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Artikel Asli/*Original Articles*

Fear of Falls, Physical Performance and Physical Activity Levels among Older Adults with Falls and Recurrent Falls

(Ketakutan Jatuh, Tahap Aktiviti Fizikal dan Prestasi Fizikal, dalam Kalangan Warga Emas yang Jatuh dan Jatuh Berulangan)

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ABSTRACT

Older adults who fall recurrently have sub-optimal physical performance especially muscle strength, mobility and balance. Recurrent falls lead to a heightened fear of falls. However, there is limited information regarding other domains of physical performance, namely flexibility and endurance. In addition, there is still limited knowledge pertaining fear of falls and physical activity levels among Malaysian community-dwelling older adults who are recurrent fallers. The aim of our study was to compare fear of falls, physical performance and physical activity levels among older adults with falls and recurrent falls. This cross- sectional study was carried out in two Malaysian urban districts. Physical performance was examined using Functional Fitness MOT (FFMOT). Modified Baecke Questionnaire and Activities-Specific Balance Confidence (ABC-6) Scale were administered to evaluate the level of daily physical activity and fear of falls respectively. A total of 35 older adults participated in this study, 20 fallers (mean age: 71.95±8.22) and 15 recurrent fallers (mean age: 76.73±8.82) respectively. Our study results showed that older adults with recurrent falls had significantly reduced lower extremity strength, dynamic balance, endurance, balance confidence in activities of daily living and physical activity levels compared to faller group ($p < 0.05$). Although flexibility and upper limb strength were not significantly different among fallers and recurrent fallers, overall improvement in physical performance should be targetted in falls prevention and management. This is vital to prevent further deterioration in physical performance among older adults with recurrent falls.

Keywords: Recurrent fallers; fallers; older adults; FFMOT

ABSTRAK

Warga emas yang mengalami insiden jatuh berulangan mempunyai prestasi fizikal yang kurang, terutama dari segi kekuatan otot, mobiliti dan keseimbangan. Walau bagaimanapun, terdapat maklumat yang terhad dalam parameter prestasi fizikal lain seperti fleksibiliti dan ketahanan kardiovaskular. Manakala data mengenai ketakutan jatuh dan tahap aktiviti fizikal antara warga emas dalam komuniti yang jatuh berulangan di Malaysia adalah terhad. Tujuan kajian ini adalah untuk membandingkan prestasi fizikal, ketakutan jatuh dan tahap aktiviti fizikal di kalangan warga emas yang jatuh dan jatuh berulangan. Kajian keratan rentas ini telah dijalankan di dua bandar di Malaysia. Prestasi fizikal diukur dengan menggunakan Functional Fitness MOT (FFMOT). Soal selidik Modified Baecke digunakan untuk menilai tahap aktiviti fizikal harian dan Skala Activities-Specific Balance Confidence (ABC-6) untuk menilai ketakutan jatuh. Seramai 20 warga emas yang jatuh dan 15 warga emas yang jatuh berulangan dengan purata umur 71.95±8.22 dan 76.73±8.82 masing-masing mengambil bahagian dalam kajian ini. Hasil kajian ini menambah bukti bahawa warga emas yang jatuh berulangan menunjukkan kemerosotan yang signifikan dari segi kekuatan otot, keseimbangan dinamik, ketahanan kardiovaskular, keyakinan seimbang dalam aktiviti harian serta tahap aktiviti fizikal berbanding dengan warga emas yang jatuh ($p < 0.05$). Walaupun fleksibiliti dan kekuatan otot tangan tidak berbeza secara signifikan antara warga emas yang jatuh dan jatuh berulangan, penambahbaikan prestasi fizikal secara keseluruhan perlu diambil kira dalam pencegahan dan pemulihan masalah jatuh. Ini adalah penting untuk mencegah kemerosotan dalam prestasi fizikal dalam kalangan warga emas yang mengalami jatuh berulangan.

Kata kunci: Jatuh; jatuh berulangan; warga emas; FFMOT

INTRODUCTION

Older adults aged 60 and above make up 13% of the global population and is estimated to increase by 3% per annum (United Nations 2015). By the year 2050, the number of older adults is expected to triple (United Nations 2015). In Malaysia, the average life span has increased dramatically, and Malaysia will be categorised as an 'ageing nation' with older persons constituting more than 15% of the population by year 2035 (Tengku Aizan & Norizan 2008).

Falls are a major health concern among older adults as they lead to decline in quality of life and increase in early mortality rates (Muhamad Iqbal et al. 2018, Zunaidah et al. 2018). Falls have a range of impact from no injury to serious injury or even death (Hartholt et al. 2011). Fear associated with recurrent falls may lead to self-imposed limitation of activity and decrease in functional ability. Along with physical and functional burden, the financial burden associated with falls cannot be ignored with the cost of hospitalisations estimated to be between six to eight billion dollars a year in the United States among community dwelling older adults (Caroll et al. 2008).

Approximately one third of community dwelling older adults are expected to sustain a fall at least once annually, out of which half would fall multiple times (Gill et al. 2005). The prevalence of falls among older adults who are institutionalised has been reported to be about 40% (Yoshida 2007) and may be related to other conditions such as malnutrition (Singh et al. 2014). An individual is considered a faller, if he or she has sustained one to two falls within the past 12 months, whereas a 'recurrent faller' is when the incident of falls is more than twice per year (Tahir 2001). In Malaysia, it was reported that the prevalence of falls and recurrent falls were 47% and 57.7% respectively among community dwelling older adults (Azianah et al. 2017; Sazlina et al. 2008; Muhamad Iqbal et al. 2018).

Older adults who have experienced recurrent falls have demonstrated lower physical performance in terms of muscle strength, mobility and balance as compared to single fallers (Grace et al. 2009; Boye et al. 2015). It was hypothesized that the susceptibility of an older adult to recurrent falls could account for underlying age-related pathology and frailty (Boye et al. 2015). In addition, older adults with higher risk of falls were found to have reduced functional mobility and balance (Nor Najwatul et al. 2018). Regarding fear of falls, recurrent fallers within specific populations with debilitating health conditions such as multiple sclerosis and Parkinsonism are found to demonstrate higher fear of falls (Mak et al. 2009; Mazumder et al. 2015). There is limited information regarding fear of falls and physical performance among community-dwelling older adults with recurrent falls in Malaysia. Results from western countries cannot be extrapolated due to cultural differences with difference in health and activity status (Chen 2017). Furthermore, data on aspects of physical performance such as cardiovascular endurance and flexibility is lacking. The aim of our study was to compare physical performance, fear of falls and physical activity levels among older adults with falls and recurrent falls.

EXPERIMENTAL METHODS

This cross-sectional study was carried out in two urban districts in Peninsular Malaysia namely Kuala Lumpur and Petaling Jaya. The targeted sample size was 52 participants when calculated using G-Power analysis. Older adults with falls were recruited via convenience sampling method through phone call invitations from a list of older adults registered for activities at Center for Healthy Aging and Wellness, Faculty of Health Sciences and from University Malaya Medical Centre Falls Clinic. Eligible participants were then provided with an information sheet and briefed verbally regarding the study prior to obtaining their informed written consent. Anonimity and confidentiality of participants' personal information was assured. This study was approved by the Medical and Research Ethics Committee of Universiti Kebangsaan Malaysia (UKM PPI/111/8/JEP-2018-265) and University Malaya (201782-5458).

Participants of this study were Malaysian older adults aged 60 years and above, able to ambulate independently with or without walking aid and have sustained at least 1 fall in the past 12 months. Participants were excluded if they were unable to comprehend basic instructions, had acute illnesses and/or sustained a recent fracture, consumed prescribed drugs that could affect balance and muscle strength, diagnosed with unstable chronic diseases and/or neurological diseases, severe visual impairment, cognitively impaired measured with the Visual Cognitive Assessment Test (VCAT) score less than 18 and mild depression with Geriatric Depression Scale (GDS) score more than 4.

Sociodemographic data, clinical characteristics and history of falls were recorded for all participants in a structured questionnaire. Physical performance was assessed using the Functional Fitness MOT test battery for older adults (FFMOT) which comprised of 6 standardised, validated, age-appropriate tests as explained below.

The 30-second sit to stand test was used to test lower limb strength. A standardised back supported chair without arm rests placed against a wall was used. Participants were asked to sit in the chair against back rest, arms crossed across the chest and feet flat on the floor. At 'Go' participant was to rise to full stand, then return to fully seated position, as many times as possible within 30 seconds. The intra-class correlation coefficient for the sit to stand test was shown to be high (0.89; 95%CI = 0.79-0.93) (Jones et al. 1999).

The chair sit and reach test was used to measure lower limb flexibility. Participants were asked to sit at the edge of a chair with one leg on the ground and another leg in full extension and reach forward as far as possible with both

hands to touch the toes or beyond. The distance reached from fingertips to the toes was measured. This test has been deemed reliable with, r = 0.92 for men and r = 0.96 for women as well as good criterion validity (r = 0.76 for men; r = 0.81 for women) (Jones et al. 1998).

The back-scratch test was used to measure upper limb flexibility. Participants were asked to reach over the shoulder with one hand and behind the back in an attempt to touch or overlap the two hands in standing. The distance between the tips of the middle fingers or the distance of overlap was measured. This test has an excellent test-retest reliability (ICC = 0.99) (Prasanta et al. 2016).

The Timed Up and Go test (TUG) was used to test for the functional mobility and dynamic balance. During the test, participants rose from a chair, walked a distance of 3 meters at normal walking pace, made a 180º turn at the 3-meter mark and returned back to the chair and sat down. Time taken to complete the test was recorded. The TUG has an excellent test-retest reliability (ICC = 0.99) and excellent correlation with Berg Balance test (r = -0.81) (Podsiadlo et al. 1991).

Dominant handgrip strength (DHS) test was used to measure upper limb strength. A calibrated digital hand dynamometer (Jamar, Lafayette Instrument Company, USA) was held with the dominant hand and squeezed as tightly as possible, sustained over 5 seconds. Reliability and validity of the DHS has been reported to be excellent (ICC = 0.98) (Bohannon et al. 2005).

The two-minute walk test (2MWT) was used to measure cardiovascular endurance. It was modified from the six-minute walk test in FFMOT. During the test, the hallway was cleared of obstacles and the participant was asked to "Cover as much ground as possible over two minutes." The distance covered in two minutes was recorded. This test has a high test-retest reliability (ICC = 0.95) and good correlation with the 6MWT (r = -0.93) (Connelly et al. 2009).

The Modified Baecke Physical Activity Questionnaire (MBPAQ) assessed the level of physical activity in the past year. The domains of physical activity consisted of occupation, leisure and sporting activities. Participants rated the level, frequency and intensity of activities enlisted for each item in a Likert-type scale. Test-retest reliability has been reported to be good (ICC = 0.75) (Washburn et al. 1993).

The Activities Specific Balance Confidence Scale (ABC-6) Scale was used to assess fear of falls when performing daily activities. The participants were asked to rate their confidence in performing daily activities from 0-100% (not confident to fully confident) and the average score indicated fear of falls. The test has been found to be highly reliable in terms of internal consistency (Cronbach's alpha = 0.96) (Huang et al. 2009).

Statistical Package for Social Science (SPSS Inc. Chicago, USA) version 21 was used to analyze the data. Sociodemographic data, physical performance data and scores for questionnaires were analyzed using descriptive analysis. To compare physical performance, fear of falls and physical activity level among older adults with falls and recurrent falls, independent T-test was used for continuous data and Chi-square test for categorical data. Statistical significance level was set at $p < 0.05$.

RESULTS

Demographic, physical performance, physical activity and fear of falls data of participants is as enumerated in Table 1. A total of 35 older adults with mean age of 75 ± 8.7 years participated in this study. Women made the majority (71%) of the study population. Mean body mass index (BMI) of the participants showed that they were considered to be 'normal' falling under the healthy weight group. When categorized according to number of falls, 57% of the participants were categorized as 'fallers' and 43% were 'recurrent fallers.'

TABLE 1. Participants demographic characteristic (n = 35)

Variables	N (%)
Gender	
Males	10 (28.6)
Females	25 (71.4)
Age (mean±s.d)	74.0±8.7
Level of Education	
Primary	2 (5.7)
Secondary	17 (48.6)
Tertiary	16 (45.7)
Number of Medications	
0-3	20 (57.1)
≥ 4	15 (42.9)
Number of co-morbidities	
1	10 (28.6)
≥ 2	25 (71.4)
Body Mass Index (kg/m^2) (mean s.d)	23.5 ± 3.2
Underweight < 18.5	3 (8.6)
Normal 18.5-24.9	22 (62.9)
Overweight > 25	10 (28.6)
Number of falls in past 12 months	
1-2	20 (57.1)
≥ 3 (recurrent falls)	15 (42.9)
Physical Performance (FFMOT) (mean±s.d)	
30s Sit to Stand Test (n)	9.9 ± 5.1
Dominant Handgrip Strength Test (kg)	19.9 ± 7.1
Chair Sit and Reach Test (mm)	-5.3 ± 155.6
Back Scratch Test (mm)	-89.4 ± 117.4
Timed Up and Go Test (s)	9.7± 3.5
2 min Walk Test (m)	109.2± 46.9
Fear of Falls (ABC-6 Score)	59.1± 24.3
Level of Physical Activity (mean s.d) (MBPAQ Score) (mean s.d)	6.8±1.4

ABC-6: Activities Specific Balance Confidence Scale; MBPAQ: Modified Baecke Physical Activity Questionnaire; FFMOT: Functional Fitness MOT Test

Table 2 summarizes the baseline characteristics and results of physical performance, fear of falls and level of physical activity between fallers and recurrent fallers. Statistical analysis showed that there is no significant difference between the two groups in terms of age, gender, BMI, level of education, number of medication and number of co-morbidities. In terms of physical performance as tested using the FFMOT, the 30-second sit to stand, TUG and 2MWT were found to be significantly lower in scores among recurrent fallers ($p < 0.05$). Regarding the fear of falls and level of physical activity, the ABC-6 and MBPAQ scores was found to be lower among recurrent fallers ($p < 0.05$). This could imply lower physical performance and heightened fear of falls among recurrent fallers as compared to fallers.

TABLE 2. Comparison of participants characteristic and difference between fallers and recurrent fallers (n = 35)

Variables (Unit)	Number of Falls		p-value
	Fallers (n = 20)	Recurrent Fallers (n = 15)	
Age (years)	71.95 ± 8.22	76.73 ± 8.82	0.108[a]
Gender			
Males	5 (14.3%)	5 (14.3%)	0.712[b]
Females	15 (42.9%)	10 (28.6%)	
Body Mass Index (kg/m^2)			
Underweight (< 18.5)	1 (2.9%)	2 (5.7%)	0.484[b]
Normal (18.5-24.9)	12 (34.3%)	10 (28.6%)	
Overweight (> 25.0)	7 (20.0%)	3 (8.6%)	
Level of Education			
Primary	1 (2.9%)	1 (2.9%)	0.838[b]
Secondary	9 (25.7%)	8 (22.9%)	
Tertiary	10 (28.6%)	6 (17.1%)	
Number of Medication			
0-3	13 (37.1%)	7 (20.0%)	0.278[b]
≥ 4	7 (20.0%)	8 (22.9%)	
Number of Co-Morbidities			
1	5 (14.3%)	5 (14.3%)	0.712[b]
≥ 2	15 (42.9%)	10 (28.6%)	
Physical Performance (FFMOT) (mean ± s.d)			
30s Sit to Stand test (n)	11.40 ± 4.69	7.93 ± 5.12	0.045*[a]
Dominant Handgrip Strength test (kg)	20.20 ± 7.66	19.44 ± 6.46	0.759[a]
Chair Sit and Reach test (mm)	11.55 ± 142.63	2.93 ± 176.29	0.790[a]
Back Scratch test (mm)	-74.75 ± 130.10	-108.88 ± 99.01	0.403[a]
Timed Up and Go test (s)	7.81 ± 0.96	12.23 ± 4.14	0.001*[a]
2min Walk test (m)	124.93 ± 41.23	88.30 ± 47.13	0.020*[a]
Fear of Falls (ABC-6 Score)	69.40 ± 18.29	45.41 ± 24.99	0.002*[a]
Level of Physical Activity (MBPAQ Score)	7.38 ± 1.30	6.04 ± 1.20	0.004*[a]

[a] Independent t-test; [b] $\chi 2$ test; FFMOT: Functional Fitness MOT Test; ABC-6: Activities Specific Balance Confidence Scale; MBPAQ: Modified Baecke Physical Activity Questionnaire

DISCUSSION

We aimed to compare physical performance, fear of falls and physical activity level between older adults with falls and recurrent falls. The results of our study showed that recurrent fallers had significantly lower performance in lower limb muscle strength, dynamic balance and exercise endurance in comparison with fallers. In addition, recurrent fallers had significantly higher fear of falls and lower physical activity level compared to fallers.

Consistent to findings of similar studies, participants with recurrent falls showed significantly lower physical performance in mobility, muscle strength and balance as compared to those who were non-fallers and single fallers (Grace et al. 2009; Boye et al. 2014). This can be explained by the physiological changes that may occur with aging. Aging is associated with musculoskeletal changes causing muscle atrophy, reduced lean muscle mass and bone mineral density that leads to sarcopenia (Clark 2019). In addition, age related cardiovascular changes such as reduction in peak heart rate and maximum aerobic capacity ultimately

contribute to lower endurance levels in older adults (Fleg & Strait 2011). Neuromuscular changes lead to decrease in neural reaction time and motor coordination which impairs dynamic balance and postural stability leading to increased susceptibility to falls (Oliveira et al. 2015).

A review by Anne et al. (2013) showed that gait pattern in older adults with recurrent falls was altered and less coordinated, which illuminates the link between falls and impaired dynamic balance. Therefore, they may have lesser capability in weight shifting or taking a rapid step to avoid falls when their balance is perturbed. Older adults with recurrent falls also have declined ability to execute reach-to-grasp reaction rapidly, to recover equilibrium during perturbation although older adults are more reliant on arm reaction in maintaining their balance (Anne et al. 2013).

Lower limb muscle strength was significantly lower in recurrent fallers compared to fallers. In a global report on epidemiology of falls, lower extremity muscle weakness was found to interfere with balance, resulting in a three-fold risk for recurrence in falls (Yoshida 2007). Muscle strength is important in balance and standing posture that enables the body to cope with sudden postural disturbance. Reduction in strength and balance leads to impairments in daily activities in older adults. Thus, reducing functional independence and physical performance that eventually lead to recurrent falls (Grace et al. 2009).

As for cardiovascular fitness, recurrent fallers had significantly lower performance than fallers in our study. At present, there is lack of evidence to support the association between cardiovascular endurance among recurrent fallers. However, a decline in exercise tolerance and further decrease in general activity is expected with aging and recurrent falls. In older adults, increased rigidity of chest wall, decline in respiratory muscle strength and endurance results in loss of elastic recoil which causes respiratory function to deteriorate progressively that lead to reduce in endurance (Mendonca et al. 2016, Nor Najwatul et al. 2017). The link between declination of cardiac, neuromuscular, brain and physical function in aging are shown to be the primary causes of reduction in endurance capacity (Mendonca et al. 2016).

In our study, recurrent fallers also reported higher fear of falls and lower physical activity level compared to fallers. Fear of falls lead to several consequences including physical, functional, psychological and social changes among older adults (Scheffer et al. 2008). Fear of falls causes older adults to cut down on activities or avoid participation in activities altogether (Scheffer et al. 2008). Moreover, fear of fall prompts caregivers to take protective measures by further restricting physical activity and movements to avoid consequences of falls (Grace et al. 2009). Therefore, it starts the vicious cycle of sedentary lifestyle and reduced physical performance, causing loss of independence hence leading to recurrent falls (Grace et al. 2009). It is presumed that older adults with lower physical activity tend to be more frail due to muscle atrophy (Chan et al. 2006).

Although mean handgrip strength of recurrent fallers was observed to be lower than fallers, upper limb strength was not found to be significantly different between faller groups. In the study by Hoda et al. (2013), it was found that handgrip strength of both hands was significantly different between fallers and recurrent fallers, with positive correlation between lower grip strength and number of falls.

Similarly, both upper and lower flexibility was not found to be significantly different between faller groups in our study. However, flexibility is a vital component in maintaining balance and postural stability. A study by Goncalves et al. (2017) found and association between decreasing flexibility and risk of falls with the aging population. It could be implied that less than optimum flexibility could impair the normality of performing activities of daily living and consequently increasing the risk of falls. As a recommendation for future studies delving into falls and physical performance, there is a need for further investigations relating upper limb strength, flexibility and recurrent falls.

The limitations of this study should be addressed. Firstly, sample size was small, and the participants were limited from only two urban cities. This limits data extrapolation to the entire Malaysian older adult population. However, post hoc analysis showed that the power achieved for this sample size was 0.74 and large effect size of 0.87 with $\alpha = 0.05$ (one tailed). Future studies should consider including a larger sample size that include older adults from both urban and rural populations across the nation. The strength of this study was that the physical performance tests were comprehensive and evaluated many aspects of physical performance including flexibility and endurance. This study also adds on to existing literature regarding falls, more specifically recurrent falls within the Malaysian population.

CONCLUSION

The findings of our study suggest that recurrent fallers have significantly lower extremity strength, dynamic balance, cardiovascular endurance, physical activity levels and have higher fear of falls level compared to fallers. Falls are a major geriatric concern and there is a need to address the specific aspects of physical performance to prevent recurrent falls. Improving physical performance and daily activity levels are vital as a part of holistic falls prevention and management strategy among older adults.

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