

To Compare the Effect of Modified Pilates and Core Stabilization Exercise on Balance, Core Muscle Endurance and Lumbopelvic Flexibility in Elderly Women

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ABSTRACT

Background: The abundance of physical independence is diminished by the aging process, so it is important to adopt techniques that can assist in preserving the functional autonomy and quality of life of elderly. Therefore this study aims to compare the effect of two exercise protocols.

Objective: To compare the effect of modified pilates and core stabilization exercise on balance, core muscle endurance and lumbopelvic flexibility in elderly women.

Study Design: Experimental design

Source of Data Collection: DAV institute of physiotherapy, Yamunanagar.

Methodology: 30 Subjects were included in study on the basis of inclusion criteria were randomly allocated into 2 groups: Group A performed Modified Pilates exercise and Group B performed Core Stabilization Exercise. Treatment was given for 4 weeks. Balance, Core Muscle Endurance and Lumbopelvic Flexibility were measured as Outcome measure on 1st, 14th and 28th day using Mini-BEST TEST, McGill's core endurance tests, sit and reach test respectively.

Result: Statistically significant improvement ($p < 0.05$) noticed in both groups for all the outcomes. However, non-significant difference is found between the groups.

Conclusion: The study provides evidence that both the interventions are effective and can be applied in clinical setup to improve balance, core muscle endurance and lumbopelvic flexibility in elderly women.

KEY WORDS: Modified Pilates, core stabilization exercises, Balance, lumbopelvic flexibility.

INTRODUCTION

Advancing age is associated with predictable sensory, motor and cognitive changes, many of which can potentially impact an older person's ability to effectively function in society.¹ These age-related physiological changes including reductions in muscle mass, muscle strength, flexibility, vital capacity, bone mineral density, etc. affect a broad range of body tissues, organ systems and functions, which cumulatively can affect activities of daily living and upholding the physical

independence of older adults.² In old age, the muscular system loses mass and strength, causing difficulties with maintaining balance, which is mainly connected with core muscles which are responsible for trunk stability.³ Women even fall three times more often than men and are hospitalized five times more often due to falls.⁴

One of the forms of physical activity suggested for seniors is Pilates. The subject literature contains a growing number of studies that confirm the effectiveness of

Pilates in improving various aspects of health. The results confirmed the effectiveness of Pilates in all assessed indicators. In the elderly, Pilates also affects the strength and mass of lower limb muscles which helps to prevent loss of balance.⁵

Because the aging process causes several structural and functional changes, exercises aimed at muscle strengthening and/or increased flexibility in large joints is extremely important for the elderly population. Among the different types of physical training, the Pilates method has emerged as an option to reduce changes caused by the aging process. This method was developed by German national Joseph Pilates (1883– 1967).⁶ Due to limitations in movement and loss of strength, there is an increasing usage of complementary and alternative medicine therapies such as Pilates as developed by Joseph Hubertus Pilates. This mode of exercise is enjoyable and can be used by the majority of people, extending across different ages and genders and can best be described as an extremely orderly system of smooth, controlled, flowing movements. Pilates has been shown to effectively improve the musculoskeletal system by enhancing muscle strength, tone, posture, flexibility, joint mobility, bone density and dynamic balance, body composition by improving body mass index (BMI) and efficiency of the respiratory, circulatory and lymphatic systems . As such, Pilates may be able to assist in the prevention of falls and recovering from injuries, especially in the elderly.⁷

Numerous studies support the use of Pilates and core muscle strengthening in improving the balance, mobility and muscle strength. There is, however, a dearth of literature comparing the effect of pilates and core muscle strengthening in elderly subjects. The purpose of this study is to compare the effect of pilates and core muscle strengthening on balance, core muscle endurance and lumbopelvic flexibility.

METHODS

Participants

Study design was Experimental and sampling technique was non-randomized convenient sampling technique. Total 30 subjects were included in the study on the basis of inclusion criteria and were randomly allocated into 2 groups as Group A and B using computer software program that generates random sequence.

Sampling criteria:

Inclusion Criteria:

- Gender: Females.
- Studies with a mean age 60-67 years.
- Subjects that are not willing to participate in any other exercise program during the length of the research.
- Absence of any acute or chronic low back injury.

Exclusion Criteria

- Presence of any orthopedic, neurological, psychological, cardiovascular or any other impairment that would not allow them to perform the study tasks.
- Presence of any congenital or acquired anomalies in limbs.
- History of low back pain or any recent abdominal or other surgery.
- Subjects undergoing regular exercises/yoga/sports.

Outcome Measures

Balance, Core Muscle Endurance and Lumbopelvic Flexibility were measured as Outcome measure on 1st, 14th and 28th day using Mini- BEST TEST, McGill's core endurance tests ,sit and reach test respectively.

Study Protocol

Subjects in Group A performed Modified Pilates exercise and Group B performed Core Stabilization Exercise .



Figure no. 1. Modified pilates based exercises

The Modified Pilates Based Exercise protocol ⁸

1. **Modified side kick:** In side lying position, Subject was asked to inhale and prepare the movement then exhale, lift the upper leg upwards and inhale and return to the starting position. The same was repeated for the other side
2. **Modified one leg stretch:** In supine position and the legs slightly apart on the top of the Swiss ball. Subject was asked to inhale, and prepare the movement then exhale, extend the left leg, inhale and return to the starting position. The same was repeated for the right leg.
3. **Modified shoulder bridge:** In the supine position, keeping the knees flexed, feet apart. Subject was asked to inhale and prepare the movement, then exhale, flexing the lumbar spine and elevating the coccyx. Inhale and return to the starting position.
4. **The hundred:** In supine position, the arm on the side of the body, hip and knee were flexed 90 degrees so that legs rest on the Swiss ball. Curling the head, neck and shoulders up. The subject was asked to inhale and prepare the movement, then exhale, move both arms up. Then Inhale and return to the starting position
5. **Swimming:** In prone position with the arms stretched forward, lifts the head and chest off the mat. Subject was asked to inhale and prepare for the movement and then exhale, raise the left arm and right leg with the knee extended. Then Inhale and return to the starting position. Repeat the same with an alternate side.
6. **Modified swan dive:** In prone position with both shoulders flexed and elbows extended and hands resting on a roller.

The subject was asked to inhale and prepare the movement, then exhale, lift the head and extend the spine by sliding up with the assistance of the roller. Then Inhale and return to the starting position.

7. **Modified roll up:** In long sitting position on the mat holding the pilate ball in the hands. The subject was asked to inhale and prepare the movement, then exhale, reach forward towards the toes, head down without stiffing the shoulder. Then inhale and press the knees downwards while maintaining the gap between chin and chest and return to starting position.
8. **Modified spine twist:** In sitting position on the Swiss ball, Subject was asked to inhale and prepare the movement, then exhale, rotate the trunk on the left side, keeping the hip stabilized. Then Inhale and return to the starting position. Repeat the same movement with rotation on the right side.

9. **Double arm stretch:** In standing position, back to back with a partner, with legs and feet parallel, abducted and aligned with the waist, keeping the spine in neutral position and the abdomen contracted. Patients were asked to inhale and prepare the movement, then exhale, place the arms above their head, and extend the spine, passing the ball over to their partner. Then Inhale and return to the starting position.

10. **Modified one leg circle:** In supine position, Subject was asked to Inhale and prepare the movement, then exhale, lift the left leg towards the ceiling with a slightly flexed knee, and make a circle with the foot in clockwise direction for 5 times. Then Inhale and return to the starting position. Repeat the same in an anticlockwise direction for 5 times. Repeat the same exercise with the opposite leg.



Figure no. 2 Core stabilization exercises

Core stabilization exercise protocol⁹

1. **Abdominal bracing:** Patients were instructed in supine lying position to perform drawing- in maneuver of the abdomen.
2. **Bracing with heel slides:** Patients were instructed in supine lying position to perform drawing- in maneuver of the abdomen and hold it with sliding of the heel per leg.
3. **Bracing with leg lift :** Patients were instructed in supine lying position to perform drawing - in maneuver of the abdomen and hold it with raising up the leg
4. **Bracing with bridges:** Patients were instructed in supine lying position to perform a drawing-in maneuver of the abdomen and gently lift up the buttock.
5. **Bracing with bridging and leg lift:** Patients were instructed in supine lying position to perform a drawing-in maneuver of the abdomen and gently lift up the buttock and hold it with raising up the leg
6. **Bracing with standing:** Patients were instructed to perform drawing - in maneuver of the abdomen in standing.
7. **Quadruped Arms Lift With bracing:** Patients were instructed in a prone kneeling position to perform a drawing-in maneuver of the abdomen, flex one upper extremity.

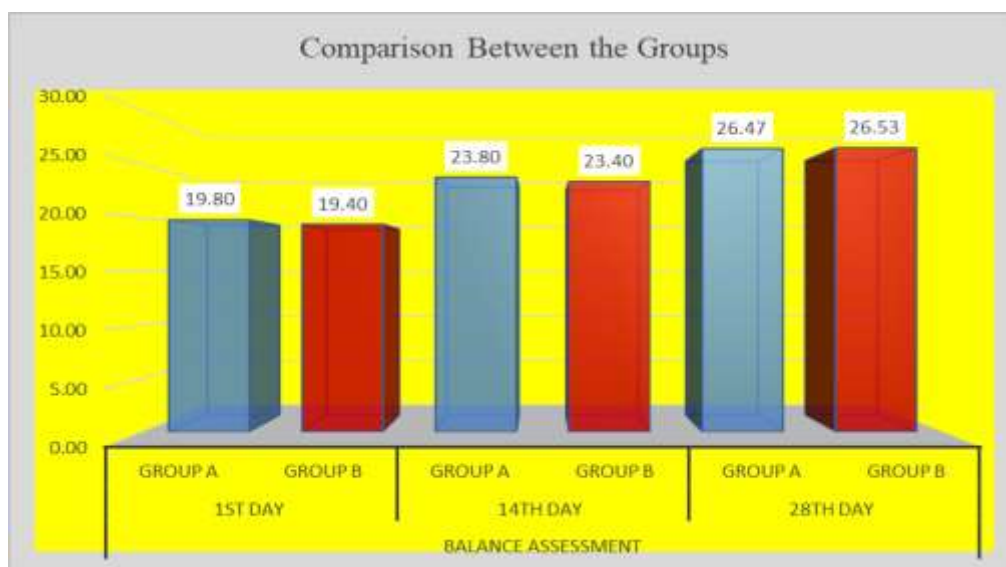
8. **Quadruped Legs Lift with bracing:** Patients were instructed in prone kneeling to perform the drawing- in maneuver of the abdomen, extend one lower extremity and lift it off exercise mat.
9. **Quadruped alternate arm and leg with bracing:** Patients were instructed in prone kneeling to perform the drawing- in maneuver of the abdomen, flex one upper extremity and extend contralateral lower extremity.

Exercises were performed 6 times a week for 4 weeks. 8 to 10 repetitions were performed for each exercise, according to their level of difficulty. The exercise order was maintained throughout the protocol. There was a pause of 3 seconds between repetitions and a 60-second rest between each exercise.

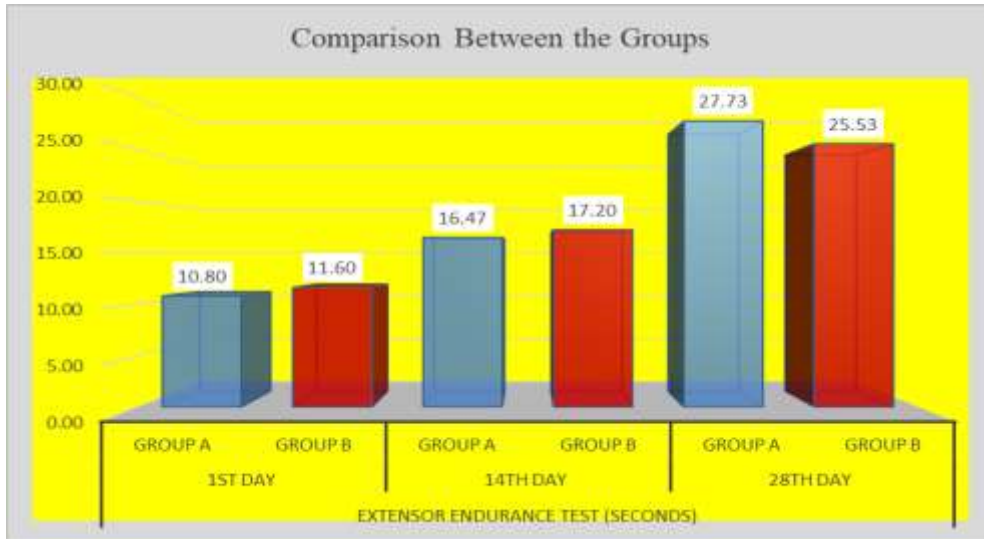
DATA ANALYSIS

The data analysis was done with the help of SPSS v-20. Unpaired t- test used for between group comparisons. Repeated ANOVA and Tukey's method for pairwise comparison was used within the group comparison. The results were found to be non- significant at $p > 0.05$.

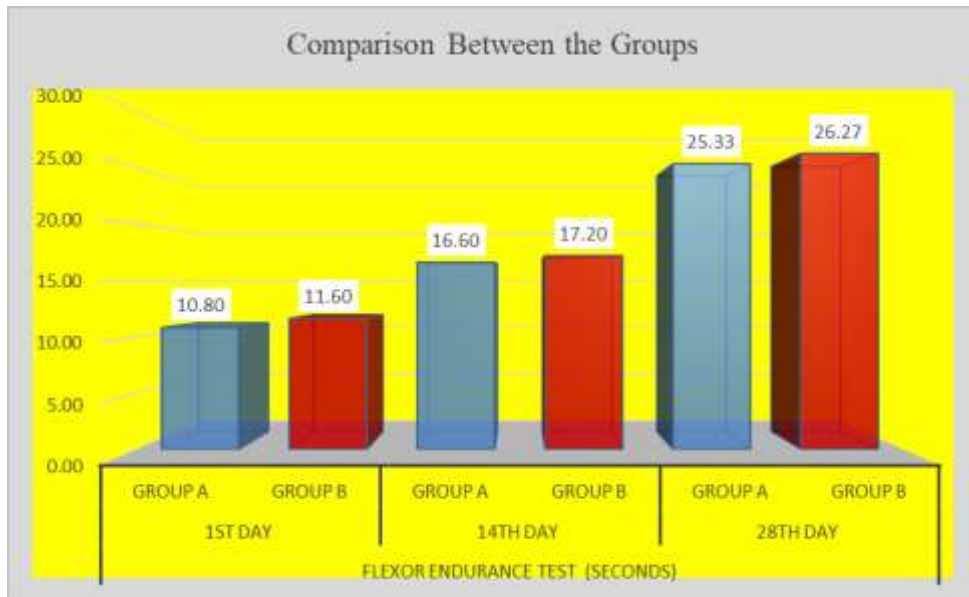
RESULT



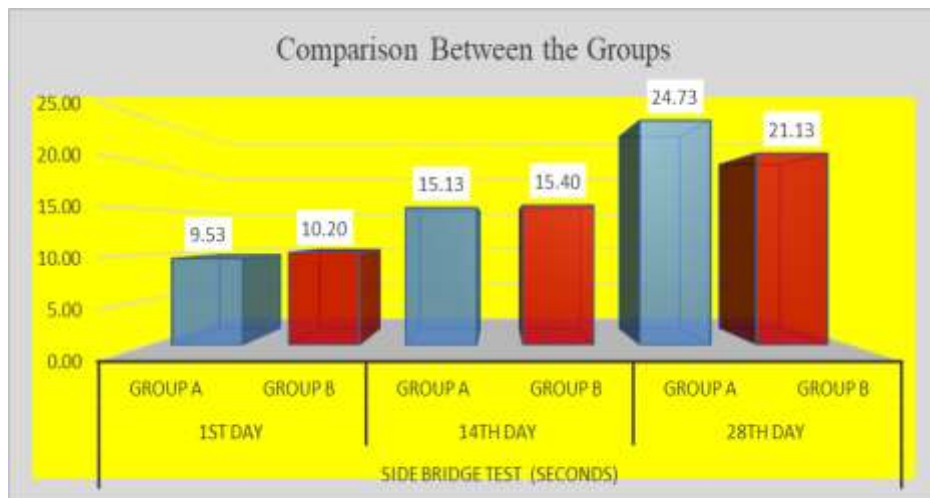
Graph No. 1 Comparison of Balance between the Groups



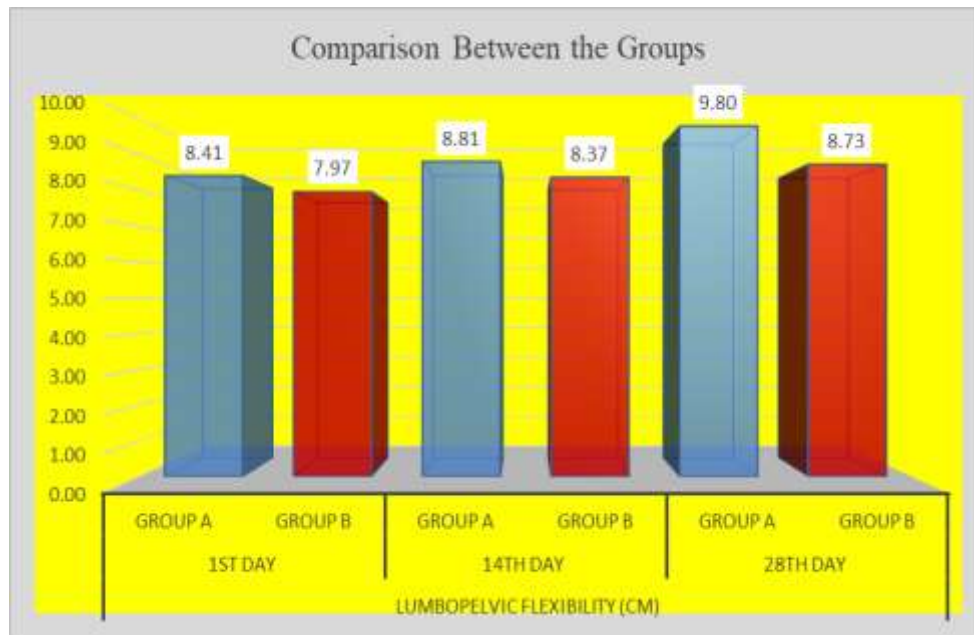
Graph No. 2 Comparison of extensor endurance test between the Groups



Graph No. 3 Comparison of flexor endurance test between the Groups



Graph No. 4. Comparison of side bridge test Between the Groups



Graph No. 5. Comparison of lumbopelvic flexibility Between the Groups

DISCUSSION

The study found significant improvement in balance, core muscle endurance and lumbopelvic flexibility in both the groups, which buttress the significance of exercise therapy in improving the functional ability of elderly women.

Modified Pilates exercises:

Effect of modified pilates on Balance:

With age, proprioception diminishes, the number of cutaneous receptors in the legs decreases and the threshold for vibrational stimuli changes, all of which lead to lower postural stability in seniors. Furthermore, neural conductivity diminishes, leading to longer reaction times, and the integration of sensory and motor responses becomes impaired. Present study found significant improvement on balance performing modified pilates is well supported by Wilmore, Costill & Kenney, 2008 who stated that Balance improvement might have possibly been due to neural adaptations, such as motor unit recruitment or increased rate coding of motor units.¹⁰

Effect of Modified Pilates on core muscle

endurance: Present study showed significant improvement in core muscle endurance that support the study performed

by M. Fourie et.al. that analyzed the effects of a mat Pilates programme on muscular strength and endurance in elderly women.¹¹ The improvements in endurance observed could have been due to a decrease in fat mass and an increase in lean body mass. This is plausible since an increased LBM is as a result of muscle hypertrophy, as muscles with larger cross-sectional areas have larger numbers of sarcomeres in parallel thus facilitating more potential cross-bridge heads in contact with actin molecules and thus yielding greater potential for applying force. However, strength gains might also have possibly been due to neural adaptations, such as motor unit recruitment or increased rate coding of motor units.¹⁰

Effect of modified pilates on lumbopelvic flexibility:

The Pilates exercise was successful to enhance lumbopelvic flexibility which is in accordance with the study performed by Oliveira et al. reported better Pilate's results for flexibility in older people, compared to static stretching.¹² This effect can be explained by the specific concept of Pilates approach, mechanical response of both contractile and non-contractile tissues and neurophysiological response. The Pilates method is a

combination of static and dynamic stretching exercises which are proper and safe to provide an increasing flexibility. During Pilates stretching position, slow stretching to soft tissues (i.e., skin, tendon, joint capsule) and muscles activates Golgi tendon organ., which inhibits alpha motor neuron activity and permits the lengthening of sarcomeres.

Core stabilization exercises:

Effect of core stabilization exercises on Balance: Core training presumably improved the balance of the lumbo-pelvic-hip complex, corrected postural alignments, and increased balance of the whole body. Also the core stabilization exercises provide protection to the low back muscles that challenges the balance, flexibility and coordination. The exercises enabled improvement of reaction time which is an important factor in optimal balance. The repetitive exercises and weekly progression helped in improving the endurance which was associated with balance performance. Panjabi also stated that contraction of core muscle activates the postural responses by CNS which help in controlling the balance. Motor learning which occurs during the core training improves muscle reflexes and accelerates proprioception which affects balance control.¹³

Effect of Core stabilization exercises on core muscle endurance: The result of the present determined significant effect of core stabilization exercises on Balance occurs which is in accordance with the study performed by Alex McCaskey et.al, the study concluded that Core stability training program can positively affect dynamic stability and core muscular endurance. The various studies reported that core stabilization exercise is effective for improving the physical activities in patients with Nonspecific low back pain (NSCLBP). This must have led to the improved stability of the spine thereby allowing dynamic control of the spine.¹⁴

Effect core stabilization exercises on lumbopelvic flexibility: The improvement in lumbopelvic flexibility could be due to the fact that the core stabilization exercises aim to correct muscle tightness, and allow the patient to assume a neutral position so that strength can be developed to help maintain correct neutral positioning during both static and dynamic conditions. Due to eccentric muscle contraction there is an overall increase in muscle length.¹⁵ According to (Susan C et al.) “Flexion during the exercises may reduce facet joint compressive forces and provide stretch to the lumbar muscles, ligaments, and myofascial structures.”

CONCLUSION

The result of the present study found non-significant difference between the groups. However, significant improvement is found in both groups in all the outcomes. Therefore, the study concluded that both exercises are effective and can be applied in clinical setup to improve balance, core muscle endurance and lumbopelvic flexibility in elderly women.

Declaration by Authors

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Conflict of Interest: The authors declare no conflict of interest.

REFERENCES

1. Chodzko-Zajko et al. Physical Activity and Aging: Implications for Health and Quality of Life in Older Persons. President's Council on Physical Fitness and Sports, 3(4), Dec. 1998, 1–8.
2. Poon L.W., et al; Active living, cognitive functioning and aging. Human Kinetics, Champaign 2006, 18–53.
3. Błaszczyk, J. et al; Postural stability in the process of aging. Gerontol. Pol. 2005, 13, 25–36.
4. Makowska, I.; et al. Vestibular and balance rehabilitation therapy. Pol. Prz. Otorinolaryn. 2014, 3, 20–26.

5. Bacsi, A.M. et al; Evidence for reflex and perceptual vestibular contributions to postural control. *Exp. Brain Res.* 2005,160, 22–28.
6. Borzym, A. Falls in old age—Reasons, consequences, prophylaxis. *Psychoger. Pol.* 2009, 6, 81–88.
7. Tinetti, M.E.; et al. A Multifactorial Intervention to Reduce the Risk of Falling among Elderly People Living in the Community. *N. Engl. J. Med.* 1994, 331, 821–827.
8. U. Albert Anand et.al; To analyse the efficacy of modified pilates based exercises and therapeutic exercises in individuals with chronic nonspecific low back pain, *International journal of physical therapy and research*,2(3),june 2014,525-29.
9. Akodu Ashiyat et.al, Comparative efficacy of core stabilization exercise and pilates exercise on patients with non-specific chronic low back pain, *Romanian journal of physical therapy*,22(38),December 2016,13-20.
10. Wilmore, J.H., et al ; *Physiology of Sport and Exercise* (4th ed.).Champaign, IL: Human Kinetics, Medicine & Science in Sports & Exercise,27(5),792,1995.
11. M. Fourie1, et.al. Effects of mat Pilates programme on muscular strength and endurance in elderly women, *African Journal for Physical, Health Education*, Vol. 18(2) June 2012, pp. 299-307.
12. Oliveira, L.C. de, et al ; Comparison between static stretching and the Pilates method on the flexibility of older women. *J. Bodyw.Mov. Ther.* 20, 800–806.
13. Ketki ponde et al., Effect of core stabilization exercises on balance performance in older adults , *international journal of contemporary medicine*,9(1),june 2021,12-17.
14. Akodu AK, et al ; Effect of stabilization exercise on Lumbar Multifidus muscle thickness in patients with non-specific chronic low back pain. *Iranian Rehabilitation Journal* 12:20.
15. Ashima Datta, et al; Effects of Core Strengthening on Cardiovascular Fitness, Flexibility and Strength on Patients with Low Back Pain, *journal of novels physiotherapies*,4(2),Feb 2014,1-6.

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