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Association between level of physical activity and risk of fall among community-dwelling elderly living in Dhulikhel: A cross-sectional study

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ABSTRACT

Introduction: Falls are a major public health concern among older adults, contributing to significant mortality, morbidity, and disability. Physical activity has been shown to improve balance, strength, and overall physical function, which can help reduce fall risk.

Objectives: To explore the association between physical activity levels and fall risk among community-dwelling elders.

Methodology: A cross-sectional study was conducted in Dhulikhel municipality from 10 May, 2024, to 12 March, 2025. A total of 128 elderly individuals (aged ≥65 years) were selected using cluster random sampling. Data were collected through face-to-face interviews using a structured questionnaire, and the Global Physical Activity Questionnaire was used to assess physical activity. Risk of fall was assessed using the Timed Up and Go test. Descriptive statistics were used to describe socio-demographic characteristics, and a chi-square test was used to examine the association between physical activity levels and fall risk.

Results: Among 128 participants, 45.3% were at risk of falls. The prevalence of falls increased with age, particularly in individuals aged ≥75 years (p-value <0.001). A significant association was found between physical activity levels and fall risk,(p-value <0.001). Participants with low physical activity were more likely to be at risk of falling compared to those with moderate to high physical activity.

Conclusion: The study highlights the protective role of physical activity in reducing fall risk among the elderly. Tailored interventions promoting regular physical activity may help reduce fall-related injuries and improve overall health in elderly populations.

Keywords: Elderly; Fall; Physical activity; Sedentary

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INTRODUCTION

Older adults are vulnerable to diseases and death due to the decline in biological functions that comes with ageing.[1] The global elderly population (aged 65+) is increasing, with WHO predicting it will double by mid-century. [2,3] In Nepal, the 65+ population grew from 3.3% in 1974 to 6.2% in 2023.[4] Falls are a significant issue, contributing to mortality, morbidity, and disability. [5] Annually, 28-35% of people aged 65+ fall, increasing to 32-42% for those over 70. [6] A survey in Nepal recorded an 8.2% fall injury prevalence among elderly.[7]

Addressing fall risk requires considering physical, psychological, and environmental factors.[8] Physical activity, including exercise, has been shown to improve balance, strength, and physical functioning, reducing fall rates. WHO recommends 150-300 minutes of moderate aerobic exercise and at least three balance and strength training sessions weekly for older adults, but adherence is low, especially among those over 80.[9,10,11]

Although exercise is associated with reduced fall risk, research findings are inconsistent. Some studies show no significant link, while others report reduced risk or injury. This highlights the need for further research.[12,13,14,15] Therefore, this study aims to explore the relationship between physical activity levels and fall risk among elderly residents in Dhulikhel.

METHODOLOGY

This cross-sectional study was conducted from 10 May, 2024 to 12 March, 2025 in Dhulikhel municipality, Kavrepalanchok district. There are a total of 12 wards, which were considered as clusters for this study. The study clusters for the data collection was selected using a cluster random sampling technique. This was done by identifying the total elderly population from Dhulikhel municipality from annual report. We selected 4 clusters (wards 4, 6, 7 and 8) through the lottery method. The study participants from selected clusters were then selected according to the convenience of the researcher, and they were the elders of age group of 65 years and above including both genders, with or without using assistive devices. The participants were approached at their homes until the required sample size for the cluster was met. Participants with recent major surgery, recent history of fracture (6-8 months), who are unable to communicate and follow instructions, walk independently, bed-bound individuals and persons who do not consent to participate were excluded from the study. The calculated sample size for the study was 128, and it was calculated based on the formula: $n= Z^2 * p * q/e^2$ where p (prevalence of falls among Nepalese elders) was 8.2%, Z=1.96 at 95% confidence level, q= 1-p, and e (margin of error)=5% with addition of 10% non-response rare.[7] Proportionate sampling technique was used to ensure an equal number of participants (32) from all the selected wards.

Ethical approval was taken from Kathmandu University School of Medical Sciences – Institutional Review Committee (KUSMS-IRC)-196/24. Data collection was done through a door-to-door survey. All the participants were informed about the purpose of the study, and written consent was obtained. Participants were interviewed face-to-face using a structured questionnaire for demographics, and Global Physical Activity Questionnaire (GPAQ) was administered to assess physical activity.[17] Total Metabolic Equivalent to Task (MET) -min/week was calculated as the sum of MET min/week for moderate intensity activities (minutes of moderate activity × 4) and MET min/week for vigorous intensity activities (minutes of vigorous Activity × 8). Physical activity was categorized into low, moderate and high if participants' total MET-min/week was <600 MET-min/week, 600-3000 MET-min/week or >3000 MET-min/week, respectively. The Timed Up and Go (TUG) test was used to assess risk of falls. TUG test is a widely used and validated tool to assess mobility, balance, and fall risk in older adults. It is simple, quick, and requires no specialized equipment, making it ideal for clinical and community settings. Participants having TUG time greater than 13.5 seconds were considered having risk of falls [18]

The data were systematically coded, entered into Microsoft Excel and analysed using the statistical package for social sciences, IBM SPSS Statistics for Windows version 21 (IBM Corp., Armonk, N.Y., USA). Descriptive statistics such as frequency, percentage, mean, and standard deviation were computed to describe socio-demographic characteristics, physical activity and risk of falls. Chi-square test was used to measure the association between fall risk and, level of physical activity and sociodemographic characteristics.

RESULTS

A total of 128 participants aged 65-96 were included, with a mean ± SD age of 74.4 ±7.3 years and a slight female predominance 67 (52.3%). The population was predominantly Newar 64 (50%), followed by Brahmins 31 (24.2%) and Chhetri 17 (13.3%). The mean ± SD height of participants was 149.72 ± 11.3 cm, and the mean ± SD BMI was 26.31 ± 4.0 kg/m^2 (range: 15.40-38.20). A notable gender difference was observed in obesity rates, with 47 (70.1%) of women falling into the obese category compared to 32 (52.2%) of men. Additionally, men were more likely to be active smokers and drinkers, while women predominantly comprised the non-smoking and non-drinking groups. Most participants 67 (52.3%) had moderate levels of physical activity (Table 1).

The mean ± SD total MET min/week of the participants was 1135.7± 991.9 while, sedentary behavior averaged about 220.5 220.5 ± 143.9 minutes per week (Table 2).

Males 46 (75.4%) tended to be moderate to vigorously active (p-value=0.02). Similarly, elderly people under 75 years old 53 (74.6%) were moderate to vigorously active, in comparison with older which is significant (p- value <0.001, Table 3).

Regarding risk of falls, out of the total participants, 56 (43.75%) were at risk of fall, those 22 (36.1%) of those were male and 34 (50.7%) were female, with a mean ± SD time of 13.80 ± 3.93 seconds. Physical activity and age showed a significant association with risk of fall (p<0.001,Table 4)

Table 1: Participant's demographic characteristics and level of physical activity

Characteristics		n (%)
Gender	Male	61 (47.7)
	Female	67 (52.3)
Age (years)	<75 years	71 (55.4)
	≥ 75 years	57 (44.5)
Ethnicity	Newar	64 (50.0)
	Brahmin	31 (24.2)
	Chhetri	17 (13.3)
	Others	16 (12.5)
Level of PA	Low	44 (34.3)
	Moderate	67 (52.3)
	High	17 (13.2)
Risk of fall	Yes	56 (45.3)
	No	72 (56.2)

Table 2: Mean ± SD of Total MET and sedentary time

Characteristics	Mean ± SD
Total MET min/week	1135.7 ± 991.9
Sedentary time (min/week)	220.5 ± 143.9

DISCUSSION

The findings of this cross-sectional study shed light on the complex relationship between physical activity, age, gender, and fall risk among community-dwelling elderly living in Dhulikhel municipality. With nearly half (45.3%) of participants reporting falls in the study period.

Our findings showed a clear connection between physical activity and an increased risk of falls, which supports previous research indicating that older adults who lead more sedentary lifestyles are 39% more likely to fall compared to those who are moderately active.[12] This makes sense since staying inactive can lead to declines in strength, balance, and mobility, all of which contribute to a higher risk of falls.

However, the relationship between physical activity and fall risk isn't always straightforward. While moderate activity tends to lower the risk of falling, engaging in high-intensity physical activity, particularly vigorous, can sometimes increase the chance of injury, especially for frail older adults. Vigorous exercise can put too much strain on weakened muscles or joints, making these individuals more vulnerable to falls. [13] This highlights the

Table 3: Relationship between levels of physical activity and demographic characteristics.

Characteristics		Low PA n(%)	Moderate to High PA n(%)	p-value
Gender	Male	15(24.6)	46(75.4)	0.02*
	Female	29(43.3)	38(56.7)	
Age	<75 years	18 (25.4)	53 (74.6)	<0.001*
	≥ 75 years	26 (45.6)	31(54.4)	

p-value <0.05 significant *= chi- square test

Table 4: Relationship between risk of fall with other characteristics

Characteristics		Risk of fall		p-value
		Yes n(%)	No n(%)	
Gender	Male	22(36.1)	33(63.9)	0.094
	Female	34(50.7)	33(49.3)	
Age	65 – 74 years	21(29.6)	50(70.4)	<0.001
	75 – 96 years	35(61.4)	22(38.6)	
Physical Activity	Low	29(65.9)	15(34.1)	<0.001
	Moderate to High	27(32.1)	57(67.9)	
BMI	< 30	46(44.2)	58(55.8)	0.819
	>= 30	10(41.7)	14(58.3)	

p-value <0.05 significant *= chi- square test

need to be mindful of exercise intensity when creating fall prevention programs for older adults. Additionally, the study found a moderate to low prediction of fall among the elderly with physical activity. Low level of physical activity creates a cycle of inactivity, which in turn increases their fall risk.[15]

Even though both sexes had comparable levels of physical activity, women were accountable for 63.9% of fall events. One possible explanation for this discrepancy is that the majority of the female participants were postmenopausal. Women who have gone through menopause are more likely to fall because of a loss in their physical capacities, muscular strength, and balance.[19] Our study does not find any association between obesity and risk of fall; however, a meta-analysis carried out in seven different countries found that having a higher BMI or being overweight also increases this risk.[20] Biomechanical stressors may be further exacerbated by cultural variables unique to Nepal, such as the prevalence of women performing repetitive bending-intensive household tasks (such as gardening and collecting water). In order to fully comprehend these differences, more qualitative research on gender-specific activity patterns and their biomechanical effects is necessary.

The risk of falling increases significantly as people get older. In our study, we found a noticeable jump in fall rates between adults aged 65–74 (37.5%) and those aged 75 and above (62.5%, p<0.001). This is in line with other research showing that older age groups are more likely to report falls than those in their mid-60s.[21] As people age, the natural decline in physical strength, balance, and coordination, combined with health conditions like poor vision and chronic illnesses, contributes to a higher risk of falling. It's not just about getting older—it's the physical challenges that come with it.

However, another study shows a different trend for men aged 65–74, finding that they are more likely to report falls than women and older men when their physical health starts to decline. [22] This could be because men in this age group might stay more active, perhaps engaging in tasks or activities that increase their fall risk when their physical condition worsens. Unlike older men, they may still feel physically capable and take more risks, despite any limitations in their health.

These contrasting findings remind us that fall risk is influenced by more than just age. Gender, health status, and daily activities all play a role, showing how complex fall prevention can be. Understanding these differences can help us create more personalized strategies to reduce falls, addressing specific risks for men and women in various age groups.

In this study, we observed that moderate to high levels of physical activity did not significantly lower the risk of falls (p=0.121), which is different from findings from the longitudinal study done in Australia.[23] Many studies suggest a more complex relationship between PA and fall risk in older adults. For instance, while moderate PA generally helps reduce the likelihood of falls, some studies have noticed a U-shaped pattern, where those who are either inactive or very active are more prone to falls than those with moderate activity levels.[13,24,25] This shows that both doing too little and doing too much physical activity can increase the risk of falls in older adults.

The protective benefits of PA seem to depend not only on how much activity is done but also on the type and consistency of the activity. Physical activities that last at least 10 minutes at a time appear to offer stronger protection against falls compared to more scattered or irregular activities. [25] We used GPAQ does not assess balance exercise, which that are particularly important, showing the greatest impact in preventing falls among low physical activity and hence should be incorporated in future studies while exploring physical activity and risk of falls.[25] Beyond just fall prevention, regular moderate to high physical activity has also been shown to help slow down the progression of disability in daily life activities. This makes PA essential for older adults in maintaining independence and reducing the strain on healthcare services. [26]

This study's cross-sectional design limits the ability to establish causality between physical activity levels and fall risk, capturing only a snapshot in time without determining temporal relationships. Self-reported physical activity data via the GPAQ may be subject to recall and social desirability bias, affecting accuracy. Convenience sampling may limit the generalizability of findings to the broader elderly population. The focus on community-dwelling elderly excludes institutionalized populations.

The differences between our findings and earlier research suggest that more investigation is needed to understand the most effective types, intensities, and patterns of physical activity for preventing falls in various groups of older adults. Such studies would help identify the best ways to ensure that physical activity provides maximum benefit with minimal risk. These insights point to the importance of designing physical activity programs that

are tailored to the needs of older adults. Such programs should take into account their physical limitations, frailty, and fear of falling, ensuring that they can safely stay active and reduce their risk of falls, ultimately enhancing their quality of life.

CONCLUSION

Physical activity has protective effect against falls, but also reveals nuances related to gender, age, and potentially the type of activity. This study also underscores the critical need for targeted fall prevention strategies particularly focusing on increasing physical activity levels among older adults. Future research should explore these nuances further, investigating specific exercise interventions tailored to the unique needs of this population, considering cultural factors and biomechanical impacts, especially for women. This will inform the development of more effective, culturally sensitive interventions that reduce fall risk and improve the overall well-being and independence of elderly residents, which can have implications in physiotherapy practices and community health programs.

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