

Original article

Effectiveness of Progressive Balance Training and Information Brochure on Balance, Fear of Fall and Lower Extremity Function in Geriatric Population

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ABSTRACT:

Background: Balance disorders are among the most common causes of falls in older adults which often lead to injury and disability. Balance training program have potential to reduce fear of falls, improve balance impairments and increase lower extremity function. Decline in cognitive function, associated with aging makes it difficult for geriatric individuals to continue exercises at home. Therefore, information brochure regarding details of how to do exercises to reduce fall risks, to improve balance performance in simpler way is essential. This study was conducted to study the effectiveness of Progressive Balance Training and Information Brochure on Balance, Fear of Fall and Lower Extremity Function in geriatric population.

Method: 54 participants with balance impairments and fear of fall were screened and divided into 2 groups (27 each). Group A received a supervised intervention for 3 days in a week for 6 weeks, Group B group received information brochure with same intervention like Group A. Then the participants of both the group were asked to perform exercises at home for more 6 weeks. The after 12 weeks, timed-up and go test, berg balance scale and falls efficacy scale were assessed.

Result: The result of the present study shows that P - value was < 0.005 which was proved to be statistically extremely significant for Timed Up and Go Test, Berg Balance Scale and Falls Efficacy Scale of Group B than of Group A.

Conclusion: Progressive Balance Training along with Information Brochure can be effective in improving balance performance, reduction in fear of fall and increase in lower extremity function in geriatric population.

Keywords: Fall, balance, lower extremity function and geriatrics

Introduction:

Aging is a complex biological process in which changes at molecular, cellular and organ levels result in a progressive, inevitable and inescapable decrease in the body's ability to respond appropri-

ately to internal and/or external stressors.¹Balance, or postural stability, is a generic term used to describe the dynamic process by which the body's position is maintained in equilibrium. When the body is at rest it's static equilibrium and when the

body is in steady-state motion it's known as dynamic equilibrium. Balance is greatest when the body's Center of Mass (COM) or Center of Gravity (COG) is maintained over its Base of support (BOS).² Declines in sensory function, motor function and integration have been identified as the major factors contributing to poor balance and falls.³ Impairments of balance and gait have been implicated in increased risks of falls.⁴

The major problems in the elderly are falls and they are considered one of the "Geriatric Gaints".⁵ In adults aged 65 and older, the estimated annual prevalence of falls is 28%.⁶ Falls are associated with significant morbidity and mortality in the elderly. They are the most common cause of accidental death and nonfatal accidental injury in those 65 and older, accounting for 55.8% of accidental deaths.⁷ Fear of falling (FOF), is defined as undergo concerns about future falling, and is usually a psychological consequence of previous falls but is also common in older adults with no history of falls.⁸ Reduced activities in daily life of an elderly causes greater decrease of sensorimotor function especially motor function.⁹ Balance training mainly focuses on improving postural control by challenging the alignment of the body's center of gravity with reference to the base of support. It is effective in improving measures of postural control and ultimately fall risk and rate in older adults.¹⁰ A step is a fundamental component of walking; it represents the initiation of body weight transfer and basic expression of human mobility.^{11,12,13} There are many exercise programs that helps to improve balance in older adults for e.g., unstable surface balance training, progressive stepping program, Swiss ball etc.^{14,15,16} Progressive Stepping Program consists of stepping tasks with movement of upper or lower limb to make a new contact with the support surface while negotiating obstacles around the field.¹⁷ Patient education plays a key role in quality long-

term care, but is not a fully developed resource.¹⁸ As the population ages, traditional teaching tools and techniques are becoming less effective and more difficult for patients to understand.¹⁹ Aging can also affect memory and recall information. Older adults may take longer time to retain and recall the information than a younger population.²⁰ The main objective of patient education is to provide individuals and society with assistance so that they can lead a healthy life through their own efforts and actions. It supports and develops all kinds of individual learning processes. Similarly, it makes changes in the beliefs and value systems of individuals, their attitudes and skill levels and changes individual's lifestyle.²¹ Information Brochure makes the patients know and understand what they have to do, and get the motivation to sustain these exercises.²²

Previous study has supported the use of therapeutic exercises which plays restorative and accommodative role in minimizing loss of stability in the elderly through balance and mobility improvement, hence reducing fall risk.²³ Other individuals have to perform exercises lifelong to obtain physical and psychological health benefits and hence this study was conducted in which information brochure were given to participants, containing information about exercises to improve balance and prevent falls in community.²⁴

Materials and Methods:

This was an interventional study conducted during January 2019 to December 2019. The study was conducted at department of Community Physiotherapy, Dr. A.P.J Abdul Kalam College of Physiotherapy, PIMS, Loni. The participants included 54 older individuals who were taken from falls screening camps in villages under Gramin Arogya Bank of Pravara Medical Trust. Participants were screened according to eligibility criteria: (1) aged - 60 years; (2) balance impairment with Berg Bal-

ance Scale Score <26 and timed up and go test >7 seconds (3) fear of fall assessed with Falls Efficacy Scale score <70 were included in the study. Participants with impaired vision, hearing and cognitive impairments who has Mini-Mental State Examination (MMSE) score < 24 were excluded from study.

Intervention:

The study received ethical approval from Institutional Ethical Committee. (Ref no.PIMS/CPT/IEC/2019/81). The Participants were screened according to inclusion and exclusion criteria. The sample size was calculated using a ready reckoner table. An expected standard deviation of 5 each, intraclass correlation coefficient of 0.3 with 3 repeated measures, a significance level of 5%, a power of study of 80% and an expected 10% dropout for each group; the sample size derived was 54 elderly subjects; 27 in each group. The informed written consent was obtained from participants regarding the procedure prior to the study. Pre assessment of the participants were done according to the Outcome measures: Berg Balance Scale (BBS), Timed up and GO Test (TUG) and Falls Efficacy Scale (FES). Participants were allocated with permuted block randomization with sealed envelopes in Control group (Group A) which received Progressive Balance Training and experimental group (Group B) which received Progressive Balance Training along with Information Brochure. Group A participants were treated with Progressive Balance Training which included Physical exercises at 3 levels Basic, Moderate and Advance. All these exercises are given in Sitting, Standing and Walking position. Motor and cognitive tasks were added in Moderate and Advanced level. Group B participants were treated with same Progressive Balance Training and Information Brochures were provided to them. The Information brochure consisted information regarding detailing the causes of falls and how to avoid falls, how to protect ourselves from

falling, how to perform exercises and importance of exercises. The information brochure was in local language i.e. Marathi to communicate about exercises and as a means of both engaging and memorable. Participants of both groups received intervention for session of 45 minutes 3 times per week for 6 weeks. Then Participants were asked to follow same exercises at home for more 6 weeks, 3 times per week at home. After completion of these 6 weeks means after completion of total 12 weeks, all outcome parameters (TUG, BBS and FES) were assessed at OPD.

Progressive Balance Training protocol:

The intervention consisted of a set of balance exercises that progressed in difficulty. The balance training program included exercises in sitting, standing and walking.

In basic level, there were different exercise, which progressed in different one or two components tasks in moderate level and then progressed more difficulty for more than two components tasks in advanced level. First was sitting, sitting in a circle and passing (rolling) a large ball then Sitting in pairs facing each other, hands together, pushing gently. In moderate level a motor or cognitive task was added to sitting, then sitting in a circle and passing (rolling) a large ball, one foot on cushion and nest sitting, parrying a gentle push. In advanced level, sitting, adding both a motor and cognitive task then sitting in a circle and passing (rolling) a large ball, both feet on a cushion. Progressing to sitting in a line, rolling a large ball, slalom, both feet on a cushion.

Following exercises were done in standing. Basic level consisted of standing in a circle, passing around a big balloon, standing on one leg, standing, both feet on one balance cushion. In moderate level of standing in a circle then hitting a balloon doing a lunge when hitting and standing in a line, passing a small ball, slalom, with different bases of support

(one foot on balance cushion, semi tandem. After that standing with one hand lightly resting on back of chair for support, one foot on balance cushion, doing lunges with other leg in different directions. In advance level of standing a cognitive task (reciting or counting) is added to the exercises in moderate level followed by standing with different bases of support (tandem stance, standing one balance cushion under each foot, both feet on one balance cushion), adding both motor and cognitive tasks.

The 3 levels of exercises in walking were as follows: In basic level walking, stepping with one foot on balance cushions (4–7 cushions) followed by walking forward at a fast speed and returning walking backwards and semi-tandem or tandem walking. In moderate level, walking, stepping on balance cushions, placed in a row wide apart, walking forward at a fast speed and returning walking backwards, adding motor or cognitive task, tandem walking, adding motor or cognitive task. Advance level of walking exercises consisted of walking, stepping on balance cushions placed in a row, walking forward at a fast speed and returning walking backwards, adding both motor and cognitive task. Next was tandem walking along with motor and cognitive task.

Motor task included moving arm, leg, head, or trunk (leaning, turning), buttoning and unbuttoning clothing, juggling a balloon, throwing and catching a ball, kicking a ball, carrying a glass of water, a tray with several glasses of water, or a large ball, a Ping-Pong ball on a tray, closing eyes.

Cognitive task consisted of counting - adding or subtracting by three or seven from a given start number, reading a newspaper, silently or aloud,

reciting categories of flowers, animals, countries, cities, names, etc.

Data Analysis:

The objective of the study was to know the effectiveness of progressive balance training and information brochure on balance, fear of fall and lower extremity function in older people. The data was entered in excel spread sheet tabulated and subjected to statistical analysis. Data was analysed using Graph Pad Instat Version 13.3. Descriptive statistics for all outcome measures were expressed as mean, standard deviation and test of significance such as paired 't' test and unpaired 't' test. Paired t test was used to evaluate the variables within the same group with P value <0.0001 considered to be significant and Unpaired t test was used to evaluate the variables of both the group with P value <0.05 considered to be significant.

Results:

In this study 54 participants were included above the age group of 65 years. Among 54 participants 36 were males and 18 were females.

The result of this study showed that in Group A participants, TUG score of was decreased, BBS score was increased and FES score was decrease after 12 weeks of intervention with P value ($P < 0.0001$) which proved to be statistically significant after comparing these scores with pre-intervention by using paired 't'-test. In Group B participants, TUG score of was decreased, BBS score was increased and FES score was decrease after 12 weeks of intervention with P value ($P < 0.0001$) which proved to be statistically significant after comparing these scores with pre-intervention by using paired 't'-test. (Table 1)

Table 1. Shows the difference between pre and post mean and standard deviation of Group A and Group B after 12 weeks of intervention using paired ‘t’-test.

Group A				Group B		
	Pre	Post	<i>P</i> value	Pre	Post	<i>P</i> value
TUG (Mean+SD)	12.627±2.123	11.843±2.061	(<i>P</i> <0.0001)	11.271 ±1.634	10.186 ±1.440	(<i>P</i> <0.0001)
BBS (Mean+SD)	43.259±4.147	47.89 ±3.766	(<i>P</i> <0.0001)	43.593 ±4.142	49.593 ±3.693	(<i>P</i> < 0.0001)
FES (Mean+SD)	74.111±2.592	67.667 ±2.057	(<i>P</i> <0.0001)	69.37 ±2.29	64.815 ±2.418	(<i>P</i> <0.0001)

After comparison of mean of post-intervention score values between both the groups using unpaired ‘t’-test it was observed that more significant improvements were seen in the scores of Group B participants in all outcome parameters i.e TUG,

BBS and FES with *P* value (*P*< 0.05) which proved to be statistically extremely significant. (Table 2).

Table 2. Comparison of post intervention mean for Timed Up and Go Test (TUG), Berg Balance Scale (BBS) and Falls Efficacy Scale (FES) between Group A and Group B after 12 weeks of intervention using unpaired ‘t’-test.

	GROUP A	GROUP B	P VALUE	t value
TUG (Mean+SD)	0.7841 ± 0.4767	1.086 ± 0.5832	<0.05	2.082
BBS (Mean+SD)	4.63 ± 4.124	6.593 ± 2.308	<0.05	2.158
FES (Mean+SD)	6.44 ± 1.625	4.556 ± 2.326	<0.05	3.459

Discussion:

The study was conducted to find out the effectiveness of progressive balance training and information brochure on balance, fear of fall and lower extremity function. Older participants are reluctant to do exercise (especially if they are not physically active in the past), lack of guidance about what exercises are appropriate for them, fear of injury or pain, chronic physical illness, and lack of social support for exercise.

Good improvement in group B may be due to information brochure which must have helped the participants to remember how to perform exercises correctly at home and motivated them. Nitzet al, conducted a pilot randomized controlled trial on the efficacy of a specific balance-strategy training programme for preventing falls among older people in which treatment sessions were given once a week for 10 weeks. Assessment before and after intervention and at 3 months follow-up included number of falls, co-morbidities, medications, community services and activity level, functional motor ability, clinical and laboratory balance measures and fear of

falling. Their results showed that all participants significantly reduced the number of falls.²⁵ Similarly a study done by Kulkarni et al (2017), reported that improving the balance and lower extremity strength helps in reducing the fall risk, which might be due to the effect of balance exercises and resistance exercises improves leg muscle strength and proprioception of neuromuscular system through muscle contraction and stimulation of proprioceptive sense.²³ Another study concluded that the balance exercises and elastic-resistance exercises conducted for 8 weeks improved leg muscle strength and proprioception of the neuromuscular system through muscle contraction and stimulation of proprioceptive sense.²⁶ Also a study done by Lena Fung et al (2012), showed that the Progressive Stepping Program was effective in improving dynamic balance and lower limb function. The experimental group showed more significant improvement than the control group may be because the information brochure helps to retain the information with participants. One study strongly suggested that Falls risk alert card with information brochure, ex-

ercise programme, education programme reduces risk of fall and improves balance.²⁷ Another study supporting the results of the current study, revealed that evidence-based educational brochure was effective for improving and retaining information 2-weeks later regarding exercise during pregnancy which might be a probable reason of good results in Group B participants.²⁸

Limitations of the study: Long-term follow up was not carried out to assess long term effect of information brochure. Results cannot be generalized to the whole geriatric population.

Future scope: Future study must be done on larger sample of more heterogeneous older participants with long term follow up.

Conclusion:

The study concluded that Progressive Balance Training along with Information Brochure can be effective in improving balance performance, reduction in fear of fall and increase in lower extremity function in older people.

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Ethical Clearance: The study was approved by the Institutional Ethical Committee of PIMS-DU (Ref no. PIMS/CPT/IEC/2019/81)

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