IJRAR.ORG E-ISSN: 2348-1269, P-ISSN: 2349-5138

INTERNATIONAL JOURNAL OF RESEARCH AND ANALYTICAL REVIEWS (IJRAR) | IJRAR.ORG

An International Open Access, Peer-reviewed, Refereed Journal

A Study To Assess The Effectiveness of Dual Task Exercises On Improving Balance And Gait Pattern Among Elderly In Selected Urban Areas of Lucknow

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ABSTRACT

INTRODUCTION- As elderly adults age they often experience a decline in balance and gait, characterized by increased variability in their walking patterns. This heightened variability is linked to a higher risk of falls among this population, negatively impacting their quality of life and longevity. Dual task exercise refers to the activities which were taught to the elderly to improve their gait and balance including walking, counting the numbers while forward walking, counting the numbers while backward walking, walking between obstacles, Figure of eight walking. So the researcher decided to conduct a study to assess the effectivenesss of dual task exercises on improving balance and gait pattern among elderly in selected urban areas of Lucknow.

OBJECTIVES- 1. To assess the pre-test and post-test level of balance among the elderly using the Berg Balance Scale.2. To assess the pre-test and post-test level of gait pattern among the elderly using the Functional Gait Assessment Scale.3. To determine the effectiveness of dual-task exercises on improving balance among the elderly.4. To determine the effectiveness of dual-task exercises on improving gait pattern among the elderly.5. To correlate the effectiveness of dual-task exercises on the level of balance and gait pattern among the elderly.6. To associate the post-test level of balance among the elderly with their selected demographic variables.7. To associate the post-test level of gait pattern among the elderly with their selected demographic variables**.**

METHODS – Quasi-experimental one group pretest posttest design. The study was conducted in urban areas of Lucknow. Through mixed sampling technique50 samples were taken under the study. Pretest was done using Berg balance scale and Functional gait assessment scale. After that dual task exercises were given for 4 weeks thrice a week followed by posttest.

RESULTS- The elderly demonstrated significant improvement in their level of balance. The mean score of the Berg Balance Scale increased from 32.90 in the pre-test to 40.14 in the post-test, indicating a positive impact on balance.

Significant improvement was observed in the level of gait pattern among the elderly. The mean score of the Functional Gait Assessment Scale increased from 16.74 in the pre-test to 22.44 in the post-test, reflecting a positive effect on gait pattern.The improvement in mean scores for balance and gait pattern highlights the necessity of dual-task exercises for preventing falls and injuries among the elderly. A strong positive correlation was found between dual-task exercises and the improvement in balance and gait pattern, reinforcing their importance.A significant association was found between the level of balance and specific demographic variables such as age, gender, occupation, exercise habits, and frequency of exercise. Socio-

demographic variables such as physical problems and exercise habits were significantly associated with the level of gait pattern among the elderly.

CONCLUSION- This study provides valuable insights into the positive effects of dual task exercises on balance and gait pattern among elderly, careful consideration of the limitations and the application of recommendations are essential for advancing the field and improving the quality of care of the elderly population.

Keywords

[Effectiveness; Dual task exercises; Balance; Gait pattern; Elderly]

CHAPTER I

INTRODUCTION

"Ageing is not lost youth but a new stage of opportunity and strength".

(Betty Friedan)

Ageing is a natural process which starts with intrauterine life continues until death and is caused by irreversible degeneration of cells and systems.[1]Old age is usually associated with declining faculties both mental and physical and a reduction in social commitments.[2]Old age encompasses the years approaching and exceeding life expectancy, often described with terms like seniors, senior citizens, and the elderly. Compared to younger adults, older individuals typically experience reduced regenerative abilities and increased susceptibility to illness. However, the definition of old age varies culturally and historically, with chronological age not being a fixed biological stage. Instead, aging is a natural process known as senescence.[3]

As individuals grow older they tend to encounter a mix of health issues such as hearing loss, cataracts, osteoarthritis, COPD, diabetes, depression, and dementia. This clustering of conditions can significantly impact overall health and quality of life in older adults.Moreover, geriatric syndromes such as frailty, urinary incontinence, falls, delirium, and pressure ulcers often emerge in older age due to various underlying factors such as physiological changes, chronic conditions, medications, and social factors. These syndromes can further complicate the management of health conditions and require specialized approaches for assessment and intervention to maintain optimal health and function in older individuals.[4]The aging process is influenced by a combination of genetic factors and the physical and social environments individuals are exposed to throughout their lives.The physical and social environments can directly impact health and well-being or create barriers and incentives that influence health behaviours and decisions. For instance, access to healthy food options, opportunities for physical activity, and the absence of tobacco exposure can significantly reduce the risk of non-communicable diseases and enhance both physical and mental capacities as people age.Moreover, supportive physical and social environments play a crucial role in enabling older adults to maintain their independence and continue engaging in activities that are important to them despite potential declines in health. In developing public health strategies for aging populations, it's essential to consider not only interventions that mitigate the challenges associated with aging but also those that foster resilience, adaptation, and psychosocial growth. This holistic approach can enhance the overall well-being and quality of life for older individuals, promoting healthy aging and active participation in society.[5]

BACKGROUND OF THE STUDY

Old age isn't a pathological condition but rather encompasses various changes across physiology, psychology, sociology, and chronological aspects.[6] Therefore, its definition is broad and intricate. Physiological aspects highlight structural and functional declines, psychological aspects relate to reduced perception and problem-solving abilities, and sociological aspects reflect societal devaluations experienced

by individuals.[7]The medical study of aging is known as gerontology, while the study of diseases affecting the elderly is termed geriatrics.[8]

The World Health Organization defines old age as beginning at age 65, focusing on the decline in an individual's ability to adapt to their environment. On December 14th, 1990, the United Nations General Assembly designated October 1st as the International Day of Older Persons to recognize the significant contributions older individuals make to society and to address the challenges and issues related to aging in the modern world.[9] Also The United Nations designated the period from 2021 to 2030 as the " Decade of healthy ageing" to promote healthy ageing and address the challenges associated with an ageing population worldwide. This initiative aims to ensure that older adults can live longer, healthier and more fulfilling lives.[10]Global life expectancy has increased, with a majority of people now expected to live into their sixties and beyond. This demographic shift is evident worldwide, with every country experiencing growth in both the size and proportion of older populations.[11]

According to WHO - By 2030, approximately 1 in 6 people globally will be aged 60 or over, with the population of individuals in this age group projected to increase from 1 billion in 2020 to 1.4 billion by 2030. By 2050, the number of people aged 60 and older is expected to double to 2.1 billion, and the number of those aged 80 and older is projected to triple, reaching 426 million by 2050.[12]

According to report by Census Bureau on Ageing in Asia - In Asia alone, an estimated 414 million individuals were aged 65 and older, surpassing the total population of the United States. By 2060, it is projected that there will be over 1.2 billion older individuals in Asia, highlighting the significant demographic shift occurring in the region, with one in every ten individuals worldwide being an older Asian.[13]

According to India ageing report 2023 - The proportion of elderly individuals in India has been rapidly increasing, a trend expected to persist in the coming decades.

The share of the population aged over 60 is projected to rise from 10.5 percent in 2022 to 20.8 percent in 2050, and it's anticipated to exceed 36 percent by the end of the century. [14]

According to the NHM (National health mission) and NHRC(National human rights commission in india) Health dossier 2021, elderly individuals aged 60 and above in Uttar Pradesh constitute 8% of the state's total population.[15]

Elderly individuals are invaluable assets to society, despite the challenges and opportunities that come with aging. Factors such as increased longevity, the decline of joint family structures, and social fabric breakdown contribute to issues like loneliness and neglect among seniors.[16]

The older people exhibit greater variability and changes in gait characteristics compared to younger individuals, attributed to factors like impaired balance, reduced muscle strength in the lower limbs, diminished vision and proprioception, and overall decline in health.[17]Gait and balance disorders are prevalent among the elderly, directly impacting their mobility, independence, and overall functional capacity. Maintaining a stable and efficient gait is crucial for performing daily tasks, reducing fall risk, and enhancing quality of life in later years.These disorders encompass various abnormal walking patterns, such as decreased speed, smoothness, symmetry, stride length, and synchrony of body movement, often indicating underlying health conditions.[18]

Additionally, cognitive functions gradually decline with age, affecting short-term working memory, processing speed, memory retrieval, attention, and problem-solving abilities. These changes further contribute to challenges in maintaining a steady and coordinated gait as individuals age.[19]

NEED OF THE STUDY

As elderly adults age they often experience a decline in balance and gait, characterized by increased variability in their walking patterns. This heightened variability is linked to a higher risk of falls among this population,[20] negatively impacting their quality of life and longevity.[21]

Falls represent a significant global public health concern, with approximately 68,400 fatal incidents annually, positioning it as the second most prevalent cause of unintentional injury death, following road traffic injuries. More than 80% of these fatalities occur in low and middle-income countries, particularly in regions such as the Western Pacific and Southeast Asia, which collectively contribute to 60% of these deaths. Notably, death rates are highest among individuals aged 60 years and older across different regions worldwide.[22]

Injuries resulting from falls are disproportionately common among older individuals, leading to significant pain, disability, loss of independence, and even premature death. Statistics show that approximately 28-35% of individuals aged 65 and over experience falls each year, with this percentage increasing to 32-42% for those over 70 years old. The financial burden associated with fall-related injuries is substantial and is on the rise worldwide. Considering the profound personal, familial, and societal implications of these injuries, along with the potential for effective interventions, addressing this issue emerges as a crucial global health concern.[23]

Maintaining a healthy lifestyle, including physical activity, a nutritious diet, and abstaining from harmful substances, is essential for promoting well-being in old age. Additionally, positive attitudes and mental well-being play crucial roles in enhancing the quality of life for seniors.[16]As per the World Guidelines for Fall Prevention and Management in Elderly individuals, it's recommended that all seniors receive guidance on preventing falls and engaging in physical activity. Additionally, a thorough assessment of fall risks from multiple factors should be conducted alongside prevention efforts.[24]

The combined systematic review of analysis of various studies found that exercise can enhance cerebrovascular function, cognitive abilities, and neuroplasticity in adults aged 50 and above, regardless of their health condition. This improvement occurs in brain regions linked to executive functions and memory.[25]

Likewise, a systematic search of the literature was performed using PubMed, Medline, CochraneCentral and Google Scholar to identify randomized clinical trials investigating the impact of exercise on balance and falls in individuals aged 65 and above. Sixteen articles were selected for review, and the Cochrane Risk of Bias tool was used to assess their quality. Three studies were classified as having a low risk of bias, while four were considered to have a high risk of bias.The meta-analysis revealed enhancements in dynamic and static balance, decreased fear of falling, improved balance confidence, better quality of life, and enhanced physical performance among patients engaging in physical exercise compared to those in control groups. Additionally, the analysis of total falls indicated a reduced risk of falls in individuals participating in exercise programs. Moreover, there was a significant decrease in the number of patients experiencing at least one fall in the intervention group. These findings highlight the effectiveness of physical exercise in enhancing balance and lowering fall rates in older adults.[26]

A systematic review and meta-analysis investigated the impact of dual-task training on cognitive and physical functions in older adults with cognitive impairment. The study synthesized emerging evidence regarding the effectiveness of dual-task training for improving cognitive and physical functions in individuals with cognitive impairment, dementia, or Alzheimer's disease. A thorough search was conducted across databases such as Medline, Cochrane Library, PubMed, and EMBASE, identifying 21 studies with a total of 2,221 participants. The findings indicated a small-to-medium positive effect of dual-task training intervention on cognitive functions and medium-to-large positive effects on gait, function, and balance.[27]

In another experimental study conducted in India, researchers examined the effectiveness of dual-task training on cognition in older adults living in the community over a four-week period. Sixty-seven community-dwelling older adults aged between 60 to 79 years were selected using a convenient sampling method. A pre-test was conducted using the Montreal Cognitive Assessment Scale. The dual-task intervention, lasting 60 minutes, was administered three days a week on alternate days with rest intervals, over the course of four weeks. A post-test was conducted after the intervention period, and the data collected were statistically analyzed using the Paired t- test. The study results indicated that dual-task training effectively improved cognition in community-dwelling older adults.[28]

Maintaining the above literature shows that dual-task exercises are effective in treating gait and balance problems among the elderly, but there are only limited studies related to dual-task exercises, especially in India, so the researcher planned to conduct a study to assess the effectiveness of dual-task exercises on improving balance and gait pattern among the elderly.

AIM OF STUDY

The aim of the study was to assess the effectiveness of dual task exercises on improving balance and gait pattern among elderly in selected urban areas of Lucknow.

STATEMENT OF PROBLEM

"A study to assess the effectiveness of dual task exercises on improving balance and gait pattern among elderly in selected urban areas of Lucknow".

OBJECTIVES OF THE STUDY

1. To assess the pre-test and post-test level of balance among the elderly using the Berg Balance Scale.
2. To assess the pre-test and post-test level of gait pattern among the elderly using the Functional Gait Assessment Scale.
3. To determine the effectiveness of dual-task exercises on improving balance among the elderly.
4. To determine the effectiveness of dual-task exercises on improving gait pattern among the elderly.
5. To correlate the effectiveness of dual-task exercises on the level of balance and gait pattern among the elderly.
6. To associate the post-test level of balance among the elderly with their selected demographic variables.
7. To associate the post-test level of gait pattern among the elderly with their selected demographic variables.

HYPOTHESES

The hypothesis will be tested at 0.05 level of significance.

H_1. There will be a significant difference between the pre-test and post-test level of balance among the elderly.

H_2. There will be a significant difference between the pre-test and post-test level of gait pattern among the elderly.

H_3. There will be a significant correlation between the effectiveness of dual-task exercises on the level of balance with gait pattern among the elderly.

H_4. There will be a significant association between the post-test level of balance among the elderly and their selected demographic variables.

H_5. There will be a significant association between the post-test level of gait pattern among the elderly and their selected demographic variables.

OPERATIONAL DEFINITION

Effectiveness: In this study it refers to the expected outcome such as improving balance and gait pattern which was measured used Berg Balance Scale and Functional Gait Assessment Scale respectively.

Dual task Exercise: In this study dual task exercise refers to the activities which were taught to the elderly to improve their gait and balance including walking, counting the numbers while forward walking, counting the numbers while backward walking, walking between obstacles, Figure of eight walking.

Balance: In this study, balance refers to the ability of the elderly to maintain stable position without falling which was assessed by using Berg Balance Scale.

Gait pattern : In this study gait refers to the pattern of walking which was assessed by using Functional Gait Assessment Scale.

DELIMITATION

1. Sample size is only 50.
2. Data collection is only upto six weeks.

CONCEPTUAL FRAME WORK

The conceptual framework presents logically constructed concepts to provide a general explanation of the relationship among the concepts of the research study. [29]

The frame work used in the study was based on wiedenbach's prescriptive theory. Wiedenbach's model of nursing provide as any person receiving help of some kind from the health care system. Help can include care, teaching and advice. In this nursing theory, a patient does not need to be ill or injured since health education qualifies someone as a patient.[30]

Wiedenbach's prescriptive theory is based on three factors [30]

1. The central purpose
2. Prescription
3. Realities

Central purpose

The central purpose which the nurse recognizes an essential to the particular discipline.In this study central purpose is to improve balance and gait pattern among elderly.

Prescription

Prescription is the fulfillment of the central purposes.In this study prescription is an intervention, dual task exercises given to the elderly.

Outcome

Outcome is the improvement or achievement of goal.

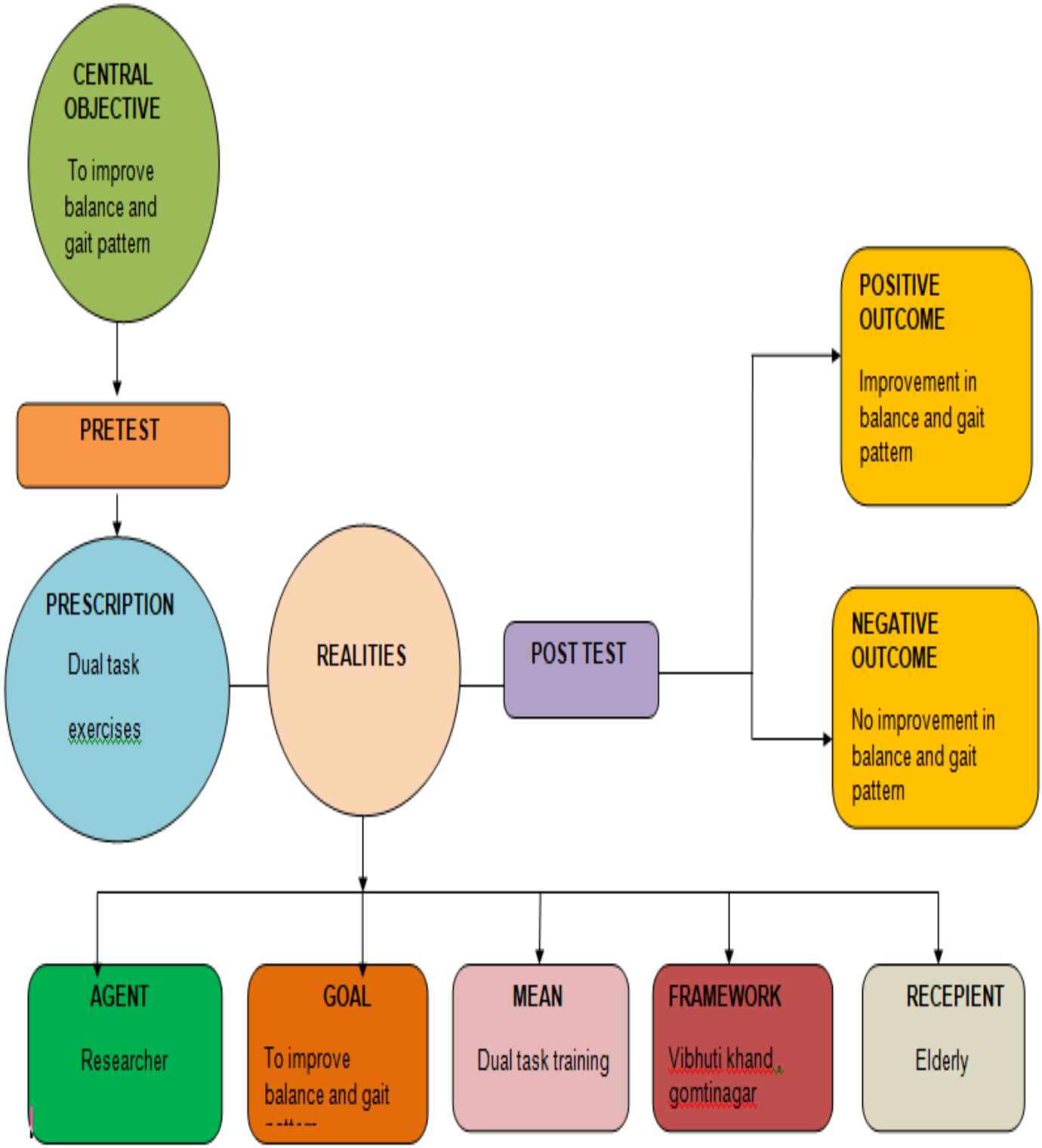

Fig 1 : Conceptual framework based on Wiedenbach's prescriptive theory

CHAPTER II

REVIEW OF LITERATURE

A literature review is a body of text that aims to review the critical points of knowledge on a particular topic of research .[31]

Review of literature is one of the most important steps in the research process. It is an account of what is already known about a particular phenomena. The main purpose of literature review is to convey to the readers about the work already done and the knowledge and ideas that have been already established in a particular topic of research. [31]

The researcher organized the literature under following headings:

A. Literatures related to effect of dual task exercises on body balance.
B. Literatures related to effect of dual task exercises on gait performance .
C. Literatures related to effect of dual task exercises on gait performance and body balance.

A. Literatures related to effect of dual task exercises on body balance.

An RCT was carried out in Taiwan to examine the impact of an Exercise Cognitive Dual Task Program conducted in the Chinese language on cognitive functions and functional fitness among older adults. The study involved 70 participants aged 60 to 84 years, who were conveniently allocated to one of three groups: Exercise Cognitive Dual Task (EC) group (n=28), Exercise group (n=22), and Control group (n=20). Both the EC group and the Exercise group participated in a 90-minute class comprising multi-component exercises twice weekly. Meanwhile, the control group maintained their usual level of physical activity and general lifestyle. The intervention lasted for a total of 12 weeks. Pre-test and post-test evaluations of cognitive and functional fitness were conducted using the Taiwanese Frontal Assessment Battery score, the Chang-Gung University Orthographical Fluency Test score, and the Mini-Mental State Examination score. The results of the study revealed greater enhancements in verbal fluency, endurance, and muscular strength compared to both the exercise-only group and the control group.[32]

A study was carried out to examine the impact of a dual-task, multi-modal physical exercise training combined with cognitive stimulation on cognitive and physical function in healthy older adults living in the community. The training regimen comprised 24 group sessions conducted twice weekly, each lasting 75 minutes at moderate intensity. Cognitive function was evaluated using the CANTAB automated neuropsychological test, while functional capacity for exercise was assessed using a specific test. Performance changes from baseline to post-intervention were analyzed, and comparisons were made with a non-exercise control group using mixed linear models for repeated measures. The study compared performance changes from baseline to post-intervention, as well as to a non-exercise control group, using a mixed linear model for repeated measures. The findings indicated that the combination of dual-task multi-sensory cognitive stimulation and multi-modal moderate physical exercise training twice a week could serve as an effective program. This program showed promise in reducing the progression of age-related cognitive decline and enhancing physical fitness and quality of life among healthy older adults.[33]

An RCT study was undertaken in Spain to investigate the effects of physical and cognitive training programs, as well as their combination using a dual-task paradigm, on cognitive functions and physical capacities in women aged over 80 years. A total of 43 women participated in the study and were divided into three experimental groups and one control group. Experimental group 1 underwent cognitive training, experimental group 2 received physical cognitive training, and experimental group 3 engaged in physical training only. The training program lasted for 8 weeks, with each session lasting 60 minutes, amounting to a total of 5 sessions per week. Pre-test and post-test data were collected, with cognitive variables assessed using the Stroop test, the Trail Making Test, and the D2 Test. Physical variables were evaluated using the hand grip strength test, the minute step test, and the visual-acoustic real-time test. The study's results indicated that after 8 weeks of physical, cognitive, or combined dual-task paradigm training, there were improvements in both physical and cognitive functions among older adults. Additionally, this training appeared to protect them from the negative effects of the aging process.[34]

A systematic review and meta-analysis was carried out in Turkey to investigate the effects of dual-task training (DTT) on balance in healthy older adults.Searches were conducted across several databases, including PubMed, EbscoHost, Web of Science (WOS), Scopus, Cochrane Library, MEDLINE, EBSCO Open Dissertations, ULAKBIM (TR Index), and the Council of Higher Education Thesis Center (YOK), along with gray literature. The quality of the included studies was evaluated using the Cochrane Risk of Bias tool, and data analysis was performed using Comprehensive Meta-Analysis (CMA) software. Publication bias was assessed with a funnel plot and Egger's test. The review included 14 studies with a total of 691

participants. The findings demonstrated that DTT significantly improved balance in older adults when compared to non-intervention groups (standardized mean difference (SMD): -0.691, 95% confidence interval (CI): -1.153 to -0.229). Additionally, DTT was more effective than other interventions in enhancing balance (SMD: -0.229, 95% CI: -0.441 to -0.016).The study concluded that DTT is an effective strategy for improving balance in healthy older adults.[35]

A quasi-experimental study using a pretest-posttest control group design was conducted to assess the effectiveness of a cognitive/exercise dual-task program on cognitive function, health status, depression, and life satisfaction in community-dwelling elderly individuals. The study involved 65 participants (intervention group: n = 32, control group: n = 33) living in Seoul, South Korea. The intervention consisted of 20 sessions over 10 weeks, held twice weekly, with each session lasting approximately 50 minutes.Data collection was done using tools such as the Korean version of the Mini-Mental State Examination (MMSE-K), the Korean Elderly Health Status Assessment Tool, the Korean version of the Geriatric Depression Scale, and the Elderly Life Satisfaction Scale. The data was analyzed using SPSS/ WIN software. The findings showed significant differences between the intervention and control groups, with improvements in cognitive function, health status, and life satisfaction, and a reduction in depression in the intervention group. This study demonstrated that the cognitive/exercise dual-task program is an effective intervention for enhancing the well-being of elderly individuals in the community. Health care providers are encouraged to consider implementing such programs in community-based elder care.[36]

This systematic review investigated the theories supporting the effectiveness of dual-task (DT) training in improving balance and reducing falls among older adults in Hong Kong ,China. Eleven electronic databases were searched from their inception to June 2022. Two reviewers independently conducted study screening and data extraction. The Cochrane Collaboration RoB 2 tool was used to evaluate the risk of bias in the included studies. The results of the study identified 1,478 citations, with 30 studies meeting the inclusion criteria. Of these, 22 studies implemented motor-cognitive DT training, six used motor-motor DT, and two focused on cognitive-cognitive DT. The studies proposed 20 different theories to explain DT's effectiveness, with attention theory being the most common (n = 14). Improvements in balance were reported in 26 studies, and five studies documented reduced fall rates after DT interventions. Notably, 15 motor-cognitive DT studies demonstrated significant enhancements in balance and reductions in fall risk. The study concluded that DT training helps older adults improve balance and reduce falls by enabling attention shifts between tasks. Motor-cognitive DT training, in particular, facilitates this process by prioritizing attention allocation between motor and cognitive tasks based on their complexity and importance.[37]

A quasi-experimental study in Pakistan evaluated the effectiveness of cognitive dual-task training versus conventional single-task training in improving balance and quality of life in older adults. The study included 30 community-dwelling older adults (15 males, 15 females).Group A (Experimental): Received physical and cognitive dual-task training.Group B (Control): Received single-motor task training. Mean ages: Group A: 59.27 ± 3.73 years; Group B: 62.13 ± 5.40 years. Balance was assessed using the Berg Balance Scale, and quality of life was evaluated using the Quality of Life Index. Pretest and posttest comparisons were conducted using parametric tests, with significance set at $p < 0.05$. The results revealed that Group A (dual-task training) showed a greater pretest-posttest improvement (3.20 ± 2.96) in balance compared to Group B (1.0 ± 1.77, $p < 0.05$).Group A demonstrated significantly greater improvements in quality of life scores compared to Group B after six weeks. The study found that dual-task training was significantly more effective than single-task training in enhancing both balance and quality of life in older adults. These results suggest that incorporating cognitive dual-task training into interventions for the elderly may yield superior outcomes. [38]

A systematic review conducted in Australia examined the effectiveness of combined cognitive and exercise training in older adults with and without cognitive impairment, as well as the methodological quality of the studies. The review included eight studies, five of which focused on populations with cognitive impairment and three on cognitively healthy individuals, identified through database searches (Cinahl, Medline,

PsycINFO, ProQuest, EMBASE, and the Cochrane Library) and manual reference checks. The findings indicated that this combined intervention improves cognitive functions and functional status in older adults, regardless of cognitive impairment. However, evidence remains limited in populations with cognitive impairment, particularly when studies involved active control group comparisons. The review concludes that further well-designed research is needed to better understand the potential benefits of this intervention approach.[39]

A randomized controlled trial conducted in Spain assessed the effectiveness of a 12-week combined physical and cognitive training program in older adults with mild cognitive impairment. The study involved 95 participants (mean age 72.12 ± 4.25 years), with 48 individuals in the experimental group (EG) undergoing the combined program and 47 in the control group (CG) receiving only cognitive stimulation. Assessments included balance (Tinetti scale), upper body strength (arm curl test), lower body strength (30-s chair stand test), flexibility (back scratch and chair sit-and-reach tests), physical function (Timed Up and Go test), cognitive function (Mini Mental State Examination), cognitive impairment (Montreal Cognitive Assessment), verbal fluency (Isaac test), and executive functions (Trail Making Test). The experimental group showed significant improvements in physical and cognitive health compared to the control group. The study concluded that combining physical exercise with cognitive training is an effective strategy for enhancing physical and cognitive functions, improving the quality of life in older adults with mild cognitive impairment.[40]

A pre-post experimental study in India evaluated the effectiveness of three balance training strategies in enhancing dual-task balance performance in older adults with balance impairments. Forty-five participants were randomly divided into three groups: single-task balance training, dual-task training with fixed priority, and dual-task training with variable priority. Each group participated in one-hour individualized sessions, five days a week for two weeks. Balance was assessed using the Berg Balance Scale and the Timed Up and Go Test before and after the intervention. One-way ANOVA showed significant improvements ($p \leq 0.05$) in both dual-task training groups compared to the single-task group, with the variable-priority group showing slightly better outcomes. The study concluded that dual-task training is more effective for improving balance under dual-task conditions, while single-task training may not translate to dual-task performance.[41]

A pre-experimental study was conducted to assess the effectiveness of motor-cognitive dual-task training in reducing fall risk among elderly individuals in Indonesia. The study utilized a one-group pre-test post-test design involving 14 elderly participants residing in community settings. The intervention consisted of dual-task training sessions conducted three times per week over a four-week period.Balance and fall risk were measured using the Berg Balance Scale (BBS), the Timed Up-and-Go Test (TUG), and the Tinetti Balance Assessment Tool. Data analysis, employing both descriptive and inferential statistics, demonstrated significant improvements in participants' balance after the intervention. The risk of falls showed a marked reduction after 12 training sessions, with the greatest improvement observed during the first six sessions. The findings suggest that motor-cognitive dual-task training is a highly effective approach for improving balance and mitigating fall risk in elderly populations.[42]

A quasi experimental study was conducted to find out the effect of dual task training on improving balance among geriatric population in India. This pre- and post-test experimental study was conducted using the Berg Balance Scale (BBS) to assess balance deficits. Thirty elderly participants with balance impairments were randomly assigned to either an experimental group (n=15) or a control group (n=15). The experimental group underwent 24 sessions of dual-task training, while the control group received conventional occupational therapy. Post-intervention measurements were taken to assess outcomes.The findings showed a statistically significant improvement in BBS scores in the experimental group compared to the control group ($p = 0.04236$), highlighting the effectiveness of dual-task training in improving balance among the geriatric population.[43]

An RCT study was undertaken in Spain to investigate the effects of physical and cognitive training programs, as well as their combination using a dual-task paradigm, on cognitive functions and physical capacities in women aged over 80 years. A total of 43 women participated in the study and were divided into three experimental groups and one control group. Experimental group 1 underwent cognitive training, experimental group 2 received physical cognitive training, and experimental group 3 engaged in physical training only. The training program lasted for 8 weeks, with each session lasting 60 minutes, amounting to a total of 5 sessions per week. Pre-test and post-test data were collected, with cognitive variables assessed using the Stroop test, the Trail Making Test, and the D2 Test. Physical variables were evaluated using the hand grip strength test, the minute step test, and the visual-acoustic real-time test. The study's results indicated that after 8 weeks of physical, cognitive, or combined dual-task paradigm training, there were improvements in both physical and cognitive functions among older adults. Additionally, this training appeared to protect them from the negative effects of the aging process.[44]

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A randomized control trial study wasconducted in Korea to examinethe effects of cognitive–physical dual-task training on balance and executive function in older adults. Fifty-eight participants were randomly assigned to either an experimental group (EG) receiving dual-task training or a control group (CG) undergoing functional balance training. Over six weeks, both groups completed 12 sessions, and their static and dynamic balance, along with executive function, were assessed using the One Leg Standing Test (OLST), the Timed Up and Go (TUG) test, and part B of the Trail-Making Test (TMT-B). Results showed that the EG had significantly greater improvements in OLST ($p < 0.001$; $\eta 2 = 0.332$), TUG ($p < 0.001$; $\eta 2 = 0.375$), and TMT-B ($p < 0.001$; $\eta 2 = 0.224$) compared to the CG. These findings suggest that dual-task training is an effective approach for enhancing balance and executive function in older adults , highlighting the need to consider cognitive function in balance training programs.[46]

A randomized control trial study was conducted in India with the aim to assess the impact of dual-task training on balance and Activities of Daily Living (ADL) performance among older adults in India. The participants provided consent and underwent a pre-assessment, followed by a four-week intervention with one-hour sessions, five days a week, and a follow-up assessment after one week. The results showed significant improvements in balance and ADL performance, as measured by the Performance-Oriented Mobility Assessment (POMA) and KATZ Index. The findings highlight the effectiveness of dual-task training in enhancing mobility, balance, and independence in daily activities among elderly individuals.[47]

B. Literatures related to effect of dual task exercises on gait performance .

A randomized controlled trial was conducted in Rome, Italy, to assess the impact of a 12-week physical-cognitive training program on executive cognitive function and gait performance in older adults. The study involved 36 healthy, active participants (average age: 72.30 ± 5.84 years), who were assigned to either a physical single-task (ST) training group (n = 16) or a physical-cognitive dual-task (DT) training group (n = 20).Participants were evaluated before and after the intervention for executive functions, including inhibition and working memory, using the Random Number Generation test. Gait performance was also assessed

under single-task and dual-task conditions, involving walking with and without hurdles. Data was analyzed usingthe statistical package. The level of statistical significance was set at $p < 0.05$. Both groups demonstrated improvements in gait performance; however, inhibitory performance declined in the ST training group but tended to improve in the DT training group. Changes in inhibitory function were associated with changes in dual-task walking performance, with differences between groups depending on the complexity of the motor task (e.g., walking with hurdles).The findings suggest that group exercise programs are effective in enhancing gait performance among older adults. Furthermore, physical-cognitive dual-task training may help mitigate age-related declines in executive functions essential for everyday activities.[48]

A quasi-experimental study in Pakistan examined the impact of dual-task training on balance limitations in older adults. Sixty-six participants aged 65 and above, with a history of falls in the past year and no neurological conditions, were recruited, with 61 completing the study (mean age 69 ± 4.07 years; 28 males and 33 females). Balance was measured using the Timed Up and Go Test (TUGT) and the Berg Balance Scale (BBS) before and after a 4-week training program. The average TUGT improved from 16.98 seconds to 15.77 seconds, and the BBS increased from 41 to 50. These improvements were statistically significant ($p < 0.05$). The study concluded that dual-task training produced statistically significant changes.[49]

C. Literatures related to effect of dual task exercises on gait performance and body balance.

A single-blinded controlled clinical trial was conducted in Brazil to investigate the effects of three-month dual-task training on the motor and cognitive functions of community-dwelling older adults. The study included a sample of 40 participants who were randomly assigned to either the experimental group or the control group (no exercise group). The intervention involved a combination of motor and cognitive exercises, which were conducted twice a week on alternate days. Pre-test and post-test data were collected for analysis. The impact of dual-task training was evaluated using multiple analyses of variance, with effect sizes (η^2p) reported. Significance was set at 5%. Participants who underwent dual-task training demonstrated favourable outcomes in terms of postural stability, cognitive functions, and mobility compared to the control group. The study concluded that the three-month dual-task exercise regimen was beneficial for cognitive functions, mobility, and postural control. It also recommended that the integration of dual-task training exercises into clinical practice by healthcare professionals.[50]

A double-blind RCT study was conducted in Brazil to explore the effects of a 12-week dual-task physical-cognitive training program on gait performance (GP), body balance (BB), lowerlimb muscle strength (LEMS), and cognitive performance (CP) in cognitively normal older adult women. The study included 44 participants (n=44), with 22 assigned to the dual-task training (DT) group and 22 to the cognitive group (CG) after randomization. The total training period lasted 12 weeks. Pre-test and post-test assessments were conducted using the timed up and go (TUG), timed up and go manual (TUGm), timed up and go cognitive (TUGc), balance test (TEC), sit-to-stand test (STS), and verbal fluency test (VF). Significant time × group interactions were observed in all motor assessments (BB, GP, LEMS), as well as in the three cognitive tests (VF grouping, VF exchange, VF total), following 12 weeks of dual-task (DT) training. The study's findings concluded that 12 weeks of physical-cognitive DT training effectively enhanced body balance (BB), gait performance (GP), and lower limb muscle strength (LEMS), along with cognitive performance (CP), in cognitively normal older adult women. Furthermore, the effects of the interventions were sustained up to 12 weeks later.[51]

A study was conducted with the aim to review the dual-task exercises proven effective in enhancing balance and other physical attributes like fall prevention and walking speed among older adults. The review encompassed studies retrieved from PubMed, PEDRO, CINAHL, and Web of Science databases, yielding 498 references. Among these, 11 studies were pinpointed detailing dual-task exercises, revealing a spectrum of exercises and considerable variability in outcome measures. Notably, dual-task exercises were primarily employed for balance enhancement and walking speed improvement. The study concluded that dual-task training in older adults has the potential to enhance balance and walking speed, consequently lowering the

risk of falls, contingent upon specific characteristics such as training in targeted motor learning concepts and dual-task modalities.[52]

A randomized control trial study was conducted in Brazil to evaluate the impact of mixed dual-task training on mobility, cognitive function, and balance in older adults living in the community.Sixty participants were randomly assigned to one of two groups:Experimental group: Performed single motor tasks (SMT) and simultaneous dual tasks (SDT) alternately during the first 12 weeks (stage 1) and exclusively SDT in the next 12 weeks (stage 2).Control group: Carried out SMT and SDT alternately throughout both stages.Gait parameters were measured using inertial sensors.Physical and cognitive performance were evaluated with standardized questionnaires.Generalized linear mixed models were used to analyze main and interaction effects.Results of the study revealed that in terms of gait performance no significant differences were observed between the groups.Mobility (mean change (MC) = 0.74),Dual-task effect (MC = -13.50),Lower limb function (MC = 4.44),Static balance (MC = -0.61),Dynamic balance (MC = -0.23),Body sway (MC = 4.80),Cognitive function (MC = 41.69). The study concluded that both mixed single-task and dual-task training protocols effectively enhanced mobility, balance, and cognitive performance, emphasizing the benefits of dual-task exercises for older adults.[53]

A randomized controlled trial in Turkey was conducted to examine the effects of single-task, dual-task, and successive physical-cognitive training on fall risk, balance, and gait performance in older adults. The study involved 45 healthy participants (average age 73) who underwent one of three interventions, three times a week for four weeks. Key measures included gait speed under single-task and dual-task conditions, the Berg Balance Scale (BBS), the Timed Up and Go (TUG) test, and Tinetti's Falls Efficacy Scale.The results revealed that Single-task gait speed was Improved across all groups.TUG test was Improved in all groups.BBS scores was Improved in all groups. Dual-Task Gait Speed was enhanced in Group-2 (simultaneous physical and cognitive training) and Group-3 (successive physical and cognitive training), but not in Group-1 (single-task training).Group-3 demonstrated the most significant improvements in BBS and TUG scores compared to Group-2.Reductions in fear of falling (as measured by Tinetti's Falls Efficacy Scale) were observed in Group-1 and Group-3, with Group-3 showing the greatest progress.The study concluded that Combined physical and cognitive training (Groups-2 and 3) resulted in better dual-task gait performance compared to physical training alone. Successive cognitive-physical training (Group-3) was the most effective for improving balance, mobility, and reducing the fear of falling, likely due to its structured approach to addressing cognitive and physical skills separately. This study highlights the value of integrating cognitive components into exercise programs for older adults to enhance outcomes and reduce fall risks.[54]

A randomized controlled trial in Pakistan evaluated the effects of single-task versus dual-task training on gait, balance, and quality of life (QoL) in older adults with mild cognitive and balance impairments. Sixty-six participants were divided into two groups for a 12-week training program, followed by a six-month follow-up. Outcomes included gait speed, balance (Timed Up and Go [TUG] test), and QoL (using a standardized questionnaire). The dual-task group showed significantly greater improvements in physical health (median score: 74 vs. 66, $p<0.001$) and mobility (TUG test median duration: 11 seconds vs. 17 seconds, $p<0.001$) compared to the single-task group. The findings highlight the superiority of dual-task training in enhancing gait, balance, and QoL, suggesting its potential to prevent falls and improve overall well-being in older adults.[55]

A randomized controlled trial conducted in Turkey examined the effects of combined motor and cognitive training on balance, fall risk, and functional mobility in
older adults. Sixty participants aged 65 and above were randomly assigned to one of three groups: combined motor-cognitive training, motor training only, or cognitive training only. All groups participated in 60-minute sessions three times per week for 12 weeks. The combined training group showed significant improvements in balance (BBS: 42.5 to 47.8, $p = 0.035$), fall risk (TUG: 15.3 to 12.8 seconds, $p = 0.042$), and functional mobility (DGI: 18.6 to 22.3, $p = 0.029$) compared to the other groups. The motor training group showed moderate improvements, while the cognitive training group showed minimal changes. The

study concluded that combined motor and cognitive training is a more effective strategy for improving balance, reducing fall risk, and enhancing mobility in older adults compared to single-task interventions.[56]

A randomized controlled trial investigated the effects of dual-task physical-cognitive training on body balance, gait performance, lower limb muscle strength, and cognitive performance in cognitively normal older adult women in Brazil. The study included 44 participants, randomly divided into a dual-task training (DT) group (n=22) and a control group (CG) (n=22).Assessments were conducted at baseline, after 12 weeks of intervention, and at a 12-week follow-up .After 12 weeks of DT training, the intervention group showed significant improvements in motor performance, including body balance (BB), gait performance (GP), and lower limb muscle strength (LEMS), as well as in cognitive performance (VF grouping, exchange, and total scores). However, no significant change was observed in the VF category test. The control group showed no changes in physical or cognitive performance across all time points. The study concluded that 12 weeks of dual-task physical-cognitive training effectively enhanced body balance, gait performance, lower limb strength, and cognitive function in cognitively normal older adult women, with benefits sustained up to 12 weeks after the intervention. [57]

A randomized controlled trial was conducted in Iran to compare the effects of single- and dual-task balance training on gait smoothness and balance in community-dwelling older adults. Sixty-nine participants were randomly assigned to single-task, dual-task, or control groups and completed 18 training sessions over six weeks.Gait smoothness was measured using the harmonic ratio of trunk acceleration with a tri-axial accelerometer, while balance performance was assessed using the Fullerton Advanced Balance Scale, Timed Up and Go (TUG) test, Activity-Specific Balance Confidence (ABC) scale, and gait speed.Results showed significant improvements across all variables in the training groups. Compared to the control group, the intervention groups demonstrated significant improvements in all measures except for the TUG test. However, no significant differences were found between the single-task and dual-task training groups. The study concluded that both single- and dual-task balance training effectively improve gait smoothness and balance in older adults.[58]

An experimental study was conducted to evaluate the effect of two weeks of dual-task training on balance and gait in older adult men 60- 80 yrs in India. Following ethical approval, patients were screened, and informed consent was obtained. The study included a sample size of 39 participants.The intervention consisted of dual-task training provided five days a week for two weeks. Each session lasted 30 minutes, comprising 10 tasks of three minutes each. Balance and gait were assessed using the Berg Balance Scale (BBS) and the Functional Gait Assessment (FGA) at baseline and after two weeks of intervention. Statistical analysis was performed using Graph Pad InStat software.The results revealed significant improvements in both the Berg Balance Scale and Functional Gait Assessment scores after the intervention. The study concluded that two weeks of dual-task training effectively improved balance and gait in older adult men.[59]

A systematic review and meta-analysis investigated the impact of dual-task training on cognitive and physical functions in older adults with cognitive impairment in China. The study synthesized emerging evidence regarding the effectiveness of dual-task training for improving cognitive and physical functions in individuals with cognitive impairment, dementia, or Alzheimer's disease. A thorough search was conducted across databases such as Medline, Cochrane Library, PubMed, and EMBASE, identifying 21 studies with a total of 2,221 participants. The findings indicated a small-to-medium positive effect of dual-task training intervention on cognitive functions and medium-to-large positive effects on gait, function, and balance.[60]

The study aimed to evaluate the impact of dual-task exercises on the balance and gait patterns of elderly individuals in selected old age homes in India using a pre-experimental one-group pre-test-post-test design. Thirty participants meeting the inclusion criteria were selected through purposive sampling, and their balance and gait were assessed using the Berg Balance Scale (BBS) and Functional Gait Assessment Scale (FGAS) before and after the intervention. Dual-task exercises were administered twice weekly for four weeks, with post-tests conducted in the fifth week. Results showed that 86.7% of participants had a high fall risk and 40% had moderate gait impairment in the pre-test, which improved to 100% low fall risk and 20%

normal ambulation in the post-test. The mean BBS score significantly improved from 17.9±2.5 to 52.4±2.3 (P<0.001), and the mean FGAS score increased from 12.0±3.3 to 28.4±2.2 (P<0.001), confirming the effectiveness of dual-task exercises. The study concluded that dual-task training effectively enhances balance and gait in elderly individuals, highlighting the role of nursing personnel in implementing such interventions to reduce fall risks and improve mobility[61]

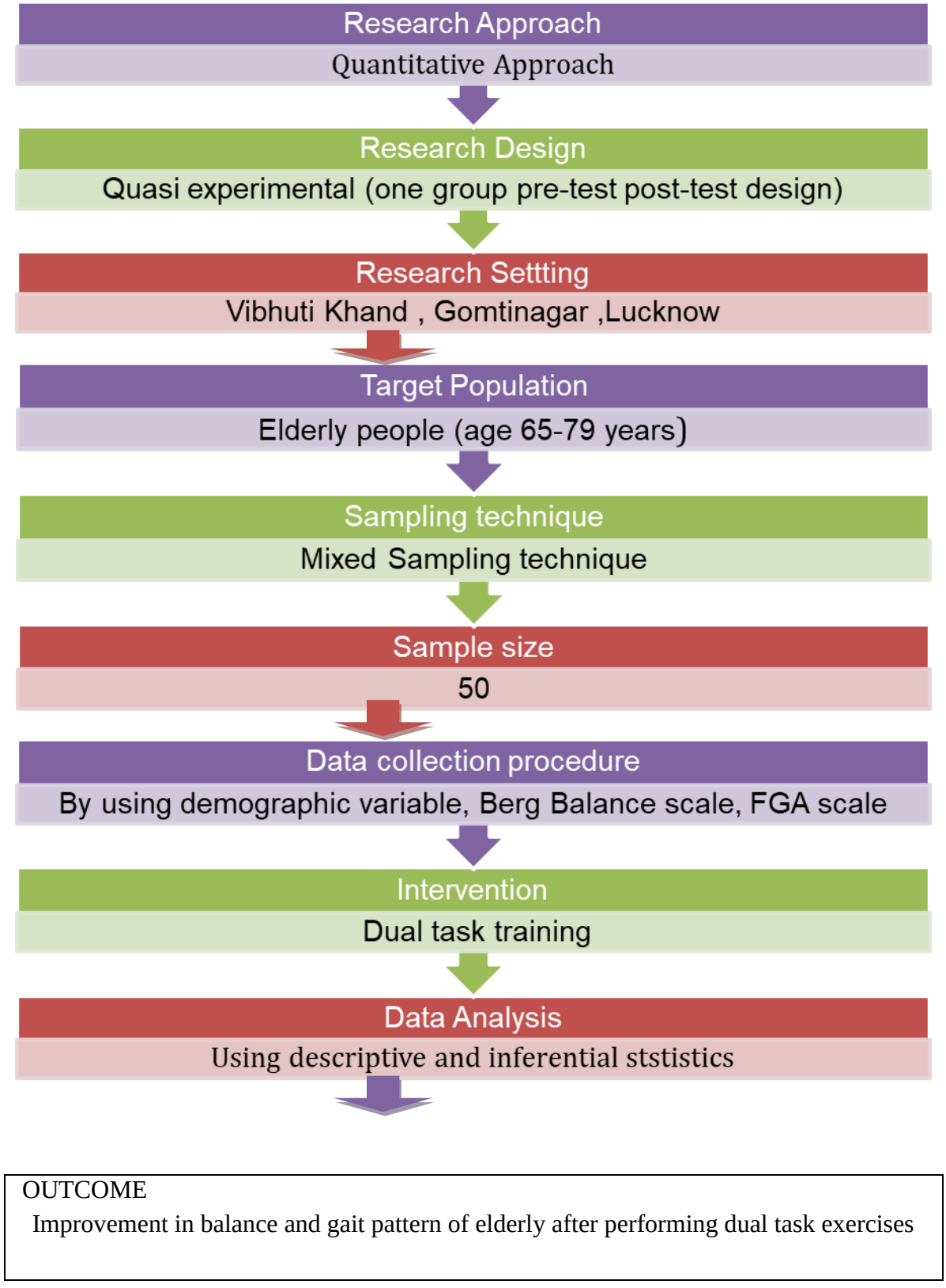

Fig 2 : Schematic representation of research methodology

CHAPTER III

REASEARCH METHODOLOGY

Research methodology is the primary principle that will guide your research. A research methodology is important as it provides a clear plan that helps researchers stay on track and avoid missing steps. It helps ensure that research is valid, effective and ethical.[62]

RESEARCH APPROACH

A research approachis defined as the plans and procedures for research that spans the steps from broad assumptions to detailed methods of data collection, analysis and interpretation. [62]

A quantitative approach was adopted to assess the effectiveness of dual task exercises among elderly.

RESEARCH DESIGN

Research design is the master plan specifying the methods and procedures for collecting and analyzing the needed information in a research study.[63]

In this study, quasi experimental one group pretest- post-test design was used.

Fig 3 : Schematic representation of research design

VARIABLES UNDER STUDY

Research variables are the qualities, properties, or characteristics which are observed or measured in a natural setting without manipulating and establishing cause and effect relationship.[64]

In this study, the three types of variables identified were-:

- **Independent Variable**

An independent variable is the variable that stands alone and is not dependent on any other.[64]

In this study, the independent variable was the dual task exercises.

- **Dependent Variables**

Dependent variable is the response behavior or outcome that the researcher wants to predict or explain.[64]

In this study, the dependent variables were the balance and gait of elderly.

- **Extraneous Variable**

Any uncontrolled variable that greatly influence the results of the study is called as an extraneous variable.[64]

In this study, the extraneous variables include habit of exercise , type of exercise and frequency of exercise which would influence the dependent variable.

STUDY SETTING

Research setting is the physical location and condition in which data collection takes place. Setting of the study is essential constituent to ensure effective planning to conduct a research study. [65]

This study was conducted at urban areas of Vibhuti Khand, Gomti Nagar, Lucknow.It was approximately 15 kms away from the St. Mary's College of Nursing, Lucknow. The total number of participants were 50.

TARGET POPULATION

Population is defined as the entire aggregation of cases that meet a designed set of criteria.[66]

In this study, the population included all the people aged between 65- 79 years residing in urban areas of Vibhuti Khand, Gomti Nagar, Lucknow.

INCLUSION AND EXCLUSION CRITERIA FOR SAMPLE SELECTION

INCLUSION CRITERIA

Elderly people those who were staying in urban areas of Vibhuti Khand, Gomti Nagar, Lucknow

- Could speak in Hindi.
- Were willing to participate in the study.
- Had mild to moderate gait and balance problems.
- Were below 80 years of age.

EXCLUSION CRITERIA

Elderly people who

- Were not willing to participate in the study.
- Had severe gait and balance problem.
- Not able to follow instruction due to mentally unfit or hearing disorders.
- Suffers from any congenital defect anomaly, vertigo , dyspnoea.
- Was on treatment for any other medical conditions such as myocardial infarction, cerebrovascular accident.

SAMPLE

Sample is the subset of population elements, which are the most basic units about which data are collected and Sampling is the process of selecting a representative segment of the population under study.[67]

Samples are elderly people who met the inclusion and exclusion criteria.

SAMPLING SIZE

The number of elements in the sample is the sample size.[67]

In the present study , the sample included 50 elderly persons between the age of 65 to 79 years, who had mild to moderate balance and gait problems.

SAMPLING TECHNIQUE

Sampling technique is the process of selecting a portion of the population to represent the entire population so that inferences about the population can be made.[68]

Here the researcher has used mixed sampling technique.

- Probability sampling technique (cluster/multistage sampling technique) for area selection.
- Non probability sampling technique for sample selection

First, the probability sampling technique that is 3 stage cluster sampling technique was adopted to select the area.

1. In the first stage cluster sampling- the 15 km urban area around St. Mary's College of Nursing was divided into three equal parts.

A. From St. Mary's College of Nursing kursi road to Bakshi ka talab.
B. From St. Mary's College of Nursing kursi road to Kallu purva.
C. From St. Mary's College of Nursing kursi road to Gomtinagar.

By using chit method area between St. Mary's College of Nursing kursi road to Gomtinagar was selected.

2. In the second stage cluster sampling- the urban area between St. Mary's College of Nursing kursi road to Gomtinagar was divided into three parts.

A . From St. Mary's College of Nursing kursi road to Mahanagar.

B. From Mahanagar to Indiranagar.

C. From Indiranagar to Gomtinagar.

Randomization was done by the use of computers and the urban area from Indiranagar to Gomtinagar was selected.

3. In the third stage cluster sampling the urban areas from Indiranagar to Gomtinagar was divided into six parts:

A. Indiranagar A block

B. Indiranagar B block

C. Indiranagar C block

D. Vibhuti Khand,

E. Vibhav Khand,

C. Vikalp Khand.

Randomization was done using chit method and after that Vibhuti Khand area was selected.In the selected Vibhuti Khand area of Gomti Nagar, the sample selection here was done using Non-Probability Purposive Sampling Technique.

A total of 50 samples from urban areas of Vibhuti Khand, GomtiNagar Lucknow were selected .All elderly people who fulfilled the inclusion criteria were selected as sample by using purposive sampling technique.

SAMPLE SIZE CALCULATION

The sample size is calculated using the power analysis method.

$$N = \frac{ó^2 (z_1 - \beta + z_1 - \alpha/2)^2}{(\mu_0 - \mu_1)^2}$$

Where

μ_0 = population mean (1000)

μ_1 = mean of study population (100)

N = sample size of study population

ó = variance of study population

α = probability of type 1 error (usually 0.05)

β = probability of type 2 error (usually 0.2)

z = critical Z value for a given α or β

$$N = \frac{(2000^2 (1.64 + 1.96)^2}{(1000 - 100)^2}$$

N = 64

Based on the sample size estimation 64 samples need to be selected. The adjusted sample size was 55.65 and so the researcher selected 50 elderly persons between the age of 65 to 79 years, who had mild to moderate balance and gait problem

DESCRIPTION OF TOOLS

The data collection tools consist of three sets of items

Section A - Demographic data
Section B – Berg balance scale [69]
Section C- Functional gait assessment scale [70]

Section A: Demographic data consisted of age, gender, marital status, religion, education, occupation, income, any history of illness, any physical problem facing, any psychological problems facing, perception of strength of social support, habit of exercise , if yes type of exercise, if yes frequency of exercise.

Section B: The Berg Balance Scale was used to assess the balance which consisted of 14 items. Each item was scored from 0 to 4. The minimum attainable score was 0 and maximum score was 56. High score indicated low risk of fall. The total score was interpreted as follows.

0-20	High fall risk
21-40	Medium fall risk
41-56	low fall risk

- **Section C**: The gait was assessed using Functional Gait Assessment Scale. The scale consisted of 10 items. Each item was scored from 0 to 3. The minimum attainable score was 0 and maximum score was 30. High score indicated normal gait. The total score was interpreted as follows.

0-10	Severe impairment
11-20	Moderate impairment
21-30	Mild impairment
30	Normal

ETHICAL CONSIDERATION

- The study was conducted after the approval of the dissertation committee of St. Mary's College of nursing, Lucknow
- Formal permission was obtained to conduct the study from the Parshad of vibhuti khand, Gomtinagar, Lucknow to conduct the study.
  Oral consent was obtained from the elderly after explaining the purpose of the study.

PILOT STUDY

Pilot study refers to a small scale study conducted to test the plan and method of a research study. It is a smaller version of a study carried out before the actual investigation is done.[71]

A pilot study was conducted to assess the feasibility of the study. A pilot study was conducted from 12/ 08 /2024 to 24/08 2024 in the urban areas of Indira Nagar, Lucknow, after obtaining permission from the principal and administrator of St. Mary's Polyclinic. Ten elderly participants were selected using a mixed sampling technique, and a one-group pre-test post-test quasi-experimental design was adopted. The participants were assessed using the Berg Balance Scale and Functional Gait Assessment Scale before and after a four-week intervention of dual-task exercises. The post-test results showed significant improvements in balance and gait scores, demonstrating the effectiveness of the intervention. The pilot study finding revealed that the study was feasible and practical.

VALIDITY AND RELIABILITY

VALIDITY

Validity is a quality criterion referring to the degree to whichinterferences made in a study are accurate and well founded in measurement, the degree to which an instrument measures what it is intended to measure.[72]

The content validity of the tool was checked by obtaining opinion from experts from the field of Medicine, Medical Surgical Nursing and Physiotherapy .

RELIABILITY

Reliability is the degree of consistency or dependability with which an instrument is designed to measure.[72]

In this study reliability of the Berg balance scale tool was assessed by Test re-test method and showed excellent reliability (intra class correlation ICC = 0.994).[72]

DATA COLLECTION PROCEDURE

The main study was conducted for 4 weeks starting from 02/09/2024 to 30/09/2024. The study was conducted at urban areas of Vibhuti Khand, Gomtinagar, Lucknow. After getting formal permission from the Parshad of that area, data were gathered. Each day the researcher interviewed about 8-9 elderly people based on the inclusion criteria. The interview lasted for 25-30 minutes for a sample. The data was collected in three phases.

Phase I: The investigator introduced herself in the beginning and developed rapport with the elderly. After explaining the purpose of the study, the investigator obtained oral consent from elderly people. The demographic variables of the elderly were collected by face to face interview using structured questionnaires. The gait and balance of elderly were assessed using Berg Balance Scale and Functional Gait Assessment Scale. Samples were selected based on inclusion and exclusion criteria.

Phase II: Dual task exercises were administered to individuals thrice in a week for 4 weeks. There were 4 session of training. Each session lasted for30 minutes.

I Session - Number counting while forward walking.

II Session - Number counting while backward walking.

III Session –Walking between obstacles.

IV session– Figure of Eight Walking,

After teaching to the elderly, they were allowed to practice under the supervision of the investigator for 4 weeks.

Phase III: Post-test was done on 5thweek of data collection using Berg balance Scale and Functional Gait Assessment Scale.

PLAN FOR DATA ANALYSIS

The data analysis was analyzed according to the objectives and hypotheses of the study by using descriptive statistics and inferential statistics.

CHAPTER IV

DATA ANALYSIS AND INTERPRETATION

This chapter deals with the analysis of data collected. Data analysis is the process of organizing and synthesizing data to answer research questions and test hypotheses. This phase is a critical component of the research process, as it involves computing various measures and identifying patterns and relationships among different datagroups . [73]

The process of data collection is followed by analysis and interpretation, where the collected data are systematically examined in alignment with the study's objectives. Through this process, researchers derive meaningful insights and conclusions that contribute to addressing the research goals and validating the hypothesis.[73] The data was analyzed by using descriptive and inferential statistics according to the objectives to prove the hypothesis.

OBJECTIVES –

The objectives of the study are to -:

1. To assess the pre-test and post-test level of balance among the elderly using the Berg Balance Scale.

2. To assess the pre-test and post-test level of gait pattern among the elderly using the Functional Gait Assessment Scale.

3. To determine the effectiveness of dual-task exercises on improving balance among the elderly.

4. To determine the effectiveness of dual-task exercises on improving gait pattern among the elderly.

5. To correlate the effectiveness of dual-task exercises on the level of balance with gait pattern among the elderly.

6. To associate the post-test level of balance among the elderly with their selected demographic variables.

7. To associate the post-test level of gait pattern among the elderly with their selected demographic variables.

PLAN OF ANALYSIS

Analysis and interpretation of data was done according to the objectives using descriptive inferential statistics. The level of significance chosen was at $p = 0.05$.

ORGANIZATION OF DATA ANALYZED

The data was analyzed according to the objectives and presented under the following sections :-

Section A: Description of samples according to their demographic variables.

Section B: Assess the pre-test and post-test level of balance among elderly using the Berg Balance Scale.

Section C: Assess the pre-test and post-test level of gait pattern among elderly using the Functional Gait Assessment Scale.

Section D: Determine the effectiveness of dual-task exercises on improving the balance among elderly.

Section E: Determine the effectiveness of dual task exercises on improving the gaitpattern among the elderly.

Section F: Correlate the effectiveness of dual task exercises on level of balance with gait pattern among the elderly.

Section G: Associate post test level of balance among elderly with their demographic variables.

Section H: Associate post test level of gait pattern among elderly with their selected demographic variables.

SECTION A: DESCRIPTION OF SAMPLES ACCORDING TO THEIR DEMOGRAPHIC VARIABLES

TABLE -1:Frequency and Percentage Distribution of Demographic

Variables Among the Elderly

n = 50

S. No.	Demographic Variable	Frequency	Percentage
1	**Age (in years**		
(a)	65-69	26	52%
(b)	70-74	14	28%
(c)	75-79	10	20%
2	**Gender**		
(a)	Male	38	76%
(b)	Female	12	24%
3	**Marital Status**		
(a)	Married	42	84%
(b)	Unmarried	0	0
(c)	Divorced	0	0
(d)	Widow/Widower	8	16%
4	**Religion**		
(a)	Hindu	42	84%
(b)	Muslim	8	16%
(c)	Christian	0	0

5	**Education**		
(a)	School	36	72%
(b)	Undergraduate	8	16%
(c)	Graduate	6	12%
(d)	Post- graduate	0	0
6	**Occupation**		
(a)	Business	10	20%
(b)	Private Job	6	12%
(c)	Retired	22	44%
(d)	No ocupation	12	24%
7	**Income (Rs./Month)**		
(a)	Below Rs. 5000	0	0
(b)	Rs. 6000-10,000	8	16%
(c)	Rs.10,000-15,000	32	64%
(d)	Rs. Above15,000	10	20%

8	**Any history of Illness**		
(a)	Diabetes Mellitus	18	36%
(b)	Hypertension	28	56%
(c)	Chronic Dysponea	0	0
(d)	Cataract	4	8%
9	**Any Physical problems facing**		
(a)	Decreased Vision	32	64%
(b)	Decreasing memory	10	20%
(c)	Processing speed	8	16%
(d)	Others	0	0
(b)	Depression	5	10%
(c)	Fear	0	0
(d)	Insecurity	4	8%
(e)	Lonliness	8	16%
(f)	No Psychological Problems	21	42%

11	**Perception of strength of social support**		
(a)	Feels highly adequate	6	12%
(b)	Feels adequate	40	80%
(c)	Feels inadequate	4	8%
12	**Habit of exercise**		
(a)	Yes	38	76%
(b)	No	12	24%
13	**If yes, type of exercise**		
(a)	Walking	42	84%
(b)	Jogging/Running	0	0
(c)	Swimming	0	0
(d)	Yoga	8	16%
(e)	Stretching	0	0
14	**If yes, frequency of exercise**		
(a)	Regular	8	16%
(b)	Often	34	68%
(c)	Ocasionally	8	16%
(d)	Never	0	0

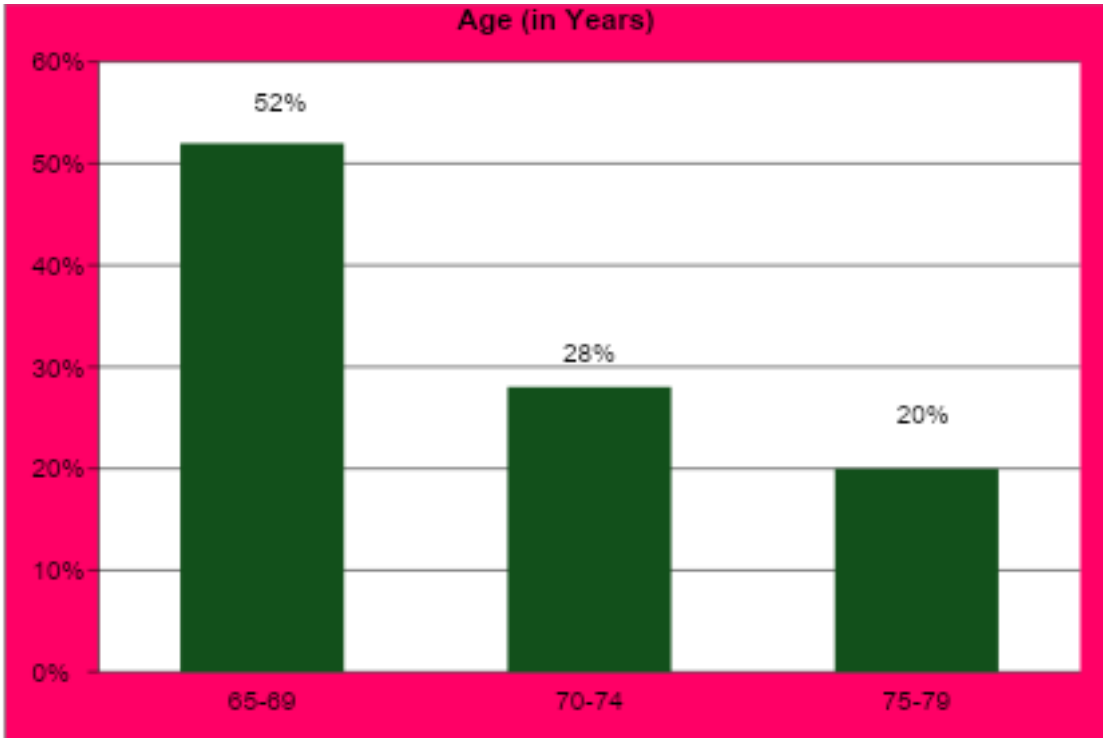

FIG 4: Percentage distribution of elderly participants according to their age group

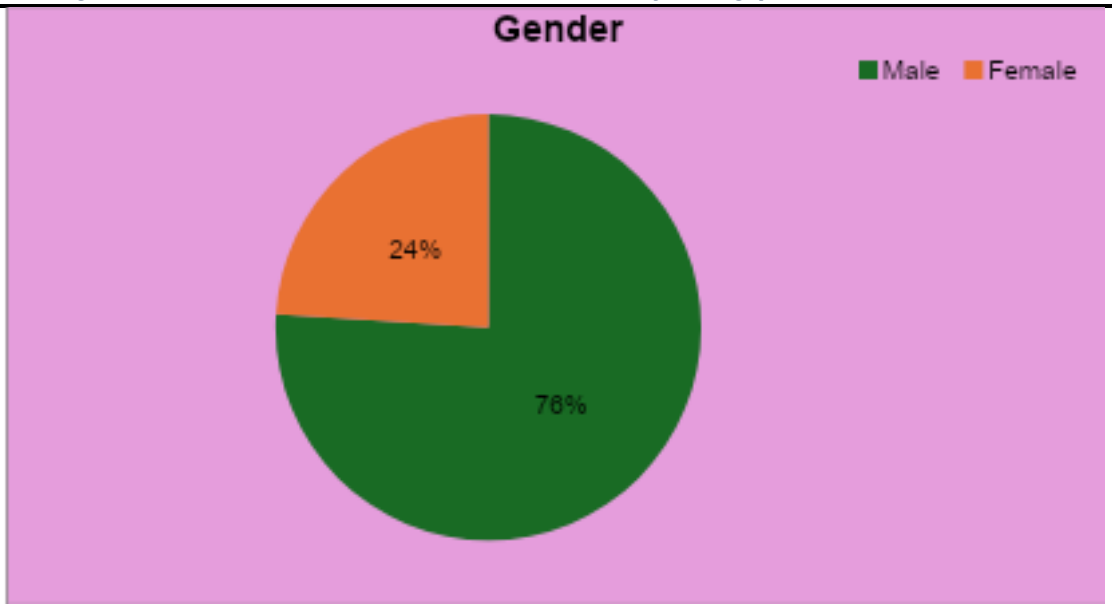

FIG 5: Percentage distribution of elderly participants according to their gender

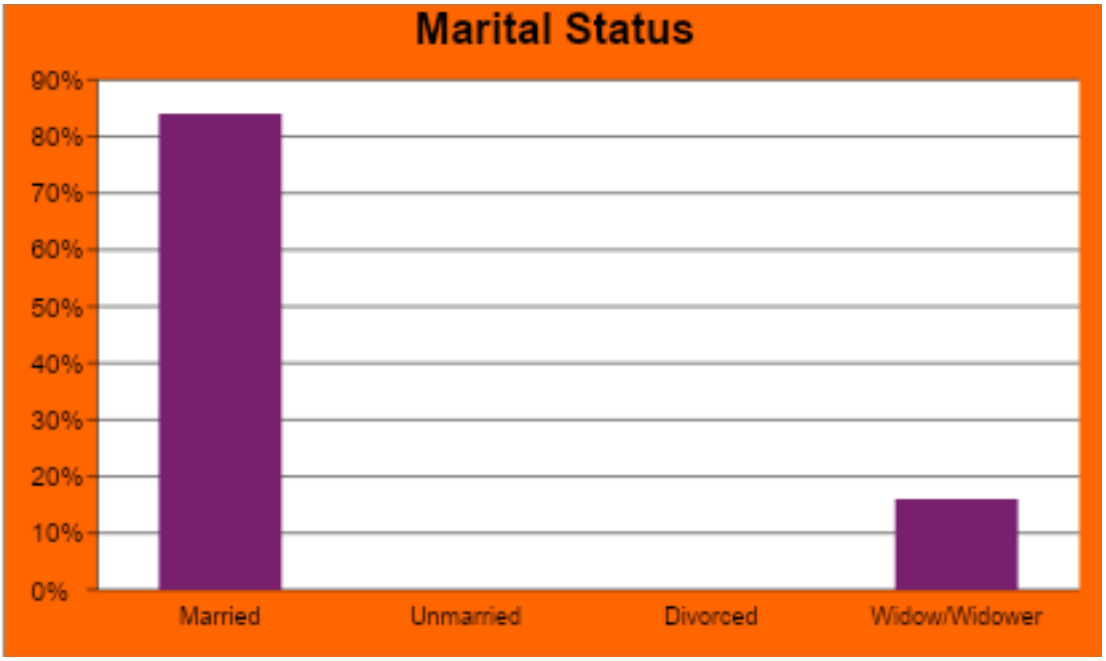

FIG 6 : Percentage distribution of marital status of the elderly participants

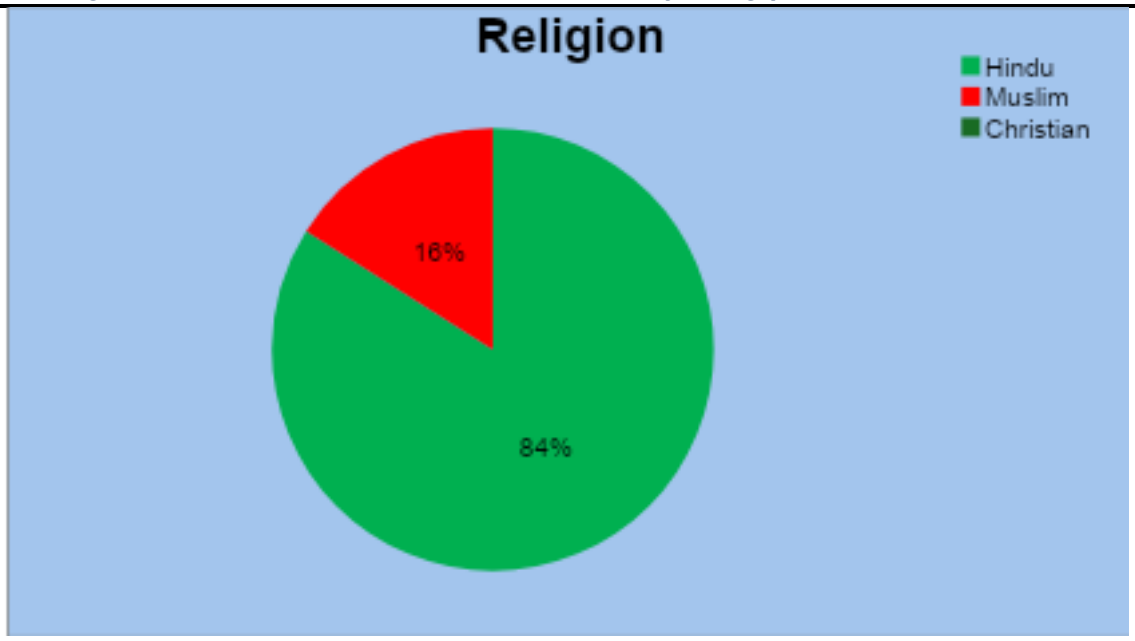

FIG 7: Percentage distribution of religion of the elderly participants

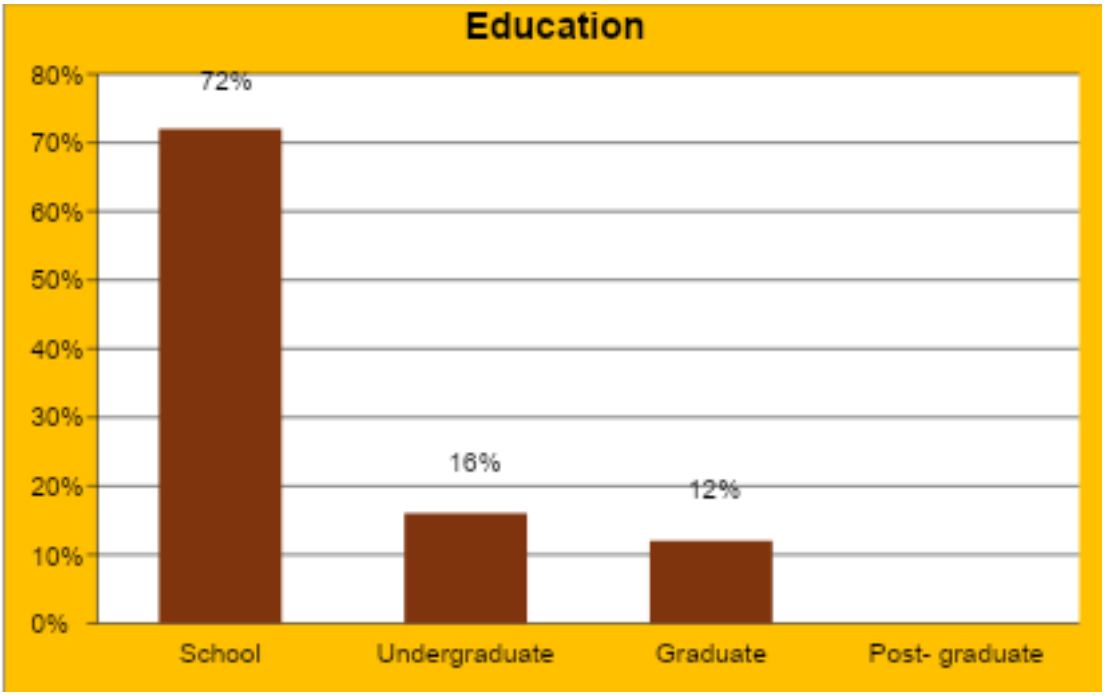

FIG 8: Percentage distribution of education of the elderly participants

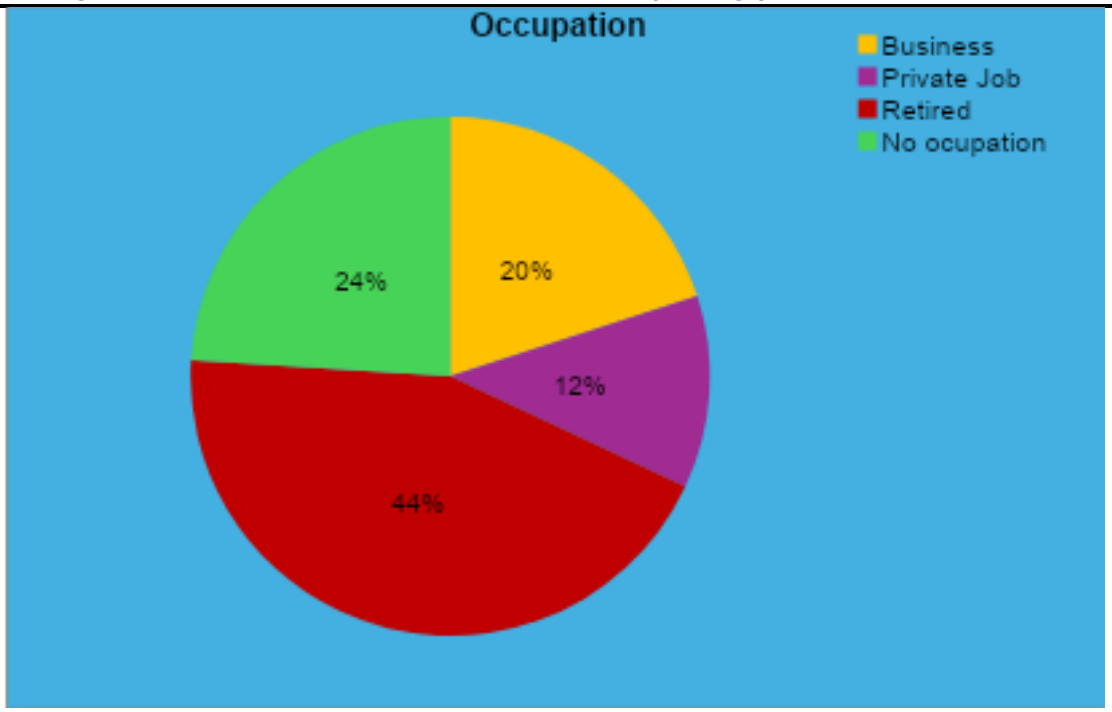

FIG 9: Percentage distribution of occupation of the elderly participants

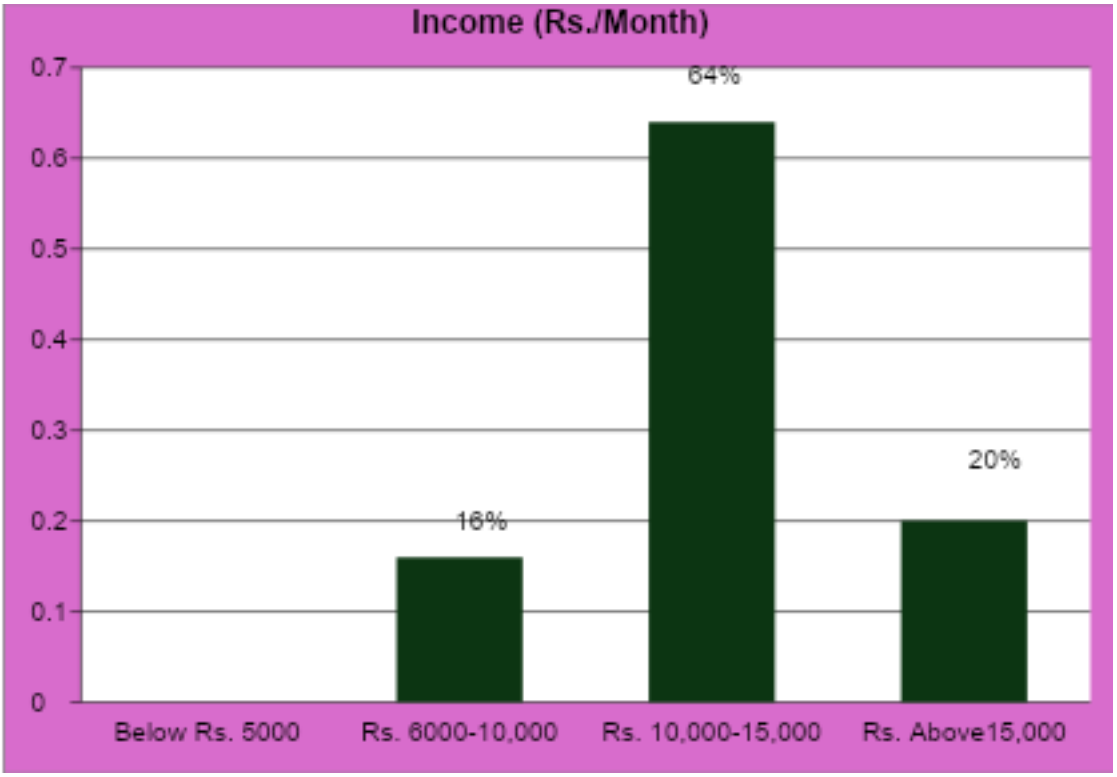

FIG 10: Percentage distribution of monthly income of the elderly participants

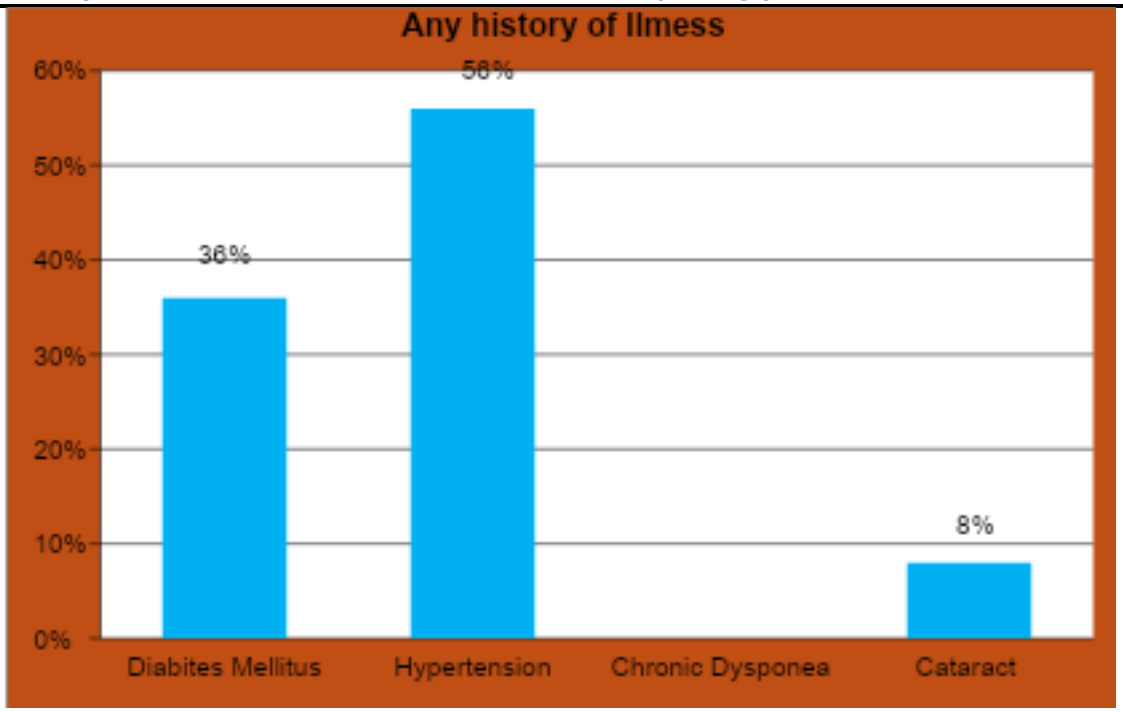

FIG 11: Percentage distribution of any history of illness of elderly participants

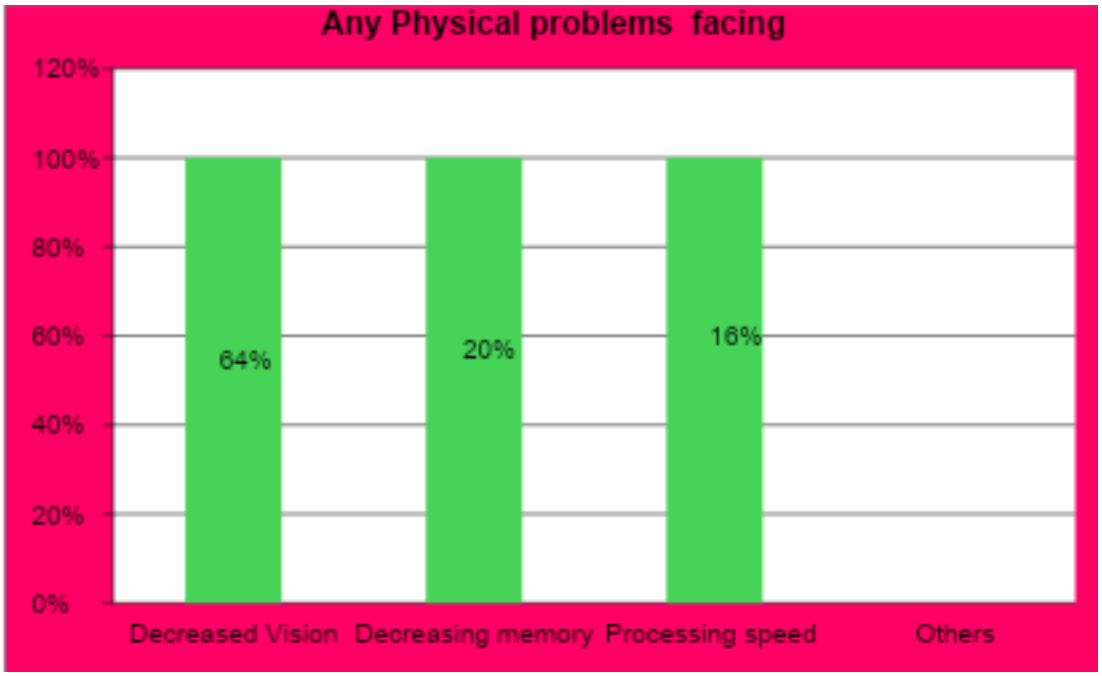

FIG 12: Percentage distribution of any physical problems faced by elderly participants

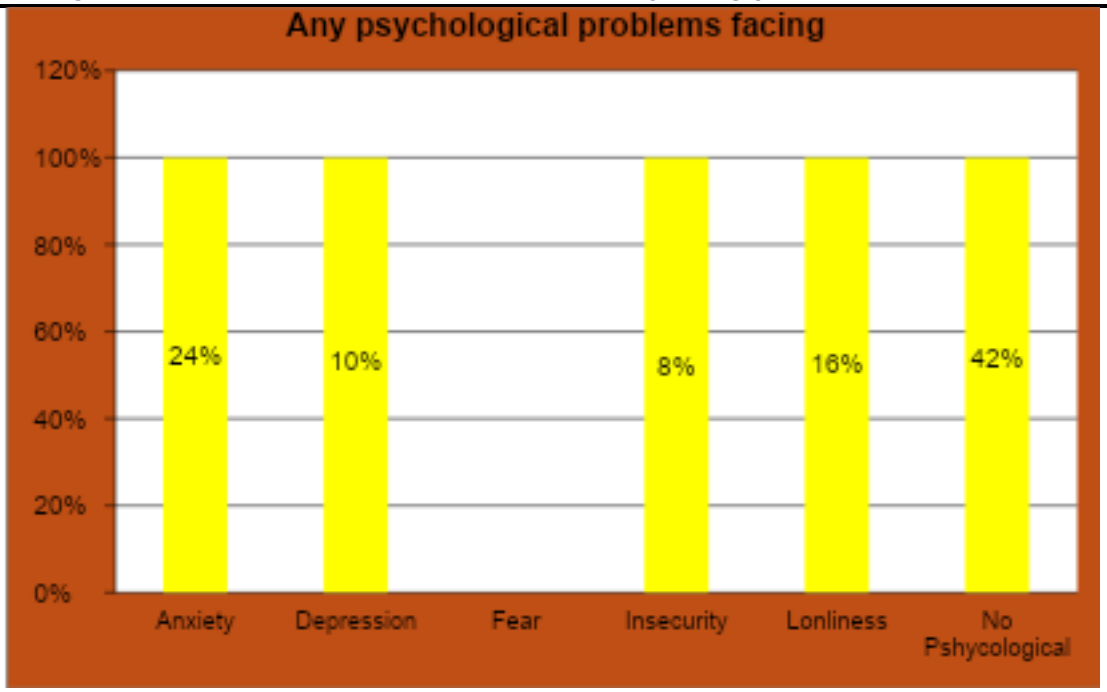

FIG 13: Percentage distribution of psychological problems faced by elderly participants

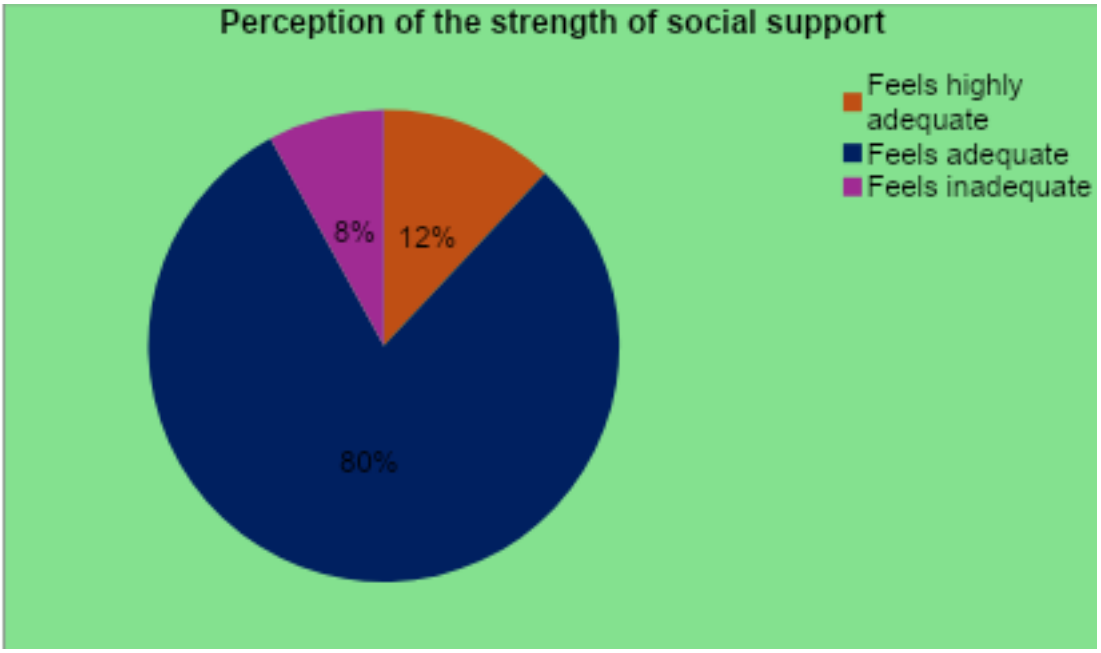

FIG 14:Percentage distribution of perception of strength of social support

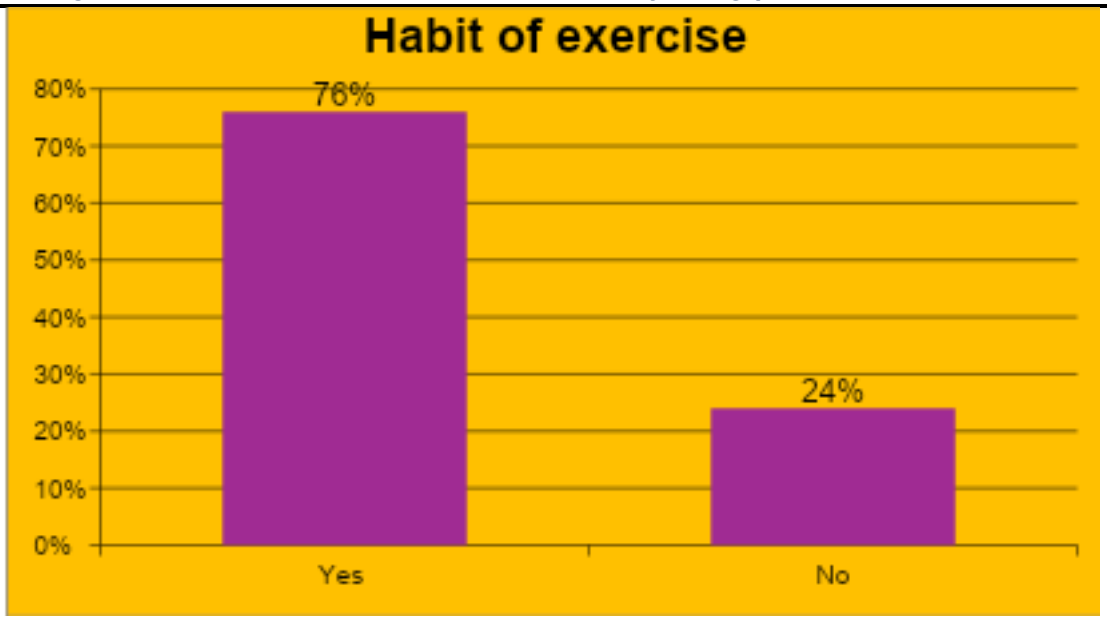

FIG 15: Percentage distribution of habit of exercise of the elderly participants

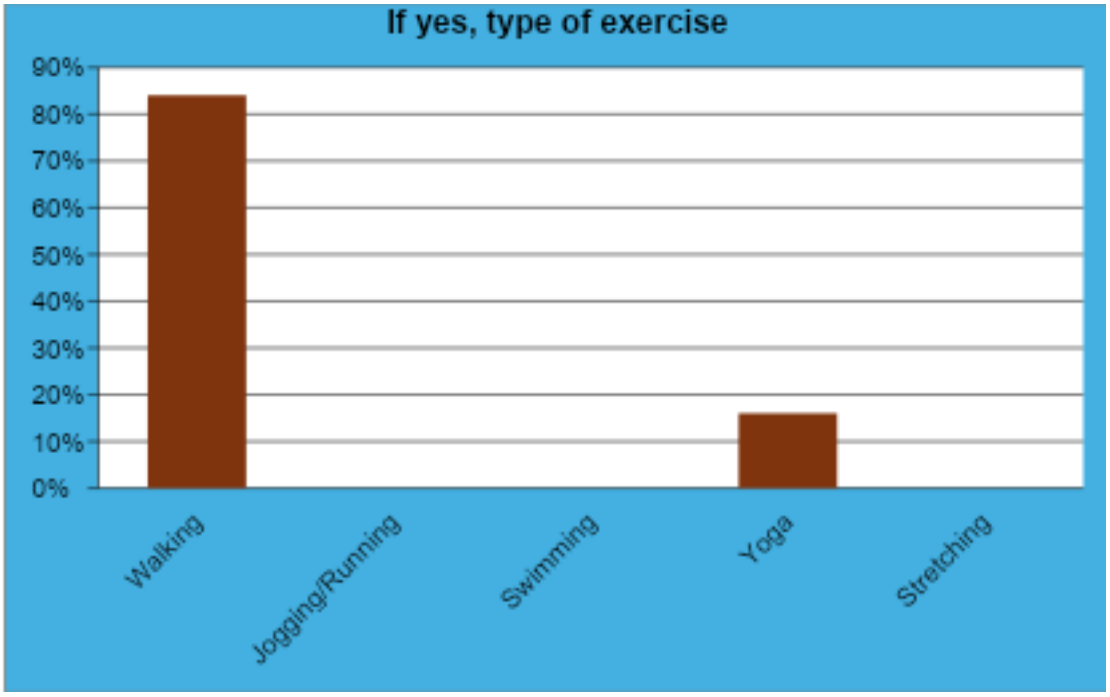

FIG 16: Percentage distribution of the type of exercise practised by the elderly participants

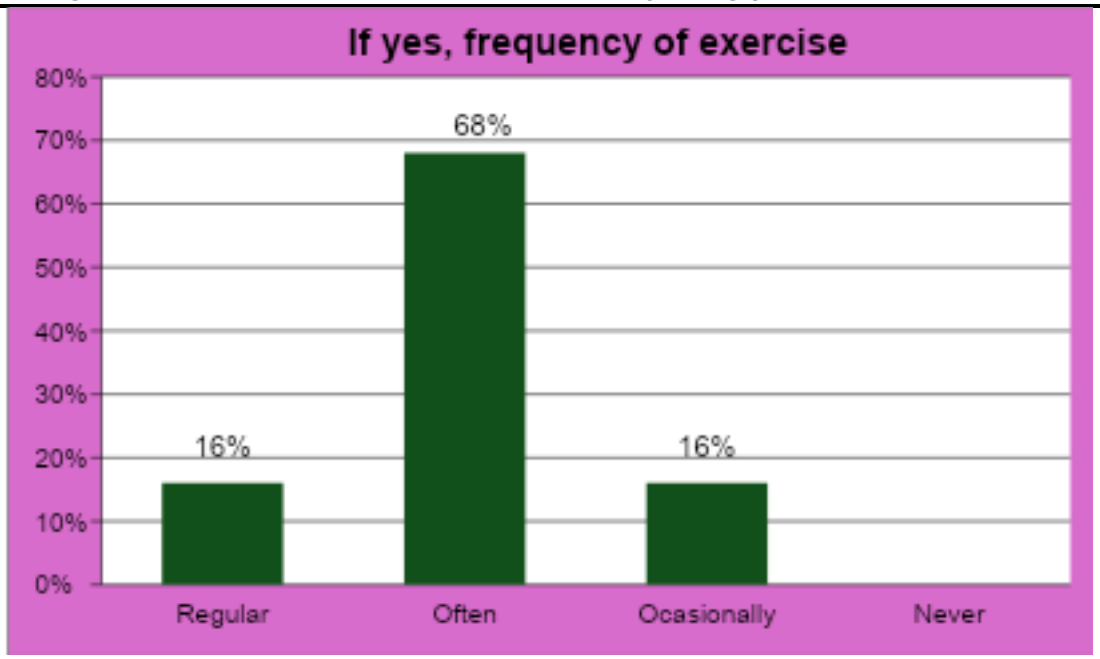

FIG 17: Percentage distribution of frequency of exercise of the elderly participants

The majority of participants fall in the age range of 65-69 years with 52 %. The age group 70-74 years and 75 – 79 years also show participation but to a lesser extent with 28% and 20% respectively.There were no participants of 80 years of age.

A greater number of participants were male, comprising 76 percent, while female participants made up 24 percent. Almost all participants were Hindus (84 percent), with a smaller representation of Muslims (16 percent). There were no participants from the Christian community.

In terms of education, most participants had completed schooling (72 percent), while fewer were undergraduates (16 percent) or graduates (12 percent). None of the participants had pursued post-graduation studies.

Regarding employment, a significant portion of participants had retired (44 percent), and 24 percent were without any occupation. About 20 percent were engaged in their own businesses, while only 12 percent were working in private jobs.

The majority of participants (64 percent) reported a monthly income between 10,000 to 15,000. Around 20 percent earned above 15,000 per month, and 16 percent fell into the income range of 6,000 to 10,000 per month. None of the participants earned below 5,000 per month.

A majority of participants had a history of hypertension (56%), while 36% reported a history of diabetes mellitus. About 8% of participants had a history of cataract, and none reported a history of chronic dyspnoea.

In terms of physical problems, the dominant issue was decreased vision, affecting 64% of participants. Around 20% reported issues with decreasing memory, and 16% experienced problems with processing speed. No participants reported any other physical problems.

Regarding psychological issues, 42% of participants reported no problems. About 24% experienced anxiety, 16% reported loneliness, and 10% faced problems with depression. Additionally, 8% of participants reported issues with insecurity, while none mentioned experiencing fear.

Regarding the perception of the strength of social support, a vast majority of participants (80%) reported feeling an adequate level of social support, while 12% felt highly adequate, and only 8% perceived their social support as inadequate.

In terms of exercise habits, most participants (76%) reported having a habit of exercising, whereas 24% do not exercise.

Among those who exercise, the majority (84%) reported walking as their preferred type of exercise, while 16% practiced yoga. None of the participants were involved in other forms of exercise such as jogging, running, swimming, or stretching.

When it comes to exercise frequency, the largest proportion of participants (68%) reported exercising often, while 16% exercised regularly, and another 16% exercised occasionally. None of the participants reported never exercising.

SECTION B: ASSESS THE PRE-TEST AND POST-TEST LEVEL OF BALANCE AMONG ELDERLY USING THE BERG BALANCE SCALE.

Table - 2 : The pre-test and post-test levels of balance among the elderly, assessed using the Berg Balance Scale.

					n = 50	
S.No.	**Name of Test**	**Level of Fall Risk**	**Frequency**	**Percentage**	**Mean**	**SD**
1	PRE-TEST	Low Fall Risk (41-56)	0	0	32.9	3.51
		Medium Fall Risk (21-40)	50	100%		
		High Fall Risk (0-20)	0	0		
2	POST-TEST	Low Fall Risk (41-56)	15	30%	40.14	3.91
		Medium Fall Risk (21-40)	35	70%		
		High Fall Risk (0-20)	0	0		

In the pre-test, all participants (100%) fell into the medium fall risk category, scoring between 21 and 40. None of the participants were classified in the low fall risk (41–56) or high fall risk (0–20) categories.In the post-test, 70% of participants remained in the medium fall risk group, while 30% improved and reached the low fall risk category. Notably, none of the participants were categorized under high fall risk.

The mean score on the Berg Balance Scale increased from 32.90 in the pre-test to 40.14 in the post-test, indicating an overall improvement in balance. The standard deviation of the scores was also relatively high, reflecting some variability among the participants.

SECTION C: ASSESS THE PRE-TEST AND POST-TEST LEVEL OF GAIT PATTERN AMONG ELDERLY USING THE FUNCTIONAL GAIT ASSESSMENT SCALE.

Table - 3 : The pre-test and post-test levels of gait patterns among the elderly, assessed using the Functional Gait Assessment Scale.

						n=50
S No.	**Name of Test**	**Level of gait impairment**	**Frequency**	**Percentage**	**Mean**	**SD**
1	PRE-TEST	Severe (0-9)	0	0	16.74	2.68
		Moderate (10-19)	42	84%		
		Mild (20-29)	8	16%		
		Normal (30& above)	0	0		
2	POST-TEST	Severe (0-9)	0	0	22.44	4.74
		Moderate (10-19)	8	16%		
		Mild (20-29)	42	84%		
		Normal (30&above)	0	0		

In the pre-test, 84% of participants had a moderate level of gait impairment (scores between 10 and 19), while 16% had a mild level of impairment (scores between 20 and 29). None of the participants fell into the severe (0–9) or normal (30 and above) gait categories.In the post-test, 84% of participants improved to the mild level of gait impairment, while 16% remained in the moderate level. No participants were categorized as having severe gait impairment or achieving a normal gait pattern. The mean score on the Functional Gait Assessment Scale increased from 16.74 in the pre-test to 22.44 in the post-test, demonstrating a noticeable improvement in gait patterns. The standard deviation of the scores remained relatively high, indicating some variability among participants.

SECTION D: DETERMINE THE EFFECTIVENESS OF DUAL-TASK EXERCISES ON IMPROVING THE BALANCE AMONG ELDERLY.

Table – 4: The effectiveness of dual-task exercises in improving balance among the elderly.

n = 50

S No.	Name of Test	Mean	SD	Mean difference	Paired t test	Remarks
1	PRE-TEST	32.9	3.51	7.24	t = 66.71 df = 49 p = 2.012	S
2	POST-TEST	40.14	3.91			

***S = significant , p = 0.05**

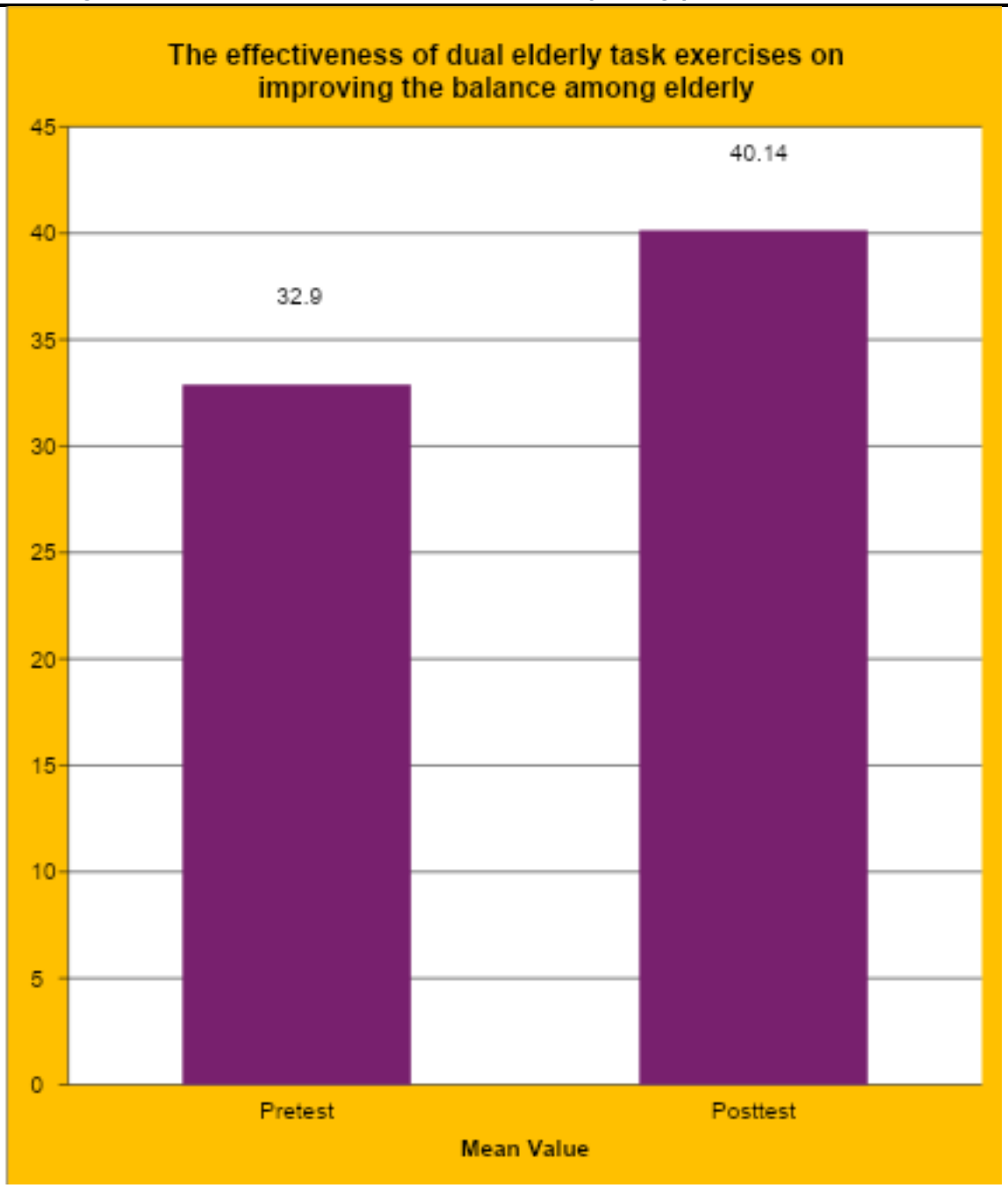

FIG 18: The effectiveness of dual task exercises on improving the balance among the elderly particiants.

The table presents the mean and standard deviation values for both the pre-test and post-test groups.The results indicate a significant mean difference of 7.24 between the pre-test and post-test scores. The calculated t-value of 66.71 exceeds the tabulated t-value of 2.012 at the 0.05 level of significance, demonstrating a significant improvement in balance.

Thus, the hypothesis H1 is accepted, confirming that there is a significant difference between the pre-test and post-test levels of balance among the elderly.

SECTION E: DETERMINE THE EFFECTIVENESS OF DUAL TASK EXERCISES ON IMPROVING THE GAIT PATTERN AMONG THE ELDERLY.

Table - 5 : The effectiveness of dual-task exercises in improving the gait pattern among the elderly.

n = 50

S No.	Name of test	Mean	SD	Mean difference	Paired t test	Remarks
1	PRE-TEST	16.74	2.68	5.7	t = 57 df = 49	**S**
2	POST-TEST	22.44	4.78			

***S = Significant , p = 0.05**

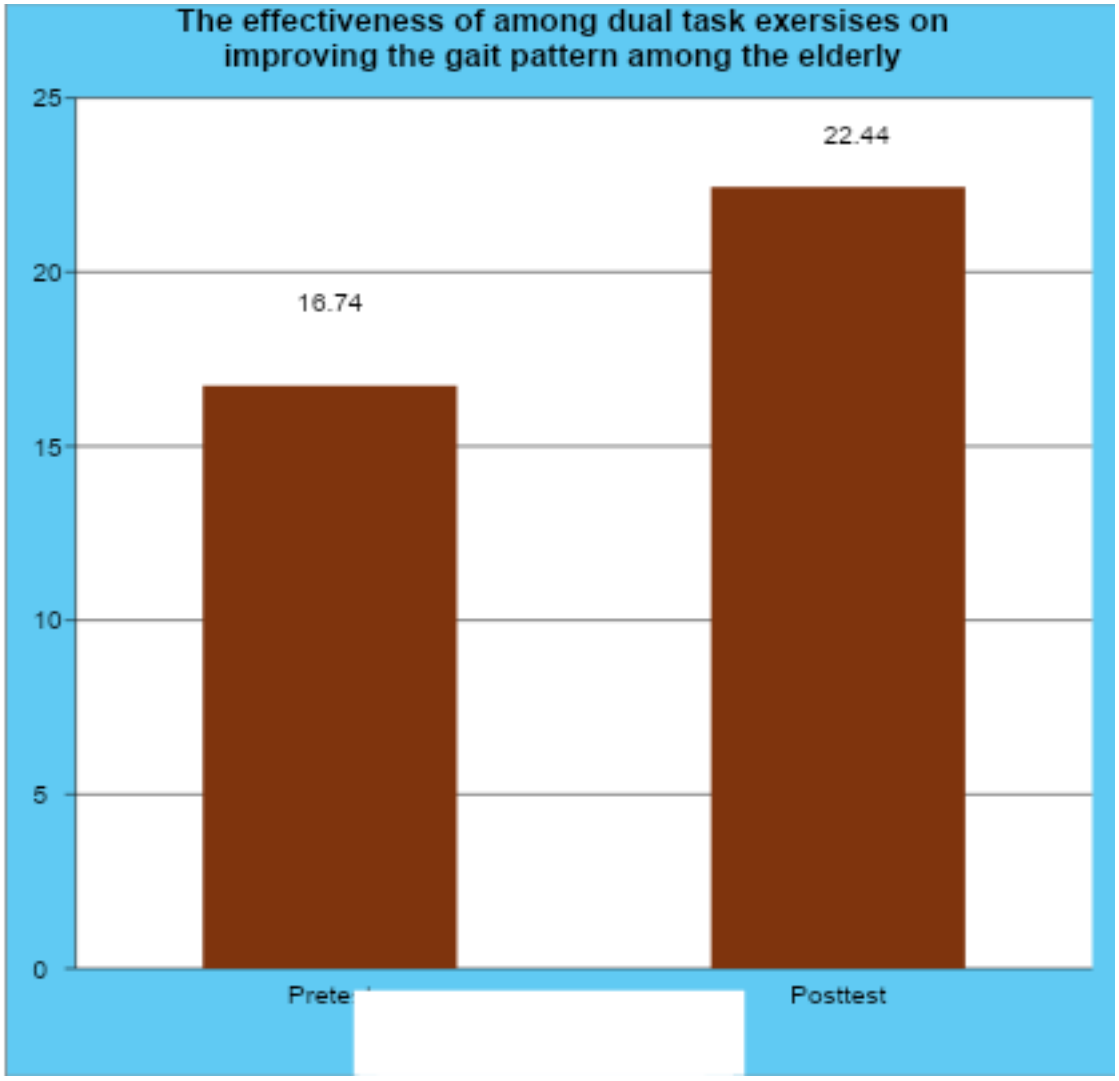

FIG 19: The effectiveness of dual task exercises on improving the gait pattern among the elderly

The table presents the mean and standard deviation values for the pre-test and post-test groups. The results revealed a significant mean difference of 5.70 between the pre-test and post-test scores. The calculated t-value of 57 is greater than the tabulated t-value of 2.012 at the 0.05 level of significance, indicating a statistically significant improvement in the post-test scores.

Thus, the hypothesis H2 is accepted, confirming that there is a significant difference between the pre-test and post-test levels of gait pattern among the elderly.

SECTION F: CORRELATE THE EFFECTIVENESS OF DUAL TASK EXERCISES ON LEVEL OF BALANCE WITH GAIT PATTERN AMONG THE ELDERLY.

Table – 6: To correlate the effectiveness of dual task exercises on the level of balance with gait pattern among the elderly

n = 50

S No.	Name of Group	Post test observation	r value	Remarks
1	POST TEST	Level of balance versus Level of gait pattern	**0.814**	**S**

***Significant at p =0.05**

Table No. 6 represents the correlation between the effectiveness of dual-task exercises on balance and gait pattern among the elderly. The results indicate a strong positive correlation between balance levels and gait patterns, with an r-value of 0.814.

Hence, the hypothesis H3 is accepted. These findings suggest that higher scores on the Berg Balance Scale are associated with better gait patterns, and vice versa, among the elderly.

SECTION G: ASSOCIATE THE POST TEST LEVEL OF BALANCE AMONG ELDERLY WITH THEIR DEMOGRAPHIC VARIABLES.

Table -7 : Association of the post test level of balance among elderly with their socio- demographic variable

n = 50

S.No.	Demographic Variables	Low Risk	Medium Risk	High risk	Chi Square (χ^2)
1	**Age (in Years)**				
(a)	65-69	15	11	0	χ^2=33.4
(b)	70-74	0	14	0	df = 6
(c)	75-79	0	10	0	p = 12.59
(d)	80	0	0	0	**S**

2	**Gender**				
(a)	Male	15	23	0	χ^2 = 11.07
(b)	Female	0	12	0	df = 4
					p=9.46, **S**
3	**Marital Status**				
(a)	Married	15	27	0	χ^2= 4.06
(b)	Unmarried	0	0	0	df = 6
(c)	Divorce/ Seperated	0	0	0	p= 12.59
(d)	Widow/Widower	0	8	0	**NS**
4	**Religion**				
(a)	Hindu	14	28	0	χ^2=1.38
(b)	Muslim	1	7	0	df = 4, p = 9.49
(c)	Christian	0	0	0	**NS**
5	**Education**				
(a)	School	12	24	0	χ^2=1.369
(b)	Under Graduate	1	7	0	df=6
(c)	Graduate	2	4	0	p=12.59
(d)	Post Graduate	0	0	0	**NS**
6	**Occupation**				
(a)	Business	8	2	0	χ^2= 37.3
(b)	Private Job	5	1	0	df=6
(c)	Retired	2	20	0	p = 12.59
(d)	No occupation	0	12	0	**S**
7	**Income (Rs/Month)**				
(a)	Below Rs 5000	0	0	0	χ^2= 5.01
(b)	Rs. 6000-10000	5	3	0	df = 6
(c)	Rs. 10000-15000	7	25	0	p= 12.59
(d)	Rs. Above 15000	3	7	0	**NS**
8	**Any History of Illness**				
(a)	diabetes Mellitus	4	14	0	χ^2= 4.18
(b)	Hypertension	11	17	0	df= 6
(c)	Chronic Dyspnoea	0	0	0	p = 12.59
(d)	Cataract	0	4	0	**NS**
(e)	Other specify	0	0	0	

9	**Any Physical Problem Facing**				
(a)	Dcreased vision	15	17	0	χ^2= 11.73
(b)	Dcreasing Memory	0	10	0	df = 6
(c)	Processing Speed	0	8	0	p = 12.59
(d)	Others	0	0	0	**NS**
10	**Any Psychological problems facing**				
(a)	Anixiety	4	8	0	χ^2=15.04
(b)	Depression	0	5	0	df= 10
(c)	Fear	0	0	0	p = 18.31
(d)	Insecurity	4	0	0	**NS**
(e)	Lonliness	0	8	0	
(f)	No psychological problems	7	14	0	
11	**Perception of The Strength of Social Support**				
(a)	Feels highly adequate	2	4	0	χ^2= 2.169
(b)	Feels adequate	13	27	0	df= 4
(c)	Feels inadequate	0	4	0	p = 9.49, **NS**
12	**Habit of Exercise**				
(a)	Yes	15	23	0	χ^2=6.75 df=2 p= 5.99 **S**
(b)	No	0	12	0	
13	**If yes type of exercise**				
(a)	Walking	13	29	0	χ^2= 0.079
(b)	Jogging / Running	0	0	0	df= 8
(c)	Swimming	0	0	0	p= 15.51
(d)	Yoga	2	6	0	**NS**
(e)	Stretching	0	0	0	
14	**If yes frequency of exercise**				
(a)	Regular	8	0	0	χ^2= 23.51
(b)	Often	7	27	0	df= 6
(c)	Occassionally	0	8	0	p= 12.59
(d)	Never	0	0	0	**S**

S = Significant NS = Non Significant p = 0.05

Table No. 7 aimed to investigate the association between the post-test level of balance among the elderly and their socio-demographic variables. The results revealed no significant association between the post-test level of balance among the elderly and certain socio- demographic variables, such as marital status, religion, education, income, history of illness, physical problems, psychological problems, perception of social support, and type of exercise.

However, the Chi-Square results indicated a significant association between the post-test level of balance among the elderly and specific socio- demographic variables, including age, gender, occupation, habit of exercise, and frequency of exercise. Therefore, Hypothesis 4 is partially accepted, i.e., there is a significant association between the post-test level of balance among the elderly and their selected socio-demographic variables.

SECTION H: ASSOCIATE THE POST TEST LEVEL OF GAIT PATTERN AMONG ELDERLY WITH THEIR SELECTED DEMOGRAPHIC VARIABLES.

Table - 8: Association of the post test level of gait pattern among elderly with their socio- demographic variables

n = 50

S.No.	Demographic Variables	Mild	Moderate	Severe	Chi-square (χ^2)
1	**Age (in Years)**				
(a)	65-69	25	1	0	χ^2= 7.51
(b)	70-74	11	3	0	df= 6
(c)	75-79	6	4	0	p= 12.59
(d)	80	0	0	0	**NS**
2	**Gender**				
(a)	Male	32	6	0	χ^2=0.0048, df= 2
(b)	Female	10	2	0	p= 5.99, **NS**
3	**Marital Status**				
(a)	Married	37	5	0	χ^2= 15.57
(b)	Unmarried	0	0	0	df= 6
(c)	Divorce/ Seperated	0	0	0	p= 12.59
(d)	Widow/Widower	6	6	0	S
4	**Religion**				
(a)	Hindu	37	5	0	χ^2=10.62, df=4
(b)	Muslim	3	5	0	p= 9.49
(c)	Christian	0	0	0	**S**
5	**Education**				
(a)	School	32	4	0	χ^2= 2.44
(b)	Under Graduate	6	2	0	df= 6

(c)	Graduate	4	2	0	p= 12.59
(d)	Post Graduate	0	0	0	**NS**
6	**Occupation**				
(a)	Business	10	0	0	χ^2=5.14
(b)	Private Job	6	0	0	df= 6
(c)	Retired	16	6	0	p = 12.59
(d)	No occupation	10	2	0	**NS**
7	**Income (Rs/Month)**				
(a)	Below Rs 5000	0	0	0	χ^2= 1.809
(b)	Rs. 6000-10000	8	0	0	df= 6
(c)	Rs. 10000-15000	26	6	0	p = 12.59
(d)	Rs. Above 15000	8	2	0	**NS**
8	**Any History of Illness**				
(a)	diabetes Mellitus	15	3	0	χ^2 = 4.017
(b)	Hypertension	25	3	0	df= 6
(c)	Chronic Dyspnoea	0	2	0	p = 12.59
(d)	Cataract	2	0	0	**NS**
(e)	Other specify	0	0	0	
9	**Any Physical Problem Facing**				
(a)	Decreased vision	31	1	0	χ^2 = 18.84
(b)	Decreasing Memory	6	4	0	df= 6
(c)	Processing Speed	5	3	0	p = 12.59
(d)	Others	0	0	0	**S**
10	**Any Psychological Problems facing**				
(a)	Anixiety	11	1	0	χ^2= 3.927
(b)	Depression	3	2	0	df =10
(c)	Fear	0	0	0	p= 18.31
(d)	Insecurity	4	0	0	**NS**
(e)	Lonliness	6	2	0	
(f)	No psychological problems	18	3	0	
11	**Perception of sense of social support**				
(a)	Feels highly adequate	4	2	0	χ^2=2.119,
(b)	Feels adequate	34	6	0	df= 4
(c)	Feels inadequate	4	0	0	p= 9.49
					NS
12	**Habit of Exercise**				
(a)	Yes	38	0	0	χ^2= 31.06
(b)	No	4	8	0	df= 2
					p= 5.99,

					S
13	**Ifyes type of exercise**				
(a)	Walking	36	6	0	χ^2= 7.011
(b)	Jogging / Running	0	0	0	df = 8
(c)	Swimming	0	0	0	p = 15.51
(d)	Yoga	7	1	0	**NS**
(e)	Stretching	0	0	0	
14	**If yes frequency of exercise**				
(a)	Regular	8	0	0	χ^2 = 8.33
(b)	Often	30	4	0	df =6
(c)	Occassionally	4	4	0	P= 12.59
(d)	Never	0	0	0	**NS**

S = Significant NS = Non Significant p = 0.05

Table No. 8 displays the association between the post-test level of balance, post-test level of gait pattern among the elderly, and their socio-demographic variables. The CHI-square results revealed no significant association between the post-test level of gait pattern among the elderly and most socio-demographic variables, including age, gender, education, occupation, income, history of illness, psychological problems, perception of social support, and both type and frequency of exercise. However, there was a significant association between the post-test level of gait pattern among the elderly and some socio demographic variables including marital status, religion, any physical problems as well as habit of exercise.

The study suggests that Hypothesis 4 is partially accepted, as there is no significant association between the post-test level of gait pattern and most socio-demographic variables. Nevertheless, variables such as marital status, religion, any physical problems and habit of exercise were found to be significantly associated with the post-test level of gait pattern among the elderly.

DISCUSSION

This study aimed to evaluate the effectiveness of dual-task exercises on balance and gait patterns among elderly individuals residing in urban areas of Lucknow. A total of 50 participants, aged 65 to 80 years, were included in the study. The sampling process employed a mixed technique, combining probability sampling for area selection and non-probability sampling for participant selection. Data were collected through a structured questionnaire using a face-to-face interview method.

A quasi-experimental one-group pre-test-post-test design was utilized to assess the intervention's impact. Baseline (pre-test) scores were collected using the Birch Balance Scale and the Functional Gait Assessment Scale. Participants then underwent dual-task exercise interventions for a duration of four weeks. Post-intervention scores were subsequently measured using the same scales to evaluate changes in balance and gait performance.

OBJECTIVES –

The objectives of the study are to -:

1. To assess the pre-test and post-test level of balance among the elderly using the Berg Balance Scale.
2. To assess the pre-test and post-test level of gait pattern among the elderly using the Functional Gait Assessment Scale.
3. To determine the effectiveness of dual-task exercises on improving balance among the elderly.

4. To determine the effectiveness of dual-task exercises on improving gait pattern among the elderly.

5. To correlate the effectiveness of dual-task exercises on the level of balance with gait pattern among the elderly.

6. To associate the post-test level of balance among the elderly with their selected demographic variables.

7. To associate the post-test level of gait pattern among the elderly with their selected demographic variables.

HYPOTHESIS

H_1. There will be a significant difference between the pre-test and post-test level of balance among the elderly.

H_2. There will be a significant difference between the pre-test and post-test level of gait pattern among the elderly.

H_3. There will be a significant correlation between the effectiveness of dual-task exercises on the level of balance with gait pattern among the elderly.

H_4. There will be a significant association between the post-test level of balance among the elderly and their selected demographic variables.

H_5. There will be a significant association between the post-test level of gait pattern among the elderly and their selected demographic variables.

Description of samples according to their demographic variables

The majority of participants (52%) were aged 65–69 years. Participation in the 70–74 and 75–79 age groups was lower, at 28% and 20%, respectively. There were no participants aged 80 or above. Most participants were male (76%), while females accounted for 24%. Nearly all participants were Hindus (84%), with 16% identifying as Muslims. No participants belonged to the Christian community.

The majority of participants (72%) had completed schooling, while 16% were undergraduates, and 12% were graduates. None had pursued post-graduate studies.

A significant proportion of participants (44%) were retired, while 24% were unemployed. Additionally, 20% were self-employed, and 12% held private-sector jobs.

Most participants (64%) reported a monthly income between ₹10,000 and ₹15,000. About 20% earned more than ₹15,000, and 16% reported incomes between ₹6,000 and ₹10,000. None earned below ₹5,000 per month.

A history of hypertension was the most common condition, affecting 56% of participants. Diabetes mellitus was reported by 36%, and 8% had a history of cataracts. None reported chronic dyspnoea.

Decreased vision was the most prevalent physical problem, affecting 64% of participants. Memory issues were reported by 20%, while 16% experienced reduced processing speed. No other physical problems were reported.

Nearly half (42%) of participants reported no psychological issues. Among those who did, anxiety was the most common (24%), followed by loneliness (16%), depression (10%), and insecurity (8%). None reported experiencing fear.

The majority (80%) perceived their social support as adequate, 12% felt it was highly adequate, and 8% considered it inadequate.

Most participants (76%) had a habit of exercising, while 24% did not. Of those who exercised, 84% preferred walking, and 16% practiced yoga. None engaged in activities such as jogging, running, swimming, or stretching.

Regarding exercise frequency, 68% exercised often, 16% regularly, and 16% occasionally. No participants reported never exercising.

Objective1:- Assess the pre-test and post-test level of balance among the elderly using the Berg Balance

In the pre-test, all participants (100%) were categorized as having a medium fall risk, with scores ranging between 21 and 40 on the Berg Balance Scale. No participants fell into the low fall risk category (41–56) or the high fall risk category (0–20).In the post-test, 70% of participants remained in the medium fall risk category, while 30% improved to the low fall risk category. Notably, none of the participants were classified as having a high fall risk.The mean Berg Balance Scale score increased from 32.90 in the pre-test to 40.14 in the post-test, reflecting an overall improvement in balance. However, the relatively high standard deviation indicates variability in the participants' scores. This reinforces the necessity of training dual task exercises to the elderly to improve their level of balance to minimize the liklihood of falls and injuries.

Objective 2:- Assess the pre-test and post-test level of gait pattern among the elderly using the Functional Gait Assessment Scale.

In the pre-test, 84% of participants exhibited a moderate level of gait impairment, with scores ranging between 10 and 19 on the Functional Gait Assessment Scale. The remaining 16% had a mild level of impairment, with scores between 20 and 29. None of the participants were categorized as having severe gait impairment (scores 0–9) or a normal gait (scores 30 and above). In the post-test, 84% of participants improved to the mild level of gait impairment, while 16% remained in the moderate category. No participants were classified as having severe gait impairment or achieving a normal gait pattern.The mean Functional Gait Assessment score increased from 16.74 in the pre-test to 22.44 in the post-test, reflecting significant improvement in gait patterns. However, the relatively high standard deviation suggests variability in the participants' scores. This underlines the importance of facilitating dual task exercises for the elderly people to improve their gait pattern to lower the chances of falls and injuries.

Objective 3:- To determine the effectiveness of dual-task exercises on improving balance among the elderly

The study successfully evaluated the effectiveness of dual task exercises on improving the balance among the elderly. The mean and standard deviation values for the pre-test and post-test groups. A significant mean difference of 7.24 was observed between the two sets of scores. The calculated t-value of 66.71 exceeds the critical t-value of 2.012 at the 0.05 level of significance, indicating a statistically significant improvement in balance. As a result, the hypothesis (H1) is accepted, confirming a significant difference in balance levels between the pre-test and post-test among the elderly participants. This highlights the importance of dual task exercises for the elderly in improving their balance and preventing accidents and injuries .

A quasi experimental study was conducted to find out the effect of dual task training on improving balance among geriatric population in Pakistan. This pre- and post-test experimental study was conducted using the Berg Balance Scale (BBS) to assess balance deficits. Thirty elderly participants with balance impairments were randomly assigned to either an experimental group (n=15) or a control group (n=15). The experimental group underwent 24 sessions of dual-task training, while the control group received conventional occupational therapy. Post-intervention measurements were taken to assess outcomes.The findings showed a statistically significant improvement in BBS scores in the experimental group compared to the control group ($p = 0.04236$), highlighting the effectiveness of dual-task training in improving balance among the geriatric population.[74]

Thus the above study supports the present study.

Objective 4:- To determine the effectiveness of dual-task exercises on improving gait pattern among the elderly.

The study thoroughly analysed the effectiveness of dual task exercises on improving the gait pattern among elderly.The mean and standard deviation values for the pre-test and post-test groups. The results indicate a significant mean difference of 5.70 between the pre-test and post-test scores. The calculated t-value of 57 exceeds the critical t-value of 2.012 at the 0.05 level of significance, confirming a statistically significant improvement in post-test scores.As a result, the hypothesis (H2) is accepted, demonstrating a significant difference in gait patterns between the pre-test and post-test among the elderly participants. This emphasizes the value of dual task exercises for the elderly in improving their gait pattern and reduce the risk of falls and injuries.

A randomized controlled trial investigated the effects of dual-task physical-cognitive training on body balance, gait performance, lower limb muscle strength, and cognitive performance in cognitively normal older adult women in Brazil. The study included 44 participants, randomly divided into a dual-task training (DT) group (n=22) and a control group (CG) (n=22).Assessments were conducted at baseline, after 12 weeks of intervention, and at a 12-week follow-up .After 12 weeks of DT training, the intervention group showed significant improvements in motor performance, including body balance (BB), gait performance (GP), and lower limb muscle strength (LEMS), as well as in cognitive performance (VF grouping, exchange, and total scores). However, no significant change was observed in the VF category test. The control group showed no changes in physical or cognitive performance across all time points. The study concluded that 12 weeks of dual-task physical-cognitive training effectively enhanced body balance, gait performance, lower limb strength, and cognitive function in cognitively normal older adult women, with benefits sustained up to 12 weeks after the intervention. [75]

Thus the above study supports the present study.

Objective 5:- To correlate the effectiveness of dual-task exercises on the level of balance with gait pattern among the elderly.

The study accurately measured the correlation between the effectiveness of dual-task exercises on balance and gait patterns among the elderly. The results show a strong positive correlation, with an r-value of 0.814.As a result, the hypothesis (H3) is accepted. These findings indicate that improved scores on the Berg Balance Scale are strongly associated with better gait patterns among the elderly.This stresses the need to consider both berg balance scale and functional gait assessment scale when assessing the effectiveness of dual task exercises.

The study aimed to evaluate the impact of dual-task exercises on the balance and gait patterns of elderly individuals in selected old age homes in India using a pre-experimental one-group pre-test-post-test design. Thirty participants meeting the inclusion criteria were selected through purposive sampling, and their balance and gait were assessed using the Berg Balance Scale (BBS) and Functional Gait Assessment Scale (FGAS) before and after the intervention. Dual-task exercises were administered twice weekly for four weeks, with post-tests conducted in the fifth week. Results showed that 86.7% of participants had a high fall risk and 40% had moderate gait impairment in the pre-test, which improved to 100% low fall risk and 20% normal ambulation in the post-test. The mean BBS score significantly improved from 17.9±2.5 to 52.4±2.3 ($P<0.001$), and the mean FGAS score increased from 12.0±3.3 to 28.4±2.2 ($P<0.001$), confirming the effectiveness of dual-task exercises. The study concluded that dual-task training effectively enhances balance and gait in elderly individuals, highlighting the role of nursing personnel in implementing such interventions to reduce fall risks and improve mobility.[76]

Objective 6:- To associate the post-test level of balance among the elderly with their selected demographic variables.

The study skillfully investigated the association between the post-test level of balance among the elderly and their socio demographic variables. The results revealed no significant association between the post-test balance level and various socio demographic factors, including marital status, religion, education, income, medical history, physical and psychological problems, perception of social support, and type of exercise.However, the Chi-square analysis showed a significant association between the post-test level of balance and specific sociodemographic variables, such as age, gender, occupation, exercise habits, and frequency of exercise.

Therefore, Hypothesis 4 is accepted, confirming a significant association between the post-test balance level among the elderly and the selected socio demographic variables.

These findings emphasize the need to consider specific demographic factors when addressing and understanding the level of balance among the elderly.

Objective7:- To associate the post-test level of gait pattern among the elderly with their selected demographic variables.

The study comprihensively examined the association between the post-test level of balance, post-test level of gait pattern, and socio demographic variables among the elderly. The Chi-square results showed no significant association between the post-test gait pattern and most socio demographic factors, including age, gender, education, occupation, income, any history of illness, psychological problems, perception of social support, and both type and frequency of exercise. However, a significant association was found between the post-test gait pattern and marital status, religion,any physical problems, as well as the habit of exercise.

The study suggests that Hypothesis 4 is partially accepted, as no significant association was observed between the post-test gait pattern and most socio demographic variables. Nevertheless, marital status, religion, any physical problems and habit of exercise were found to be significantly associated with the post-test gait pattern among the elderly. This brings attention to the importance of considering specific demographic factors when addressing and understanding the level of gait pattern among the elderly.

CHAPTER V

SUMMARY CONCLUSION AND RECOMMENDATION

The study investigated the effectiveness of dual-task exercises on the level of balance and gait pattern among the elderly. The results demonstrated a significant improvement in the post test level of balance and gait pattern among the elderly . There was a significant correlation between dual-task exercises and the level of balance and gait pattern. Socio-demographic variables such as age, gender, occupation, exercise habits, and frequency of exercise were found to be associated with the level of balance, while variables such as physical problems and the habit of exercise were found to be associated with the level of gait pattern.

MAJOR FINDINGS OF THE STUDY:

1. The elderly demonstrated significant improvement in their level of balance. The mean score of the Berg Balance Scale increased from 32.90 in the pre-test to 40.14 in the post-test, indicating a positive impact on balance.

2. Significant improvement was observed in the level of gait pattern among the elderly. The mean score of the Functional Gait Assessment Scale increased from 16.74 in the pre-test to 22.44 in the post-test, reflecting a positive effect on gait pattern.

3. The improvement in mean scores for balance and gait pattern highlights the necessity of dual-task exercises for preventing falls and injuries among the elderly.

4. A strong positive correlation was found between dual-task exercises and the improvement in balance and gait pattern, reinforcing their importance.

5. A significant association was found between the level of balance and specific demographic variables such as age, gender, occupation, exercise habits, and frequency of exercise.

6. Sociodemographic variables such as physical problems and exercise habits were significantly associated with the level of gait pattern among the elderly.

LIMITATIONS OF THE STUDY:

1. The study's generalizability is limited due to the predominantly Hindu, married, and urban-dwelling participants. Future research should include a more diverse participant pool to enhance external validity.

2. The short-term nature of the intervention and follow-up may restrict the ability to assess sustained effects. Longer-term studies are required to evaluate the prolonged effectiveness of dual-task exercises.

IMPLICATIONS OF THE STUDY

The findings of this study have significant applications in nursing practice, education, research, and administration.

IMPLICATIONS FOR NURSING PRACTICE:

1. Encourage researchers and practitioners to set long-term goals for improving balance and gait patterns among the elderly.
2. Emphasize reducing balance and gait problems through dual-task exercises.
3. Plan and implement continuing education programs for nurses to update their knowledge about dual-task exercises.

IMPLICATIONS FOR NURSING EDUCATION:

1. Educate nursing students and trained nurses on the importance of dual-task exercises for the elderly.
2. Facilitate the implementation of these exercises in clinical settings.
3. Organize seminars, workshops, conferences, symposiums, and micro-teaching programs to disseminate knowledge about dual-task exercises for the elderly.

IMPLICATIONS FOR NURSING ADMINISTRATION:

1. Nursing administrators can play a key role in addressing balance and gait issues among the elderly by conducting assessments in old-age homes and organizing dual-task screening sessions.
2. Allocate funds for seminars, workshops, and conferences on balance and gait problems in the elderly.
3. Promote awareness through media campaigns, posters, charts, pamphlets, and handouts about coping mechanisms for balance and gait problems.

IMPLICATIONS FOR NURSING RESEARCH:

1. The study findings can serve as a valuable resource for future literature reviews.
2. Nurse administrators should motivate researchers to conduct further studies in this area.
3. Encourage researchers to set long-term goals for improving balance and gait patterns through evidence-based practices.

RECOMMENDATIONS:

1. Future research should include larger sample sizes and more diverse populations to validate and generalize the findings of this study.
2. Longitudinal studies are recommended to explore the sustained effects of dual-task exercises on fatigue levels and gait patterns over an extended period.
3. Comparative studies between various exercise modalities and dual-task exercises could provide insights into the most effective interventions for improving balance and gait patterns.
4. Qualitative research should focus on the subjective experiences of elderly participants engaged in dual-task exercises, enabling the development of more participant-centered interventions.

CONCLUSION

This study provides valuable insights into the positive effects of dual task exercises on balance and gait pattern among elderly, careful consideration of the limitations and the application of recommendations are essential for advancing the field and improving the quality of care of the elderly population.

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ANNEXURE VI
RESEARCH TOOLS
SECTION-A

DEMOGRAPHIC VARIABLES

1. Age (in years)

(a) 65–69 ( )

(b)70–74 ( )

(c)75-79 ( )

2.Gender

(a)Male ( )
(b) Female ( )

3.Marital status

(a) Married ( )

(b) Unmarried ( )

(c) Divorced / Seperated ( )

(d)Widow/Widower ( )

4.Religion

(a)Hindu ( )
(b) Muslim ( )
(c)Christian ( )

5.Education

(a)School ( )
(b) Undergraduate ( )
(c)Graduate ( )
(d) Post graduate ( )

6.Previous occupation

(a)Business ( )
(b)Private job ( )

(c)Retired ( )

(d) No occupation ( )

7.Income(Rs/month)

(a)BelowRs.5000

(b) Rs.6000–10000 ( )

(c)Rs.10000–15000 ( )

(d)Rs.Above15000 ( )

8.Any history of illness

(a)Diabetes Mellitus ( )

(b)Hypertension ( )

(c)Chronic dyspnoea ( )

(d)Cataract ( )

(e)Any Other (specify)..... ( )

9.Any physical problems facing

(a)Decreased vision ( )

(b)Decreasing memory ( )

(c)Processing speed ( )

(d)Any Other(specify)..... ( )

10.Any psychological problems facing

(a)Anxiety

(b)Depression ( )

(c)Fear ( )

(d) Insecurity ( )

(e)Loneliness ( )

(f)No psychological problems facing ( )

11.Perception of the strength of social support

(a) Feels highly adequate ( )

(b)Feels adequate ( )

(c)Feels inadequate ( )

12.Habit of exercise

(a)Yes ( )

(b) No ( )

13.If yes, type of exercise

(a)Walking
(b)Jogging/Running ( )
(c)Swimming ( )
(d)Yoga ( )

(e)Stretching ( )

14. If yes, frequency of exercise

(a)Regular ( )
(b)Often ( )
(c)Occasionally ( )
(d)Never ( )

ANNEXURE VII

SECTION B

Berg Balance Scale

_____ Date: _____

Location: _____ Rater: _____

Item Description Score (0-4)

Sitting to standing_____

Standing unsupported_____

Sitting unsupported_____

Standing to sitting_____

Transfers _____

Standing with eyes closed_____

Standing with feet together_____

Reaching forward without stretched arm_____

Retrieving object from floor_____

Turning to look behind_____

Turning360degrees

_____

Placing alternate foot on stool

_____

Standing with one foot in front_____

Standing on one foot_____

Total _____

General instruction

Please document each task and/or give instructions as written. When scoring, please record the lowest response category that applies for each item. In most items, the subject is asked to maintain a given position for a specific time. Progressively more points are deducted if:

- The time or distance requirements are not met
- The subject's performance warrants supervision
- The subject touches an external support or receives assistance from the examiner

The subject should understand that they must maintain their balance while attempting the tasks. The choices of which leg to stand on or how far to reach are left to the subject. Poor judgment will adversely influence the performance and the scoring.

Equipment required

- Stop watch or watch with a second hand,
- A ruler or other indicator of 2, 5, and10 inches.
- Chairs used during testing should be at a reasonable height.
- Either a step or a stool of average step height may be used for item#12.

Berg Balance Scale

1. Sitting To Standing

***Instructions*:** Please stand up; try not to use your hand for support.

( ) 4 able to stand without using hands and stabilize independently
( ) 3 able to stand independently using hands.
( ) 2 able to stand using hands after several tries
( ) 1 needs minimal aids to stand and stabilize
( ) 0 needs moderate or maximal assist to stand

2. Standing Unsupported

***Instruction*:** Please stand for two minutes without holding on

( ) 4 able to stand safely for two minutes
( ) 3 able to stand 2 minutes with supervision
( ) 2 able to stand 30 seconds unsupported
( ) 1 needs several tries to stand 30 seconds unsupported.
( ) 0 unable to stand 30seconds unsupported.

3. Sitting with Back Unsupported But Feet Supported On Floor Or On A Stool

***Instruction*:** Please set with arms folded for 2minutes.
( ) 4 able to sit safely and securely for 2minutes.
( ) 3 able to sit 2 minutes under supervision
( ) 2 able to able to sit 30 seconds
( ) 1 able to sit 10 seconds
( ) 0 unable to sit without support10 seconds.

4. Standing To Sitting

Instruction: Please sit down

() 4 sits safely with minimal use of hands
( ) 3 controls descent by using hands
() 2 uses back of legs against chair to control descent.
() 1 sit independently but has uncontrolled descent
() 0 needs assist to sit

5.Transfers

***Instructions*:** Average chairs for pivot transfer. Ask subject to transfer one way toward a seat with interest and one way toward a seat without arm rest. You may use two chairs or a bed and a chair.
( ) 4 able to transfer safely with minor use of hands.
() 3 able to transfer safely definite need of hands.
( ) 2 able to transfer with verbal cuing and supervision
( ) 1 needs one person to assist
() 0 needs two people to assist or supervise to be safe.

6.Standing Unsupported With Eyes Closed

Instruction:Please close your eyes and stand still for10seconds

( ) 4 able to stand 10 seconds safely
() 3 able to stand10 seconds with supervision
( ) 2 able to stand 3 seconds
( ) 1 unable to keep eyes closed 3 seconds but stays safely.
( ) 0 needs help to keep from falling

7. Standing Unsupported With Feet Together

Instruction: Place your feet together and stand without holding on

() 4 able to place feet together and stand without holding on
() 3 able to place feet together independently and stand 1 minute safely.
() 2 able to place feet together independently and stand 1 minute with supervision.
() 1 needs help to attain position but able to stand 15 seconds feet together.
() 0 needs help to attain position and unable to hold for 15 seconds.

8. Reaching Forward WithOut sretched Arm While Standing

Instruction: Lift arm to 90 degrees stretch out your fingers and reach forward as for as you can. (Examiner places a ruler at the end of finger tips when arm is at 90 degrees. Fingers should not touch the ruler while reaching forward. The recorded measure is the distance forward that the fingers reach while the subject is in the most forward lean position; when possible ask subject to use both arms when reaching to avoid rotation of the trunk)
() 4 can reach forward confidently 25cm (10inches)
( ) 3 can reach forward 12cm (5 inches)
() 2 can reach forward 5cm (2inches)
() 1 reaches forward but needs supervision
() 0 loses balance while trying requires external support.

9. Pickup Object FromThe Floor FromA Standing Position

Instruction: Pick up the shoe slipper which is in front of your feet.
( ) 4 able to up slipper safely and easily.
() 3 able to pick up slipper but needs supervision
( ) 2 unable to pick up but reaches 2-5cm(1-2inches) from slipper and keeps balance independently.
() 1 unable to pick up and needs supervision while trying.
() 0 unable to try needs assist to keep from losing balance or falling.

10. TurningToLookBehindOver LiftAndRight Shoulders While Standing

Instructions: Turn to look directly behind you over toward the left shoulder, Repeat to the right.
() 4 looks behind from both sides and weight shift well.
() 3 looks behind one side only other side shows less weight shift.
( ) 2 turn side ways only but maintain balance.
() 1 needs supervision when running.
() 0 needs assist to keep from losing balance or falling.

11. Place Alternative Foot On Step Or Stool While Standing Unsupported

Instruction: Place each foot alternatively on the step or stool. Continue each foot has touched the step, stool for time

() 4 able to stand independently and safely and complete 8 steps in 20 seconds.
() 3 able to stand independently and complete 8 steps in > 20seconds.
() 2 able to complete 4 steps without aid with supervision.
() 1 able to complete > 2 steps needs minimal assist.
() 0 needs assistance to keep from falling, unable to dry.

12. Turns 360 Degrees

Instruction: Turn completely around in full circle. Turn a full circle in the other direction.
() 4 able to turn 360 degrees safely in 4 seconds or less.
() 3 able to turn 360 degrees safely on side only 4 seconds or less.
() 2 able to turn 360 degrees safely but slowly.
() 1 needs close supervision or verbal cuing.
( ) 0 needs assistance while turning.

13. Standing Unsupported One Foot In Front

Instruction: Place one foot in front of the other.

() 4 able to place foot tandem independently and hold 30 seconds.
() 3 able to place foot ahead independently and hold 30 seconds.
() 2 able to take small step independently and hold 30 seconds.
() 1 needs help to step but can hold 15 seconds.
() 0 loses balance while stepping or standing.

14. Standing On One Leg

Instruction: Stand on one leg as long as you can without holding on

() 4 able to lift leg independently and hold > 10seconds.
() 2 able to lift leg independently and hold 2-3 seconds.
( ) 1 tries to lift leg unable to hold 3 seconds but remains standing independently.
( ) 0 unable to try of needs assist to prevent fall.

Cut-off scores for the elderly were reported by Berg et al 1992 as follows:
a. A score of 56 indicates functional balance.
b. A score of < 45 indicates individuals may be at greater risk of falling.

Interpretation

41-56=Low fall risk

21-40= Medium fall risk

0-20 = High fall risk

ANNEXURE VIII

SECTION C

Functional Gait Assessment Scale

A marked 6-m (20-ft) walk way that is marked with a 30.48-cm (12-in) width.

1. Gait Level Surface

Instructions*:* Walk at your normal speed from here to the next mark (6 m [20 ft.]). Grading: Mark the highest category that applies.

(3) Normal-Walks 6 m (20 ft.) in less than 5.5 seconds, no assistive devices, good speed, no evidence for imbalance, normal gait pattern, deviates no more than 15.24 cm (6 in) outside of the 30.48-cm (12-in) walkway width.

(2) Mild impairment-Walks 6 m (20 ft.) in less than 7 seconds but greater than 5.5 seconds, uses assistive device, slower speed, mild gait deviations, or deviates 15.24 –25.4 cm (6 –10 in) outside of the 30.48-cm (12-in) walkway width.

(1) Moderate impairment-Walks 6 m (20 ft.), slow speed, abnormal gait pattern, evidence for imbalance, or deviates 25.4 – 38.1 cm (10 -15 in) outside of the 30.48- cm (12-in) walkway width. Requires more than 7 seconds ambulating 6 m (20 ft.).

(0) Severe impairment-Cannot walk 6 m (20 ft.) without assistance, severe gait deviations or imbalance, deviates greater than 38.1 cm (15 in) outside of the 30.48- cm (12-in) walkway width or reaches and touches the wall.

2. Change In Gait Speed

Instructions: Begin walking at your normal pace (for 1.5 m [5 ft.]). When I tell you "go," walk as fast as you can (for 1.5 m [5 ft.]). When I tell you "slow," walk as slowly as you can (for 1.5 m [5 ft.]).

Grading: Mark the highest category that applies.

(3) Normal-Able to smoothly change walking speed without loss of balance or gait deviation. Shows a significant difference in walking speeds between normal, fast, and slow speeds. Deviates no more than 15.24 cm (6 in) outside of the 30.48-cm (12-in) walkway width.

(2) Mild impairment-Is able to change speed but demonstrates mild gait deviations, deviates 15.24 –25.4 cm (6 –10 in) outside of the 30.48-cm (12-in) walkway width, or no gait deviations but unable to achieve a significant change in velocity, or uses an assistive device.

(1) Moderate impairment-Makes only minor adjustments to walking speed, or accomplishes a change in speed with significant gait deviations, deviates 25.4 –38.1 cm (10 –15 in) outside the 30.48-cm (12-in) walkway width, or changes speed but loses balance but is able to recover and continue walking.

(0) Severe impairment-Cannot change speeds, deviates greater than 38.1 cm (15 in) outside 30.48-cm (12-in) walkway width, or loses balance and has to reach for wall or be caught.

3. Gait with Horizontal Head Turns

Instructions: Walk from here to the next mark 6m (20ft.) away.

Begin walking at your normal pace. Keep walking straight; after 3steps, turn your head to the right and keep walking straight while looking to the right. After 3 more steps, turn your head to the left and keep walking straight while looking left. Continue alternating looking right and left every 3 steps until you have

completed 2 repetitions in each direction.

Grading: Mark the highest category that applies.

(3) Normal-Performs head turns smoothly with no change in gait. Deviates no more than 15.24 cm (6 in) outside 30.48-cm (12-in) walkway width.

(2) Mild impairment-Performs head turns smoothly with slight change in gait velocity (eg, minor disruption to smooth gait path), deviates 15.24 –25.4 cm (6 -10 in) outside 30.48-cm (12-in) walkway width, or uses an assistive device.

(1) Moderate impairment-Performs head turns with moderate change in gait velocity, slows down, deviates 25.4 –38.1 cm (10 –15 in) outside 30.48-cm (12-in) walkway width but recovers, can continue to walk.

(0) Severe impairment-Performs task with severe disruption of gait (e.g., staggers 38.1 cm [15 in] outside 30.48-cm (12-in) walkway width, loses balance, stops, or reaches for wall).

4. Gait With Vertical Head Turns

Instructions: Walk from here to the next mark (6 m [20 ft.]). Begin walking at your normal pace. Keep walking straight; after 3 steps, tip your head up and keep walking straight while looking up. After 3 more steps, tip your head down, keep walking straight while looking down. Continue alternating looking up and down every 3steps until you have completed 2 repetitions in each direction.

Grading: Mark the highest category that applies.

(3)Normal- Performs head turns with no change in gait. Deviates no more than15.24 cm (6 in) outside 30.48-cm (12-in) walkway width.

(2) Mild impairment-Performs task with slight change in gait velocity (e.g., minor disruption to smooth gait path), deviates 15.24 -25.4 cm (6 -10 in) outside 30.48-cm (12-in) walkway width or uses assistive device.

(1) Moderate impairment-Performs task with moderate change in gait velocity, slows down, deviates 25.4 –38.1 cm (10 –15 in) outside 30.48-cm (12-in) walkway width but recovers, can continue to walk.

(0) Severe impairment-Performs task with severe disruption of gait (e.g., staggers 38.1cm (15 inches) outside 30.48 cm (12 inches) walkway width, loses balance, stops, reaches for wall).

5.Gait and Pivot Turn

Instructions: Begin with walking at your normal pace. When I tell you, “turn and stop,” turn as quickly as you can to face the opposite direction and stop.

Grading: Mark the highest category that applies.

(3) Normal–Pivot turns safely within 3 seconds and stops quickly with no loss of balance.

(2) Mild impairment–Pivot turns safely in >3 seconds and stops with no loss of balance, or pivot turns safely within 3 seconds and stops with mild imbalance, requires small steps to catch balance.

(1) Moderate impairment–Turns slowly, requires verbal cueing, or requires several small steps to catch balance following turn and stop.

(0) Severe impairment–Cannot turn safely, requires assistance to turn and stop.

6.Step Over Obstacle

Instructions: Begin walking at your normal speed. When you come to the shoe box, step over it, not around it, and keep walking.

Grading: Mark the highest category that applies.

(3) Normal–Is able to step over 2 stacked shoe boxes taped together (22.86 cm [9 in] total height) without changing gait speed; no evidence of imbalance.

(2) Mild impairment–Is able to step over one shoe box (11.43 cm [4.5 in] total height) without changing gait speed; no evidence of imbalance.

(1) Moderate impairment–Is able to step over one shoe box (11.43 cm [4.5 in] total height) but must slow down and adjust steps to clear box safely. May require verbal cueing.

(0) Severe impairment–Cannot perform without assistance.

7.Gait With Narrow Base Of Support

Instructions: Walk on the floor with arms folded across the chest, feet aligned heel

to toe in tandem for a distance of 3.6 m [12 ft.]. The number of steps taken in a straight line is counted for a maximum of 10 steps.

Grading: Mark the highest category that applies.

(3) Normal- Is able to ambulate for10 steps heel to toe with no staggering

(2) Mild impairment–Ambulates 7–9 steps.

(1) Moderate impairment–Ambulates 4–7 steps.

(0) Severe impairment–Ambulates less than 4 steps heel to toe or cannot perform without assistance.

8. Gait with Eyes Closed

Instructions: Walk at your normal speed from here to the next mark (6 m [20 ft]) with your eyes closed.

Grading: Mark the highest category that applies.

(3) Normal–Walks 6 m (20 ft), no assistive devices, good speed, no evidence of imbalance, normal gait pattern, deviates no more than 15.24 cm (6 in) outside 30.48-cm (12-in) walkway width. Ambulates 6 m (20 ft) in less than 7 seconds.

(2) Mild impairment–Walks 6 m (20 ft), uses assistive device, slower speed, mild gait deviations, deviates 15.24 25.4 cm (6–10 in) outside 30.48-cm (12-in) walkway width. Ambulates 6 m (20 ft) in less than 9 seconds but greater than 7 seconds.

(1)Moderate impairment–Walks 6 m (20 ft), slow speed, abnormal gait pattern, evidence for imbalance, deviates 25.4–38.1 cm (10–15 in) outside 30.48-cm (12-in) walkway width. Requires more than 9 seconds to ambulate 6 m (20 ft).

(0)Severe impairment–Cannot walk 6 m (20 ft) without assistance, severe gait deviations or imbalance, deviates greater than 38.1 cm (15 in) outside 30.48-cm (12-in) walkway width or will not attempt task.

9. Ambulating Backwards

Instructions: Walk backwards untill I tell you to stop.

Grading: Mark the highest category that applies.

(3) Normal–Walks 6 m (20 ft), no assistive devices, good speed, no evidence for imbalance, normal gait pattern, deviates no more than 15.24 cm (6 in) outside 30.48-cm (12-in) walkway width.

(2) Mild impairment–Walks 6 m (20 ft), uses assistive device, slower speed, mild gait deviations, deviates 15.24 25.4 cm (6–10 in) outside 30.48-cm (12-in) walkway width.

(1) Moderate impairment–Walks 6 m (20 ft), slow speed, abnormal gait pattern, evidence for imbalance, deviates 25.4–38.1 cm (10–15 in) outside 30.48-cm (12- in) walkway width.

(0) Severe impairment–Cannot walk 6 m (20 ft) without assistance, severe gait deviations or imbalance, deviates greater than 38.1 cm (15 in) outside 30.48-cm (12-in) walkway width or will not attempt task.

10. Steps

Instructions: Walk up these stairs as you would at home (i.e., using the rail if necessary). At the top turn around and walk down.

Grading: Mark the highest category that applies.

(3) Normal–Alternating feet, no rail.

(2) Mild impairment–Alternating feet, must use rail.

(1) Moderate impairment–Two feet to a stair; must use rail

(0) Severe impairment cannot do safely.

TOTAL SCORE: _____ MAXIMUM SCORE 30.

Interpretation

0=Severe impairment
1=Moderate impairment
2=Mild impairment
3=Normal ambulation

ANNEXURE IX

DUAL TASK EXERCISES

Dual task exercises involve performing two task simultaneously, typically combining a physical activity with a cognitive challenge. These exercises enhance coordination, balance and mental agility by engaging both the brain and body.

STEPS

Dual task exercises were administered to individually thrice in a week for 4 weeks. There were 4 session of training. Each session lasted for30 minutes.

I Session - Number counting while forward walking.

II Session - Number counting while backward walking.

III Session - Walking between obstacles.
IV session - Figure of Eight Walking.

INSTRUCTIONS: THE ELDERLY WERE INSTRUCTED TO IMMEDIATELY STOP AND REPORT ABOUT ANY DIFFICULTY.

PROCEDURE

1. NUMEBER COUNTING WHILE FORWARD WALKING

The elderly was instructed to count forward from 1 to 10 whille walking a marked 6m metre (20feet) distance. The elderly was instructed to walk at their normal pace and follow the instructions given.

2. NUMBER COUNTING WHILE BACKWARD WALKING

The elderly was instructed to count backward from 10 to 1 whille walking a marked 6m metre (20feet) distance. The elderly was instructed to walk at their normal pace and follow the instructions given**.**

3. WALKING BETWEEN OBSTACLES

Bricks and shoe boxes were used as obstacles and the elderly were instructed to walk between obstacles.

4. FIGURE OF EIGHT WALKING

The elderly were instructed to walk on the figure of eight marked area at their normal pace.

ANNEXURE X

DATA COLLECTION IMAGESOF DUAL TASK EXERCISES

1. NUMBER COUNTING WHILE FORWARD WALKING

2. NUMBER COUNTING WHILE BACKWARD WALKING

3. WALKING BETWEEN OBSTACLES

4. FIGURE OF EIGHT WALKING