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ORIGINAL ARTICLE

Physical and balance activity, mobility status and risk of falls among older people in Brunei Darussalam.

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Abstract

Background: Low levels of physical activity, balance exercises, and mobility are linked to an increased risk of falls in older people. In this study, physical activity components, mobility status, balance activity, and risk of falls among older individuals attending community centres in Brunei Darussalam were assessed. **Methods:** A cross-sectional survey was conducted regarding mobility status, balance activities, physical activity levels (using the Physical Activity Scale for Elderly, PASE), and risk of falls. **Results:** There were 92 participants. The mean PASE score was 156.3. Almost all participants were independent in mobility, and all engaged in walking activities. Only 52.2% engaged in physical activity ranging from light to strenuous intensity, while 81.5% did not perform balance exercises. Regarding fall risk, 51.1% reported worrying about falling, 59.8% were identified as being at risk of falls, and 19.6% had experienced falls within the past 12 months. Participants with secondary level education had a higher PASE score (p=0.031). Despite a non-significant association, physically active older people had a lower risk of falls and did not fall in the past 12 months. **Conclusion:** Although the participants were perceived as physically active as members of the community centres, there is a need to further increase activity levels and introduce balance exercises to reduce falls risk and maintain independence in the community.

Keywords: *Accidental falls, Exercise, Older adults, Physical activity, Postural balance.*

Introduction

Healthy or active ageing is an approach to reduce physical and cognitive decline among older people. Physical activity is a key component of active ageing [1]. Unfortunately, physical inactivity and sedentary lifestyles are common among older people, which are associated with a greater risk of frailty and disability. A survey conducted in England in 2011 of more than 92,000 people found that older people exercised less with age [2]. Physical inactivity is also a risk factor for chronic diseases, including coronary heart disease, obesity, decreased muscle mass, and osteoporosis; conversely, those who engaged in adequate physical activity had a lower risk of these conditions [3].

In older people, physical inactivity, reduced muscle strength, and muscle mass are associated with falls [4]. Falls are the second leading cause of unintentional injuries. Annually, falls result in approximately 684,000 deaths globally and 37.3 million falls require medical intervention [5]. Most falls are recurrent falls, highlighting the importance of identifying risk factors and preventing subsequent falls. Falls risk factors include postural hypotension, sedative use, medications, and gait impairment, which should be individually assessed and managed for those at risk of falls [6]. Generally, strength training should be encouraged in older people to improve functional capabilities, strength, and motor function [7]. Effective strategies for fall prevention in older people tend to include a combination of lower limb strength and balance exercises [4].

Physical activity in older people provides physical, psychological and cognitive benefits, improves resilience against chronic diseases and promotes independent living [8-10]. Despite these well-known benefits, there is poor uptake of physical activity among older people globally [11]. Brunei is a small country in Southeast Asia with a rapid increase in its ageing population. To promote active ageing, each of the four districts has a senior citizen activity centre, where older people can register to socialize and participate in group activities. In this study, the physical activity levels of older people from these centres using the Physical Activity for Elderly (PASE) questionnaire [12], mobility status, balance exercise activity, and risk of falls were evaluated. The relationship between the level of physical and balance activities with socio-demographic characteristics, co-morbidities, mobility status, and risk of falls was also evaluated.

Methods

This was a cross-sectional study conducted from November 2022 to February 2023 among community-dwelling older adults aged 60 years and older who were registered members of four senior citizen activity centres across Brunei Darussalam. These centres are government-supported community facilities that provide social, recreational, and health-promoting activities for older adults in each district.

A convenience sampling approach was used, where eligible participants attending the centres during the study period were invited to participate. Inclusion criteria were adults aged 60 years and above who were registered members of the selected centres and able to provide informed consent. Individuals with severe cognitive impairment, acute illness, or physical limitations that precluded questionnaire completion were excluded.

Data were collected using a structured questionnaire administered in hard copy format and distributed by the head of each centre. The questionnaire was primarily self-administered, with assistance provided by centre staff or researchers when required due to literacy or visual limitations. Based on information provided by each centre, the total number of registered participants in all four centres was 650 people. A total of 92 participants completed the

questionnaire, corresponding to a response rate of 14.2%.

The study questionnaire was divided into four parts. Section 1 consisted of socio-demographic characteristics (age, gender, ethnicity, marital status, education status, living condition, smoking status, and use of walking aids). Section 2 was the Physical Activity Scale for Elderly (PASE) questionnaire, a validated tool that consists of 12 items addressing leisure, physical, household, and work-related activities over the past week. Scores were calculated based on activity weightage and frequency for each listed activity. Leisure activity frequency was calculated using an hours-per-day conversion table, while household activity values were binary values of 0 or 1. Work frequency was calculated by dividing the total hours worked during the previous week by seven, while seated work was scored zero points. The frequency of each activity and weightage were multiplied together, with the total being the overall PASE score. Although individual PASE items are categorical, the total score represents a weighted composite measure of physical activity and is analysed as a continuous variable. While the maximum PASE score is 400 and there are no established cut-off values expected for an individual, the suggested minimum PASE score is 140 for males and 120 for females [3,12].

The PASE questionnaire was translated into Malay using the forward and backward translation approach by two authors proficient in Malay and English. Both the original and back-translated English versions were compared by a third author, with discrepancies resolved by discussion. The Malay version was piloted with five older people not included in the study, with no difficulties reported in understanding the Malay version.

Section 3 consisted of questions regarding balance exercises. Section 4 consisted of the three falls risk screening questions used by the Centers for Disease Control and Prevention to screen for falls risk among community-dwelling adults (whether they fell in the past 12 months, feel unsteady when standing or walking, or worry about falling) [13]. A positive response to any of the three questions deemed the participant as at risk of falls.

The minimum sample size was estimated using a single proportion formula based on a reported prevalence of physical inactivity of 48.8% among Malaysian older adults aged 60 years and above [14]. Malaysia was selected as a reference due to its geographical proximity and similar socio-demographic characteristics to Brunei Darussalam. Using a 95% confidence level and a margin of error of 10%, the required minimum sample size was 96 participants. With 92 participants recruited, the study achieved 95.8% of its minimum target. The response rate was 14.2%, meaning approximately 648 individuals were approached to obtain 92 participants. This can be attributed to variable attendance at the centres, limited availability during the data collection period, and lack of interest among some eligible participants.

Data from completed questionnaires were entered into Microsoft Excel and analysed using R-Studio® version 4.2.0. Categorical variables were summarised using frequencies and percentages, while continuous variables were presented as means and standard deviations (SD). One-way ANOVA (Type III) was used to examine associations between categorical variables and the total PASE score, which was treated as the dependent variable. The distribution of PASE scores was assessed and considered approximately normal, supporting the use of parametric analysis. Fisher's exact test was used in place of the chi-squared test when expected cell counts were less than 5, as the assumptions required for chi-square analysis were not met. A p-value of <0.05 was considered statistically significant.

The study received ethical approval from the Institute of Health Sciences Research Ethics Committee(Ref: BD/PAPRSBIHSREC/2022/51). Permission to carry out the study at the senior citizen activity centres was obtained from the Department of Community Development, Ministry of Culture, Youth and Sports.

All participants provided informed consent before participation. Participation was voluntary, and participants were informed of their right to decline or withdraw at any time. Individuals with severe cognitive impairment were excluded to ensure participants were able to provide informed responses. All data were anonymised and handled confidentially.

Results

There were 92 participants. The majority were of Malay ethnicity (92.4%), had secondary level education (80.4%), and were non-smokers (85.9%). Almost all participants were independent in mobility and did not use walking aids (96.7%). The majority had never performed balance exercises (81.5%). There were 19.6% fallers in the past 12 months. A quarter of participants felt unsteady when standing or walking, while more than half reported worrying about falling, with 59.8% considered to be at risk of falls. Table I summarises the sociodemographic characteristics, mobility status, balance activities, and falls risk.

Table 2 shows the scores for each PASE activity component and total scores. The mean PASE score was 156.3 (SD 60.81). All participants performed walking activities. While 17.4% did light sports and 34.8% strenuous sports, fewer participants engaged in moderate sports (4.3%) or muscle strengthening exercises (7.6%). For household activities, the majority carried out at least light housework, and 80.4% did heavy housework. For outdoor activities in the previous week, 67.4% did lawn work, and 62% did gardening. Home repair was the least likely household activity by participants (16.3%). Fewer than half provided care for others, and the majority (90.2%) did not work. The mean scores for leisure, household, and work-related activity components were 43.5, 102.8, and 9.9, respectively, reflecting the relative contribution of each domain to overall physical activity.

Table 3 shows the association between sociodemographic characteristics, co-morbidities, mobility status, and risks of falls with mean PASE scores (SD)**.** There was a significant association between the total PASE scores and education status (P=0.031). Participants with secondary education had the highest score (164.41), followed by higher education (128.67) and primary education (119.36). There were no significant associations between the total PASE scores and the co-morbidities, mobility status, or risk of falls. There were no significant associations between PASE scores, falls in the past 12 months, feeling unsteady when standing or walking, worrying about falls, or use of walking aids.

Table 4 shows the association between participant characteristics and balance activities. There were no significant associations between socio-demographic characteristics, co-morbidities or mobility status with balance activities. Balance activities or lack thereof was not significantly associated with falls in the past 12 months, feeling unsteady when standing or walking, worrying about falls, or risk of falls.

Discussion

In this study, the physical activity level, involvement in balance exercises, and risk of falls in community-dwelling older adults from community centres in Brunei were evaluated. As falls lead to injuries and functional decline, it is important to understand factors that may contribute to falls, in addition to implementing effective fall prevention programmes incorporating physical and balance exercises for

a healthy ageing population. This study recruited participants from community centres, who were relatively well and mobile.

In this study, there were more females than males, which may reflect higher female life expectancy and greater participation of women in community-based activities. Despite the high mobility status, more than half of the participants were considered at risk of falls. While the risk of falls increases with age, it was unexpected to have almost 60% of the participants considered at risk of falls based on the three screening questions. This emphasizes the need for structured interventions aimed at improving physical strength, balance, and mobility to significantly decrease the risk of falls in older adults [15].

The mean PASE score of our participants was 156.3, which was higher than that of a Malaysian study (mean PASE score 94.96). This may be due to a high rate of poor health and chronic diseases (81.1%) in the Malaysian study [16]. There was also an association between the total PASE score and education status, where those with secondary education had the highest scores compared to primary or tertiary levels. A study in Singapore found that higher educational levels were associated with higher PASE scores [17]. It is possible that in Brunei, those with tertiary education are more likely to have sedentary occupations and may require different interventions to increase physical activity. This is in addition to public health awareness interventions on the benefits of physical activity in falls prevention that should be provided to those with lower educational status.

Regarding the type of activities performed by the participants, household activities were the most popular, with walking being the most common type of leisure activity. Intense activities did not appear to be favoured by the participants, which may be due to health limitations or personal factors such as time and family responsibilities. Household activities as a form of physical activity have been linked to health benefits. A study conducted in Singapore found that household activity was associated with sharper mental and physical capabilities in older people, which increased with heavier household activity [18]. Walking exercises are also beneficial for older people [2]. A meta-analysis of walking exercises found an association with improved physical function in older people, specifically in lower limb muscle endurance, overall body endurance, and upper body flexibility [19]. A combination of walking and strenuous activities like jogging correlated well with a lower risk of death, particularly with increased intensities of physical activity performed [20].

Although participants with higher physical activity scores were steadier when walking or standing, had a lower risk of falls, were less worried about falling, and did not fall within the past 12 months, this association was not statistically significant. A study from Thailand found that there was an increased incidence of falls in older people who take fewer than 5,000 walking steps per day and PASE scores below 100 [21]. Older people with higher levels of physical activity exhibit more stable gait patterns, greater muscle strength and function, joint mobility and flexibility, cardiorespiratory fitness, and reduced risk of falls [22,23].

The majority of participants did not perform balance exercises, which may contribute to their falls risk. There is evidence to support balance activities in falls prevention, with a meta-analysis showing that exercise interventions focusing on balance and functional exercises significantly reduced the rate of falls and fall-related injuries in older adults [24]. Other possible balance exercises that could be introduced at the centres include *Tai Chi,* which consists of slow and controlled movements that enhance postural control, flexibility, and muscle strength. Balance activities such as *Tai Chi* and yoga have been shown to improve balance and reduce the fear of falls in older adults [25,26].

There are several limitations to this study. Participants were recruited from the community centres, which reflects active older people who were able to physically attend and were interested in the questionnaire. Not all registered older adults attend regularly. There may be unintentional biases in the responses to the questionnaire, such as the intensity of exercise or housework. The question on caring for another person may also be open to interpretation; Asian family values and households with extended families may imply they 'care' for the other older or young dependents in the households, which may increase the positive response for the PASE question on 'caring for another person' [27]. Interpretation of associations involving balance activity should be made with caution due to small subgroup sizes, particularly in higher activity categories. These small numbers may result in unstable estimates and reduced statistical power, increasing the likelihood of Type II error, where true associations may not be detected.

Recommendations to reduce falls risk among participants of these community centres include introducing specific exercise programs targeting strength, balance and mobility or incorporating aerobic exercise, resistance training and balance exercises within the weekly scheduled activities at each centre.

Conclusion

More than half of the participants from the Senior Citizen Activity Centres are at risk of falls, and there is a need to increase the level of physical activity and introduce balance activities to reduce falls risk.

Contributors

All authors were involved in study conception and design, data acquisition and analysis, drafting and finalising the manuscript.

Conflicts of Interests

The authors have no conflicts of interest to declare.

Funding / Support

This study did not receive any funds.

Data Availability

The data are available from the corresponding author upon reasonable request.

Ethics Approval

The study received ethical approval by the Institute of Health Sciences Research Ethics Committee (reference: UBD/PAPRSBIHSREC /2022/51) with prior permission obtained from the Department of Community Development, Ministry of Culture, Youth, and Sports.

Table 1. Sociodemographic characteristics, mobility status, balance activity, and risks of falls of participants.

Variable	*n* (%)
Age	
60 – 70	57 (62.0%)
70+	35 (38.0%)
Gender	
Male	41 (44.6%)
Female	51 (55.4%)
Ethnicity	
Malay	85 (92.4%)
Others	7 (7.6%)
Marital Status	
Single	38 (41.3%)
Married	54 (58.7%)
Education Status	
No Formal Education	0 (0.0%)
Primary	11 (12.0%)
Secondary	74 (80.4%)
Higher Education	7 (7.6%)
Living With	
Alone	14 (15.2%)
Not alone	78 (84.8%)
Smoking Status	
Smoker/Used to Smoke	13 (14.1%)
Never Smoked	79 (85.9%)
Use of Walking Aids	
No	89 (96.7%)
Yes	3 (3.3%)
Balance Activity (Exercises to help with balance)	
Never	75 (81.5%)
Seldom (1 – 2 days/week)	7 (7.6%)
Sometimes (3 – 4 days/week)	7 (7.6%)
Often (5 – 7 days/week)	3 (3.3%)
Falls Risk Screening	
Fallen in the past 12 months	18 (19.6%)
Feel unsteady when standing/walking	23 (25.0%)
Worry about falling	47 (51.1%)
Considered at risk of falls	
At Risk	55 (59.8%)
Not At Risk	37 (40.2%)

Table 2. Physical Activity Components Scores in the past 7 days (n=92)

Variable (Weight times Frequency)	*n* (%)	Mean (SD)
Leisure:		43.5 (28.14)
Walking Activities		
0	0 (0.0%)	
1 – 50	55 (59.8%)	
51 – 100	37 (40.2%)	
Light Sport		
0	76 (82.6%)	
1 – 50	16 (17.4%)	
51 – 100	0 (0.0%)	
Moderate Sport		
0	88 (95.7%)	
1 – 50	4 (4.3%)	
51 – 100	0 (0.0%)	
Strenuous Sport		
0	60 (65.2%)	
1 – 50	32 (34.8%)	
51 – 100	0 (0.0%)	
Muscle Strength		
0	85 (92.4%)	
1 – 50	7 (7.6%)	
51 – 100	0 (0.0%)	
Household Activities:		102.8 (35.40)
Light Housework		
0	2 (2.2%)	
25	90 (97.8%)	
Heavy Housework		
0	18 (19.6%)	
25	74 (80.4%)	
Home Repairs		
0	77 (83.7%)	
30	15 (16.3%)	
Lawn Work		
0	30 (32.6%)	
36	62 (67.4%)	
Outdoor Gardening		
0	35 (38.0%)	
20	57 (62.0%)	
Caring for Another Person		
0	48 (52.2%)	
35	44 (47.8%)	
Work-related Activity:		9.9 (36.03)
Work for Pay/Volunteering		
0	83 (90.2%)	
1 – 100	3 (3.3%)	
101 – 200	6 (6.5%)	
Total Score:		156.3 (60.81)

Table 3. Association between sociodemographic characteristics, co-morbidities, mobility status, and risks of falls with mean PASE score (SD)

Variables	n	Mean PASE score (SD)	*P*-value*
Ethnicity			0.852
Malay	85	155.96 (63.10)	
Others	7	160.47 (17.71)	
Gender			0.055
Male	41	169.86 (68.98)	
Female	51	145.41 (51.49)	
Age			0.601
60-70	57	153.69 (54.89)	
70+	35	160.57 (70.04)	
Marital Status			0.717
Single	38	153.55 (50.74)	
Married	54	158.25 (67.40)	
Living With			0.266
Alone	14	173.04 (55.65)	
Not Alone	78	153.30 (61.54)	
Education Status			0.031
Primary	11	119.36 (53.23)	
Secondary	74	164.41 (62.18)	
Higher Education	7	128.67 (10.56)	
Smoking Status			0.820
Smoker/Ex-Smoker	13	159.89 (43.22)	
Never Smoked	79	155.72 (63.44)	
Use of Walking Aids			0.637
Yes	3	172.73 (41.98)	
No	89	155.75 (61.44)	
Balance Activity			0.305
Never	75	153.96 (60.56)	
Seldom	7	192.24 (54.75)	
Sometimes	7	160.98 (69.25)	
Often	3	120.25 (49.46)	
Fallen in the Past 12 Months			0.480
No	74	158.53 (62.82)	
Yes	18	147.16 (52.34)	
Feels Unsteady when Standing/Walking			0.617
No	69	158.15 (59.17)	
Yes	23	150.77 (66.58)	
Worry About Falling			0.150
No	45	165.66 (68.85)	
Yes	47	147.35 (51.12)	
At Risk of Falls			0.290
No	37	164.53 (63.79)	
Yes	55	150.77 (58.66)	

* One-way ANOVA (Type III sum of squares used due to unequal group sizes)

Table 4. Association between participant characteristics and balance activities.

Variable	Balance Activity				
	Never, n=75*	Seldom, n=7*	Sometimes, n=7*	Often, n=3*	*P*-value†
Ethnicity					0.355
Malay	69 (92.0)	7 (100.0)	7 (100.0)	2 (66.7)	
Others	6 (8.0)	0 (0.0)	0 (0.0)	1 (33.3)	
Gender					0.157
Male	30 (40.0)	5 (71.4)	5 (71.4)	1 (33.3)	
Female	45 (60.0)	2 (28.6)	2 (28.6)	2 (66.7)	
Age					0.961
60-70	46 (61.3)	4 (57.1)	5 (71.4)	2 (66.7)	
70+	29 (38.7)	3 (42.9)	2 (28.6)	1 (33.3)	
Marital Status					0.463
Single	32 (42.7)	1 (14.3)	4 (57.1)	1 (33.3)	
Married	43 (57.3)	6 (85.7)	3 (42.9)	2 (66.7)	
Living With					0.250
Alone	11 (14.7)	0 (0.0)	2 (28.6)	1 (33.3)	
Not Alone	64 (85.3)	7 (100.0)	5 (71.4)	2 (66.7)	
Education Status					0.812
Primary	11 (14.7)	0 (0.0)	0 (0.0)	0 (0.0)	
Secondary	58 (77.3)	7 (100.0)	6 (85.7)	3 (100.0)	
Higher Education	6 (8.0)	0 (0.0)	1 (14.3)	0 (0.0)	
Smoking Status					0.672
Smoker/Ex Smoker	10 (13.3)	1 (14.3)	2 (28.6)	0 (0.0)	
Never Smoked	65 (86.7)	6 (85.7)	5 (71.4)	3 (100.0)	
Use of Walking Aids	3 (4.0)	0 (0.0)	0 (0.0)	0 (0.0)	>0.999
Fallen in the past 12 months	16 (21.3)	0 (0.0)	1 (14.3)	1 (33.3)	0.560
Feels Unsteady When Standing/Walking	20 (26.7)	3 (42.9)	0 (0.0)	0 (0.0)	0.232
Worry About Falling	39 (52.0)	3 (42.9)	3 (42.9)	2 (66.7)	0.874
At Risk of Falls	46 (61.3)	3 (42.9)	3 (42.9)	3 (100.0)	0.297

* Values are presented as frequency (%)

† Fisher's exact test

Balance activity categories: Never; Seldom (1-2 days/week); Sometimes (3-4 days/week); Often (5-7 days/week)

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