ISSN- O: 2458 - 868X, ISSN–P: 2458 – 8687
National Library of Medicine - ID: 101731606

International Journal of Medical Science and Innovative Research (IJMSIR)
IJMSIR : A Medical Publication Hub
Available Online at: www.ijmsir.com
Volume – 6, Issue – 5, September – 2021 , Page No. : 99 - 106

Correlation of core endurance with balance and fear of fall in the elderly population

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Citation this Article: Ms Drishti Doshi, Dr Priti Agni, "Correlation of core endurance with balance and fear of fall in the elderly population", IJMSIR- September - 2021, Vol – 6, Issue - 5, P. No. 99 – 106.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Background: With advancing age, there are multiple age related changes affecting Balance and fall rates thereby affecting the overall quality of life. Core Muscle Endurance may be correlated with balance and fear of falls in the elderly. However, previous studies have examined the effect of Core Strength Training rather than Core Endurance in the elderly population.

Purpose: To study the correlation of Core Muscle Endurance with balance and fear of falls in the elderly.

Methods: 30 community-dwelling elderly subjects, ambulatory between age 60-80, having Mini-Mental State scores greater than 24 without any acute medical condition participated in the study. Core Endurance (Pressure Biofeedback), Balance (Bergs Balance Scale and Timed Up and Go test), Fear of fall (Fall Efficacy Scale) were assessed in the elderly population to find the Correlation of Core Endurance with balance and **fear of fall.**

Results: A positive correlation was found between Core Endurance and the Bergs Balance Scale (p <0.0001 r=0.7360). There was a negative correlation was found between a) Core Endurance and the Timed Up And Go Test (p=0.0009 r= -0.5736) b)Core Endurance and Fall Efficacy Scale (p=0.0002 r= -0.6303)

Conclusion: The study concluded that the Core Endurance has Significant Correlation with Balance and Fear of fall in the elderly highlighting the importance of Core Endurance Training in Geriatric Rehabilitation to improve balance and prevent falls in the elderly population.

Keywords: Core Endurance, Balance, Fear of Falling, Elderly, Correlation.

Introduction

Aging is a fundamental process that affects all of our system and tissues.[1] It is a progressive physiological change in an organism that leads to senescence or a decline of biological functions and of the organism's ability to adapt to metabolic stress.[2] Beyond biological changes, aging is also associated with other life transitions such as retirement, relocation to more appropriate housing, and the death of friends and partners. Between 2015 and 2050,the proportion of the

world's population over 60 years will nearly double from 12% to 22% indicating that geriatric care and rehabilitation will become an integral part of health care system worldwide.[3]

The aging process involves changes in physiological, pathological, social and psychological condition of a person.[4] It includes functional changes (deficits in balance, strength and power performance),neural (loss of sensory and motor neurons causing visual, auditory, coordination, gait, reaction time deficits),bone related degenerative changes (osteoporosis, loss of functional range of motion, postural impairment due to spinal vertebrae degenerative changes, difficulties in functional activities of daily living), muscular (sarcopenia, atrophy of type 2 muscle fibers) Sarcopenia is a syndrome characterized by progressive and generalised loss of skeletal muscle mass and strength with a risk of adverse outcomes such as physical disability, poor quality of life and death.[5] Loss of number of muscle fiber per motor unit is the main cause of sarcopenia. Other physiological mechanisms involved in sarcopenia include denervation of muscle fiber, increased density and function of mitochondria causing decreased ATP production, reduced protein synthesis, decreased circulating testosterone, growth hormone, IGF- 1 levels, increase in IL-6 level due to inflammation causing increase rate of muscle protein degradation.[6] Approximately 22% of all men and women older than 70 years have sarcopenia which increases to 50% by the age of 80 years.[7] Sarcopenia is one of the cause of balance impairments in the aging population. Balance is an integral part of functional activities of daily living. Balance is the integration of somatosensory, vestibular, visual system which work in coordination with the neuromuscular system to maintain body alignment within the body centre of mass in static and dynamic conditions. Static balance is defined as the ability to maintain an upright posture and keeping the line of gravity within the limits of base of support.[8] Dynamic Balance is the ability to maintain postural stability and orientation with centre of mass over the base of support while the body parts are in motion.[9]Balance disorders is an area of major concern the health care system due to its association with fall and fall-related injuries. Falls are main causes of immobility, morbidity and mortality among older persons.[10] It reduces efficiency of work, limits functional activities of daily living, gives in to sedentary lifestyle, impairs cognition and increases chances of depression among elderly.

Fear of falling is defined as a lasting concern about falling that can lead an individual to avoid activities that he/she remains capable of performing.[11] Fear of falling increases with age. One study reported that approximately 18% of individuals younger than age 45 years fall each year compared to 25% of those between age 45 and 65 years and 35% of those older than 65 years of age.[12]Elderly experiencing fall pain, injuries are more afraid of falling. As a result, they take part in fewer physical activities that leads to degeneration of their physical activity and triggers a vicious cycle of repeated falls. Commonly lower extremity resistance and balance training are used to mitigate age related deficits. A research study states that the muscle strength is associated with the ability to maintain standing balance in the elderly outpatients.[13] Another research study showed improvement in balance after 12 weeks intervention with lower limb strengthening protocol. A research study showed 25% to 75% reduction in fear of fall in the experimental group with 6 months muscle

loading and functional ie (weights, repeating sit to stand or climbing up, down stairs) exercises as compared to the control group.[14] There is paucity in the literature to understand importance of Core stability in Geriatric population. Core muscles play important role in body stabilization and force generation. Functionally, the core is a kinetic link that facilitates the transfer of torques and angular momenta between upper and lower extremities.[15] Anatomically, the core is a muscular box with the abdominals in the front, paraspinals and glutes in the back the diaphragm as the roof and the pelvic floor and hip girdle musculature as the bottom.[16] It can be hypothesized that enhanced core stability may allow the old adults to use their upper and lower extremities more effectively by optimizing trunk movements. Hence the aim of the study is to find correlation between core endurance with balance and fear of fall in the elderly population.

Methodology

This was an observational cross- sectional study aimed at understanding the correlation of core endurance with balance and fear of fall in the elderly population. The study was done on 30 elderly individuals (11 males,19 females). The inclusion criteria was a)60-80 years of age group b)Community dwelling elderly c)Ambulatory (with or without) assistive device d)Subjects having Folstein Mini Mental Examination Score greater than 24.Subjects with Acute Neurological, Musculoskeletal and Cardiorespiratory Problems were excluded in the study. Also the subjects with Psychological and Cognitive impairments like delirium, schizophrenia, affective disorders, neurosis and personality disorders were not included in the study. The study was approved by the Departmental Review Board of KJ Somaiya College of Physiotherapy. Subjects were screened for Inclusion and Exclusion Criteria. A Mini Mental State Examination was performed for all the subjects taking part in the study. Following that, an informed consent was taken from the subjects. After giving informed consent, all subjects were assessed for a) Core endurance using pressure biofeedback b) Balance using bergs balance scale and timed up and go test c) Fear of fall using the fall efficacy scale. The data collection procedure for 30 subjects took place in a period of 15 days. The data records were maintained for final analysis.

Core Endurance: The Core Endurance was measured using the Pressure Biofeedback instrument.[17] [18]

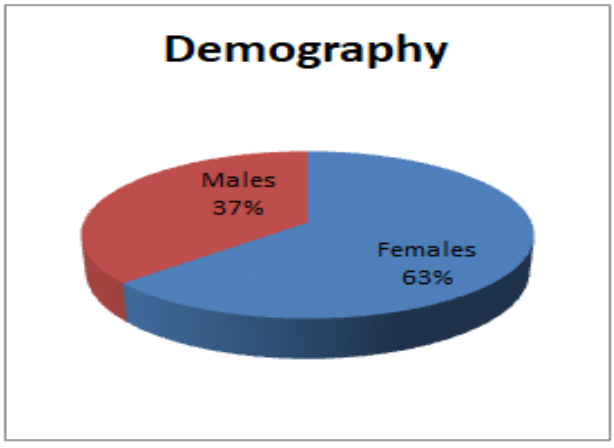
Balance: a) Berg Balance Scale (BBS) : The Berg Balance Scale (BBS) was used to evaluate static balance.[19] [20] b) Timed Up And Go Test (TUG) : The Timed Up And Go Test (TUG) was used to measure the dynamic balance.[21]

Fear of Fall: The Fall Efficacy Scale – International (FES-I) was used to measure the fear of fall in the elderly. [22]

Figure 1: Core Endurance using Pressure Biofeedback

Figure 2: Standing Unsupported with Eyes Close

Figure 3: Timed Up and Go Test

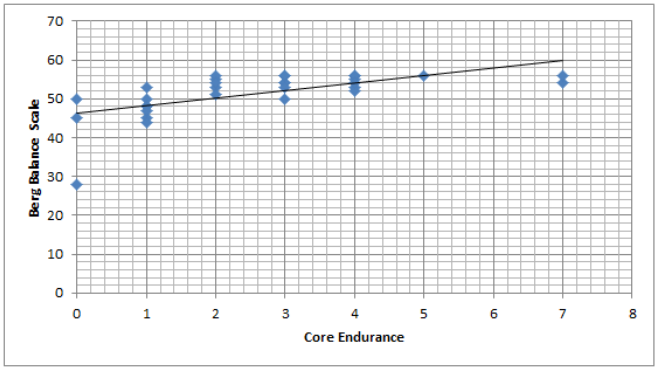


Graph 1 : Demographic ratio of male and female subjects in the study .

30 subjects in the age group 60-80 years participated in the study. Of which was the 11 subjects were males and 19 were females (graph 1). The mean age was 64 years. The data collected did not pass the normality test. Hence Spearman Correlation Coefficient was used to analyse the data. The Data Analysis is provided in the table below:

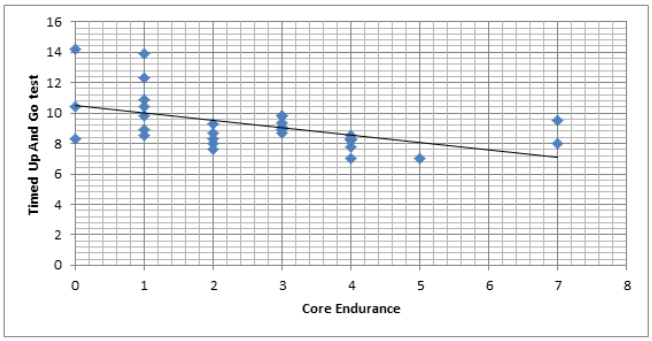
Table 1:

	BBS	TUG	FES
Core Endurance	p value is < 0.0001 r = 0.7360	p value is 0.0009 r = -0.5736	P value is 0.0002 r = -0.6303



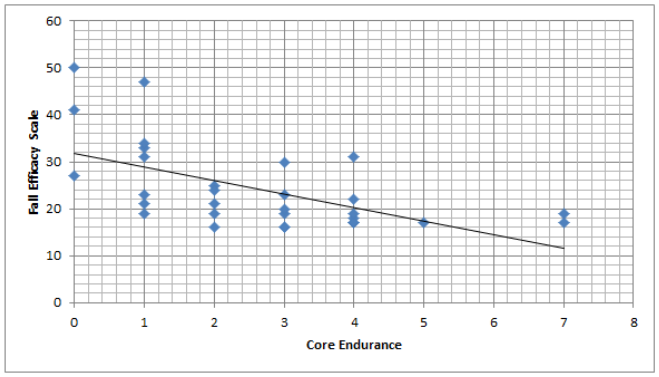
Graph 2 : Correlation of Core Endurance with the Berg Balance Scale (BBS)

Inference: On the basis of p value which is <0.0001, it can be interpreted that core endurance show a significant positive correlation with the Berg Balance Test(BBS).



Graph 3 : Correlation of Core Endurance with the Timed Up And Go Test (TUG)

Inference: On the basis of p value which is 0.0009, it can be interpreted that core endurance show a negative correlation with the Timed Up and Go Test (TUG).



Graph 4 : Correlation of Core Endurance with Fall Efficacy Scale (FES)

Inference: On the basis of p value which is 0.0002, it can be interpreted that core endurance show a negative correlation with the Fall Efficacy Scale (FES).

Discussion

The aim of the study was to find the correlation of core endurance with balance and fear of fall in the elderly population between age 60 to 70 years. This was an observational cross sectional study performed in community dwelling elderly. The result of the study proposes extremely significant correlation of core endurance with balance and fear of fall in the aged group. Functionally, Core is a kinetic link that facilitates the transfer of torque and angular momenta between upper and lower extremities during execution of whole body movements as part of sports skills ,fitness, occupational skills and daily living activities.[30] Core Endurance is ability of the core muscles to perform low-intensity, repetitive or sustained activities over a prolonged period of time.[17]Endurance is improved when an individual is able to accomplish or withstand higher amount of efforts than their original capacity.[28]There was significant positive correlation of Core Endurance with Static balance measured using Bergs Balance Test. (p value <0.0001,r value =0.7360).This suggests importance of Core Endurance in maintaining an upright posture and stability in standing with eyes open, eyes closed and also with unsupported sitting. These are functional positions which form the part of activities of the daily living. Increasing the core endurance will help to maintain better stationary postures (i.e. COG within the BOS) in the elderly populations. A research study showed significant relationship between trunk muscle endurance and static balance in Male students which supports our findings.[31] Also there was statistically extremely significant negative correlation of Core Endurance with Dynamic Balance (p value=0.0009,r value= -0.5736) which was measured using Timed Up and Go Test. Dynamic balance is a complex integration of neuromotor control, muscular system, sensory system. The Core Muscles are physiologically postural muscles having mainly large diameter type 1 muscle fibers which play crucial role in providing low levels of activity for long periods of time. Assumptions are that if Core Endurance, i.e. the capacity to sustain an isometric contraction is less, it leads to early fatigue which affects motor efficiency and thereby ability to maintain dynamic balance. Likewise, there was statistically significant negative correlation of Core Endurance with fear of fall in the old age group with (p value =0.0002, r value = -0.6303) .Previous studies have shown that BBS (positively) and TUG (negatively) test results are the most important risk factors for falls.[23] Balance which is concerned with execution and sustenance of motor activities in daily life has importance in fall prevention. Similarly upper

and lower limb strength have also been shown as an important risk factor for fall. An elderly experiencing fall, may limit their activities because develop of fear of falling .Thus after fall or due to fear of fall, an individual may lead a sedentary lifestyle. The limited physical and social activities lead to muscle atrophy and lowered physical strength affecting overall health condition including core stability and distal mobility. Kibler et al. argued that the core is especially important in everyday and sports activities because it provides proximal stability for distal mobility.[24]A Research study demonstrated improvement in strength, endurance and balance with 4 weeks of Core Stability Training using Stable and Unstable Surfaces in young individuals.[28] There is also an evidence from rehabilitation which supports our findings, that trunk position significantly affects muscle forces distally in the leg (especially hamstrings)which is vital for trunk stabilization and balance recover.[25]Another study demonstrated that 12 weeks of core strength training (CST) significantly improved trunk extensor strength, spinal mobility and driver shot performance in healthy female professional golfers with the mean age of 23 years.[26] Further, it has been shown that the core muscle endurance is strongly associated with occurrence of low back pain.[27] Majorly core endurance training has been used for athletes and in musculoskeletal rehabilitation of low back pain. Further, poor ability to recruit and sustain contraction of trunk muscles correlates with an inability to perform activities of daily living (eg rising from chair, walking) supports our findings. The Core Stability Program improves the invocation and control of the central part of the body and results in the better manifestation of the organs in the elderly. A research study stated that a fearful group showed reduced gait parameters as compared to the fearless group .[29] Prevention of falls and their subsequent injuries is an important goal of geriatric rehabilitation which helps to improve the quality of life. Hence the Core Stability trainings program can be used to improve gait parameters by improving the Core Endurance which will reduce risk of fall in the elderly.

Clinical Implications

1) Assessment of Core Endurance, Balance and Fear of Fall in the elderly for routine prognosis.

2) The findings in this study will help develop clinical guidelines for Core Stability Training protocol which can be used in addition to traditional resistance training and balance training program for the elderly population with appropriate exercises, dose and duration of the same to prevent fall rates, improve balance and functional mobility.

Conclusion

The study concluded that the Core Endurance has Significant Correlation with Balance and Fear of fall in the elderly highlighting the importance of Core Endurance Training in the Geriatric Rehabilitation to improve balance and prevent falls in the elderly population.

Acknowledgment: We would like to extend our sincere gratitude to all our participants who were very cooperative and relentless throughout the studies.

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