	MEA N	STD DEVIATI ON	P VALUE
MALE	Low concern about falling	62	40.98	9.1	
	Moderate concern about falling	138	36.71	8.7	
	High concern about falling	1	36.00	0	
	Total	201	38.02	9.06	
FEMALE	Low concern about falling	45	39.84	7.45	
	Moderate concern about falling	49	36.89	7.50	
	High concern about falling	82	33.69	4.74	
	Total	176	36.15	6.80	

Table 2. Distribution of Hamstring Strength among Elderly

GENDER		N	MEA N	STD DEVIATI ON	P VALUE
MALE	Low concern about falling	62	33.0	8.3	
	Moderate concern about falling	138	32.9	8.9	
	High concern about falling	1	18.0	0	
	total	201	382.9	8.8	
FEMALE	Low concern about falling	45	27.53	8.36	
	Moderate concern about falling				
	High concern about falling	49	31.44	10.67	
	Total	176	25.20	1048	

4. DISCUSSION

The aim of the study was to investigate the association between fear of falling and lower limb strength specifically quadriceps and hamstring among seniors living in old age homes. All the subjects were aged 60 years and above. The average age of the subjects was 63.53 +/- 2.55 years. The results indicated that a large percentage of both men (74.5%) and women (80.8%) had low quadriceps strength, which was largely related to high fear of falling. Hamstring strength had a less consistent pattern of association, although statistically significant associations were found in females but not in males. This could result from sex differences in walking patterns, fall injuries or lack of activity level among female living in old age home which leads to less engagement in strength activities Previous studies stated that quadriceps muscle strength is a strong predictor of fall risk among older adults. Also, a significant inverse relationship

was observed between quadriceps strength (QMS) and fall occurrence. Participants with low QMS (<15 kg) were three times more likely to experience a fall compared to those with high strength (≥ 30 kg), even after adjusting for demographic and clinical variables (16). But Current study stated that not only quadriceps but also hamstring strength plays a role in fall risk, particularly among older women. Also, involving residents of old age homes, a significant association was found between lower quadriceps strength and higher fear of falling in both men and women, while hamstring strength was significantly associated with fear of falling only among females. This may reflect contextual and lifestyle differences, as institutionalized older adults tend to be more sedentary and socially withdrawn, possibly leading to greater muscle deconditioning compared to community-dwelling older adults. In contrast to current study, previous studies such stated that muscle strength specifically the peak torque (PT) of knee flexors (0.80 ± 0.29 Nm/kg), knee extensors (1.57 ± 0.47 Nm/kg), was not significantly associated with the occurrence of future falls ($p > 0.05$) (17). But the current study stated that not only quadriceps but also hamstring strength plays a significant role in fear of falling, especially among older women. Current study showed that quadricep strength in males was 38.02 ± 9.06 kg, and in females 36.15 ± 6.80 kg, both significantly associated with fear of falling ($p = .008$ for males, $p < 0.001$ for females). For hamstrings, male strength averaged 32.92 ± 8.80 kg and females 25.20 ± 10.48 kg, with a significant relationship found only in females ($p < 0.001$) and not in males ($p = .236$). Research shows that as people age, muscle strength and fear of falling become closely linked, but the relationship is complex and influenced by many factors. Studies have found that lower muscle strength especially in the legs can contribute to a greater fear of falling, which in turn may lead older adults to avoid physical activity, further weakening their muscles and increasing their risk of falls (18,19). However, it's not just muscle strength that matters; agility, balance, and overall physical performance also play important roles. For example, one study found that while muscle strength is important, agility is a key factor that helps older adults feel confident in their movements and reduces their fear of falling (20). Some research suggests that fear of falling is not always directly related to muscle weakness. For instance, older adults who are afraid of falling often show limitations in balance and confidence, even if their muscle strength is similar to those without such fears (21). Other factors like chronic health conditions, previous falls, being female, and lower levels of physical activity also increase the likelihood of developing a fear of falling 58111518. In addition, psychological factors such as anxiety,

low self-confidence, and poor perceived health can make the fear of falling worse, creating a cycle that is hard to break (22). In summary, these findings underscore the importance of regular assessment and targeted interventions to maintain lower limb muscle strength and address fear of falling, especially in older women, as part of comprehensive fall prevention and healthy aging strategies.

5. CONCLUSION

The study concluded an association between fear of falling and lower limb strength among the elderly. Specifically, lower quadriceps strength was associated with higher fear of falling in both males and females. Also, an association was observed between hamstring strength and fear of falling in females, but not in males.

6. LIMITATIONS AND SUGGESTIONS

This study's limitations include its cross-sectional design, which restricts cause and effect relationship. The lack of other objective measures like gait analysis and upper limb strength. Future longitudinal studies should compare institutionalized and community-dwelling populations, and ideally include physical activity levels, cognitive status, and psychosocial variables.

Ethical Considerations:

Rights and dignity of all individuals were the prior consideration. Research process did not cause any harm to the subjects. Accurate information to patients was provided and written consent was taken from the subjects. Subject's details and data confidentiality was maintained at every level. Ethical clearance was taken from the ethical committee of the university. IRB number of the permission letter issued by university was USA/FAHS/2025/907.

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CONFLICT OF INTEREST:

The authors declare that there is no conflict of interest regarding publication of article. Moreover, the authors have no competing interests.

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