International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

A Study to Investigate the Efficacy of Cognitive Exercises on Fear of Falls and Dual Task Performance Among Geriatric Population In Jalandhar

Chahat Sharma[1], Manika Saxena[2], Dr. Parul Bawa[3], Sachin Girdhar[4]

[1]Student, M.P.T (Neurology), D.A.V.I.P.T.R, Jalandhar
[2]MPT (Neurology), Associate Professor, D.A.V.I.P.T.R, Jalandhar
[3]MPT (Neurology), Assistant Professor, D.A.V.I.P.T.R, Jalandhar
[4]Supervisor, MPT (Orthopaedics), D.A.V.I.P.T.R, Jalandhar

Abstract

BACKGROUND: Elderly population is described as 65 years of age or aged. Young–old population consists of the age group between 65 and 75 years of age. The middle–old population consists of the age group between 75 and 85 years of age. Old – old population consists of age group older than 85 years of age. Cognition is a higher cortical function. It is the process of knowing and includes awareness and judgement. Cognitive decline affects the older population by decrease in some mental functions such as verbal capability, numerical abilities, and general knowledge. Various physiotherapeutic approaches have been incorporated for making quality of life of patient worthier.

AIM: The aim of the study is to investigate the efficacy of cognitive exercises on cognitive functions, fear of falls and dual task performance among geriatric population.

METHODOLOGY: The total duration of the study was one and a half years. Subjects meeting the inclusion and exclusion criteria were selected in the study and were assessed for cognitive functions, fear of falls and dual task performance. A minimum of 30 subjects were taken. They were given dual task intervention and single task performance exercises. The treatment was carried out for 4 days per week for 7 weeks. The data was collected for dependent variables at baseline and at 7th week post treatment.

RESULTS: Data analysis was performed by SPSS Software version 18 and the variables were assessed using Paired T-test. The scores of the Falls Efficacy scale were also found to be significant when compared from baseline to 7th week with a p-value of <0.001. It was found that single task at baseline was significant. The results for average score of dual task activity of walking 4 meters with tossing ball was found to be significant at 7th week with p-value of <0.001. Dual task activity of walking 4 meters with cup of water was also found to be significant with p-value of <0.001. The dual task activity of walking 4 meters with dribbling a ball was significant by 7th week with p-value of <0.001.

While analyzing the dual task cost for walking with tossing ball it was found that the results were non-significant with a p-value of 0.7157. The results were also non-significant with a p-value of 0.8845 by 7th week for walking with holding a cup of water. However, it was found that the results were significant for dual task cost for walking 4 meters with dribbling a ball at 7th week with a p-value of <0.001.

CONCLUSION: The results have significant real -world ramifications for the health and standard of living of the aging population.

KEY WORDS: Dual task performance, fear of falls, geriatric population.

1. Introduction

The elderly population is described as 65 years of age or aged. The beginning of issues related to health in geriatric population may occur in early 50s or maybe only in 40s. But often we come across the elderly population who are fit and fine and energetic even at the age of 70 years.[1] According to the World Health Organization (WHO) people sixty-five years of age and older are defined as elderly.[2]

Three groups have been identified for the classification of geriatric population: -

Young–old: -Young – old population consists of the age group between 65 and 75 years of age. Young old patients are a bit alike to middle-aged patients. The level of disability in the young old population is least.

Middle-old: - Middle – old population consists of the age group between 75 and 85 years of age.

Old- old: - Old – old population consists of the age group older than 85 years of age. In the old-old geriatric population there is an average additional life span of 5-6 years. This population has little survival benefits from screening tests or therapeutic interventions.

1.2 PREVALANCE OF ELDERLY POPULATION

The mortality rate in society has significantly decreased because of enhanced economic prosperity, an upgraded healthcare system, and more advanced medical technology. The population's proportion of elderly individuals has increased when these factors are combined. The elderly will make up 15% of the world's population by 2025, and by 2050, the old-age dependence ratio in Asia will have doubled. The "National policy on older adults" in India classifies people 60 years of age and older as elderly. As of 2020, 10% of the Indian population is elderly.

1.3 MUSCULOSKELETAL PROBLEMS IN ELDERLY

Musculoskeletal disorders and debilitating illnesses have a major impact on health, particularly in geriatric population. Due to arthritic changes, it is also typical to have restricted movement, which eventually interferes with activities of daily life such as self-care. Since pain is the primary complaint of chronic musculoskeletal disorders, they have an impact on social involvement, independence, and quality of life. Over the world, musculoskeletal illnesses, and disabilities, including osteoarthritis, rheumatoid arthritis, osteomalacia, sarcopenia, and others, afflict the elderly population.[3]

1.3.1 NEUROLOGICAL PROBLEMS AMONG ELDERLY

Neurological disorders in the elderly population lead to significant long-term disability and a high rate of acute hospital admissions. Studies conducted on healthy older adults in the community have revealed a high frequency of several neurological disorders, including dementia, epilepsy, stroke, Parkinson's disease, Alzheimer's disease etc. In elderly individuals, the interpretation of neurophysiological examinations is considerably more complex.[4]

1.3.2 CARDIOVASCULAR PROBLEMS AMONG ELDERLY

Cardiovascular diseases are the leading cause of death and morbidity worldwide. Because aging can compromise the cardiovascular system's proper functioning, cardiovascular illnesses are more common in the geriatric population and their incidence rises with age. Cardiovascular disorders affect patients on

average of 35–40% with the age group of 40–60 years old, 75–78% when 60–80 years old, and more than 85% when 80 years old. Regarding the risk factors for the occurrence of cardiovascular diseases, various problems are such as hypertension, coronary artery disease, peripheral arterial disease, aortic aneurysm etc. [5.]

1.3.3 RESPIRATORY PROBLEMS IN THE ELDERLY

As people age, their respiratory system experiences a variety of anatomical, physiological, and immunological changes. Deformities of the thoracic spine and chest wall are among the structural alterations. These compromise the compliance of the respiratory system, increasing the effort required to breathe. The loss of structural integrity causes the lung parenchyma to enlarge the air gaps. Moreover, these changes may be in part be responsible for various respiratory disorders such as tuberculosis, COPD, asthma, pneumonia, chronic bronchitis, emphysema etc. [6]

1.3.4 INTEGUMENTARY DISORDERS IN THE ELDERLY

Longer lifespans have led to a higher need for knowledge about age-related disorders, particularly those affecting the integumentary system, or skin. The human skin is the largest organ in the body and serves a variety of purposes, such as immunological surveillance, temperature maintenance, temperature regulation, electrolyte and protein prevention, and homeostatic regulation. Age-related alterations in the skin's biochemistry, permeability, vascularization, and thermoregulation, as well as modifications to the genome, irritating and immunological response, healing capacity, injury response, and neurosensory perception, are among the physiological changes seen in the skin. So, the integumentary disorders caused due to various physiological changes in the skin are eczema, pruritis, psoriasis etc. [7]

1.4 FEAR OF FALLS AMONG ELDERLY

Falls are one of the most prevalent yet dangerous health problems that older people deal with. Falls-related injuries have a substantial effect on elderly people's psychological well-being and quality of life in addition to increasing morbidity and financial burden. Reduced independence, increased worry, and a lower quality of life are all linked to failures. Research has shown that fear of falling is a major health issue for both older people who have fallen and those who have never fallen. Moreover, fear of falling can have a devastating effect on one's capacity to carry out everyday tasks, the frequency of hospital stays, and one's quality of life. Fear of falling has been linked to lower limb strength from conditions like osteoarthritis and neuropathies, which can lead to poor postural control and an increased frequency of falls. Previous studies have reported variable prevalence rates of fear of falling, ranging from 3% to 85%. Additionally, fear of falling has been observed to instill an attitude of avoidance of physical activity and social isolation, which can deteriorate the physical and mental health of the elderly population.[8]

Mainly the risk factors for fear of falls includes previous fall, feeling unsteady, diminished health, low falls self-efficacy, reduced ability to perform activities of daily living, frailty, poor vision, no close family or friends for emotional support and sedentary lifestyle. [9]

1.5 DUAL TASK PERFORMANCE AMONG ELDERLY

The act of completing two distinct things concurrently puts a strain on one's limited cognitive resources and is known as dual tasking. A common example would be talking while walking. Dual tasking has a detrimental impact on cognition and gait that goes beyond what aging alone would indicate. One approach to investigate dual tasking is to talk to someone while walking.[10]

Dual-tasking or completing cognitive and physical activities at the same time, challenges attentional resources and is becoming more difficult for older adults and people with cognitive impairment. When compared to single task performance, performing dual-task actions may result in a drop in motor task performance. As the aging process and cognitive decline worsen this decrease, researchers have looked for significant correlations between older persons' cognitive states and their ability to do dual task at once. For example, when dementia patients were dual tasking, they showed decreased gait performances with greater gait variability and slower walking speed.[11]

Studies using cognitive-motor dual-tasks often contrast a single-task condition like a postural or walking task with a dual-task condition that combines the motor task with a cognitive task that occurs at the same time. Dual-task costs are calculated by single-task minus dual-task performance divided by single-task performance and can be computed by comparing the performance in the two situations. These numbers represent the extent to which cognitive limitations are causing one or both tasks to perform less well. When auditory challenges are applied experimentally to various motor activities, like walking or balance, or when older persons with hearing impairments undergo cognitive motor dual task, competition for cognitive capacity is also evident.[12]

2. Methodology

INCLUSION CRITERION:

- AGE: 65 to 75 years.
- Both genders were included.
- Subjects with ability to walk without assisted devices (walker or cane).
- Subjects able to walk comfortably overground up to 5 meters distance.
- Subjects with stable medical status.
- Score of <20 on Tinetti Performance Oriented Mobility Assessment Scale (POMA) for risk of falling.
- At least 1 fall in the previous year.
- Subjects with no deficits for near sightedness.

EXCLUSION CRITERION:

- Subjects with chronic degenerative diseases (Parkinson’s, Alzheimer’s).
- Subjects with any cardiorespiratory ailments (COPD, restrictive lung diseases, myocardial infarction, any lung condition that necessitates a constant use of oxygen).
- Subjects with any orthopedic impairment specially for upper limb, lower limb in past 3 months (fractures, subluxated shoulder and arthritic conditions of knee).
- Subjects with diagnosis of psychiatric disorders or any specific neuropsychiatric symptoms (Neuropsychiatric Inventory Questionnaire NPI-Q>4).
- Subjects with perceptual disorders like agnosia and apraxia.
- Subjects with aphasia or incomprehensible speech.
- Subjects with pre-diagnosed eye related pathologies and age-related macular degeneration or non-reactive pupils.

VARIABLES:

INDEPENDENT VARIABLES:

- Dual task exercises.

- Single task exercises.

DEPENDENT VARIABLES:

- Score of Falls Efficacy Scale
- Score of Dual Task Cost.

TOOLS AND INSTRUMENTS:

- Falls Efficacy Scale
- Cotton
- Tuning fork (128 Hz)
- Tennis ball
- Basketball
- Paper cup
- Stopwatch
- Measuring tape

PROTOCOL

All the subjects meeting the inclusion criteria were selected for the study. A written informed consent was undertaken from each participating subject. The required assessment of the subjects was done. A minimum of 30 subjects were selected for the study. The treatment was given for a period of 7 weeks; 4 days per week for a minimum duration of 50-60 minutes per day.

Prior to the baseline assessment, all the patients underwent a training session for a day.

PROCEDURE

Following interventions were incorporated:

The dual task performance was evaluated at baseline and post intervention 7 weeks as per the following formula.

$$\text{Dual task cost} = \frac{(\text{Dual task performance} - \text{Single task performance}) * 100}{\text{Single task performance}}$$

Dual task performance procedure:

- The subjects were asked to perform simultaneous cognitive and motor task (dual task) at baseline and post-intervention 7 weeks.
- Three trials were performed by the subject and average was calculated for dual task.

DUAL TASK INTERVENTION:

- Walking at a walkway of 4 meters with tossing ball from one hand to other.
- Walking at a walkway of 4 meters, carrying a cup of water and making sure water doesn't spill.
- Walking at a walkway of 4 meters with dribbling a ball by alternate hands.

SINGLE TASK PERFORMANCE:

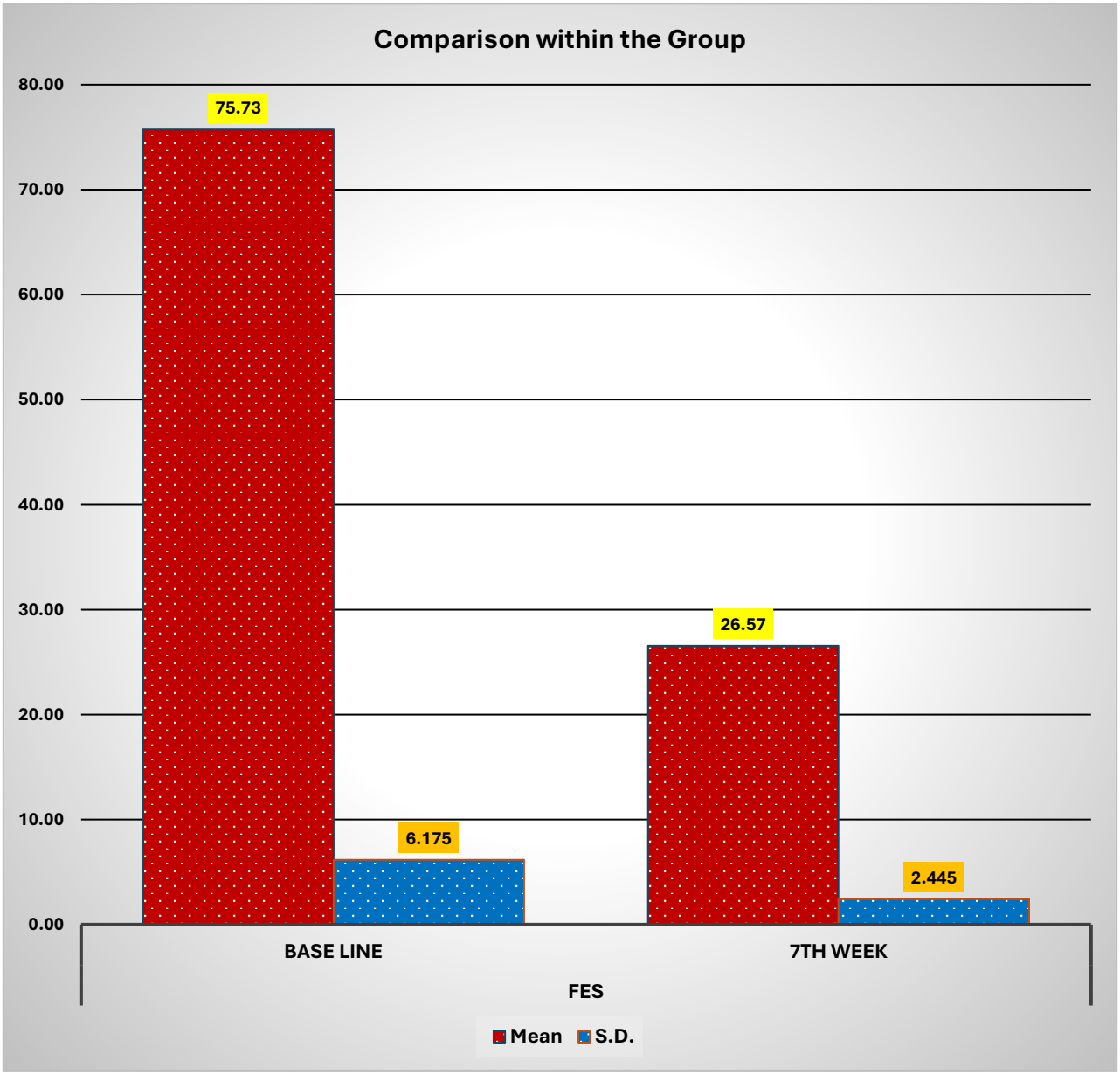
- For single tasks, the subject was asked to perform walking at 4 meters.
- Three trials were performed by the subject and the average will be calculated for a single task.

3. Results

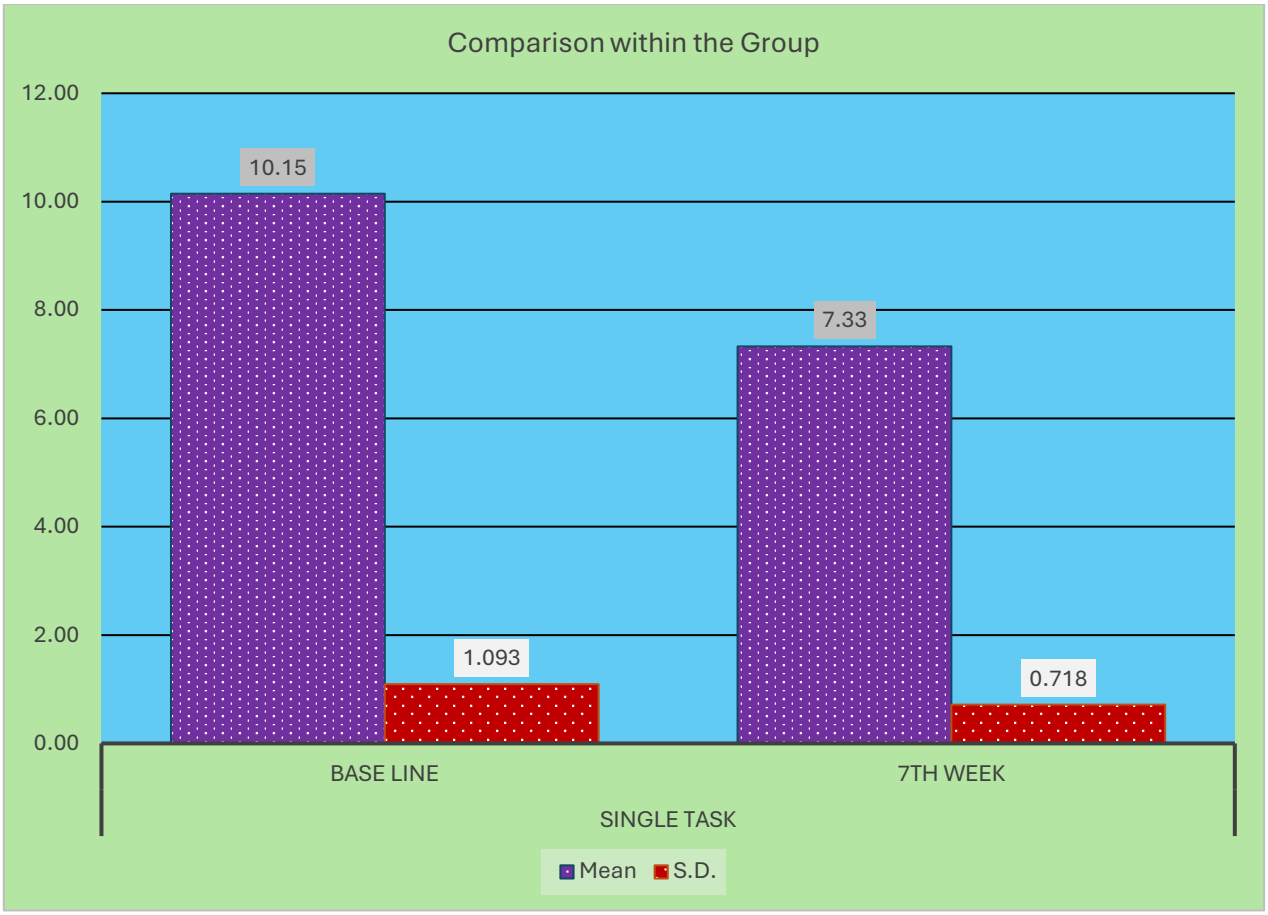
After analysis it was found that the scores of the Falls Efficacy scale were also found to be significant when compared from baseline to 7th week with a P value of <0.001.

In our study, it was found that a single task at baseline was significant. The results for average score of dual task activity of walking 4 meters with tossing ball was found to be significant at 7th week with P value of <0.001. Dual task activity of walking 4 meters with cup of water was also found to be significant with P value of <0.001. The dual task activity of walking 4 meters while dribbling a ball was significant by 7th week with P value of <0.001.

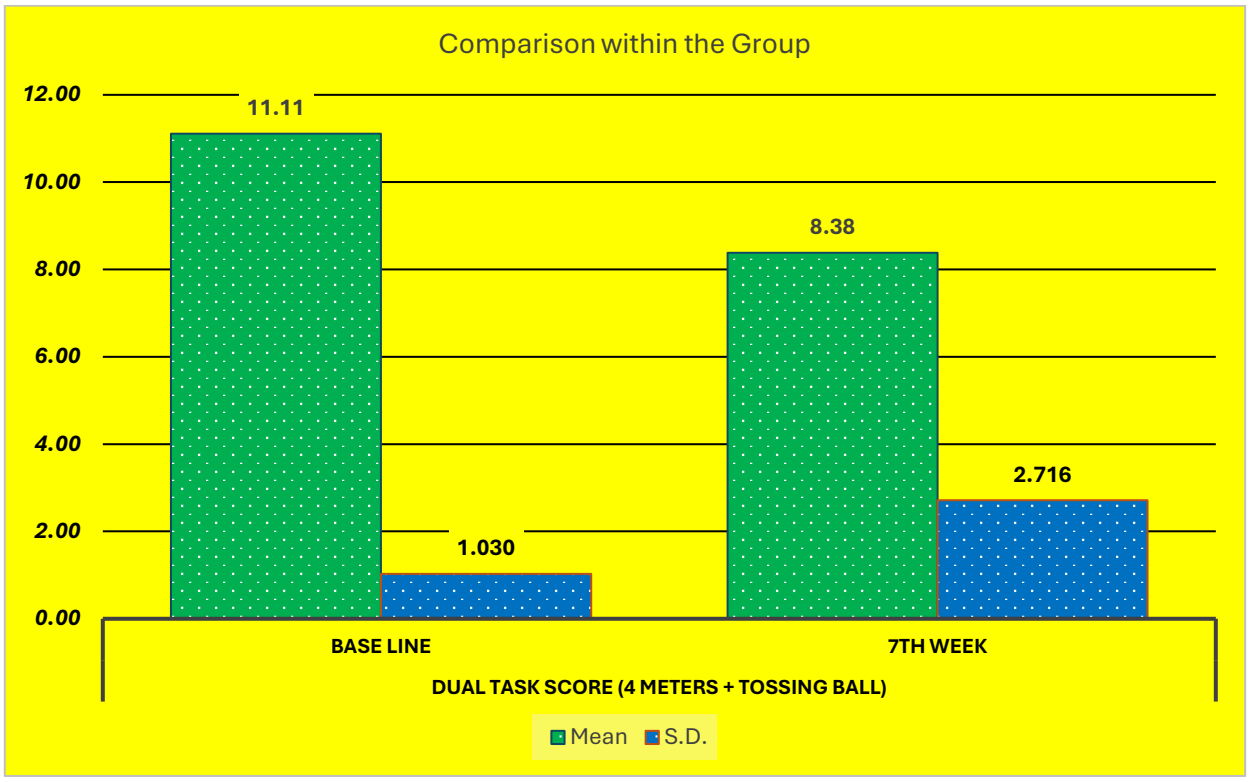
While analyzing the dual task cost for walking with tossing ball it was found that the results were non-significant with a P value of 0.7157. The results were also non-significant with a P value of 0.8845 by 7th week for walking while holding a cup of water. However, it was found that the results were significant for dual task cost for walking 4 meters with dribbling a ball at 7th week with a P value of <0.001.



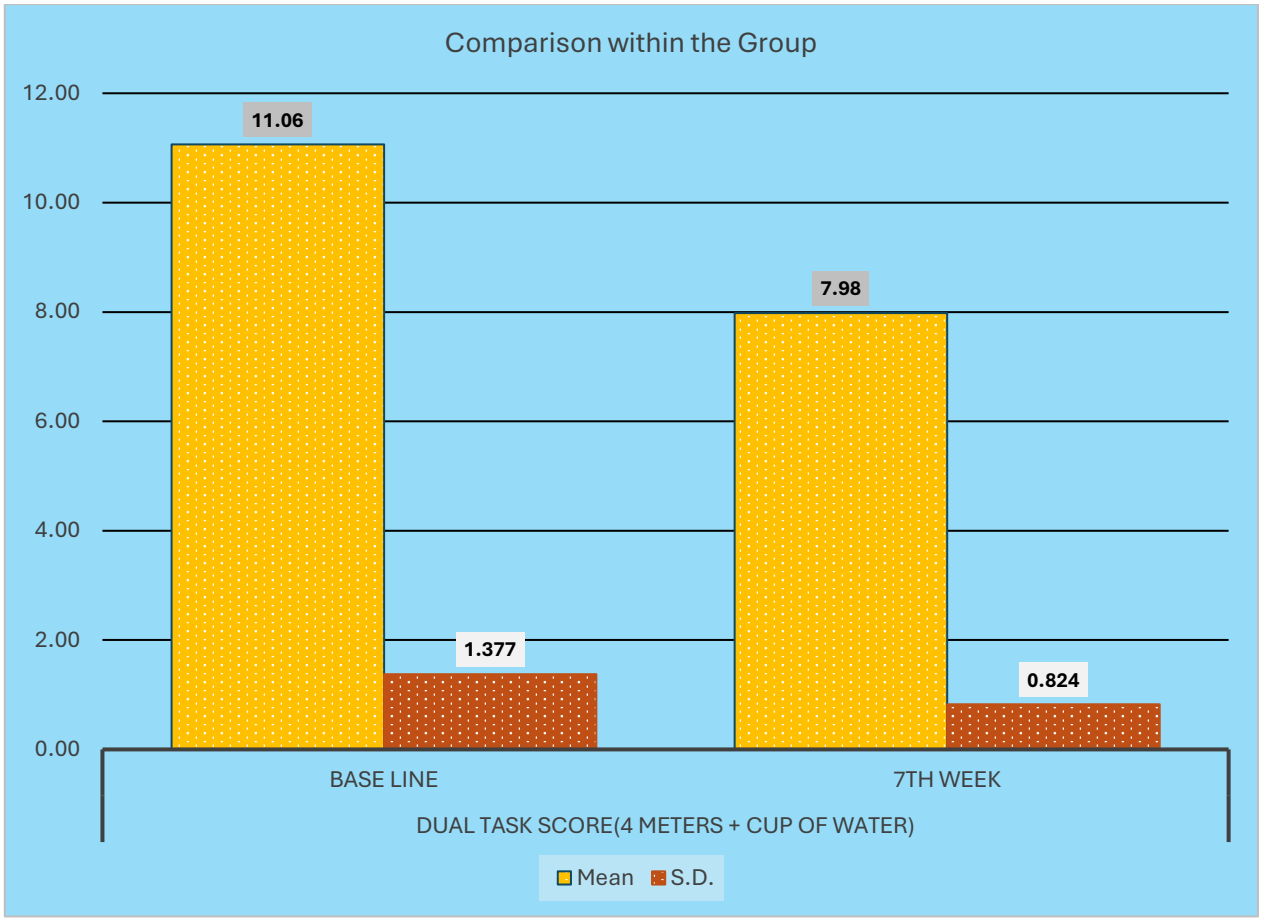
Graph 3.1. Shows Within the group differences of Falls Efficacy scale.



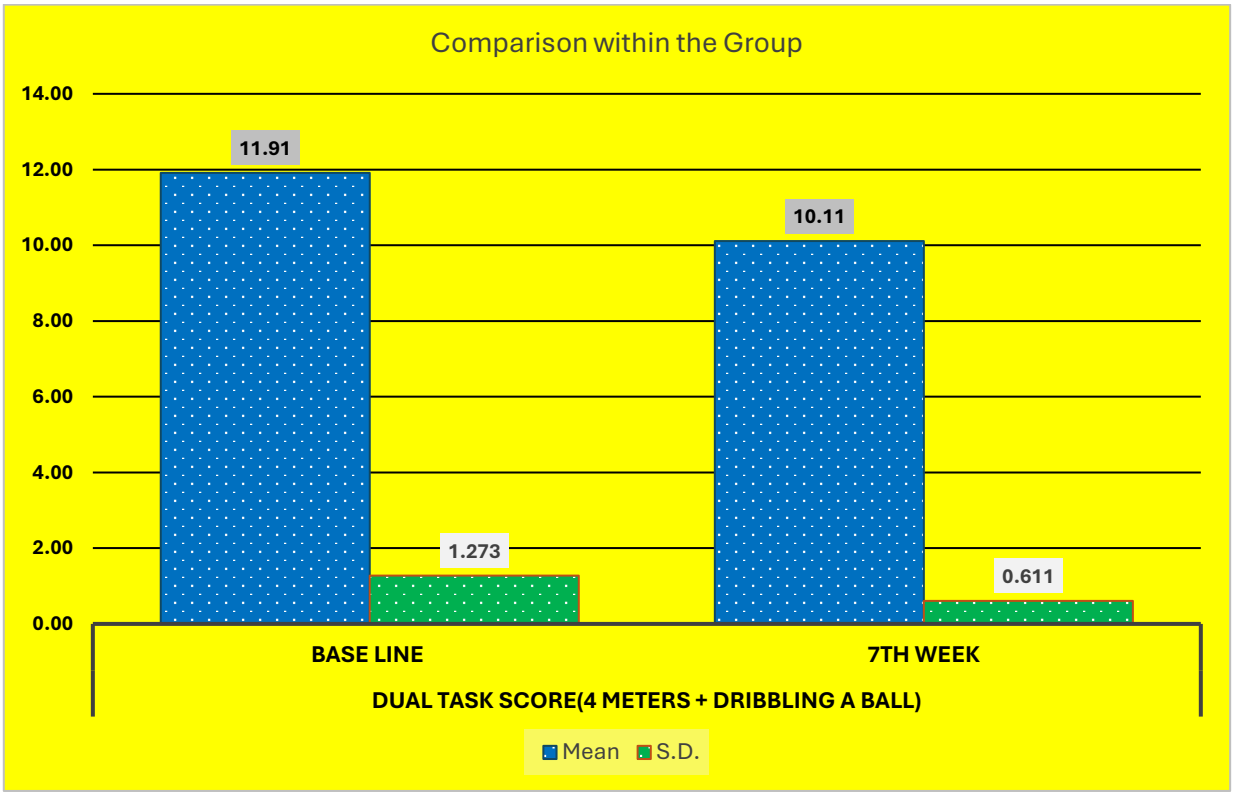
Graph 3.2. Shows Within the group differences of Single Task.



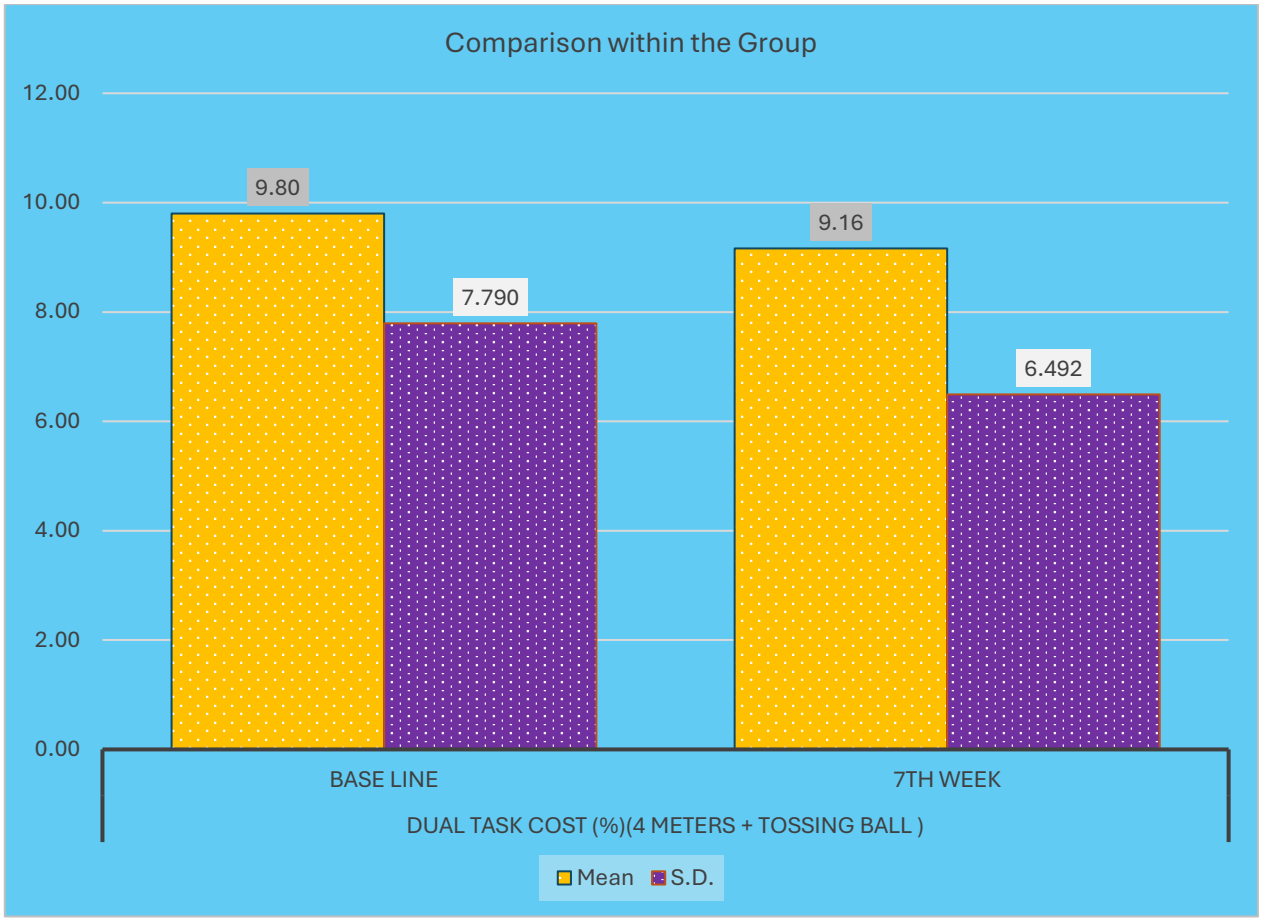
Graph 3.3. Shows Within the group differences of Dual Task score for 4 Meters + Tossing ball.



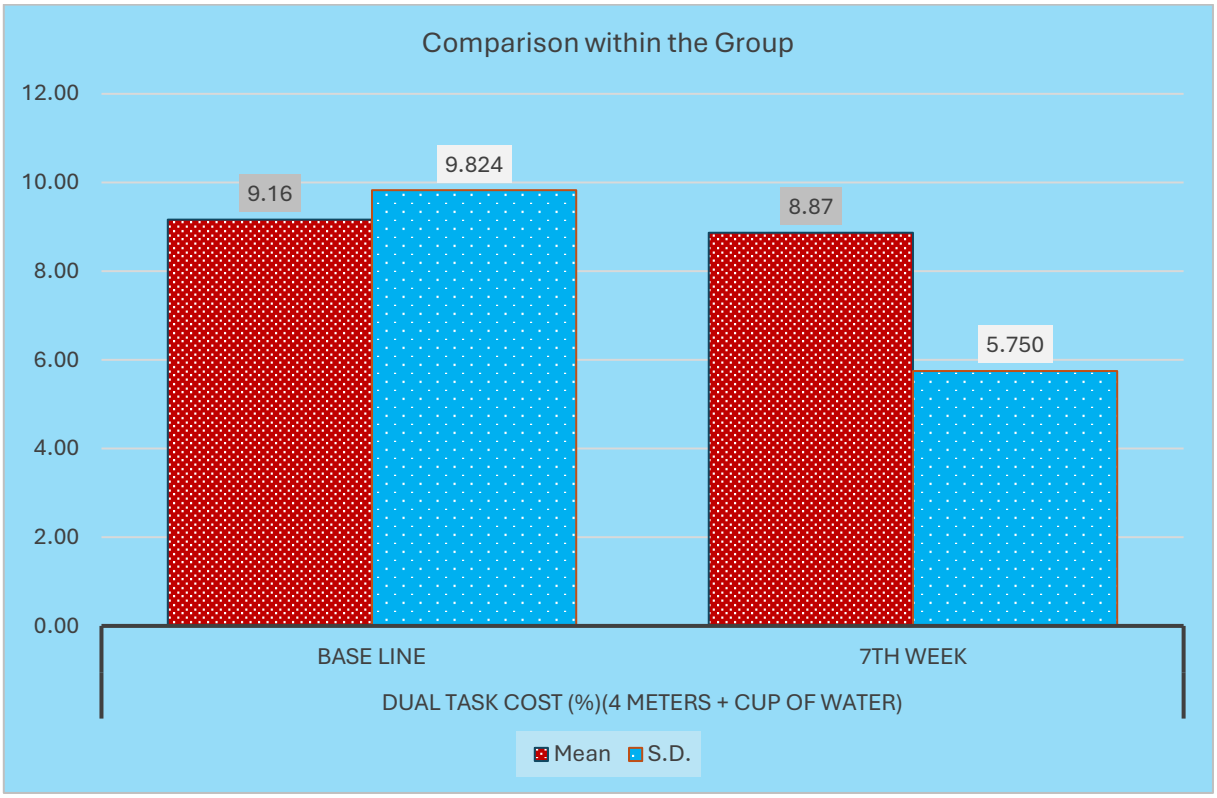
Graph 3.4. Shows Within the group differences of Dual Task score for 4 Meters + Cup of Water.



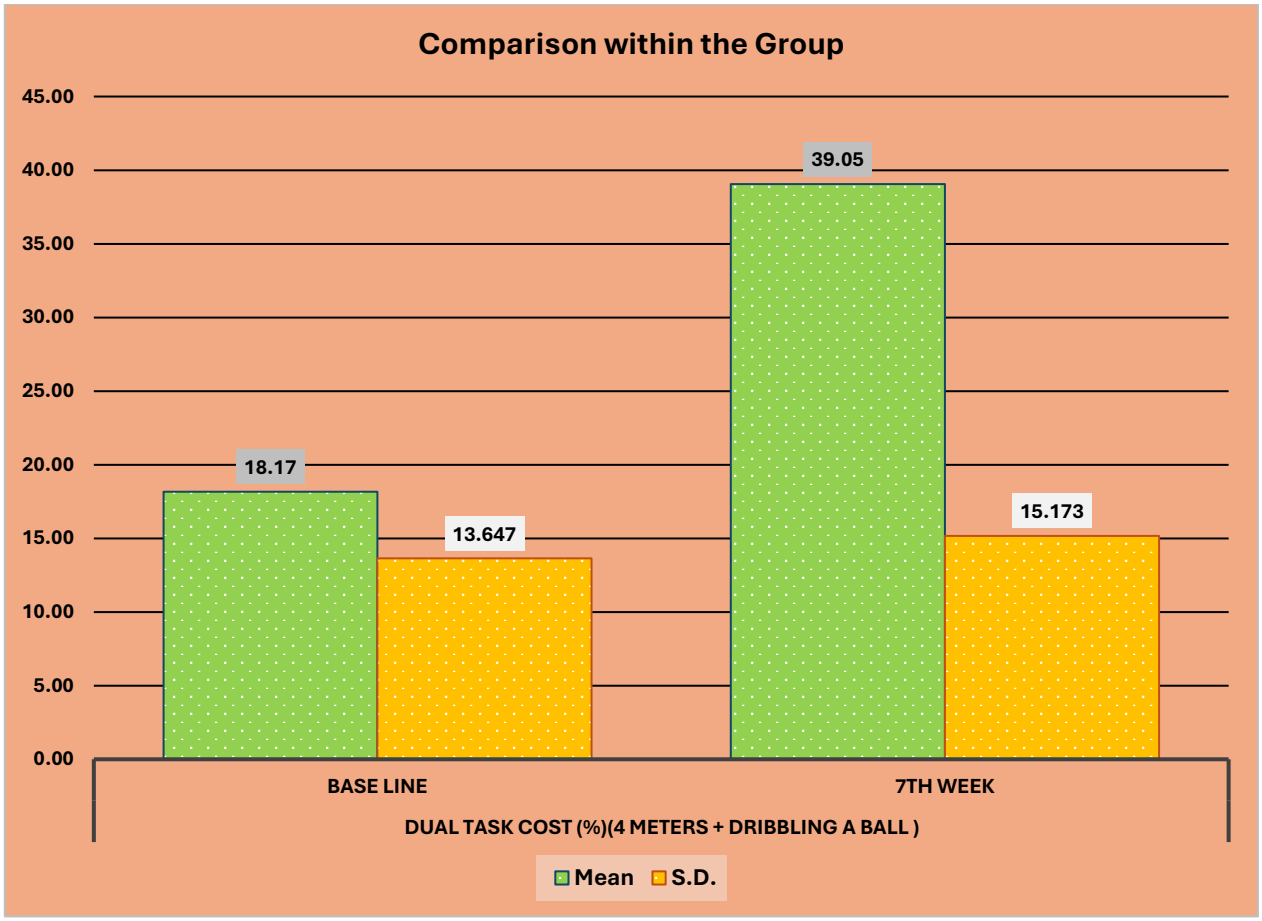
Graph 3.5. Shows Within the group differences of Dual Task score for 4 Meters + Dribbling a ball.



Graph 3.6. Shows Within the group differences of Dual Task Cost for 4 Meters + Tossing ball.



Graph 3.7. Shows Within the group differences of Dual Task Cost for 4 Meters + Cup of Water.



Graph 3.8. Shows Within the group differences of Dual Task Cost for 4 Meters + Dribbling a ball.

4. Discussion

The results of the study by **Daly RM et al.**[156]in 2015 are in lieu of the results of our study stating that dual task training is effective for improving fall efficacy among elderly.

It has been proposed that physical activity protects neurons from numerous disorders associated with neurodegeneration. The results of our study yet do not question neuroprotection, but it is still suggestive that the activity measures result in cognitive improvisation. The existing literature reports the presence of specialized neuronal circuits present in lumbar spinal cord which are known as central pattern generators allowing coordinated and purposeful motor activity even in the absence of higher center control.

Various research has advocated that there occurs improvisation of neurotransmitter systems, increased brain volumes and blood flow, IGF-1 factor and increase in brain derived neurotrophic factors.[106]

Various inferences have been documented for planned rehabilitation for geriatric population. It has been significantly noted that higher levels of severity about disabilities and lack of functional capacities are a major contributing factor for less active exercises during rehabilitation.

5. Limitations of the study

- The current study had a smaller sample size that limits generalizability.
- Control group was lacking which might have affected the functional outcomes.
- The chances of having type II errors could have been probable.

- The training session given to the geriatric population was of less duration and could be undertaken for longer aspect.

6. Future scope of the study

- Apart from dual task motor aspects personal and physical factors correlation should also be evaluated.
- Hematological studies analyzing neurotrophic factors like BDNF should be undertaken.
- The verbal component of higher function was not taken into consideration.

7. Conclusion

The study concluded that it was noticeable that dual task performance for all the three tasks improved statistically and clinically whereas the secondary outcome of the dual task cost improved for dribbling ball task. The realm of technology and forthcoming innovations is constantly thriving and continually reshaping the conventional rehab system.

8. References

1. Multani N. K, Verma S.K. Principles of Geriatric Physiotherapy. First Edition: Jaypee Brothers Medical Publishers (P) LTD; 2007
2. Rajati F, Rajati M, Rasulehvandi R, Kazeminia M. Prevalence of stroke in the elderly: A systematic review and meta-analysis. Interdisciplinary Neurosurgery. 2023 Jun 1; 32: 101746.
3. Jahan S, Islam R, Rahman T, Kabir MF, Islam MW, Hossain K, Hossain KA, Hossain MZ, Rahman E, Chakrovorty SK, Sarker AH. The assessment of musculoskeletal disorders, quality of life, and comorbidities in older people in Bangladesh. Frontiers in Public Health. 2023 Dec 15; 11: 1269444.
4. Stanton BR. The neurology of old age. Clinical medicine. 2011 Feb; 11(1): 54.
5. Ciumărnean L, Milaciu MV, Negrean V, Orășan OH, Vesa SC, Sălăgean O, Iluţ S, Vlaicu SI. Cardiovascular risk factors and physical activity for the prevention of cardiovascular diseases in the elderly. International Journal of Environmental Research and Public Health. 2021 Dec 25; 19(1): 207.
6. Sharma G, Goodwin J. Effect of aging on respiratory system physiology and immunology. Clinical interventions in aging. 2006 Jan 1; 1(3): 253-60.
7. Miller MA, Maibach HI. Degenerative Changes in Aging Skin. Textbook of Aging Skin. 2009 Dec 2; 19: 25.
8. Dhar M, Kaeley N, Mahala P, Saxena V, Pathania M, SAXENA V. The prevalence and associated risk factors of fear of fall in the elderly: A hospital-based, cross-sectional study. Cureus. 2022 Mar 25; 14(3).
9. https://www.physio-pedia.com/Fear_of_Falling
10. Lilja-Lund O, Nyberg L, Maripuu M, Laurell K. Dual-task performance in older adults with and without idiopathic normal pressure hydrocephalus. Frontiers in Aging Neuroscience. 2022 May 30; 14: 904194.
11. Ehsani H, Mohler MJ, O'connor K, Zamrini E, Tirambulo C, Toosizadeh N. The association between cognition and dual tasking among older adults: the effect of motor function type and cognition task difficulty. Clinical interventions in aging. 2019 Apr 8: 659-69.
12. Wunderlich A, Vogel O, Šömen MM, Peskar M, Fricke M, Gramann K, Protzak J, Marusic U, Wollesen B. Dual-task performance in hearing-impaired older adults—study protocol for a cross-sectional mobile brain/body imaging study. Frontiers in aging neuroscience. 2021 Nov 12; 13: 773287.