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Research Article

Dual Task Training for Better cognition and Balance

Effects of Dual Task Training Versus PNF Pattern on Balance and Cognition in Geriatric Population

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Abstract: The aim of this study is to examine the effects of Dual task training versus Proprioceptive Neuromuscular Facilitation (PNF) training on balance and cognition in geriatric population. There is growing evidence of the involvement of executive control in the maintenance of balance in older people. Balance is considered as one of the risk factors for fall especially in older adults. Proprioceptive Neuromuscular Facilitation training is one of the effective way to maintaining balance. PNF pattern exercise can activate joint sense by moving almost all joints of the body simultaneously. This is an experimental design with pre and post comparative study. This was conducted in the Physiotherapy Outpatient department in ACS Medical College and Hospital. The study duration was about 12 weeks. The subjects between the age group of 65 – 85 years of both sex those without orthopedic problems were included in this study. The subjects with severe dementia, severe cardiac problems, who had undergone recent surgery were excluded from the study. 50 Geriatric individuals were selected and divided into two groups in which Group AReceived Dual Task Training and Group B received PNF training for a period of 12 weeks. The outcome measures were Balance and cognition. The outcome tools were Berg Balance Scale, Falls Efficacy Scale, Brief Cognitive Rating Scale and Performance Oriented Mobility Assessment Scale. On comparing Pretest and Post test within Group A and Group B on Fall Efficacy Scale, Berg Balance Scale, Performance Oriented Mobility Assessment and Brief Cognitive Rating Scale shows highly significant difference in Mean values at P $\leq$0.001. Thus this study concludes that Dual Task training increases Balance and Cognition in Geriatric population.

Keywords: Geriatric, Balance, Cognitive, Dual task, PNF pattern

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1. INTRODUCTION

In the westernized world, societal and medical institutions alike are increasingly focusing attention on the health and well-being of the increasing older adult population, defined by the age of 65 years or older[1]. Moreover, the population of adults aged 65 and older is expected to double by 2050, increasing from 55 to 88 million [2]. India is the second most populated country in the world, with over 1.21 Billion people and according to the population census in India 2011, the percentage of older adults above the age of 60 is 8.6% [3]. It is estimated that 13% of adult's self-report balance issues from 65 to 69 and this proportion increases to 46% in those aged 85 and older[4]. Aging decreases mobility[5], and this decrement leads to a decline in the number of daily activities[6]. Activities of daily living (ADL) require balance maintenance during the concurrent performance of two or more tasks[7]. This effect decreases the quality of life[6]. The decline in physical performance and cognitive capabilities with age causes progressive impairment of muscle strength, coordination, and balance[8]. Older people who perform poorly in dual-tasks are at increased risk of falls[7]. Even contributes to falls[9] and death[10].Balance is considered one of the key risk factors for fall, especially in older adults and those with postural control dysfunction. It is the capability of maintaining the body's center of gravity within the base of support while one maintains a static position, makes a voluntary movement, or reacts to external disruptions. It is a complex construct incorporating multiple biomechanical, neurological, and sensory systems[11]. Postural stability is an integral component of the motor control and coordination process of body[12].Cognition has emerged as an important factor in the maintenance of postural stability. Cognitive impairment in older adults, including subtle changes in the absence of dementia, is associated with increased fall risk[13,14]. Physical activity especially Aerobic and Strengthening exercises is known to play an important role in the protection against cognitive decline [15-17], Physical activity intervention studies in older adults have demonstrated effects on brain structure, function and connectivity[18-21]. Important information about balance can be gathered by analyzing how adults react to visual perturbations[22].Dual-task training is defined as the ability to perform two or more cognitive and motor activities simultaneously while maintaining postural control[7]. Divided attention is the ability to perform more than 1 thing at the same time[23]. The dual-task methodology is the primary approach used to investigate interactions between cognitive processing and motor performance[24]. Impaired dual-task balance performance predicts adverse outcomes such as falls[25-27] and declines in both cognitive and physical function[28-30]. The degree of task difficulty influences the cognitive capacity needed to perform the task[31]. Dual task NSE is capable of improving cognitive and gait performance in healthy older adults[32].Neuromuscular training has been considered an elemental therapeutic strategy to enhance the neurophysiological entity of joints for coordinated functioning[33], and an imbalance is associated with a poor joint sense[34]. Proprioceptive neuromuscular facilitation (PNF) training is an effective way which plays an important role in maintaining balance[35]. In addition, PNF pattern exercise can activate joint senses by moving almost all joints of the body under a gravity load condition[34]. Improvement of Body balance control ability, Cardiovascular function and flexibility through regular exercise was effective[36,37]. PNF using a diagonal movement pattern and dual task training are being used for improving the balance[38,39]. The Berg Balance Scale was developed to evaluate abilities in both static and dynamic balance through the direct observation of three domains: Sitting, standing, and changing posture. Seong-Hi Park and Young-Shin Lee (2016) revealed that.It is also helpful to assess the risk of falls based on the evaluation of balance[40,41]. Meta-analysis provides evidence that the BBS is an appropriate screening tool to predict fall risks at a moderate accuracy level[42].The Falls Efficacy Scale is a 16 item questionnaire which assesses the concern about falling in both basic and demanding physical and social activities[43]. Daniela Figueiredo, Sónia Santos (2016) revealed that FES had excellent reliability and validity properties and it can be used as an important instrument of assessment of fear of falling[44].Performance-Oriented Mobility Assessment (POMA) to evaluate both gait and balance in the elderly[45]. POMA is easily administered and provides useful information on the ability of older people to assess mobility. The POMA test can be administered in less than 5 minutes[46]. BahmanMoulodi, AkramAzad, GhorbanTaghizadeh, Mahtab Roohi-Azizi, Parvaneh Mohammadi has revealed that POMA has an acceptable test-retest and inter-rater reliability, as well as internal consistency for assessing balance and gait in the elderly[45].Hence this study aims to analyze the effectiveness of Dual task training versus PNF training on balance and cognition in geriatric population

2. MATERIALS AND METHODS

This study was an experimental study design with pre and post type. This was conducted in the physiotherapy outpatient department in ACS medical college and hospital for a duration of 12 weeks. This study included 50 subjects based on the inclusion criteria. This study included samples of age above 65 years, both men and women, berg balance scale between 20-40, falls efficiency scale score between 50-80, brief cognitive rating scale less than 6, POMA scale between 18-25 and excluded those with severe dementia, severe cardiac problems, who had undergone recent surgery and non-cooperative patients. Then they were divided into two groups by a simple random sampling method. The samples were also explained about the study and a written consent form was collected duly signed. Group A received Dual Task Exercise for 12 weeks/ 5 sessions per week and Group B received PNF pattern exercise for 12 weeks/ 5 sessions per week. Pre and post test was evaluated using Falls Efficacy Scale, Berg Balance Scale, Brief Cognitive Rating Scale and Performance Oriented Mobility Assessment Scale Group A – Integrated Dual task training group performed balance and cognitive tasks simultaneously. Walking on straight line while carrying a cup of water, crossing over the obstacles placed on their path, standing on one leg, walking while bouncing a ball, walking backward and sideways, walking while carrying heavy objects on both the hands, sitting on top of Swiss ball, walking while tossing a ball from one hand to other hand, Transfer of weight. Cognitive exercise like Find a letter in a mixed letter, walking according to the command, recall 5 words which they read on the previous sheet of paper, naming some places with the letter given, climbing up & Descend stairs without support, Moving an object from one place to another place[46][47].Group B received PNF Lower Extremity D1 Flexion Pattern, Lower Extremity D2 Flexion Pattern, Lower Extremity D1 Extension Pattern, Lower Extremity D2 Extension Pattern, Upper Extremity D1 Flexion Pattern, Upper Extremity D2 Flexion Pattern, Upper Extremity D1 Extension Pattern, Upper Extremity D2 Extension Pattern[47] [48].

3. DATA ANALYSIS

The collected data were tabulated and analyzed using both descriptive and inferential statistics. All the parameters were assessed using the statistical package for social science (SPSS) version 24. Paired t-test was adopted to find the statistical difference within the groups & Independent t-test (Student t-Test) was adopted to find statistical difference between the groups.

4. RESULTS

On comparing the Mean values of Group A & Group B on Falls Efficacy Scale, it shows significant decrease in the post test Mean values in both groups but (Group A – Dual Task Training) shows 42.36 which has the Lower Mean Value is more effective than (Group B – PNF Pattern) 52.92 at P < 0.001. Hence Null Hypothesis is rejected. (TABLE -1)

Table-1 Comparison Of Falls Efficacy Scale Between Group – A And Group – B In Pre And Post Test

#FES	#Group – A		# Group – B		T- Test	Df	Significance
	Mean	S.D	Mean	S.D			
PRETEST	61.88	11.48	61.28	6.71	.225	24	.823*
POSTTEST	42.36	11.79	52.92	6.80	-3.877	24	.000***

(- P > 0.05), (*** - P ≤0.001)*

On comparing the Mean values of Group A & Group B on Berg Balance Scale, it shows significant increase in the post test Mean values in both groups but (Group A – Dual Task Training) shows 45.08 which has the Higher Mean Value is more effective than (Group B – PNF Pattern) 37.84 at P ≤0.001. Hence the Null Hypothesis is rejected. (TABLE -2)

Table – 2 Comparison Of Berg Balance Scale Between Group –A And Group –B In Pre And Post Test

#BBS	#Group –A		#Group –B		T- Test	Df	Significance
	MEAN	S.D	MEAN	S.D			
PRE TEST	34.32	9.18	33.32	6.74	.439	24	.663*
POST TEST	45.08	5.67	37.84	6.79	4.08	24	.000***

(- P > 0.05), (*** - P ≤0.001)*

On comparing the Mean values of Group A & Group B on Brief Cognitive Rating Scale, it shows significant decrease in the post test Mean values in both groups but (Group A – Dual Task Training) shows 18.84 which has the Lower Mean Value is more effective than (Group B – PNF Pattern) 23.84 at P ≤ 0.001. Hence Null Hypothesis is rejected. (TABLE-3)

Table - 3 Comparison Of Brief Cognitive Rating Scale Between Group –A And Group –B In Pre And Post Test

#Bcrs	# Group –A		# Group –B		T - Test	Df	Significance
	Mean	S.D	Mean	S.D			
PRE TEST	28.80	3.39	29.16	3.81	-0.35	24	.726*
POST TEST	18.84	3.94	23.84	3.74	-4.59	24	.000***

(- P > 0.05), (***- P ≤0.001)*

On comparing the Mean values of Group A & Group B on Performance Oriented Mobility Assessment Scale, it shows significant increase in the post test Mean values in both groups but (Group A – Dual Task Training) shows 11.72 which has the Higher Mean Value is more effective than (Group B – PNF Pattern) 9.88 at P ≤ 0.001. Hence Null Hypothesis is rejected. (TABLE-4)

Table – 4 Comparison Of Performance Oriented Mobility Assessment Scale Between Group –A And Group –B In Pre And Post Test

# Poma	# Group –A		# Group –B		T-Test	Df	Significance
	Mean	S.D	Mean	S.D			
PRE TEST	7.68	1.95	8.00	1.87	-0.59	24	.557*
POST TEST	11.72	1.59	9.88	1.56	4.12	24	.000***

(- P > 0.05), (*** - P ≤0.001)*

Comparing the Pre and Post test within Group A& Group B on Activities of Falls Efficacy Scale, Berg Balance Scale, Brief Cognitive Rating Scale and Performance Oriented Mobility Assessment Scale shows a highly significant difference in Mean values at P ≤ 0.001.

5. DISCUSSION

Balance is considered one of the key risk factors for fall, especially in older adults. The main aim of this study was to compare the effects of Dual Task training and PNF Pattern. Totally 50 subjects were selected and included as per inclusion criteria. Then divided into two groups in which one underwent Dual Task Training and PNF Pattern exercise. The post test revealed that Balance and Cognition was significantly improved in Dual Task Training than PNF pattern exercise. Fusun Sahin et al., (2008) concluded that The Turkish version of the Berg balance scale is a reliable and valid scale to be used in balance assessment of Turkish older adults[48]. Kalpana P. Padala et al., (2017) reported that FES has also been shown to have a good reliability (α 0.89) in cognitively impaired population[49,50]. Graham J. Mc Dougall et al., (1990) reported that The BCRS has also been used as a cognitive screening instrument in a study of agitated behaviors in nursing home residents[51]. Seung Heon An et al., (2014) concluded that the performance-oriented mobility

assessment subscale is a valid tool for assessing the physical function and fall risk of stroke survivors[52²]. Elżbieta Mirek et al., (2015) concluded that PNF-based physiotherapy is effective and safe and improvement in all measures of balance and gait[53³].Eun-Kyung Kim et al., (2015) concluded that performing aquatic proprioceptive neuromuscular facilitation patterns in the lower extremity enhances balance and ADL in stroke patients[54]. Laiana Sepúlveda de Andrade Mesquita et al., (2015) concluded that they found a significant increase in dynamic balance as verified by the functional test performance in the Pilates and Proprioceptive Neuromuscular Facilitation groups[55]. Igor Almeida Silva et al., (2017) concluded that older people showed a tendency to decrease plantar support areas and a significant improvement in static and dynamic balance after the four-week PNF protocol[56].Christopher S. Cayco et al., (2016) concluded that PNF was safe and effective in improving stepping reactions and LOS in an older adult with chronic stroke with persisting balance impairment[57]. Wontae Gong et al., (2020) concluded that Dynamic trunk stabilization exercise utilizing the proprioceptive neuromuscular facilitation patterns seem to help increase the balance of healthy adults[58]. Ju-Min Song et al., (2008) concluded that aquatic exercise program applied PNF patterns could increase edema index and muscular weight of affected lower extremity and improve the balance performance[59]. Patima Silsupadol et al., (2010) concluded that Dual-task training is effective in improving gait speed under dual-task conditions in elderly with balance impairment[23]. Jun Hwan Choi et al., (2015) dual-task training could be as effective as conventional balance training for improving balance and cognition in subacute post-stroke patients[60]. MarwaShafiek Mustafa Saleh et al., (2019) concluded that Aquatic motor dual task training is more effective in improving balance and gait abilities of patients with chronic stroke than land motor dual task training[61¹]. Ki-Hun Cho et al., (2010) concluded that two motor dual task training improved static balance on the foam, dynamic balance, gait function[62²]. Money Rajput et al., (2014) concluded that motor dual task training is better than motor-motor dual task training and balance training over the balance, gait and quality of life in elderly[133].

6. CONCLUSION

This study concludes that both Dual Task Training and PNF training improves balance and cognition in geriatric population on within group comparison between pre and post test. But on comparing between group dual task training and PNF training, Dual task training group had significant better improvement than PNF training group. Hence dual task training can be used to reduce the incidence of fall, fall risk group. It also improves balance, cognition and gait of the geriatric population

7. AUTHORS CONTRIBUTION STATEMENT

V.Rajalaxmi& J.Arthi conceptualized, designed and gathered data. G.Mohan Kumar &N. Muthukumaran analyzed these data and inputs were given K.Balathandayutham, K. Saraswathi& E Kavitha discussed the methodology, results and contributed to the final manuscript.

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9. CONFLICT OF INTEREST

Conflict of interest declared none

10. REFERENCE

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