

Experimental Study on Effectiveness of Square Stepping Exercise for Fall Risk Mitigation Among Senior Citizens

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Abstract:-

➤ *Background*

General fitness establishes the quality of life, but it often decreases with age. Therefore, it becomes vital to find out a method of evaluation of individual fitness level and to design a targeted exercise programme, ie SSE.. Falls in the elderly are common and associated with major morbidity and mortality. Fall in the elderly is considered as a geriatric syndrome ,decreased physical functioning and autonomy and is associated with other geriatric syndromes.

➤ *Objective*

To find the effectiveness of square stepping exercise and strength and balance to reduce the risk of falls among elderly people.

➤ *Method*

30elderly subjects are selected from the population who fulfill inclusion and exclusion criteria . These subjects randomly divide in to two groups[15 each Group]. ABC Scale and Tinetti performance oriented mobility assessment score checked as pre and post test. The SSE group participate sessions 5 days in a week ,each session comprise 15 minutes of warm-up activities such as stretching and free walking ,30 minutes of SSE and 15 minutes of cool-down activities. Each step pattern repeat 4–10 times. The group B performs 30 minute of strengthening and balance exercise instead of SSE.

➤ *Result and Discussion*

SSE is as equally effective as SB training in improving lower-extremity functional fitness. SSE may also be recommended for older adults, due to its low cost and effectiveness. The findings suggest that SSE is safe and acceptable, and it improves the functional fitness of the lower extremities, which is a fall risk factor, in older adults.

➤ *Conclusion*

low-cost and feasible alternative to practice physical activity with good impact on improvement of functional mobility and maintenance of mood states, preventing depressive symptoms In older people and reduce the risk of fall in elderly.

Keywords:- Fall, Balance, Square Stepping Exercise ,Tinetti Performance Oriented Mobility Assessment, ABC Scale.

I. INTRODUCTION

A fall is an event in which a person unintentionally comes to rest on the ground, floor, or lower level. Falls can occur due to various reasons such as loss of balance, tripping, slipping, or a medical condition that affects stability or coordination.

Falls are a significant concern for seniors because they can lead to serious injuries, such as fractures, head trauma, and other complications, which may impact their mobility and independence. Factors contributing to falls in seniors include muscle weakness, balance issues, vision problems, medication side effects, and environmental hazards. One of the most risk factor for fall is the pathology of musculoskeletal system, including osteoarthritis ,sarcopenia, osteopenia and osteoporosis as well as chronic pain .3

Balance is crucial for overall health and well-being, especially in senior citizens. Good balance helps to:

- Prevent Falls: Fall mitigation ,fall can cause to serious injuries.
- Maintain Mobility: Enables independent movement and daily activities without assistance.
- 3.Improve Coordination: Enhances the ability to perform complex movements smoothly.
- Enhance Posture: Supports proper alignment of the body, reducing strain on muscles and joints.
- 5.Boost Confidence: Increases self-assurance in physical activities, promoting an active lifestyle.
- 6. Support Overall Health: Contributes to cardiovascular, muscular, and neurological health by encouraging regular physical activity.

Senile gait, also known as geriatric or age-related gait, refers to the characteristic walking pattern often observed in elderly individuals. It is characterized by a slow, broad-based, shuffling, and cautious walking pattern.¹⁰ The use of multiple medications (four or more), as well as specific classes of medications, can lead to gait disorders and an increased rate of falls.

11 Square stepping exercise is a type of physical activity designed to improve balance, coordination, and cognitive function, particularly in older adults. It involves stepping in specific patterns on a grid of squares marked on the floor, often following a sequence that can become progressively more complex.

➤ Objectives of the Study

- To find the effectiveness of square stepping exercise for fall risk mitigation among senior citizens
- To find the effectiveness of strength and balance for fall risk mitigation among senior citizens
- To compare the effectiveness of square stepping exercise and balance & strength exercise for fall risk mitigation among senior citizens

➤ Hypothesis

• Null Hypothesis(H₀)

There will be no significant difference in effectiveness of Square stepping exercise for fall risk mitigation among senior citizens.

• Alternative Hypothesis(H₁)

There will be significant difference in effectiveness of Square stepping exercise for fall risk mitigation among senior citizens.

II. MATERIALS

- Square stepping mat
- 1 kg Weight cuff
- Examination table
- Chair
- Stopwatch
- Tape
- Pen
- Book

III. METHODOLOGY

- Study setting : ST.JOSEPH OLD AGE HOME KOORACHUND
- Research design : Experimental
- Sample design : Purposive
- Sample size : Thirty Subjects
- Study duration : Bi- monthly
- Outcome measures :
- The Activities-Specific Balance Confidence (ABC) Scale
- Tinetti performance oriented mobility assessment

➤ Selection Criteria

Inclusion criteria

- Individual willing to participate
- Age more than 70-75 years
- Both males and females
- Exclusion criteria
- Lower limb deformities
- Obesity
- Vestibular disorders
- Severe neurological conditions (PD, Stroke, Multiple sclerosis)
- Recent fracture, severe pain
- Mobility limitation
- Patient with high risk health status
- Psychiatric patient or patient unable to concentrate instructions

IV. STUDY PROCEDURE

The subjects in study was given a written consent and a base line questionnaire. Then body weight & height was also measured. Subjects were randomly divided in to two groups Experimental Group & Control Group. ABC Scale and Tinetti performance oriented mobility assessment score were checked as pre and post test.

➤ Experimental Group:

The SSE group participated in sessions of 5 days in a week, each session comprise light stretching or slow walking for 5-10 minutes to prepare the muscles. Subjects performed simple stepping patterns on frames of square ie stepping forward, backward, and side-to-side. At the end they were engaged in light stretching or slow walking for 5-10 minutes to relax the muscles and cool down.

➤ Control Group:

The subjects in the control group, performs 30 minutes of and balance and strengthening exercise Balance training consist of following exercises,

- Two leg balance with the toes or heel raised
- Tandem standing (with eyes open/closed), walking with walking
- Side walking And along with these exercise lower limb strengthening exercise such as, 2 sets with 10 repetitions of the following exercises: squat, hip flexion, hip extension, hip abduction, knee extension (with 1 kg weight) and calf raise.

V. DISCUSSION

In this study, the subjects with elderly are taken in to consideration. From a large number of subjects with elderly, subjects were selected by proper screening and fulfilling the inclusive and exclusive criteria. 30 elderly subjects were selected and grouped in to experimental and control group [15 subjects in each group]. The SSE group will be participated sessions 5 days in a week, each session comprise 15 minutes of warm-up activities such as stretching and free walking, 30 minutes of SSE and 15 minutes of cool-down activities. Each step pattern will repeat 4–10 times. The control group, will be

similar to those in experimental group , except that the former perform 30 minute of and balance and strengthening exercise instead of SSE.

Statistical data reveals that here, we can observe that our p value is less than the Confidence interval 0.05,we reject the null hypothesis the there is an effect between pre-test and post test between the samples of ABC scale of square stepping group. Cohens d test can be used as an effect size statistic for a paired t-test.It is calculated as the difference between the means of each group, all divided by the standard deviation of the data. A Cohen's d value near to 0.1 indicates there is a large effect size is there between pre-test and post test in experimental group but in control group we can observe that our significance value is 0.044,which is less than 0.05,so here also reject the null hypothesis.

The statistical data of POMA Scale score can observe that our significance values for both pretest and post test or greater than 0.05,which is greater than the significance level and Conclude that pretest and post test both are normally distributed in the experimental group. In the control group can see that pre test significance value is .001 which is less than 0.05 and the the conclusion was data is not normally distributed.

A study by Camila Vieira Ligo Teixeira [2013] their evidence shows that SSE is a physical activity that positively influences cognitive functions in non demented older people,SSE and basic exercise practiced together or alone.

VI. CONCLUSION

In this study ,Control group were treated with strength and balance training and in experimental group with square stepping exercise. In both group has significant improvement in confidence ,gait and balance.

Here square stepping exercise (SSE) can be particularly effective in mitigating falls among senior citizens because it enhance balance by requiring participants to step in specific patterns, thereby improving their stability. The exercise improves coordination by challenging seniors to remember and execute complex step sequences, which can help them navigate real-world environments more safely. Regular practice of SSE can strengthen the lower body muscles, which are crucial for maintaining balance and preventing falls. By incorporating cognitive tasks such as memorizing step patterns, SSE helps keep the brain active, which can improve overall cognitive function and contribute to better decision-making and reaction in daily activities.

CONFLICT OF INTEREST : No

SOURCE OF FUNDING: Self

ETHICAL CLEARANCE : College ethical committee

REFERENCES

- [1]. Anderson KE. Falls in the elderly. JOURNAL-ROYAL COLLEGE OF PHYSICIANS OF EDINBURGH. 2008 Jan 1;38(2):138.
- [2]. Alshammari SA, Alhassan AM, Aldawsari MA, Bazuhair FO, Alotaibi FK, Aldakhil AA, Abdulfattah FW. Falls among elderly and its relation with their health problems and surrounding environmental factors in Riyadh. Journal of family & community medicine. 2018 Jan;25(1):29.
- [3]. Rosen T, Mack KA, Noonan RK. Slipping and tripping: fall injuries in adults associated with rugs and carpets. Journal of injury and violence research. 2013 Jan;5(1):61.
- [4]. Berg RL, Cassells JS. The second fifty years: Promoting health and preventing disability.
- [5]. Krishnaswamy B, Usha G. Falls in older people: national/regional review India. Chennai: Madras Medical College and Government. 2006:1-9.
- [6]. Thomas E, Battaglia G, Patti A, Brusa J, Leonardi V, Palma A, Bellafiore M. Physical activity programs for balance and fall prevention in elderly: A systematic review. Medicine. 2019 Jul;98(27).
- [7]. Hessol NA, Zepf R, Zobell E, Weiser SD, John MD. Food insecurity and aging outcomes in older adults living with HIV. AIDS and Behavior. 2017 Dec;21(12):3506-14.
- [8]. Salzman B. Gait and balance disorders in older adults. American family physician. 2010 Jul 1;82(1):61-8.
- [9]. Winter DA, Patla AE, Frank JS, Walt SE. Biomechanical walking pattern changes in the fit and healthy elderly. Physical therapy. 1990 Jun 1;70(6):340-7.
- [10]. Snijders AH, Van De Warrenburg BP, Giladi N, Bloem BR. Neurological gait disorders in elderly people: clinical approach and classification. The Lancet Neurology. 2007 Jan 1;6(1):63-74.
- [11]. Leipzig RM, Cumming RG, Tinetti ME. Drugs and falls in older people: a systematic review and meta analysis: I. Psychotropic drugs. Journal of the American Geriatrics Society. 1999 Jan;47(1):30-9.
- [12]. Shigematsu R, Okura T. A novel exercise for improving lower-extremity functional fitness in the elderly. Aging clinical and experimental research. 2006 Jun;18(3):242-8.
- [13]. Shigematsu R, Okura T, Nakagaichi M, Tanaka K, Sakai T, Kitazumi S, Rantanen T. Square-stepping exercise and fall risk factors in older adults: a single-blind, randomized controlled trial. The Journals of Gerontology Series A: Biological Sciences and Medical Sciences. 2008 Jan 1;63(1):76-82.
- [14]. Bhanusali H, Vardhan V, Palekar T, Khandare S. Comparative study on the effect of square stepping exercises versus balance training exercises on fear of fall and balance in elderly population. Int J Physiother Res. 2016;4(1):1352-59.

- [15]. Shigematsu R, Okura T, Nakagaichi M, Nakata Y. Adherence to and effects of multidirectional stepping exercise in the elderly: a long-term observational study following a randomized controlled trial. *The Journal of Physical Fitness and Sports Medicine*. 2013 Mar 25;2(1):127-34.
- [16]. Pereira JR, Gobbi S, Teixeira CV, Nascimento CM, Corazza DI, Vital TM, Hernandez SS, Stella F, Shigematsu R. Effects of Square-Stepping Exercise on balance and depressive symptoms in older adults. *Motriz: Revista de Educação Física*. 2014 Dec;20(4):454-60
- [17]. Luchies CW, Alexander NB, Schultz AB, Ashton Miller J. Stepping responses of young and old adults to postural disturbances: kinematics. *Journal of the American Geriatrics Society*. 1994 May;42(5):506-12.
- [18]. Lord SR, Fitzpatrick RC. Choice stepping reaction time: a composite measure of falls risk in older people. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*. 2001 Oct 1;56(10):M627-32.
- [19]. Maki BE, McIlroy WE. Control of rapid limb movements for balance recovery: age-related changes and implications for fall prevention. *Age and ageing*. 2006 Sep 1;35(suppl_2):ii12-8.
- [20]. Okubo Y, Schoene D, Lord SR. Step training improves reaction time, gait and balance and reduces falls in older people: a systematic review and meta-analysis. *British journal of sports medicine*. 2017 Apr 1;51(7):586-93.