



## COMPARISON OF CORE STRENGTHENING AND PELVIC PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION ON DYNAMIC BALANCE AND LOWER LIMB FUNCTION ON GERIATRIC POPULATION

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### ABSTRACT

**Background:** Aging, define as the time-dependent functional decline that affects most living organisms. Characteristics of Aging are increased mortality with age after maturation, changes in biochemical composition in tissues with age, progressive decrease in physiological capacity with age, reduced ability to respond adaptively to environmental stimuli with age and increased susceptibility and vulnerability to diseases. **Objectives:** To study the Effect of Core Strengthening and Pelvic Proprioceptive Neuromuscular Facilitation on dynamic balance and lower limb function in Geriatric Population **Methods:** 40 aspiring Geriatric people were recruited from TDTRDAV Institute of Physiotherapy and Rehabilitation. They were randomly divided in two groups (A, B). The group A (n=20) performed core strengthening exercise and conventional exercises program and group B (n=20) performed Pelvic PNF exercise program and conventional exercises program. Exercises were performed for sixty minutes 5 times a week for four weeks. **Results:** Significant improvement was noted in both the groups over the intervention period. When within group mean values of TUG, BBS AND LEFS was analysed. It was found statistically significant in both the groups but when comparison was done between groups, statistically significant difference was found. There was more improvement in group B than group A. **Conclusion:** The result of the present study suggests that core strengthening exercise and pelvic PNF improve dynamic balance and lower limb function in geriatric population. But significant and noticeable improvement is seen in patients who received pelvic PNF for 4 weeks. So, it is concluded that Pelvic PNF is recommended to improve balance, lower limb function in geriatric population.

**KEYWORDS :** Geriatric Population, Core Strengthening, Pelvic PNF, Dynamic Balance.

### INTRODUCTION

Ageing is a biological process which involves all living organisms including human beings. This period is the result of complex interactions between genetic, metabolic, hormonal, immunological and structural factors which affect cellular and tissue levels and bodily systems as well as their function, consequently leading to oldness [1]. Aging, define as the time-dependent functional decline that affects most living organisms. Characteristics of Aging are increased mortality with age after maturation, changes in biochemical composition in tissues with age, progressive decrease in physiological capacity with age, reduced ability to respond adaptively to environmental stimuli with age and increased susceptibility and vulnerability to disease [2]. In humans, aging is inexorable. Several physical disorders are commonly found in individuals over 60 years of age, such as weakness and decrease on the muscular mass, reduction of sensory information secondary to visual, hearing and tactile deficits, decrease of the flexibility and balance and coordination dysfunction. Such alterations can influence the life quality of these people, limiting them in their functionality and social life [3]. The number of older people increases at a faster rate than the number of people who are born, generating a change in the structure of spending in several areas, among them health. This is a trend that will persist over the next few years, and by the year 2025 it is estimated that there will be more than 800 million people over the age of 65 worldwide. This longevity can be associated with improvements in the population's health conditions, together with advances in health care [4]. According to the World Health Organization (WHO), the proportion of people older than 60 is growing more rapidly than any other age group [5, 6].

The number and proportion of older adults among the world population has increased due to socio-economic developments and better medical services. Although this general increase in lifespan can be considered a positive development [7]. Postural control (balance) is defined the ability to maintain BOS with minimal movement and dynamic balance as the ability to perform a task while maintaining a stable position. Balance has been described as the ability of an individual to maintain his or her body's centre of gravity over the base of support, whether that base of support is stationary or unstable [8]. To maintain balance, a person must

sense these forces and implement muscle responses that offset them, a skill that is achieved by the corresponding efforts of sensory and motor systems. Three sensory systems supply input concerning the body's position and movement through the surrounding environment: visual, vestibular and somatosensory systems [9]. If any of these somatosensory systems is harmed, the body's ability to maintain postural balance is reduced. Consequently, it is essential to concentrate on both sensory and motor components during balance training and incorporate these systems to obtain appropriate reaction to feedback [10]. A deterioration of balance function, as a consequence of disease or simply increasing age, will increase the occurrence of clinical balance problems as well as the risk of balance loss and falls [8].

The core is defined as the lumbo-pelvic hip complex. It is where our centre of gravity is located and where movement of the body originates. There are many muscles associated with the core. An efficient core allows for optimal acceleration, deceleration and stabilization of the entire kinetic chain during functional exercises [11]. The core is also a stabilizer for efficient lower extremity movements, and operates as a functioning unit. The core needs to be trained appropriately in order to efficiently distribute weight, absorb force, and transfer ground reaction forces during functional movements [12]. Venu Akuthota et al., (2004) studied about Core strengthening and the author discussed about Muscles of core: divided into two types [13];

1. Local muscles (postural, tonic, segmental stabilizers): They are multifidus, psoas major, Transverses abdominis, quadratus lumborum, diaphragm, internal oblique (posterior fibers), iliocostalis and longissimus (lumbar portions)

2. Global muscles (dynamic, phasic, torque producing): They are rectus abdominis, external oblique, internal oblique (anterior fibers), iliocostalis (thoracic portion) [14].

Pelvic proprioceptive neuromuscular facilitation (PNF) helps to improve control of pelvis which is a key point for maintaining trunk control, gait and balance [15]. Pelvic PNF is a method that uses diagonal and spiral movements, aiming at facilitating, strengthening, gaining control and coordinating movements [16]. Bobath et al. noted that the pelvis is the key

point for both leg control and gait pattern [17]. Wang et al. showed that PNF pelvic exercises resulted in changes in walking speed and rate in patients [15]. Trueblood et al. applied the PNF pelvic exercise to examine the effect of pelvic movement on the walking ability of patients [18]. Kim et al. when applying PNF pelvic and lower extremity exercises, showed a change in the balance [19].

A certain level of lower-extremity functional fitness is necessary, in order to make protective responses and to avoid falling [20]. Lower extremity functional scale (LEFS) is used to evaluate the functional status of lower limb. Lower-extremity physical function (LEPF) is a primary risk factor for falling [21]. The current study therefore intended to compare the effect of Core Strengthening and Pelvic Proprioceptive Neuromuscular Facilitation on Dynamic Balance and lower limb function in Geriatric Population.

### Methodology Study Design

Comparative study designed approved by the institutional Review Board of TDTR DAV institute of physiotherapy, Yamunanagar. This comparative study was conducted at TDTR DAV institute of physiotherapy, Yamunanagar. The sampling technique used for this study was non-randomized sampling. Total 40 participants were taken. They were randomly divided into two groups 20 subjects in each group named as Group A (core strengthening training) and Group B (pelvic PNF training). The study was conducted from 24<sup>th</sup> February 2022 to 24<sup>th</sup> July 2022. This study includes participants were male and females of age lies in between 65-75 years. Participants who have independent gait ability with or without walking aid for a minimum of 15 m. participants must have Mini-Mental State Examination 9 (MMSE) score greater than 24/30. Subjects must have adequate vision, hearing, ability to follow written and oral instruction for completion of the study protocol and have capacity to understand and follow instruction. Participants who had any history of trauma to lower limb and spine, malignancies, recent steroid infiltration, acute infection or neurological impairments were excluded from the study. Outcome measures of the study were Time Up and Go Test and Berg Balance Scale for Dynamic Balance and Lower Extremity Functional Scale for Lower Limb Function.

### Procedure

40 aspiring Geriatric people were recruited from TDTR DAV Institute of Physiotherapy and Rehabilitation. They were randomly divided in two groups (A, B). The group A (n=20) performed core strengthening exercise and conventional exercises program and group B (n=20) performed Pelvic Proprioceptive neuromuscular facilitation exercise program and conventional exercises program. Exercises were performed for sixty minutes 5 times a week for four weeks. Informed consent was taken from all the subjects meeting the inclusion criteria. Procedure was explained to the subjects in detail.

#### Group A: Core Strengthening Exercise program

Conventional Exercise	15 minutes
Core Specific Exercise Program	45 minutes
Total Time	60 minutes

#### Group B: Pelvic PNF Exercise Protocol

Conventional Exercise	15 minutes
Pelvic PNF Exercise Program	45 minutes
Total Time	60 minutes

### Data Analysis

The data analysis was done with the help of SPSS-18 and excels 2010. Descriptive statistics (mean and standard deviation) was used for demographic data. Within group

analysis was done with paired t-test. Between groups analysis was done with unpaired t-test.

### RESULT:

This study includes the 40 subjects, out of which 20 subjects participated in Group A i.e. core strengthening exercise while remaining 20 subjects participated in Group B who performed pelvic PNF.

**Table-1.1** total number of participants in Group A is 35% male and 65% female. In Group B number of male 40% and female is 60%.

Group	Group A	Group B
Male(%)	35	40
Female(%)	65	60
Male(f)	7	8
Female(f)	11	12

**Table 1.2:** mean, standard deviation and p value of Age in Group A and Group B. (unpaired t-test)

GROUP	Mean $\pm$ SD AGE (IN YEARS)	p-value
GROUP A- CORE STRENGTHENING GROUP	68.40 $\pm$ 2.703	0.4588 N.S
GROUP B- PELVIC PNF GROUP	67.75 $\pm$ 2.789	0.4588 N.S

**N.S=NON SIGNIFICANT**

**Table 1.3:** comparison of Time Up and Go (TUGT), Berg Balance Scale (BBS) and Lower Extremity Functional Scale (LEFS) Pre- intervention scores between group A and group B (unpaired t-test)

Scales	Pre-intervention scores of group A(N=20) (Mean $\pm$ S.D)	Pre-intervention scores of group B(N=20) (Mean $\pm$ S.D)	P-VALUE
Time Up and Go test	13.17 $\pm$ 1.869	13.10 $\pm$ 1.597	0.0000
Berg Balance Scale	49.05 $\pm$ 2.502	47.85 $\pm$ 1.424	0.0010
Lower Extremity Functional Scale	21.20 $\pm$ 3.533	20.90 $\pm$ 3.144	0.0000

**Table - 1.4:** comparison of Time up and go (TUGT), Berg Balance Scale (BBS) and Lower Extremity Functional Scale (LEFS) Post- intervention scores between group A and group B (unpaired t-test)

Scales	Post-intervention scores of group A(N=20) (Mean $\pm$ S.D)	Post-intervention scores of group B(N=20) (Mean $\pm$ S.D)	P-VALUE
Time Up and Go test	11.42 $\pm$ 2.009	9.53 $\pm$ 2.350	0.0000
Berg Balance Scale	51.70 $\pm$ 2.940	53.75 $\pm$ 3.878	0.0010
Lower Extremity Functional Scale	25.50 $\pm$ 4.261	32.70 $\pm$ 8.658	0.0000

**Table-1.5:** within group comparison of TUGT, BBS and LEFS (Paired t-test)

Scales	Pre-intervention scores(Mean $\pm$ S.D)	Post-intervention scores(Mean $\pm$ S.D)	p-value
Group A TUGT	13.17 $\pm$ 1.869	11.42 $\pm$ 2.009	0.0000*

BBS	51.70±2.940	51.70±2.940	0.0010*
LEFS	25.50±4.261	25.50±4.261	0.0000*
Group B TUGT	13.10±1.597	9.53±2.350	0.0000*
BBS	47.85±1.424	53.75±3.878	0.0000*
LEFS	20.90±3.144	32.70±8.658	0.0000*

## DISCUSSION:

This study aimed to find the effectiveness of core strengthening and pelvic PNF on dynamic balance and lower limb function in geriatric population. The participant in this study had similar baseline values of all dependent variables suggesting that all groups had homogenous distribution of patients.

Core strengthening and Pelvic PNF are common interventions used by physical therapists to improve dynamic balance and lower extremity function. This study of 4 weeks of Core strengthening and Pelvic PNF was found to have significant improvement in dynamic balance and lower extremity function. In this study 40 subjects were taken between age group of 65-75 years and were divided into two groups: Group A (n=20) received Core strengthening exercise and Group B (n=20) received Pelvic PNF.

The results of this study revealed that although both groups improved significantly at the end of the 4th week but addition of pelvic PNF (group B) to the core strengthening (group A) brought better results with respect to improvement in dynamic balance measured by TUG test and Berg Balance Scale. Lower limb function measured by lower extremity functional scale (LEFS) compared to control group (Group A).

Significant improvement was noted in both the groups over the intervention period. When within group mean values of TUG, BBS AND LEFS was analysed. It was found statistically significant in both the groups but when comparison was done between groups, statistically significant difference was found. There was more improvement in group B than group A.

Dynamic balance is a complex phenomenon; requiring integration of the sensory, musculoskeletal, and nervous systems [22]. Dynamic balance refers to the capability of having suitable reactions regarding the motor system, in order to be able to cope up with the requirements needed for the quick alterations of position in the torso, while performing activities that add stress on the knee joint [23].

In PNF the specific pattern of anterior elevation and posterior depression is an integral aspect. As this movement pattern of the pelvis is reinforced, it increases motor response and motor learning that occurs due to the facilitator techniques along with resistance thus leading to the improvement in the balance. All these techniques help to facilitate pelvic motion and stability [16]. Numerous studies are available in the literature, among different patient groups, which also indicate beneficial effects of PNF. Kabat and Knott were the first to describe the method as successful for in rehabilitating patients with paresis in Polio. Song et al. reported that PNF method significantly increases flexibility, mobility, muscle strength and self-care in the elderly [24].

The statistical findings in this study postulates that both exercise groups had significantly improved dynamic balance and lower limb function but pelvic PNF group showed highly significant improvement compared to core strengthening group. The reason why there was more significant improvement in Pelvic PNF group after four weeks of therapy was the order of movement, patient and therapist position, manual contact and knowledge of techniques and principal and other factors during the intervention.

The experimental hypothesis, says that there would be a significant difference between pelvic PNF group and core

strengthening exercise group in geriatric population. Since the present study produced a similar result, the experimental hypothesis was accepted. So the null hypothesis was rejected at 0.05 level of confidence.

## CONCLUSION:

The result of the present study suggests that core strengthening exercise and pelvic PNF improve dynamic balance and lower limb function in geriatric population. But significant and noticeable improvement is seen in patients who received pelvic PNF for 4 weeks. So, it is concluded that Pelvic PNF is recommended to improve balance, lower limb function in geriatric population.

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