Relationship between physical activity levels with risk of falls and social participation among elders attending daycare centers in Colombo, Sri Lanka: A descriptive cross-sectional study

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Abstract

Background
The older adult population is rapidly increasing worldwide including in Sri Lanka. Daycare centers for older adults is a newly introduced concept for Sri Lankan community-dwelling elders which has not been studied previously.

Objective
To evaluate the relationship between physical activities (PA), risk of falls (RF) and social participation (SP) among community-dwelling elders from daycare centers in Colombo, Sri Lanka.

Methods
Descriptive cross-sectional study. Randomly selected sixty elders (aged ≥60 years) from all six registered daycare centers in Colombo. PA, RF and SP was measured using International Physical Activity Questionnaire (IPAQ) short form, Berg Balance scale (BBS) and Participation scale (P-scale) respectively. Chi-square and Spearman correlation were used for statistical analysis.

Results
AMean age (+SD) was 73.23±6.02 years. Majority were women (90%). Median (Range); BBS and P-scale scores were 51 (34-56) and 8.5 (1-52) respectively. Median (Range) PA per week was 2133 (33-6426) MET-minutes. A low RF was seen among 88.3% of the population, 66.7% had a high SP and 58.3% had moderate PA levels. Increased PA levels correlated with higher BBS score and lower RF (r=0.31, p<0.05). There was no significant association between PA and SP.

Conclusion
High PA levels were associated with lower RF. Further studies with larger populations are recommended. Exercises programs that improve PA and balance among elders would be beneficial. Strategies that enhance social bonding and participation of elders should be promoted within the Sri Lankan society.
Background

The older adult population in the world is increasing rapidly. The proportion of adults over 60 years in Sri Lanka is expected to rise up to 25% by 2030 [1]. Majority of elders in Sri Lanka live in the western province (31%), and Colombo district has one of the highest ageing index in Sri Lanka along with three other districts [2,3]. In 2012, 99% of older adults in Sri Lanka were living with their families, while only 1% were institutionalized [2].

Low physical activity is a known risk factor for falls [4]. The tendency to fall also increases with age [5]. Each year 28-35% of older adults over 65 years have accidental falls [6]. Falls may lead to fatal or non-fatal injuries [5], causing significant morbidity [7]. Out of multiple risk factors associated with falls among older adults physical inactivity is known to be a major contributing factor [7]. Moreover, physical inactivity can adversely affect social participation of older adults and vice versa [8-10]. Being more socially active is associated with a high quality of life. Physical activity level among older adults has not been widely investigated in Sri Lanka. Most studies have analyzed physical activity and risk of falls among institutionalized elders, but studies among community-dwelling older adults are scarce [11].

Social participation has shown to be a protective factor in older age. Evidence suggest that social participation positively influences health, while social isolation leads to adverse health outcomes in older adults. Studies on social participation of Sri Lankan community-dwelling aged population is sparse [12]. Marsh et al. suggested that there is a necessity to study the contributing factors for social participation among elders (13). Although many studies have been carried out to investigate social participation of elders in high income counties, only few studies have been conducted in low and middle income countries like Sri Lanka [13].

Community-dwelling elders are described as older adults who live in the community [14]. Most of them live with their extended families. Daycare centers for older adults are a new concept initiated by the Sri Lankan government to enhance the physical, mental and social well-being of community-dwelling elders. Most older adults in urban settings prefer to stay in daycare centers during daytime while their children are working [15]. Daycare centers for older adults support active participation in recreational, spiritual, and cultural programmes which enhances mental and social health [3]. The objectives of this study was to describe physical activity levels, risk of falls and social participation in a group of community-dwelling older adults attending daycare centers in Colombo, Sri Lanka and study the relationship between their physical activity, risk of falls and social participation.

Methods

Study population

A community-based, descriptive cross-sectional study was conducted in all six daycare centers for older adults in the Colombo district registered under National Secretariat for Elders (NSE) from June to July 2019. Males or females who were 60 years or older were included in the study. Due to safety concerns participants were excluded if, they were using a gait aid (walking frame/stick/wheelchair), suffering from organ failure (as diagnosed by a physician) or suffering from a severe hearing or visual impairment. Ten participants from each daycare center were randomly selected by lottery method (fish ball technique) from a list of eligible participants. The number of participants who attended daily on average in a single daycare center was 16. Ethics approval for the study was obtained from the Ethics Review Committee, Faculty of Medicine, University of Colombo (UCP/AL/14/300). Permission was also obtained from the National Secretariat for the Elders (NSE), Department of Social Services, Sri Lanka and from the supervisors of the respective daycare centers. Informed written consent was obtained from all the participants prior to inclusion in the study.

Data collection and study instruments

Interviewer-administered questionnaire evaluated sociodemographic parameters. Social and recreational activities conducted in each daycare center were also observed with their permission.

Physical activity

Physical activity (PA) was measured using the interviewer-administered International Physical Activity Questionnaire short version (IPAQ-SF) validated for the Sri Lankan population [16]. The IPAQ estimates the weekly energy expenditure expressed in MET minutes/week (Metabolic Equivalent of Task). It is obtained by multiplying value of energy expenditure for a given PA in METs by weekly frequency (days per week) and time in minutes (minutes per day). Subsequently, level of PA is classified into three categories: ‘inactive’, ‘moderately active’, and ‘highly active’ based on PA type and Met-minutes/week [17]. High PA indicates; vigorous intensity activity on at least 3 days achieving a minimum total physical activity of 1500 MET minutes a week or, 7 or more days of any combination of walking, moderate intensity or vigorous intensity activities achieving a minimum total physical activity of 3000 MET minutes a week. Moderate PA indicates, 3 or more days of vigorous activity and/or walking for at least 30 minutes/day OR 5 or more days of moderate activity and/or walking at least 30 minutes/day OR 5 or more days of any
combination of walking, moderate intensity or vigorous intensity activities achieving a minimum total physical activity of at least 600 MET minutes a week. Low level of PA in IPAQ-SF is when PA does not meet any of the criteria for either moderate or high levels. The scoring of IPAQ-SF was done using an easy-to-use automatic scoring excel spreadsheet [18].

**Balance and risk of falls**

Risk of falls was assessed using Berg balance scale (BBS) consisting of 14 items which measure balance through direct observation of their performance [19]. All 14 items are ranked on a 5-point scale ranging from 0-4 (“0” lowest and “4” highest level of function). Participants were asked to perform these simple balance related tasks one by one in various positions, for a specific duration of time. Simple tasks were performed according to the order in BBS (sitting to standing, standing unsupported, sitting unsupported, standing to sitting, transferring, standing with eyes closed, standing with feet together reaching forward with outstretched arm, retrieving objects from the floor, turning to look behind, turning 360°, and lastly placing alternate foot on a stool). To minimise these tests were performed by the same person. The final balance score was obtained by summing the scores of the individual items. According to this final score, interpretations were made by categorizing into 3 groups, low risk of fall (41-56), medium risk of fall (21-40) and high risk of fall (00-20) [20].

**Social participation**

Social participation (SP) was assessed using participation scale (P-scale, 18 item interviewer-administered questionnaire:) which assess the participation restrictions in people [21]. Although, P-Scale has not been validated in Sri Lanka, it was translated to Sinhala and back translated English to check for consistency and pretested before administering. It has six potential responses, ranging from 0-5. If yes (0) - SP opportunity is similar to their peers, if no, then how big of a problem is it to you? 1- No problem, 2-small problem, 3- medium problem, 5-large problem). The participation score is a summation of marks for individual items. Restriction in SP of a person was further graded into five categories based on P-scale score; no significant restriction (00-12), mid restriction (13-22), moderate restriction (23-32), severe restriction (33-52), and extreme restriction (53-90) [21].

**Statistical analysis**

Associations between continuous variables were assessed using Spearman correlation. Chi-square test was used and statistical significant p-value was considered as 0.05. Data was analyzed using the Statistical Package for the Social Sciences (SPSS) version 23.0.

**Results**

Daycare centers were spread across Colombo district; Maharagama (16 daily participants), Rathmalana (15 daily participants), Moratuwa (30 daily participants), Dehiwala (Two centers, 12 daily participants in each), and Kolonnawa (14 daily participants). The sample selection is summarized in Figure 1. Total number of participants from all six registered daycare centers were 60 (response rate 100%).

Socio-demographic details are summarized in Table 1. Majority were females (90%). Mean±SD age was 73.2±6 years (range 61-86 years). Most participants were married (85%), retired (86.7%) and had an education up to the GCE ordinary level.

**Table 1. Socio-demographic details of study population**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Study Sample (n=60)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years), mean±(SD)</td>
<td>73.2±6</td>
</tr>
<tr>
<td>Gender %</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>10</td>
</tr>
<tr>
<td>Female</td>
<td>90</td>
</tr>
<tr>
<td>Civil status %</td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>85</td>
</tr>
<tr>
<td>Unmarried</td>
<td>15</td>
</tr>
<tr>
<td>Occupation %</td>
<td></td>
</tr>
<tr>
<td>Occupied</td>
<td>13.30</td>
</tr>
<tr>
<td>Retired/ Un-occupied</td>
<td>86.70</td>
</tr>
<tr>
<td>Education level %</td>
<td></td>
</tr>
<tr>
<td>No schooling</td>
<td>-</td>
</tr>
<tr>
<td>Up to grade 8</td>
<td>43.30</td>
</tr>
<tr>
<td>Up to Ordinary level</td>
<td>50</td>
</tr>
<tr>
<td>Up to Advance level</td>
<td>5</td>
</tr>
<tr>
<td>Graduated/Vocationally trained</td>
<td>1.70</td>
</tr>
</tbody>
</table>

Values are presented as mean ± Standard deviation or percentages

The median (range) PA was 2133 (33-6426) MET min/week. Most had moderate level of PA (58%). Median (range) score of the BBS and social participation scale were 51 (34-56) and 8.5 (1-52), respectively. Majority had no significant restriction (67%) in SP and had a low falls risk (88.33%). There were no participants with extreme participation restriction (Table 2).
No. of registered elders in all 6 daycare centers  
n=103, Mean=17.1

Total No. of absentees in all 6 daycare centers  
n=14

No. of daily attendees in all 6 daycare centers  
n=89, Mean=14.8

Removed due to exclusion criteria  
n=17

No. of eligible participants in all 6 daycare centers  
n=72, Mean=12

Simple Random Sampling

Excluded during Random selection  
n=12

Main Sample  
n=60

Figure 1. Sample selection flow chart.
Table 2. Physical activity, risk of falls and social participation level in the study population

<table>
<thead>
<tr>
<th>Variable</th>
<th>Median (range) or %</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPAQ (continuous), MET min/week, mean±(SD)</td>
<td>2133 (33-6426)</td>
</tr>
<tr>
<td>IPAQ (categorical)</td>
<td></td>
</tr>
<tr>
<td>Low physical activity level¹</td>
<td>8.33</td>
</tr>
<tr>
<td>Moderate physical activity level²</td>
<td>58.33</td>
</tr>
<tr>
<td>High physical activity level³</td>
<td>33.33</td>
</tr>
<tr>
<td>Berg balance score (continuous), mean±(SD)</td>
<td>51 (34-56)</td>
</tr>
<tr>
<td>Berg balance score (categorical)</td>
<td></td>
</tr>
<tr>
<td>Low falls risk (56-41)</td>
<td>88.33</td>
</tr>
<tr>
<td>Moderate falls risk (40-21)</td>
<td>11.67</td>
</tr>
<tr>
<td>High falls risk (20-00)</td>
<td>-</td>
</tr>
<tr>
<td>Participation scale (continuous), mean±(SD)</td>
<td>8.5 (1-52)</td>
</tr>
<tr>
<td>Participation scale (categorical)</td>
<td></td>
</tr>
<tr>
<td>No significant restriction (00-12)</td>
<td>66.67</td>
</tr>
<tr>
<td>Mild restriction (13-22)</td>
<td>25</td>
</tr>
<tr>
<td>Moderate and Severe restriction (23-52)</td>
<td>8.33</td>
</tr>
<tr>
<td>Extreme restriction (53-90)</td>
<td>-</td>
</tr>
</tbody>
</table>

Values are presented as mean ± Standard deviation or percentages (%).

IPAQ-International Physical activity questionnaire, SD-Standard deviation, n-total number of participants, MET minutes/week-(Metabolic Equivalent of Task).

¹ High PA means, vigorous intensity activity on at least 3 days achieving a minimum total physical activity of 1500 MET minutes a week OR 7 or more days of any combination of walking, moderate intensity or vigorous intensity activities achieving a minimum total physical activity of 3000 MET minutes a week.

² Moderate PA means, 3 or more days of vigorous intensity activity and/or walking of at least 30 minutes per day OR 5 or more days of moderate intensity activity and/or walking of at least 30 minutes per day OR 5 or more days of any combination of walking, moderate intensity or vigorous intensity activities achieving a minimum total physical activity of at least 600 MET minutes a week.

³ Scoring a low level of PA on the IPAQ-SF means that you are not meeting any of the criteria for either moderate or high levels of physical activity.

Relationship between physical activity, risk of falls and social participation

When the level of PA was compared with BBS, and with P-scale scores (SP) using Spearman correlation (Table 3), we found that physical activity had weak correlation with BBS score (Spearman’s rho Correlation Coefficient \(r\)=0.31, \(p=0.014\)), but not with participation scale \(r\)= -0.092, \(p=0.486\).

Furthermore, we assessed the relationship between physical activity with BBS and physical activity with P-scale using Chi-square independent test. (Table 3). No significant association was found between physical activity and risk of falls \(\chi^2 (2) = 4.75, p=0.093\) or between physical activity and restriction in social participation \(\chi^2 (6) = 5.30, p=0.50\).

Table 3. Association between IPAQ with Berg balance scale and Participation scale

<table>
<thead>
<tr>
<th>Continuous IPAQ score</th>
<th>Spearman’s Correlation Coefficient</th>
<th>P-value¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berg balance scale¹</td>
<td>0.315</td>
<td>0.014²</td>
</tr>
<tr>
<td>Participation scale¹</td>
<td>-0.092</td>
<td>0.486</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Categorical IPAQ score</th>
<th>Pearson Chi-Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berg balance scale²</td>
<td>4.75</td>
</tr>
<tr>
<td>Participation scale²</td>
<td>5.30</td>
</tr>
</tbody>
</table>

¹Correlation Significant at 0.05, \(p<0.05\), IPAQ – International Physical activity questionnaire, ²p-value

¹ Association of continuous scores of IPAQ with continuous scores of Berg balance scale and Participation scale

² Association of categorical scores of IPAQ with categorical scores of Berg balance scale and Participation scale
Discussion

We believe that this is the first study to investigate PA, risk of falls and SP among community-dwelling elders from daycare centers in Colombo, Sri Lanka. Majority of the study population were females which aligned with the census 2012 data for Sri Lanka (56%). Literacy level of the geriatric population in 2012 showed two-thirds of older adults having only secondary level or below [2]. But in our study most participants (55%) had an education up to secondary level or more.

Correlation between PA and falls risk indicates a significant association between IPAQ and BBS (negative correlation between falls with PA level). Similar results were found in a prospective observational survey in Australia using healthy community-dwelling women (70-75 yrs), where high PA was associated with a decreased risk of reported falls [7]. Our study revealed a linear relationship between BBS and IPAQ score; indicating an inverse relationship between PA and risk of falls similar, to a previous study [22].

Studies done among community dwelling elders in other countries shows that the level of PA is reduced [23] and the commonest reason for it was poor health [24]. Previous studies have found that the presence of chronic diseases reduced the ability to be physically active [24]. Exclusion of elders with physical disabilities, serious medical conditions and visual/hearing impairment and those using gait aids may have influenced our results and it is a limitation of our study.

Our findings showed that majority had a low falls risk, with none having a high risk of falls. These results differ from a previous study which assessed prevalence and associated factors for falls among non-institutionalized elders in Brazil where participants had high falls risk of falls, 84.9% had comorbidities and 35.6% were frail [25].

Previous study shows that history of falls, use of assistive devices and gait impairment lead to increase fall risks [26]. Furthermore, elders with impaired vision and hearing also have high falls risk [22]. The low falls risk found in the present study could be due to selecting comparatively healthier older adults due to safety concerns.

Relationship between PA, SP and psychological distress among 86 healthy older adults was studied in Japan [27]. Findings suggested that psychological distress is associated with SP but not PA [27]. Our study population from an urban setup had high SP. In contrast to a study carried out to analyze the factors associated with SP among elders in rural Sri Lanka, where SP was low. The same study showed that domestic work and cultural constraints often prevented older women from engaging in social activities [13].

Although our study included a selected sample of participants, results shows that majority of them had satisfying level of PA and SP. Possible reasons are interactive environment and recreational activities within the daycare centers. This may suggest that daycare centers for elders are a good solution to maintain optimal care for elders in the community setting. However, to confirm this, further island-wide studies with large sample sizes are needed.

Limitations of our study includes small sample size and exclusion of participates with comorbidities. Participation scale was pre-tested but it is not validated for the Sri Lankan population. Not all community-dwelling elders attend daycare centers. Hence, findings cannot be generalized to the entire population of community-dwelling elders. The data on PA and SP relied on participants’ ability to recall which results in a recall bias.

Conclusion

The findings provide an understanding of the PA levels and, how it affects falls risk and SP in older adults attending daycare centers in an urban setting. However, large scale studies are needed for better understanding factors affecting health of community dwelling elders in different setups.

Conflict of Interests

The authors declare that there are no conflicts of interest.

Acknowledgements

We would like to thank the Director of National Secretary of Elderly (NSE) for giving permission to carry out this study in the daycare centers for older adults in Colombo, Sri Lanka. We would like to thank Prof. Charukshi Arambepola who granted the permission to use the validated Sinhala version of International Physical Activity Questionnaire short form and Dr. Romain Perera of the department of Allied Health Sciences for the support.

Ethics Clearance

Ethics Approval was obtained from Ethics Review Committee, Faculty of Medicine, University of Colombo (UCP/AL/14/300).

Author Contribution

Data collection and data analysis and writing of the research article was done by UR. Development of research protocol, supervision of data collection and analysis and editing the final manuscript was done by CD.

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