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Outcome Of Functional Task and Resistance Training on Balance Among Geriatric Population: A Quasi Experimental

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ABSTRACT

Background: Balance problem often occur with aging, even for those with good health. Functional task training and resistance training can improve the balance of older adults maintaining independence and quality of life.

Study design: A Quasi experimental design.

Aim: To assess the impact of functional task training and resistance training on balancing in older adults.

Objective: To evaluate outcome of functional task training and resistance training on balancing in older adults by using berg balance scale (BBS).

Participants: The participants were recruited based on exclusion and inclusion criteria. The participants were divided into four groups; Functional task training group, Resistance training group, Functional task training +Resistance training group and Conventional balance training. With 12 participants in each group. A Total of 48 participants were included in the study.

Methods: A quasi-experimental design was conducted on 48 participants at Santosh college of Occupational therapy, Ghaziabad. The total sample was randomly divided into four equal groups. Functional task training (N=12), Resistance training (N=12), Functional task training + resistance training (N=12) and Conventional balance training (N= 12).

Result : In Berg balance scale (BBS) pre and post mean score for Functional task training, resistance training, functional task training +resistance training and Conventional were (30.00, 30.00, 28.08, 31.75) respectively accompanied by standard error (2.216, 3.885, 5.368, 2.927) respectively and subsequently post mean value of BBS increased (33.50, 32.42, 31.75, 34.25) standard error (.764, .981, .845, .827) and standard deviation (2.646, 3.397, 2.927, 2.864) which indicate progress.

CONCLUSION: The study highlights that the outcome of Functional task training and Conventional training is more effective than Resistance training and combination of Functional task training with resistance training to improve balance abilities in older adults.

KEYWORDS: FTT, RT, conventional training, older adults, balance, berg balance scale.

INTRODUCTION

Ageing is marked by reduced function across various physiological aspects, including balance.[1,2] Balance refers to the body's ability to maintain posture and prevent falls, influenced by inertial forces and body segment characteristics.[3] It is crucial for stability during movement, daily activities, and community engagement.[4] The postural control system, integrating motor, sensory, and nervous functions, plays a pivotal role in maintaining balance during activities and postures.[5] Visual, vestibular, and somatosensory functions determine body position in space.[6]

Impaired balance significantly increases the risk of falls in older adults, with studies noting a higher prevalence among women compared to men.[7,8] However, recent research has shown conflicting results, suggesting poorer balance in men in certain tests.[9,10] Age, gender, and other factors collectively affect balance performance, making falls predictable through assessment of multiple risk factors.[11]

People across the globe are living longer, with a notable rise in the number and proportion of elderly individuals in every country. By 2030, approximately one out of every six people worldwide will be aged 60 or older, marking a significant

increase from 1 billion in 2020 to 1.4 billion. Looking further ahead to 2050, the global population of those aged 60 and above will double to 2.1 billion, while the number of people aged 80 or older is projected to triple, reaching 426 million.[11]

Aging in India presents unique characteristics. While common factors such as rapid population aging, health issues, socio-economic challenges, and strong family support are typical of many developing countries, India's vast size and large elderly population contribute to significant heterogeneity among the aged, making generalizations difficult. Different regions experience varying socio-economic influences.[12] The country faces challenges from both communicable and degenerative diseases amidst economic constraints. However, the cultural emphasis on family care, respect for the elderly, non-materialistic values, and vegetarianism offers significant societal support for aging populations. Health issues prevalent among the elderly in India include chronic conditions like visual impairment, hearing loss, mental health disorders, hypertension, coronary heart disease, and diabetes, which disproportionately affect this demographic.[12]

The demographic structure of the global population is undergoing continuous change, marked by an increasing number of elderly individuals alongside a decline in younger populations.[13] However, achieving the maximum life span is rare for individuals. Life expectancy, which indicates how long a member of a population, can expect to live, varies among different populations rather than species.[14]

Aging leads to the gradual decline of various physiological functions, including balance, which is essential for preventing falls. Balance issues are common in older adults due to age-related changes in the vestibular, visual, and somatosensory systems, as well as reduced lower-body strength, coordination, and flexibility. These factors increase fall risk, with falls potentially causing injury, disability, or even death. Additionally, fear of falling can further limit mobility and independence. Balance is disrupted when performing secondary tasks, and older adults may struggle to maintain balance when multitasking.[15] According to Rafi Mohammed and SD Shahnawaz both the functional task training and resistance training were effective in improving balance. However, the improvement by the functional task training was better than the resistance training in older adults.[15]

The purpose of this study is to assess the combined effect of functional task training and resistance training on balancing in older adults. While the previous research has highlighted the potential benefits of functional task training and resistance training to improve balance in older adults.

METHODOLOGY

The total of 48 participants included in the study and randomly divided into 4 equal groups Functional task training group, resistance training group, functional task training with resistance training group and conventional balance training. The treatment was given to the participants for duration of 12 weeks, 3 sessions per week for 1 hour. Study was taken place at Santosh college of Occupational therapy, Ghaziabad.

As per inclusion criteria, age above 65 years, both male and female, Individual able to lift weight up to 1.5 kg, and those who can walk without assistive device and those willing to participate in the study were included. As per exclusion criteria, Individual with neurological condition, musculoskeletal disease, cardiovascular and respiratory condition and those who are not able to lift weight were excluded. Participants were given an informed consent form outlining the goals, methods, possible hazards and advantages of the study prior to its commencement. They were given sufficient time, as well as explanation, to go over the document and ask any question before giving their written agreement. Each participant underwent a pre- assessment to establish baseline measurement using BBS and BORG CR10 for screening.

OUTCOME MEASURE Berg Balance Scale

The Berg Balance Scale (BBS) is generally considered to be the gold standard and is the widely used test for measuring static and dynamic balance in elderly people. It consists of a set of 14 simple and common balance-oriented tasks.[16] Studies in various elderly population have shown high intra-rater and inter-rater reliability.[17] Content validity of the BBS was established in a 3-phase development process involving 32 health care professionals who were experts working in geriatric settings. Criterion-related validity has been supported by moderate to high correlations between BBS scores and other functional measurements in a variety of older adults with disability. [18]

SCREENING TOOL: - BORG PERCIEVED EXCERTION SCALE

The Borg scale is a tool to measure a person's perception of their effort and exertion, breathlessness, and fatigue during physical work. Borg scale is 15-point scale ranges from 6 = no exertion at all to 20 = absolute maximum. It took 5 minutes to administer.[19]

TREATMENT PROTOCOL 1. FUNCTIONAL TASK TRAINING [15]

TIME	ACTIVITIES
1 Minute	Step on and off a bench.

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1 Minute	Sit to stand from a chair while holding an object.
1 Minute	Stopping on commands while walking.
1 Minute	Walking through a curved path.
1 Minute	Walking and turning right/ left/ back.
1 Minute	Pick an object from the floor and place it on shelf.
1 Minute	Walking while passing an object from hand to hand.
1 Minute	Walking and avoiding obstacles while listening to music.
1 Minute	Walking up and down a ramp while carrying a weighted box.
1 Minute	Climbing up and down stairs while carrying a weighted box.
1 Minute	Walking and avoiding obstacles while carrying a glass of water on tray.
1 Minute	Walking and passing through a raised surface carrying a glass of water on a tray.

2. RESISTANCE TRAINING[15]

SETS AND REPITITION	WEIGHT	ACTIVITIES
3 Sets and 8 Repetition	Minimum weight 0.5 kg	Four ways straight leg raises; ankle weight was used to offer resistance.
3 Sets and 8 Repetition	Minimum weight 0.5 kg	Seated knee extension exercise: the exercise was performed on a quadriceps table.
3 Sets and 8 Repetition	Minimum weight 0.5 kg	Raising the body as high as possible on the toes to strengthen plantar flexors.
3 Sets and 8 Repetition	Minimum weight 0.5 kg	Walls slides; introduced weight to the body weight by holding a dumbbell close to the chest with both hands.
3 Sets and 8 Repetition	Minimum weight 0.5 kg	Step up exercise – forward and lateral; introduces additional weight to bodyweight by holding dumbbells in each hand at the sides or over the tops of shoulder flexing elbows.

3. FUNCTIONAL TASK TRAINING +RESISTANCE TRAINING[15]

Functional task training [Each exercise performed for 1 minute].	**Resistance training program** [Each exercise performed in 3 sets of 8 repetitions].
Step on and off a bench	Four-way straight leg raises; ankle weights were used to offer resistance
Sit to stand from a chair while holding an object	Seated knee extension exercises: the exercise was performed on a quadriceps table
Stopping on commands while walking	Wall slides; Introduced additional weight to bodyweight by holding a dumbbell close to the chest with both hands. alternatively, dumbbells were held in each hand at the sides or over the tops of shoulder flexing elbows
Walking through a curved path	Step up exercise – forward and lateral; introduces additional weight to bodyweight by holding dumbbells in each hand at the sides or over the tops of shoulder flexing elbows.
Walking and turning right /left / back	
Pick an object from the floor and place it on a shelf	
Walking while passing an object from hand to hand	
Walking and avoiding obstacles while listening to music	
Walking up and down a ramp while carrying a weighted box	
Climbing up and down stairs while carrying a weighted box	
Walking and avoiding obstacle while carrying a glass of water on a tray	

Walking a passing through a raised surface carrying a glass of water on a tray	

4. CONVENTIONAL BALANCE TRAINING[21]

TIME AND REPETITION		ACTIVITIES
15 Second and 5 Repetition.	Flexibility	Calf, hamstring, quadriceps, hip flexor and hip adductors.
10 Repetition	Strength	Abdominal (curl ups), spinal extensors (prone extension), hip abductors (side lying with a weight around the ankle), hip extensors (in prone), hamstring (prone knee flexion) and quadriceps (knee extension in high sitting)
	Postural control	Stepping in all direction, reaching to limits of stability in different position (kneeling, half kneeling, standing: on hard surface and foam surface), step up and down, tandem standing and walking, single limb standing (eyes open and closed)
12 Minutes	Endurance	Walking for 12 minutes at self-selected comfortable pace on a level surface

DATA COLLECTION:

A total of 48 participants included in the study and randomly divided into 4 equal groups, functional task training, resistance training, functional task training+ resistance training and conventional balance training.

In functional task training group functional training was given to the participants for duration of 12 weeks, 3 sessions per week for 1 hour. In resistance training group resistive exercise was given to the participants for 12 weeks, 3 sessions per week for 1 hour. In functional task training or resistance training group a combination of both functional exercise and resistive exercise was given to the participants for 12 weeks, 3 sessions per week. In conventional balance training group balance training was given to the participants for 12 weeks, 3 sessions per week. Participants selected according to inclusion and exclusion criteria; data was conducted through two phases for pre & post assessment in which hard copy of outcomes measurement distributed. Also collected consent form from all subjects of Groups who are agree to participate in the study and participants were also explain about the purpose of the study. Demographic details were also collected through data collection form then administration of scale was given for Assessment of groups. After duration of 12 weeks per week 3 sessions for 60minutes, the re-administration of scale was given for post assessment of groups and responses were recorded to calculate the pre and post data of groups. Descriptive statistics was calculated and t –test was used for pre and post analysis.

DATA ANALYSIS

After completion of all (pretreatment and post treatment) evaluation, results were collected and data were put in the master chart and analysed by using IBM SPSS.

The scoring of pre –treatment data of Outcome measure BBS scale were analyse using IBM SPSS for statistical significance result.

The pretest and Post test for scoring of groups were analysing through parametric test, T-test was used to analyse the balance for analysis of outcome measures.

RESULT

The results presented in two phases: Pretest and Post test assessment and the significance of functional task training, resistance training and conventional balance training was determined through BBS Outcome measures.

In phase one: the pretest assessment of the BBS administered to the participants before providing intervention. And in second phase the post-test assessment of the BBS was re- administered after duration of 12 weeks, per week 3 sessions for 60 minutes were provided for intervention.

Table:1 Descriptive Statistics of outcome

	N	Mean	Std. Deviation
BSS FTT	12	31.75	2.982
BSS RT	12	31.21	3.776

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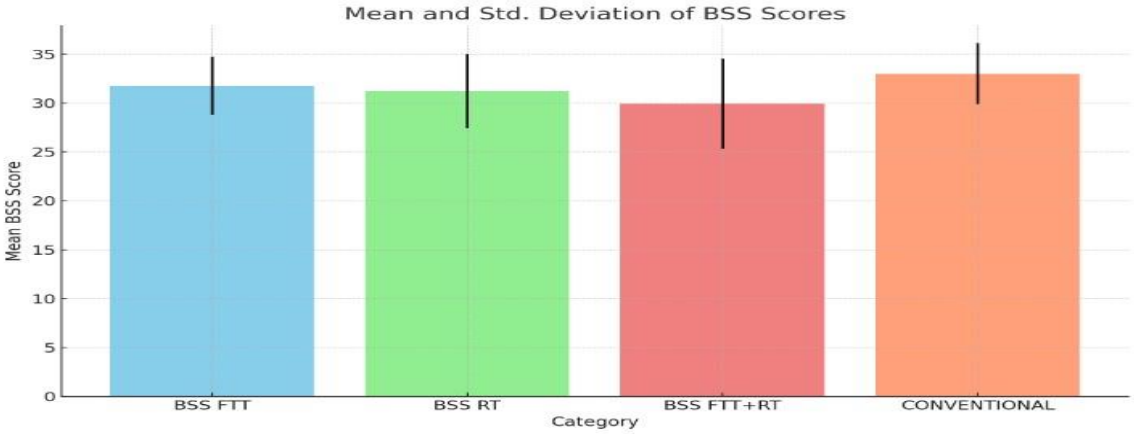
BSS FTT+RT	12	29.92	4.624
CONVENTIONAL	12	33.00	3.107

GRAPH1. Showing the Descriptive statistics of mean and standard deviation of BBS score



Graph1. Graphical presentation of the Descriptive statistics of mean and standard deviation of BBS score.

Table2. Showing the p- value of .002 for FTT group, .119 for RT group, .053 for FTT+RT group and .046 for Conventional balance training.

Table2. Pre- test and post- test of BBS in all 4 Groups

Group Statistics

	FTT Type	N	Mean	Std. Deviation	Std. Error Mean	P value
BSS FTT	Pre	12	30.00	2.216	.640	.002
	Post	12	33.50	2.646	.764	
BSS RT	Pre	12	30.00	3.885	1.121	.119
	Post	12	32.42	3.397	.981	
BSS FTT+RT	Pre	12	28.08	5.368	1.549	.053
	Post	12	31.75	2.927	.845	
CONVENTIONAL	Pre	12	31.75	2.927	.845	.046

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Table no. 3 showing the result of Mann- Whitney U test between the difference of group1 (functional task training) and (conventional balance training) for balance

GROUP	N	MEAN RANK	SUM. OF RANK
POST BBS GROUP 1 (FTT)	12	11.58	139.00
POST BBS GROUP 2 (RT)	12	13.42	161.00
TOTAL	24		
Asymp. Sig. (2- tailed)	.523		
Exact sig. [2*(1- tailed sig.)]	.551		

DISCUSSION:

This study examined the impact of intervention on balance among older adults through pre- post analyses of BBS assessment. Rafi Mohammed in 2021 conducted a study on Balance enhancement in older adults to examine the difference between functional task training (FTT) and resistance training (RT) in enhancing balance in older adults. They suggest that both the functional task training and resistance training groups improved significantly.[15] FTT group improved significantly better than RT group. The purpose of current study is to explore the combined outcome of functional task and resistance training on balance among geriatric population.

In the Intervention group, the descriptive statistics for pre- post analysis of BBS were presented, the mean pre-BBS score of FTT group was 30.00, for RT group 30.00, FTT+RT group was 28.08 and for Conventional group 31.75, suggesting moderate risk of fall among participants, while the mean post- BBS score increases to FTT group 33.50, in RT group 32.42, FTT+RT group 31.75 and in Conventional group 34.25 Indicating improvement in balance. The standard error for pre-BBS for FTT is .640, RT is 1.121, FTT+RT is 1.549 and Conventional is .845 respectively, while for post-BBS FTT, RT, FTT+RT, CONVENTIONAL they are .764, .981, .845, .827 respectively. These values suggest a decrease in variability, indicating a more consistent improvement in balancing function among participants post- intervention. Furthermore, the standard deviation for pre- BBS FTT is 2.216, RT is 3.885, FTT+RT is 5.368, and Conventional is 2.927 respectively compared to post-BBS FTT is 2.646, RT is 3.397, FTT+RT is 2.927 and Conventional is 2.864. This reduction in deviation underscores a more concentrated distribution of scores post- intervention, reflecting enhanced balancing ability among geriatric population. The statistical analysis further solidifies these observations. The obtained P- value is 0.002 for FTT group, 0.119 for RT group, 0.053 for FTT+RT group and 0.046 for Conventional balance training group.

A study conducted in which authors compared the effects of 16 weeks of dual-task training and functional training on functional fitness in older women. Functional fitness was measured using tasks like putting on a t-shirt, sit-to-stand tests, timed up and go, and the 10-meter walk test, among others. Both training approaches led too small to moderate improvements in most measures, with functional training showing greater gains in the 10-meter walk test. After detraining, both groups-maintained improvements in certain tasks. The dual-task group retained gains in the t-shirt task, while the functional training group preserved improvements in the timed up and go. Overall, both training methods were similarly effective in enhancing functional fitness, with benefits lasting after the detraining period.[22]

A previous study that aimed to compare the effectiveness of Pilates intervention (PI) and Conventional Balance Training (CBT) in enhancing functional balance and quality of life (QOL) in elderly individuals. A randomized controlled trial included 51 ambulatory elderly participants from four old age homes, divided into three groups: PI, CBT, and a control group (N=17 each). All groups underwent 6 weeks of supervised interventions. Results showed significant improvements in functional balance (FRT, TUG, DGI) and QOL (RAND-36) for PI and CBT groups (p=0.000), with no changes in the control group. PI demonstrated superior outcomes in both functional balance and QOL compared to CBT and control. Both PI and CBT improved balance and reduced fall risk, but PI was more effective in enhancing functional balance and QOL.[23]

The Mann- Whitney test conducted for post BBS assessment of group 1 (functional task training) and group 4

(conventional balance training). The mean rank was (11.58) and sum of rank was (139.00) for group1 (functional task training) and in Group 4 (conventional balance training) mean rank was (13.42) and sum of rank was (161.00) for berg balance scale. It is showing there is no comparative improvement in group1 (functional task training) and group 4 (conventional balance training). Level of significance was (.551) as shown in table number 3.
Consequently, the null hypothesis is rejected in Favor of the alternative hypothesis, affirming the presence of a significantly improvement in balance following the intervention and training regimen. Such statistical significance underscores the tangible benefits accrued by participants in the program, reinforcing the importance of proactive intervention strategies in managing balancing decline.

CONCLUSION:
This study concluded that the effect of FTT and Conventional training is more statistically significant than other intervention program of balancing for older adults. The training helps older adults to improve balancing.

LIMITATION OF THE STUDY:
The participants were recruited from a single place. This study limited to those individuals who can lift {0.5 – 1.5 kg} and who can walk without assistive device.

FUTURE RECOMMENDATION:
Future research could be done with a larger sample size and could be conducted from various places for data collection.

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